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An Empirical Study on the Influence of Internet Attention on the Performance of Individual Stocks in the Securities Market Under the Environment of Big Data

YOUWEI CHEN[1,2], (Member, IEEE), PENGWEI ZHAO[1], AND YING LIU[2,3]

[1]School of Economics and Management, Xidian University, Xi'an 710126, China
[2]Center for Computational Finance and Risk Management, Xi'an University of Posts and Telecommunications, Xi'an 710061, China
[3]Xi'an Eurasia University, Xi'an 710065, China

Corresponding author: Youwei Chen (chenyouwei@163.com)

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ABSTRACT In the era of big data, the impact of the massive public opinion information generated by the Internet on the securities market has become a factor that can't be ignored in investment decision-making and supervision. Under the influence of these factors, investors are influenced and restricted by psychology, self-cognition and limited attention, which will make them pay different attention to stocks, which spread to the securities market, and then have an impact on the market performance of individual stocks. This paper selects big data's public opinion information from securities websites, authoritative media data and mainstream social networking sites designated by China Shenzhen Stock Exchange to quantify the Internet attention index. According to different subjects and angles, it is divided into: media attention, netizens' attention, public opinion attention. Based on these three kinds of attention index data, this paper establishes the panel regression model and the GARCH (1, 1) model of the influence of different subject attention on individual stocks, and introduces abnormal media attention, abnormal netizens' attention, abnormal public opinion attention, lag attention and change of attention into the model to empirically test the three main market manifestations of individual stocks, namely, earnings, liquidity and volatility. Through comprehensive analysis and research, this paper discusses in detail and comprehensively the internal mechanism of the influence of Internet attention on the performance of individual stocks in China's securities market under the environment of big data. The conclusion of the study provides a reference for investor decision-making, market capitalization maintenance of listed companies and supervision of financial institutions.

INDEX TERMS Big data, Internet attention, the market performance of individual stocks, media attention, Netizens' attention, public opinion concern, earnings, liquidity, volatility, investment decision-making.

I. INTRODUCTION

According to traditional finance, the performance of the stock market depends on the historical information of its own market performance, the price of individual stocks can reflect all the price information, and the price deviation is offset by arbitrage. Since the launch of the Chinese stock market, compared with the relatively mature foreign stock market, there are still a large number of financial anomalies, which belong to the weak efficient market. Its main performance is that the market performance of stocks can't be perfectly explained from the traditional finance. As a new discipline, behavioral finance combines multi-disciplinary knowledge such as psychology, information behavior and finance, and applies it to the study of the stock market, aiming at the phenomenon that traditional finance can't be explained, this paper puts forward the understanding of the corresponding theory. From the perspective of behavioral finance, media reports, investor psychology, limited attention, cognitive resource restrictions and bounded rationality analyze the formation of attention and the impact

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of attention on the performance of the stock market. It is helpful to deepen the understanding of the relevant theories of behavioral finance and the analysis of the performance of the stock market. Studying the influence of attention on stock market returns is not only a test of market efficiency theory, but also a supplement to asset pricing theory. In addition, the wide application of the Internet also provides a space for investors to interact, and investors can exchange information with other investors on the Internet. Obviously, the Internet has become the main way to obtain, spread and communicate stock-related information. In the face of such a large amount of information, how should investors distribute their limited attention reasonably? Do media reports and investors' behavior of paying attention to stocks have an impact on investment decisions? What is the impact of media reports on stocks and investors' attention and comments on different stocks on the stock market? Therefore, to study and classify the attention from the Internet, and then to study the internal mechanism of its impact is of great significance to the development of China's stock market. The Internet attention degree studied in this paper includes media attention, Netizens' attention and public opinion attention. Klibanoff *et al.* [1] proposes for the first time that the price of a country's closed-end fund is affected by whether the country has reported in the New York Times during the corresponding period. Fang and Peress [2] proposed that there are 2 "media effects" in the stock market. Hillert and Ungeheuer [3] found that media reports cause attention-driven effects. Van der Meer and Vliegenthart [4] analysis shows that media attention has a negative impact on stock returns. Xiangqiang *et al.* [5] think that there is a correlation between media attention and stock market. Strycharz *et al.* [6] empirically concludes that media attention has a positive impact on the volatility of individual stock markets. Walker [7] believes that the media plays the role of information and behavior in the market. Rao *et al.* [8], [9] empirically believe that there is a media effect in China's stock market. Sun [10] concluded that under the limited attention hypothesis, media attention is positively related to stock volatility. On the relationship between Netizens' attention and stocks, Kahneman [11] for the first time, investors' attention is used in the analysis as a concept of behavioral finance. Barber *et al.* [12] found that Netizens' attention drives buying and selling behavior. Aboody *et al.* [13] found that under limited attention, attention has an impact on the next 5-day earnings of stocks. Klemola *et al.* [14] found that the change in Netizens' attention is partly related to the past returns of the stock market. Qianwei *et al.* [15] and others have verified that Netizens' attention brings buying pressure and keeps stocks at a high return for a period of time. The empirical study of Wang and Yang [16] and others shows that the high attention in the current period has a positive impact on the current trading volume and income, and then the return becomes negative. Andrei and Hasler [17] verified that there is a positive relationship between Netizens' attention and stock returns and trading volume. Vlastakis and Markellos [18] pointed out that stock volatility, liquidity and investor concern have a positive impact. Dzieliński *et al.* [19] concluded that different investors concerned about the good or bad news can lead to asymmetric volatility. Dimpfl and Jank [20] concluded that investors' concerns are highly correlated with stock market fluctuations and have a two-way influence. Adachi *et al.* [21] verified that investors' attention has a positive impact on stock returns and trading volume. Cen *et al.* [22], [23] pointed out that inverstor concern helps to reduce information asymmetry, which in turn plays a role in stabilizing the market, protecting investors and improving corporate governance. With regard to the research on the relationship between public opinion and stock, Zeng [24] proposed that ''network public opinion'' refers to the collection of cognitive, attitude, emotional and behavioral characteristics expressed by the participants in the network. Sabherwal *et al.* [25] studies have shown that stock market index price trends and trading activities can be predicted by user public opinion indicators in social networks. Ranco *et al.* [26] and others studied Twitter and found that public opinion attention has no significant impact on stock returns, but has a significant impact on stock abnormal returns. Si *et al.* [27] found that attention can better predict the trend of the stock market of the real estate S&P100 index. Li *et al.* [28] and others empirically concluded that public opinion attention from social networking sites can better predict the stock trend of the corresponding companies. Yang *et al.* [29] and others empirically concluded that stock returns are positively and negatively affected by public opinion. Hu *et al.* [30] verified that in the Chinese stock market, stocks with low attention can generate higher returns than those with high attention. Karkulahti *et al.* [31] studied the interaction between public opinion and daily stock price fluctuations. Siganos *et al.* [32] think that the difference of public opinion is positively related to trading volume and stock price volatility. Guijarro *et al.* [33] analyzed the impact of investor sentiment on market liquidity and transaction costs. Jiao *et al.* [34] proposed an asset pricing model based on public opinion. Zhang *et al.* [35] found that the sentiment index of institutional investors is the reason that can not be ignored. Yong *et al.* [36] and others study the impact of public opinion on the CSI 3000. The results show that the public opinion data have the greatest impact on the stock price in the Chinese stock market.

Combing the above research literature, it is found that in the current many academic studies, there is no unified standard for the quantification of attention in the stock market. In the previous literature, the research on the attention of the Internet, at the beginning, mostly selected the indirect indicators in the stock market, such as trading volume, turnover, rise and fall, such as Baker and Wurgler [37], using closed-end fund discount rate, turnover rate, average return and other indicators to form a compound index of investor attention. With the in-depth research and the development of Internet big data, scholars gradually begin to use media and Internet search engines, such as Baidu Index, Google Index and Hexun attention. At present, in the research on the impact of attention on the securities market, there is a lack

of comprehensive analysis and evaluation of the impact of media attention, netizens' attention, public opinion attention and derivative abnormal attention on the market performance of individual stocks in environment of big data. As for the performance characteristics of the stock market, most of them study one or two characteristics, such as stock returns, or stock trading volume, volatility and so on. At the research level, in the previous literature, there are many researches on the stock market index, but there are relatively few studies on the impact of Internet attention on the market performance of individual stocks in recent years. In addition, at the level of individual stocks, more consideration is given to the cross-sectional regression of stocks, while there are few articles considering time series and individual factors at the same time.

In view of the problems presented in the literature, this paper classifies Internet attention into media attention, Netizens' attention and public opinion attention, and studies the impact of three different attention levels on the performance of individual stock in the securities market. In the research model, we select the method of combining a variety of panel regression models, and deal with the attention to form an abnormal attention index to further test the impact of the abnormal attention of the stock in a certain period on the stock returns. This processing of data smoothes the data and increases the comparability between the cross sections of each stock. Test the influence of three kinds of attention on individual stock return and liquidity, and use dynamic panel to test the influence of lag attention on individual stock return and liquidity, and through establishing the GARCH model of attention degree, introduce the attention degree and the change of attention degree into the model to see its influence on stock return volatility, and strive to comprehensively and thoroughly analyze the influence between Internet attention and stock performance under the environment of big data.

II. MODEL CONSTRUCTION

A. CONCEPTUAL MODEL

The conceptual model studied and designed in this paper is shown in figure.1. This paper divides the attention into three categories: media attention, Netizens' attention and public opinion attention, and studies the impact of all kinds of attention and its derivative variables on the performance of the stock market (return, liquidity, volatility). Taking the media, Netizens's and public opinion as different subjects, this paper constructs the empirical model of different subjects' attention to individual stock return, the empirical model of different subjects' attention to individual stock liquidity, and the empirical model of different subjects' attention to stock volatility.

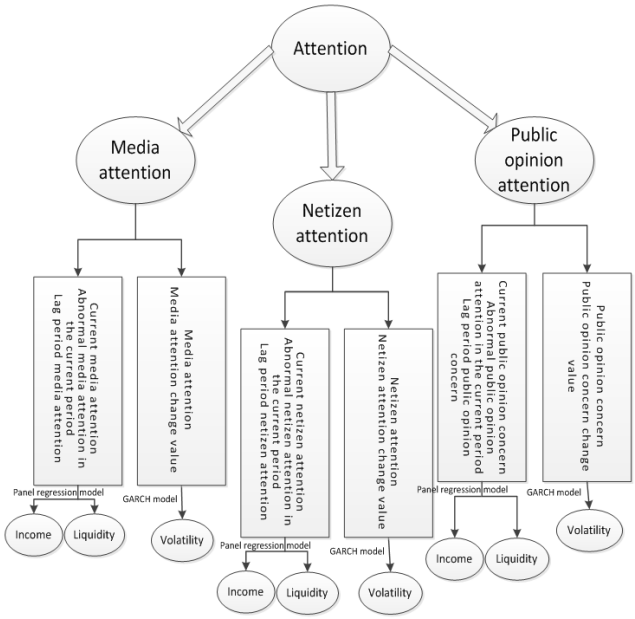

FIGURE 1. Conceptual model studied in this paper.

B. INTERNET ATTENTION DATA AND STOCK SAMPLE DATA

1) INTERNET ATTENTION DATA SOURCES

The Internet attention data used in this paper is provided by a data Technology Co., Ltd authorized by China Securities Regulatory Commission, and the attention data is authoritative. Part of the data source of Internet attention comes from Shenzhen Stock Exchange, including websites of major securities companies, Hexun, Panorama, Securities Times, and so on. The other part comes from semi-structured data of social media, semi-structured data of non-social media, and semi-structured data of authoritative news websites excavated from big data, which is generated from the Internet, and identifies the content through natural language processing. And match with listed companies, including content, release time, number of clicks, number of retweets, number of comments and so on. According to the differences of source subjects, investors' perspectives and purposes, the Internet attention is divided into media attention, netizens' attention and public opinion attention. Among them, the information release of the major media websites forms the media attention; the netizens' search attention to the stock forms the netizens' attention; the relevant information released by investors in the stock bar, Wechat and other social networking sites forms the public opinion attention. All kinds of Internet attention are calculated according to the captured authoritative media platforms, netizens' search behavior and the information data of stock bars and Wechat, and are quantified and standardized to between 0 and 100, that is, the quantitative statistics of entity reports. All kinds of Internet attention data are related to each listed company and generate daily time series data synchronously. The original data comes from a wide range of sources, with the characteristics of big data's comprehensive coverage of information, and the measurement of Internet attention is more accurate, direct, and more attractive.

For the collected return of individual stocks, trading volume, current market value, book to market value ratio and attention data from a data company, the use of python

software based on the date and stock code for integration and pre-processing.

2) STOCK SAMPLE SELECTION

In this paper, the data of A-share listed companies are collected in the Wind financial data terminal, in order to make the study of individual stock market comprehensive and representative. First of all, the selection of the research interval should include as many market states as possible, so this paper selects January 6, 2014 to February 25, 2017 as the research interval. The research interval includes the bull market rising phase from July 2014 to June 2015, the bear market decline phase from June 2015 to June 2016, and the shock adjustment phase from July 2016 to February 2017. The research interval includes a variety of market patterns, and the data are highly representative.

Secondly, using python for data integration, in all A-share markets, based on the integrity of the data, the data are screened as follows: (1) excluding newly listed stocks, ST and ST∗ stocks; (2) excluding stocks suspended for more than one month during the period; (3) excluding stocks with more negative news; (4) excluding stocks that did not participate in trading in the sample range; (5) excluding the sample stocks with missing attention data on the trading day. Based on the above operation, using the balance panel of stata software, 228 sample stocks are selected for return and liquidity analysis.

Next, when constructing a portfolio to verify the effect of returns, we only eliminate stocks with more negative news and ST and ST∗ stocks based on the early warning degree of public opinion. Based on the above, 1411 samples are selected for portfolio construction and income analysis. Finally, when analyzing the volatility of individual stocks, based on the industry classification of application level, one stock in each industry is randomly selected from 228 stocks, and a total of 22 stocks are analyzed.

To sum up, 228 stocks were selected from all China's A-share market as the research object, using the Internet attention data from January 6, 2014 to February 25, 2017, a total of 170316 daily sample attention records, a total of 510948 attention values, and each attention value is generated from the massive information on the Internet through the quantitative calculation of big data crawler and natural language processing technology. Thus, this paper constructs an empirical model of the impact of Internet attention on the performance of individual stocks in the securities market under the environment of big data.

C. VARIABLE DEFINITION

The variable definitions used by all the models in this article are shown in table 1 below.

The media attention of this article is $\boldsymbol{Mg_{it}}$, Netizens' attention is $\boldsymbol{Wg_{it}}$,The attention of public opinion is $\boldsymbol{Yg_{it}}$. In this paper, trading volume is used as an index to measure the liquidity of individual stocks,which is expressed as $\boldsymbol{Vol_{it}}$. The definition formula of individual stock return rate $\boldsymbol{R_{it}}$ is as follows:

TABLE 1. Display of variable name and definition.

Variable	Variable meaning
R_{it}	The rate of return of stock i in t period
$R`_{it}$	The Index return of Stock i in t period
Mg_{it}	Media attention of stock i in t period
A_Mg_{it}	Abnormal media attention of stock I in t period
Wg_{it}	The attention of Netizens's in the period of stock I
A_Wg_{it}	Stock I abnormal Netizens' attention in t period
Yg_{it}	Public opinion attention of stock I in t period
A_Yg_{it}	Stock I abnormal public opinion attention in t period
Vol_{it}	The logarithm of the trading volume of stock I during the t period
R_{mt}	Market rate of return in the period of Shanghai Composite Index t
Bp_{it}	Book to market value ratio, expressed as' book value per share / closing price on the trading day'
Tmv_{it}	The logarithm of the current market value of a company is expressed as' market price per share X number of outstanding common shares'.
$Delta\_mg_{it}$	Media attention change value
$Delta\_wg_{it}$	The changing value of Netizens' attention
$Delta\_yg_{it}$	The change of public opinion attention

$$R_{it} = \frac{p_{i,t} - p_{i,t-1}}{p_{i,t-1}} \tag{1}$$

where $p_{i,t}$ is the stock price of stock i on t-day.

The market rate of return $\boldsymbol{R_{mt}}$ is defined as:

$$R_{mt} = \frac{I_t - I_{t-1}}{I_{t-1}} \tag{2}$$

Among them, I_t is the value of Shanghai Composite Index on t-day. The rate of return of individual stock index is defined as:

$$R'_{it} = \ln(\frac{p_{i,t}}{p_{i,t-1}}) = \ln(R_{it} + 1) \tag{3}$$

The attention data used in this paper is calculated and generated on a daily basis. In the process of daily quantitative portfolio management, the common practice of stock fund companies is to adjust the number of stocks held and exchange stock trading objects according to the performance of attention data in a cycle of 8 to 10 consecutive days. Therefore, abnormal media attention is expressed by the difference between the current media attention and the average media attention lagging eight periods. Abnormal media attention is defined as:

$$A\_mg_{it} = \ln mg_{it} - \ln(\frac{\sum_{p=1}^{8} mg_{i,t-p}}{8}) \tag{4}$$

Abnormal Netizens' attention is expressed by the difference between the current Netizens' attention and the average Netizens' attention which lags behind eight periods. Abnormal

Netizens' attention is defined as:

$$A\_wg_{it} = \ln wg_{it} - \ln(\frac{\sum_{p=1}^{8} wg_{i,t-p}}{8}) \quad (5)$$

Abnormal public opinion attention is expressed by the difference between the current public opinion attention degree and the average public opinion attention degree of the eight periods lagging behind. Abnormal public opinion attention is defined as:

$$A\_yg_{it} = \ln yg_{it} - \ln(\frac{\sum_{p=1}^{8} yg_{i,t-p}}{8}) \quad (6)$$

Finally, through the method of grouping and constructing the investment portfolio according to the order of attention, we compare the income differences between different portfolios and show whether the degree of attention can bring excess returns. Thus we can see the influence of the degree of attention on the return of stock portfolio construction. The formula for calculating the rate of return of the portfolio is as follows:

$$R_{it} = \sum_{i=1}^{n} \omega_{jt} r_{jt} \quad (7)$$

Among them, $\omega_{\mathbf{jt}}$ is the weighted value of the number of stocks in the portfolio, and $\boldsymbol{r}_{\mathbf{jt}}$ is the rate of return of individual stocks in the portfolio.

The change in media attention is defined as:

$$Delta\_mg_t = \ln mg_t - \ln mg_{t-1} \quad (8)$$

The change of Netizens' attention is defined as:

$$Delta\_wg_t = \ln wg_t - \ln wg_{t-1} \quad (9)$$

The change of public opinion attention is defined as:

$$Delta\_yg_t = \ln yg_t - \ln yg_{t-1} \quad (10)$$

D. EMPIRICAL MODEL

1) THE MODEL SETTING OF INDIVIDUAL STOCK RETURN BY DIFFERENT SUBJECTS' ATTENTION

Attention will have an impact on the decision-making behavior of investors, and then affect the characteristics of stocks. In this section, we will use media attention, Netizens' attention and public opinion to establish panel regression models, taking the return of individual stocks as the explanatory variable and the attention as the explanatory variable. First of all, because the attention of the three subjects has a connection effect, so the correlation coefficient of attention between the subjects is larger, in order to avoid the collinearity of the model, the models are established respectively and the regression test is carried out. Secondly, the development of the financial market has made extensive development, and the influencing factors of the financial market are gradually being excavated. In traditional finance, Fama and French [38] established a three-factor model, and selected market return factor, book value factor and market size factor as explained variables, and chooses the same factor for each individual, which leads to pay attention to individual differences and ignore individual differences in cross section. In the actual financial market, the cognitive differences between different subjects and within the subjects lead to different attention to individual stocks, resulting in different corporate valuations and judgments. The subject's limited attention theory, cognitive resource theory, selective attention theory and previous theory show that the subject pays different attention to individual stocks. Based on the three-factor theory, this paper analyzes individual stocks from the cross-sectional level and individual time series level, and selects the market value of individual stocks to replace the market size factor and the book-to-market value ratio (reciprocal of price-to-book ratio) to replace the book market value factor. The panel regression model is established as follows:

$$R_{it} = \alpha + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h BP_{it} + \varepsilon_{it} \quad (11)$$

$$R_{it} = \alpha + \beta_0 \ln Mg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (12)$$

$$R_{it} = \alpha + \beta_1 \ln Wg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (13)$$

$$R_{it} = \alpha + \beta_2 \ln Yg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (14)$$

Adding abnormal attention to the model to study its impact on stock returns, the benefits of introducing abnormal attention are: one is to reduce the error caused by individual differences in attention data; the other is to smooth the data and reduce noise.

$$R_{it} = \alpha + \beta_2 A\_Mg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (15)$$

$$R_{it} = \alpha + \beta_2 A\_Wg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (16)$$

$$R_{it} = \alpha + \beta_2 A\_Yg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (17)$$

In the above model, in order to eliminate the possible heteroscedasticity, the relevant variables in the model are logarithmized. Because there are many negative numbers in R_{it} and R_{mt}, and the logarithm of Bp itself is small, the coefficient is small, so the logarithm of these three variables is not processed. In order to dynamically study the influence of attention on the rate of return of individual stocks, the fifth-order lag concern measure of attention degree and the mean attention degree of order 10 are added to the regression model to dynamically analyze the influence of lag-order attention on individual stock return. The panel regression model of dynamic establishment of each attention degree is shown as follows:

$$R_{it} = \alpha + \beta_0 \ln Mg_{i,t-j} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (18)$$

$$R_{it} = \alpha + \beta_1\left(\frac{\sum_{p=5}^{10} \ln Mg_{i,t-p}}{5}\right) + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (19)$$

$$R_{it} = \alpha + \beta_0 \ln Wg_{i,t-j} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (20)$$

$$R_{it} = \alpha + \beta_1\left(\frac{\sum_{p=5}^{10} \ln Wg_{i,t-p}}{5}\right) + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (21)$$

$$R_{it} = \alpha + \beta_0 \ln Yg_{i,t-j} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (22)$$

$$R_{it} = \alpha + \beta_1\left(\frac{\sum_{p=5}^{10} \ln Yg_{i,t-p}}{5}\right) + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (23)$$

2) THE MODEL SETTING OF INDIVIDUAL STOCK LIQUIDITY BY DIFFERENT SUBJECTS' ATTENTION

The trading volume of individual stocks is chosen as the proxy index of individual stock liquidity, because the trading volume is easily obtained by investors, and it is an important and direct index to measure liquidity in the financial market. Attention will have an impact on the returns of stocks, and similarly, this attention will also affect the trading volume of stocks. When studying the relationship between attention and trading volume, Vlastakis controls market returns and other corporate characteristics [18]. Based on the above research, this paper still selects the control variables as market rate of return (Rm), current market value (Tmv) and book market value ratio (Bp), to establish the panel regression model as follows:

$$Vol_{it} = \alpha + \beta_0 \ln Mg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (24)$$

$$Vol_{it} = \alpha + \beta_0 \ln Wg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (25)$$

$$Vol_{it} = \alpha + \beta_0 \ln Yg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (26)$$

Add abnormal attention to the model to study its impact on stock returns, and the modeling is as follows:

$$Vol_{it} = \alpha + \beta_0 A\_Mg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (27)$$

$$Vol_{it} = \alpha + \beta_0 A\_Wg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (28)$$

$$Vol_{it} = \alpha + \beta_0 A\_Yg_{it} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (29)$$

Based on the analysis of the lag of the model, the dynamic panel model is established as follows:

$$Vol_{it} = \alpha + \beta_j \ln Mg_{i,t-j} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (30)$$

$$Vol_{it} = \alpha + \beta_1\left(\frac{\sum_{p=5}^{10} \ln Mg_{i,t-p}}{5}\right) + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (31)$$

$$Vol_{it} = \alpha + \beta_0 \ln Wg_{i,t-j} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (32)$$

$$Vol_{it} = \alpha + \beta_1\left(\frac{\sum_{p=5}^{10} \ln Wg_{i,t-p}}{5}\right) + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (33)$$

$$Vol_{it} = \alpha + \beta_0 \ln Yg_{i,t-j} + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (34)$$

$$Vol_{it} = \alpha + \beta_1\left(\frac{\sum_{p=5}^{10} \ln Yg_{i,t-p}}{5}\right) + \beta_m R_{mt} + \beta_s \ln Tmv_{it} + \beta_h Bp_{it} + \varepsilon_{it} \quad (35)$$

3) THE MODEL SETTING OF INDIVIDUAL STOCK VOLATILITY BY DIFFERENT SUBJECTS' ATTENTION

At present, the GARCH model is widely used to analyze the volatility effects in the stock market. This is because the eigenvalues of financial time series such as stock return and foreign exchange rate tend to appear in clusters in a certain period of time. For example, the rate of return in the stock market is clustered, and larger fluctuations are followed by larger fluctuations. Correspondingly, smaller fluctuations will also show smaller fluctuations, and this fluctuation will change with the change of time, and its variance is not fixed and clustered. In the traditional theoretical model, the variance of the interference term is regarded as a constant, which has been proved to be unreasonable in some studies. In 1992, Campbell and Hentschel [39] through the GARCH model experiment showed that when there was news impact on the market, the discount rate of stock price volatility increased from 0.5% to 13%, and explained that considering the news shock in the model made the model more explanatory. In this section, first of all, we propose to use the GARCH model to analyze the impact on the volatility of individual stock returns after adding the explanatory variable of attention. Among them, in the stock market, the influence variable of income is more complex, this paper mainly observes the fluctuation of income, so in the mean equation, it is assumed that no variable can explain the change of income; the model GARCH (1,1) is as follows:

$$\begin{aligned} R_t &= c + \varepsilon_t \\ h_t &= c + \alpha\varepsilon_{t-1}^2 + \lambda h_{t-1}^2 + \gamma \ln mg_t \end{aligned} \quad (36)$$

$$R_t = c + \varepsilon_t$$
$$h_t = c + \alpha\varepsilon_{t-1}^2 + \lambda h_{t-1}^2 + \gamma \ln yg_t \quad (37)$$
$$R_t = c + \varepsilon_t$$
$$h_t = c + \alpha\varepsilon_{t-1}^2 + \lambda h_{t-1}^2 + \gamma \ln yg_t \quad (38)$$

Secondly, in the GARCH model, after adding the variable of attention, the influence of the change on the return fluctuation of individual stocks is tested, and the model is established as follows:

$$R_t = c + \varepsilon_t$$
$$h_t = c + \alpha\varepsilon_{t-1}^2 + \lambda h_{t-1}^2 + \gamma delta\_mg_t \quad (39)$$
$$R_t = c + \varepsilon_t$$
$$h_t = c + \alpha\varepsilon_{t-1}^2 + \lambda h_{t-1}^2 + \gamma delta\_wg_t \quad (40)$$
$$R_t = c + \varepsilon_t$$
$$h_t = c + \alpha\varepsilon_{t-1}^2 + \lambda h_{t-1}^2 + \gamma delta\_yg_t \quad (41)$$

III. EMPIRICAL ANALYSIS

A. DESCRIPTIVE STATISTICS OF DATA

According to the description of Table 2 below, the average daily return R is 0.00120, the minimum is-0.662, the maximum is 0.102, and the variance is 0.0339, which shows that the returns of stocks of different companies are quite different. The average value of media attention is 22.50, the minimum is 0, the maximum is 99.90, and the standard deviation is 20.31, which shows that media attention varies greatly among different enterprises. Similarly, Netizens' attention and public opinion are quite different in different enterprises, indicating that it is necessary to study the influence of attention at the level of individual stocks. In addition, the standard deviation of public opinion attention is the smallest and that of media attention is the largest.

TABLE 2. Variable descriptive statistics.

	Obs	Mean	Std.Dev.	Min	Max
R	152,304	0.00120	0.0339	-0.662	0.102
Vol	152,304	3.510e+07	1.130e+08	107100	5.110e+09
Mg	152,304	22.50	20.31	0	99.90
Wg	152,304	41.15	20.17	0	100
Yg	152,304	29.98	17.20	0	99.94
Pb	152,304	3.887	10.60	-108.2	590.8
Rm	152,304	0.000865	0.0181	-0.0849	0.0576
Tmv	152,304	4.280e+10	1.570e+11	8.890e+08	2.370e+12

Data source: WIND database

According to the description of the correlation coefficient in Table 3, most of the correlation coefficients among the variables in the model are significant, only the correlation coefficient of individual circulating market value is not significant. In terms of quantity, each attention degree has a strong correlation with trading volume and a small correlation with the rate of return. The correlation between Netizens' attention and media attention is relatively small, while media attention is highly correlated with public opinion attention. On the other hand, each degree of attention has a positive correlation with the rate of return and trading volume. In addition, the absolute values of Pearson correlation coefficients between variables are all less than 0.7, indicating that there is no serious multicollinearity problem among variables. From the results of LLC stationarity test of table 4 variables, it can be seen that all variables are stationary, and a panel regression model can be established.

B. AN EMPIRICAL ANALYSIS OF THE EFFECT OF DIFFERENT SUBJECTS' ATTENTION ON THE RATE OF RETURN OF INDIVIDUAL STOCKS

1) MODEL CHECKING

Because the experimental data in this paper are panel data, the panel regression types are tested and selected before the formal regression. First of all, the model set above is tested. The cross-sectional effect of the model is determined by chow test, and the hypothesis H0 is put forward: the coefficient of each cross-section is the same, and the mixed regression effect model is selected; then, the intercept effect of the model is determined by hausman test, and the hypothesis H0 is put forward: the individual intercept is the same, and the random effect model is selected.

As shown in Table 5, the OLS regression results are listed in the first column, the fixed effect regression results are listed in the second column, and the random effect regression results are listed in the third column. The test results in the table show that the statistical value of F is 2.47 and the probability Prob is 0.0000, so the original hypothesis is strongly rejected, indicating that the fixed effect is obviously better than mixed regression. The Chi2 value is 479.56 and the probability Prob is 0.0000, so the original hypothesis is strongly rejected, indicating that a fixed effect model should be established.

The above chow test and hauseman test are used to test the model, and the results are shown in Table 6:

2) EMPIRICAL RESULT ANALYSIS

According to the set models (11), (12), (13), (14), (15), (16), (17), the rate of return is taken as the explained variable, the attention as the explanatory variable, the company's current market value, the market rate of return and the book-to-market value ratio of individual stocks as the control variables, and the sample stocks are analyzed by panel regression. The results are shown in Table 7.

According to the set model, the panel regression analysis of the sample stock is carried out by taking the rate of return as the explained variable, the abnormal attention as the explanatory variable, the company's current market value, the market rate of return and the book-to-market value ratio of individual stocks as the control variables. The results are shown in Table 8. According to the panel regression results in Table 7, media attention, Netizens' attention and public opinion attention are all significant at the significant level of 1% 16, and other control variables are also significant at 1% level. Table 8 shows that media abnormal attention,

TABLE 3. Correlation coefficient between variables.

	R	Vol	Mg	Wg	Yg	Bp	Rm	Tmv
R	1							
Vol	0.050***	1						
Mg	0.051***	0.365***	1					
Wg	0.020***	0.322***	0.420***	1				
Yg	0.045***	0.410***	0.904***	0.765***	1			
Bp	0.009***	-0.034***	-0.042***	-0.022***	-0.040***	1		
Rm	0.647***	0.009***	0.007***	-0.022***	-0.006***	0.004***	1	
Tmv	0.001***	0.415***	0.575***	0.348***	0.572***	-0.047***	0.002***	1

t statistics in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.0$

TABLE 4. LLC stationarity test results of variables.

	r	lnvol	lnmg	lnwg	lnyg	rtn	bp	lnmarval
T	-3.0e+02	-68.8603	-1.6e+02	-90.9690	-1.3e+02	-3.0e+02	-17.7310	-13.8569
P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Result	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary

TABLE 5. Model (12) regression results.

□	(1) OLS	(2) FE	(3) RE
lnMg	0.002***	0.003***	0.002***
	(24.054)	(29.723)	(25.998)
Rm	1.212***	1.211***	1.212***
	(271.804)	(331.953)	(331.976)
lnBp	-0.002***	-0.004***	-0.002***
	(-10.050)	(-5.303)	(-9.289)
lnTmv	-0.001***	0.002***	-0.001***
	(-9.071)	(7.826)	(-8.758)
_cons	0.009***	-0.058***	0.009***
	(6.605)	(-8.315)	(6.280)
N	152304	152304	152304
R2	0.4220	0.4239	0.4228
F	18674.02	27975.75	
Wald			111185.93
prob	0.0000	0.0000	0.0000

F test that all u_i=0: F(227, 152072) = 2.47 Prob > F = 0.0000

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 479.56

Prob>chi2 = 0.0000

t statistics in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

netizens' abnormal attention and public opinion abnormal attention are all significant under 1%, and the control variables are also significant.

From the regression results, first of all, when the concern variable is added to the model, the goodness of fit of the model is improved from 41.04% to 42.39%, which increases the degree of interpretation of the model. In addition, through the test results, we can see that the coefficient of attention of different subjects in the current period has a positive impact on the rate of return of individual stocks, that is, the more attention individual stocks receive, the higher the income of individual stocks; the abnormal attention of the current period also has a significant positive impact on the coefficient of income.

From the point of view of the coefficient of attention, the influence degree of abnormal attention in the current period is higher than that in the current period. Through limited attention, we can know that there is a processing link similar to a ''filter'' in the brain, and only the filtered information will stimulate investors, make investors pay attention, and then trigger buying behavior, which will produce positive pressure on prices and increase stock returns.

In order to further analyze the impact of attention on the rate of return, on the basis of the above model, adding different lag order variables of attention, a panel regression model is established for dynamic analysis. According to tables 9, 10 and 11, the lag values of different subjects' attention are significant under 1% significance, and other variables in the model are also significant at 1%. The regression results shown in table 9, 10 and 11 are analyzed. There is a multiple regression between the lag value of each period of attention and the rate of return, and the lag of attention changes from the positive relationship of the current period to the negative relationship from the first period to the tenth period. From this we can see that the income brought by the attention in

TABLE 6. All model check results in this section.

Model formula		F	P	Chi-Sq	P	Selection result
(11)		1.55	0.0000	272.08	0.0000	Fixed effect
(12)		2.47	0.0000	479.56	0.0000	Fixed effect
(13)		1.68	0.0000	304.60	0.0000	Fixed effect
(14)		2.71	0.0000	535.92	0.0000	Fixed effect
(15)		1.41	0.0000	239.05	0.0000	Fixed effect
(16)		1.50	0.0000	261.68	0.0000	Fixed effect
(17)		1.42	0.0000	242.82	0.0000	Fixed effect
	(1)	1.54	0.0000	269.98	0.0000	Fixed effect
	(2)	1.56	0.0000	273.78	0.0000	Fixed effect
(18)	(3)	1.58	0.0000	278.53	0.0000	Fixed effect
	(4)	1.61	0.0000	285.93	0.0000	Fixed effect
	(5)	1.57	0.0000	275.05	0.0000	Fixed effect
(19)		1.70	0.0000	304.04	0.0000	Fixed effect
	(1)	1.51	0.0000	265.18	0.0000	Fixed effect
	(2)	1.53	0.0000	269.78	0.0000	Fixed effect
(20)	(3)	1.53	0.0000	270.59	0.0000	Fixed effect
	(4)	1.55	0.0000	273.57	0.0000	Fixed effect
	(5)	1.54	0.0000	271.36	0.0000	Fixed effect
(21)		1.52	0.0000	265.50	0.0000	Fixed effect
	(1)	1.54	0.0000	272.30	0.0000	Fixed effect
	(2)	1.53	0.0000	268.75	0.0000	Fixed effect
(22)	(3)	1.53	0.0000	269.08	0.0000	Fixed effect
	(4)	1.55	0.0000	272.43	0.0000	Fixed effect
	(5)	1.51	0.0000	263.75	0.0000	Fixed effect
(23)		1.49	0.0000	259.87	0.0000	Fixed effect

t statistics in parentheses, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

TABLE 7. The regression results of each attention to the return of individual stocks in the current period.

	Model (11)	Model (12)	Model (13)	Model (14)
lnMg		0.003***		
		(15. 32)		
lnWg			0.001***	
			(7.94)	
lnYg				0.005***
				(8.82)
Rm	1.212***	1.211***	1.213***	1.214***
	(109.09)	(108.76)	(109.04)	(108.70)
Bp	-0.004***	-0.004***	-0.003***	-0.002***
	(-3.72)	(-3.89)	(-2.42)	(-1.51)
lnTmv	0.003***	0.002***	0.003***	0.003***
	(4.75)	(3.80)	(5.00)	(4.00)
_cons	-0.067***	-0.058***	-0.079***	-0.082***
	(-4.61)	(-4.07)	(-5.02)	(-4.56)
N	152304	152304	152304	152304
R2	0.4104	0.4239	0.4210	0.4238
F	36793.00	27975.75	27645.90	27957.29
prob	0.0000	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level.The value of t is significant when $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

TABLE 8. The regression results of each abnormal attention to the return of individual stocks in the current period.

	Model(15)	Model(16)	Model(17)
A_Mg	0.004***		
	(21.23)		
A_Wg		0.002***	
		(16.32)	
A-Yg			0.007***
			(23.36)
Rm	1.208***	1.214***	1.215***
	(109.70)	(109.37)	(109.70)
lnTmv	0.003***	0.003***	0.003***
	(4.88)	(5.06)	(5.04)
Bp	-0.004***	-0.004***	-0.003***
	(-3.53)	(-2.88)	(-3.07)
_cons	-0.063***	-0.067***	-0.065***
	(-4.65)	(-4.84)	(-4.82)
N	151164	151164	151164
R2	0.4269	0.4225	0.4272
F	28108.68	27603.04	28146.67
prob	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level. The value of t is significant when $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

the current period is only temporary, and with the passage of time, the income reverses, that is, the lag attention will make the income fall. However, the effect of fundamental indicators such as market rate of return on individual stock returns has not changed, which shows that the impact of different subjects' attention from the Internet on earnings is independent from the traditional impact indicators.

In addition, from the perspective of the persistence of the influence of attention, the income reverses in the lag period, which also means that the influence of attention is not related to the control variables. The reversal of returns can be explained as that when hot spots appear, investors will pay attention to the event subject, generate investment enthusiasm, generate overconfidence, and promote the rise of stock prices, while the market is transactional, and this ituation will reverse in a short period of time. For example, the experimental results show that when stocks lag one period, there is an inverse relationship between returns and concerns, which shows that when the market is in the doldrums, Investors conduct short-term trading in the market. At the same time, investors overreact to the lack of awareness of the incident and the lack of experience, which is then corrected by the market. And the reversal effect is persistent, which can be explained by the prospect theory, and the investors who get the return adopt the conservative trading strategy.

As can be seen from the above results, the numerical value of each lag period of media attention does not change much, but the lag value increases in the fifth period, indicating that the effect of lag attention appears to be enhanced; while

TABLE 9. Regression results of media attention to individual stock returns in the current period and lag period.

Model	(12)	(18)-(1)	(18)-(2)	(18)-(3)	(18)-(4)	(18)-(5)	(19)
lnMg	0.003***						
	(15. 32)						
$lnMg_{t-1}$		-0.001***					
		(-6.94)					
$lnMg_{t-2}$			-0.001***				
			(-10.05)				
$lnMg_{t-3}$				-0.001***			
				(-10.81)			
$lnMg_{t-4}$					-0.001***		
					(-11.77)		
$lnMg_{t-5}$						-0.001***	
						(-8. 83)	
$\overline{\sum_{J=5}^{10} \ln Mg_{t-j}}$							-0.002***
							(-7.25)
Rm	1.211***	1.212***	1.212***	1.212***	1.212***	1.211***	1.211***
	(108.76)	(109.14)	(109. 18)	(109.11)	(109.32)	(109.01)	(109.06)
lnTmv	0.002***	0.003***	0.003***	0.003***	0.003***	0.003***	0.004***
	(3.80)	(4.73)	(4.86)	(4. 95)	(5.00)	(4.94	(4.69)
Bp	-0.004***	-0.004***	-0.004***	-0.003***	-0.003***	-0.003***	-0.003***
	(-3.89)	(-3.96)	(-3.02)	(-3. 39)	(-3.35)	(-3.39)	(-3.62)
_cons	-0.058***	-0.069***	-0.071***	-0.072***	-0.073***	-0.072***	-0.076***
	(-4.07)	(-4.25)	(-3.98)	(-4.56)	(-4.59)	(-4.57)	(-3.95)
N	152304	152076	151848	151620	151392	151164	150024
R2	0.4239	0.4208	0.4212	0.4217	0.4219	0.4218	0.4248
F	27975.75	27582.54	27578.62	27593.63	27575.55	27528.21	27651.94
prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level. The value of t is significant when $*\ p < 0.1$, $**\ p < 0.05$, $***\ p < 0.01$.

Netizens' attention begins to lag in the fourth period, and the coefficient decreases gradually. It shows that in the lag period, the influence of Netizens' attention begins to weaken, while the influence of public opinion does not change significantly. The above results are because different subjects have different sources of attention, different characteristics, different persistence, media attention because of its formality, openness and information dissemination, the impact of reversal is significantly enhanced in the later stage; Netizens' attention comes from investors, investors' attention is limited, and the reversal effect begins to weaken in the later stage. The lagging value of public opinion attention in each period has always shown considerable influence. Due to the particularity of the Chinese stock market and the status of public opinion, it has been gradually recognized and the influence has maintained considerable persistence.

3) CONSTRUCTING THE RETURN TEST OF INVESTMENT PORTFOLIO

According to the above regression results, we excluded ST, ST∗ stocks from A shares, excluded stocks with a lot of negative news during the research period, extracted 1411 sample stocks, established corresponding investment portfolios, screened out all A shares to enhance the applicability of portfolio construction, and the stocks in the sample included stocks from Shanghai and Shenzhen stock markets, covering all industries, by simply buying stocks with high attention in the current period. The purpose of this paper is to construct the investment portfolio to test the effect of attention on the return of individual stocks.

First of all, at the beginning of each time period, the research samples are sorted according to the descending order of factors, which are equally divided into 5 combinations, and the grouping of the research samples is adjusted at the beginning of every 10 trading days. Then the portfolio rate of return and annualized rate of return are calculated for the five combinations of the study sample. Finally, the income differences between different combinations are compared, and the significance of the portfolio income is tested. Next, calculate the rate of return of the grouped portfolio, see how attention affects the return of individual stocks through the average rate of return of the portfolio, and calculate the equal rate of return of each portfolio in the next 10 days in the grouped sample. Finally, the average rate of return in the total time of the portfolio is obtained by averaging at the time series level.

TABLE 10. Regression results of Netizens' attention to individual stock returns in the current period and lag period.

Model	(13)	(20)-(1)	(20)-(2)	(20)-(3)	(20)-(4)	(20)-(5)	(21)
lnWg	0.001***						
	(7.94)						
$lnWg_{t-1}$		-0.001***					
		(-6.62)					
$lnWg_{t-2}$			-0.001***				
			(-9.22)				
$lnWg_{t-3}$				-0.001***			
				(-7.27)			
$lnWg_{t-4}$					-0.001***		
					(-7.95)		
$lnWg_{t-5}$						-0.000***	
						(-4.11)	
$\overline{\sum_{J=5}^{10} \ln Wg_{t-j}}$							-0.000***
							(-3.36)
Rm	1.213***	1.212***	1.212***	1.212***	1.211***	1.212***	1.212***
	(109.04)	(109.09)	(109.05)	(109.02)	(109.07)	(109.07)	(108.98)
lnTmv	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(5.00)	(4.55)	(4.42)	(4.53)	(4. 48)	(4.63)	(4.63)
Bp	-0.003***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***
	(-2.42)	(-4.11)	(-4.33)	(-4.10)	(-4.26)	(-3.91)	(-3.57)
_cons	-0.079***	-0.063***	-0.059***	-0.062***	-0.061***	-0.065***	-0.067***
	(-5.02)	(-4.17)	(-3.96)	(-4.13)	(-4.04)	(-4.30)	(-4.28)
N	152304	152076	151848	151620	151392	151164	150024
R2	0.4210	0.4208	0.4210	0.4213	0.4215	0.4215	0.4239
F	27645.90	27576.26	27565.88	27554.11	27530.53	27490.20	27556.26
prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level. The value of t is significant when * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

According to the above, the portfolio income is obtained, and the comparison results are shown in table 12, table 13 and table 14. As shown in the table, the return of each high-attention portfolio is higher than that of the low-attention portfolio, which is consistent with the positive impact of the above-mentioned high-attention combination, indicating that by buying the combination of high attention in the current period, selling the combination of low attention can obtain excess returns, and draw the portfolio income comparison figure.2 of each attention.

C. AN EMPIRICAL ANALYSIS OF THE EFFECT OF DIFFERENT SUBJECTS' ATTENTION ON THE LIQUIDITY OF INDIVIDUAL STOCKS

1) MODEL CHECKING

Because the data used in this section is still panel data, the panel data is tested separately, and the corresponding applicable model is selected. The selection results of each model are shown in table 15 below. According to the test results in the table, the panel regression model with fixed effect is still selected in this section.

2) EMPIRICAL RESULT ANALYSIS

According to the above test results, the corresponding regression model is established, and the results of the multivariate panel regression model on the attention of individual stock trading volume to different subjects in the current period are as follows. First of all, from the table 16 and table 17, the media attention, Netizens' attention, public opinion attention, abnormal media attention, abnormal Netizens' attention and abnormal media attention are all significant under 1%. Other control variables in the model are also significant under 1%. From the coefficient of each attention and abnormal attention, the influence of each attention and abnormal attention on the trading volume of individual stocks is positive, which shows that the increase of attention leads to the increase of trading volume, which is consistent with the theory of attention effect. From the point of view of the

TABLE 11. Regression results of public opinion attention to individual stock returns in the current period and lag period.

Model	(14)	(22)-(1)	(22)-(2)	(22)-(3)	(22)-(4)	(22)-(5)	(23)
lnYg	0.005***						
	(8.82)						
$lnYg_{t-1}$		-0.001***					
		(-6.94)					
lnYgt-2			-0.002***				
			(-10.03)				
lnYgt-3				-0.002***			
				(-9.76)			
lnYgt-4					-0.002***		
					(-9.97)		
lnYgt-5						-0.002***	
						(-7.50)	
$\overline{\sum_{J=5}^{10} \ln Yg_{t-j}}$							-0.002***
							(-7.25)
Rm	1.215***	1.212***	1.212***	1.212***	1.212***	1.212***	1.211***
	(109.70)	(109.14)	(109.08)	(109.03)	(109. 19)	(109.11)	(109.06)
Bp	-0.003***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***
	(-3.07)	(-3.96)	(-4.02)	(-3.97)	(-3.96)	(-3.93)	(-3.62)
.lnTmv	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(5.04)	(4.73)	(4.66)	(4.69)	(4.67)	(4. 75)	(4.69)
_cons	-0.065***	-0.064***	-0.064***	-0.064***	-0.062***	-0.064***	-0.064***
	(-4.82)	(-4.25)	(-3.98)	(-4.04)	(-3.94)	(-4.22)	(-3.95)
N	152304	152076	151848	151620	151392	151164	150024
R2	0.4238	0.4122	0.4210	0.4213	0.4216	0.4215	0.4221
F	27957.29	27580.35	27566.09	27549.13	27544.46	27489.05	27349.83
prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level. The value of t is significant when $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

TABLE 12. Comparison between media attention and current stock cross-sectional returns.

Average monthly return of each portfolio					The difference between M-AT (1) and M-AT (5)		
M-AT(1)	M-AT(2)	M-AT(3)	M-AT(4)	M-AT(5)	G	t(G)	p
1.51	1.92	2.08	2.24	2.42	0.91	0.504	0.614

TABLE 13. Comparison between Netizens' attention and current stock cross-sectional returns.

Average monthly return of each portfolio					The difference between I-AT (1) and I-AT (5)		
I-AT(1)	I-AT(2)	I-AT(3)	I-AT(4)	I-AT(5)	G	t(G)	p
1.57	1.80	2.14	2.48	2.88	1.31	5.868	0.00606

TABLE 14. Comparison between public opinion attention and current stock returns.

Average monthly return of each portfolio					The difference between Yq (1) and Yq (5)		
Yq(1)	Yq(2)	Yq(3)	Yq(4)	Yq(5)	G	t(G)	p
1.48	1.85	2.06	2.28	2.56	1.08	37.0794	0.0000

coefficient of attention, the impact of public opinion is the greatest, followed by Netizens's, and the least media attention, which is in line with the increasingly important position of public opinion in the stock market.

3) AN EMPIRICAL ANALYSIS OF THE EFFECT OF LAG ATTENTION ON STOCK LIQUIDITY

Then, the attention lag study is added to the model, and a multiple panel regression model is established to dynamically

TABLE 15. Panel model test results.

Model		F	P	Chi-	P	Selection
(24)		908.06	0.0000	715.99	0.0000	Fixed effect
(25)		911.38	0.0000	714.20	0.0000	Fixed effect
(26)		568.45	0.0000	976.13	0.0000	Fixed effect
(27)		972.04	0.0000	622.44	0.0000	Fixed effect
(28)		908.46	0.0000	718.03	0.0000	Fixed effect
(29)		903.78	0.0000	715.91	0.0000	Fixed effect
(30)		909.91	0.0000	714.80	0.0000	Fixed effect
(31)	(1)	908.44	0.0000	719.40	0.0000	Fixed effect
	(2)	906.42	0.0000	725.56	0.0000	Fixed effect
	(3)	905.64	0.0000	730.85	0.0000	Fixed effect
	(4)	905.09	0.0000	735.77	0.0000	Fixed effect
	(5)	904.85	0.0000	740.84	0.0000	Fixed effect
(32)		903.38	0.0000	764.89	0.0000	Fixed effect
(33)	(1)	968.86	0.0000	578.23	0.0000	Fixed effect
	(2)	962.39	0.0000	587.54	0.0000	Fixed effect
	(3)	956.16	0.0000	596.25	0.0000	Fixed effect
	(4)	954.04	0.0000	602.45	0.0000	Fixed effect
	(5)	949.69	0.0000	611.22	0.0000	Fixed effect
(34)		973.92	0.0000	570.08	0.0000	Fixed effect
(35)	(1)	955.84	0.0000	636.40	0.0000	Fixed effect
	(2)	942.60	0.0000	650.25	0.0000	Fixed effect
	(3)	933.83	0.0000	661.66	0.0000	Fixed effect
	(4)	930.57	0.0000	669.20	0.0000	Fixed effect
	(5)	926.90	0.0000	677.14	0.0000	Fixed effect
(36)		934.75	0.0000	665.10	0.0000	Fixed effect

TABLE 16. The empirical results of current attention to individual stock trading volume.

	Model(11)	Model(24)	Model(25)	Model(26)
lnMg		0.050***		
		(21.274)		
lnWg			0.299***	
			(112.700)	
lnYg				0.428***
				(101.748)
Rm	0.569***	0.552***	0.771***	0.736***
	(5.877)	(5.710)	(8.298)	(7.860)
Bp	0.214***	0.201***	0.301***	0.210***
	(27.795)	(26.028)	(40.396)	(28.165)
lnTmv	-2.973***	-2.981***	-2.706***	-2.846***
	(-144.943)	(-145.519)	(-136.324)	(-143.097)
_cons	12.772***	12.947***	9.587***	11.415***
	(69.223)	(70.203)	(53.415)	(63.759)
N	152304	152304	152304	152304
R2	0.2444	0.2466	0.3026	0.2925
F	16393.03	12444.43	16496.85	15719.86
prob	0.0000	0.0000	0.0000	0.0000

TABLE 17. The regression result of abnormal attention to individual stock trading volume in the current period.

	Model(27)	Model(28)	Model(29)
A_Mg	0.095***		
	(36.988)		
A_Wg		0.070***	
		(21.269)	
A-Yg			0.200***
			(41.294)
Rm	0.486***	0.662***	0.655***
	(5.036)	(6.841)	(6.800)
Bp	0.211***	0.216***	0.214***
	(27.381)	(27.878)	(27.738)
lnTmv	-2.983***	-2.983***	-2.975***
	(-145.415)	(-144.957)	(-145.163)
_cons	12.840***	12.737***	12.779***
	(69.460)	(68.699)	(69.210)
N	151164	151164	151164
R2	0.2530	0.2485	0.2545
F	12779.68	12475.96	50835.98
Prob	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level.The value of t is significant when*p < 0.1,**p < 0.05,***p < 0.01.

analyze the impact of attention on trading volume. The model regression results are shown in table 18, table 19 and table 20.

According to the above analysis results, we find that there are significant differences in the impact of different subjects' attention lag on trading volume. First of all, from the results, the impact of the lagging items of media attention on trading volume and the impact of control variables on trading volume are independent, which is reflected in the reversal of media attention in the four lagging periods, from positive to negative. The lag values of Netizens' attention and public opinion attention in each period do not show a reversal effect, but show persistence, so the impact of Netizens' attention and public opinion attention on trading volume and the influence of control volume may not be independent.

From the attention coefficient of each lag period, the influence of media attention on the trading volume showed a significant positive correlation in the current period, followed by three periods of positive correlation, which reversed from the fourth period. This is because: as an important disseminator of information in the stock market, the information and attention released by the media can give investors reference, but the trading volume brought about by media attention increases and is gradually discovered. Investors began

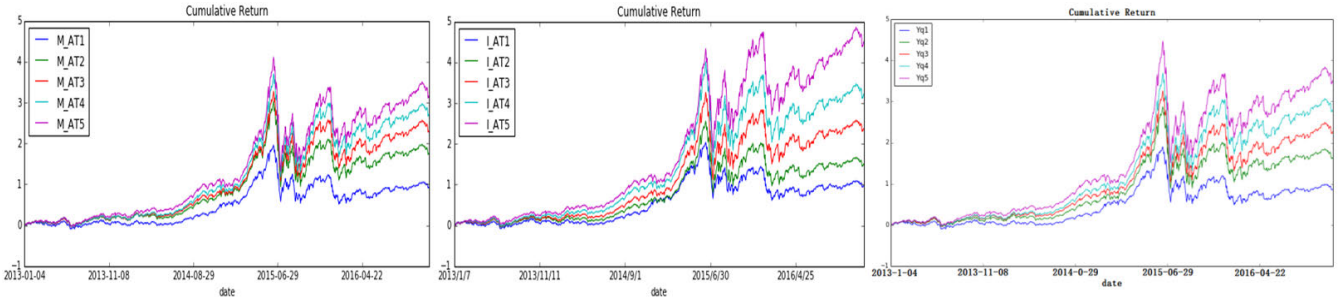

FIGURE 2. Combined income chart of three types of attention.

TABLE 18. Dynamic analysis results of media attention and trading volume in the late lag period.

Model	(24)	(31)-(1)	(31)-(2)	(31)-(3)	(31)-(4)	(31)-(5)	(32)
lnMg	0.050***						
	(21.274)						
$lnMg_{t-1}$		0.029***					
		(12.321)					
$lnMg_{t-2}$			0.001				
			(0.629)				
$lnMg_{t-3}$				-0.014***			
				(-6.101)			
$lnMg_{t-4}$					-0.020***		
					(-8.433)		
$lnMg_{t-5}$						-0.027***	
						(-11.386)	
$\overline{\sum_{j=5}^{10} \ln Mg_{t-j}}$							-0.079***
							(-24.642)
Rm	0.569***	0.573***	0.548***	0.566***	0.543***	0.521***	0.541***
	(5.877)	(5.927)	(5.669)	(5.866)	(5.631)	(5.401)	(5.635)
Bp	0.214***	0.202***	0.204***	0.203***	0.199***	0.195***	0.187***
	(27.795)	(26.068)	(26.332)	(26.140)	(25.564)	(25.009)	(23.772)
lnTmv	-2.973***	-2.982***	-2.984***	-2.985***	-2.988***	-2.989***	-3.005***
	(-144.943)	(-145.215)	(-144.977)	(-144.787)	(-144.703)	(-144.591)	(-144.074)
_cons	12.772***	12.987***	13.006***	13.079***	13.194***	13.310***	13.646***
	(69.223)	(70.255)	(70.213)	(70.517)	(71.051)	(71.605)	(72.865)
N	152304	152076	151848	151620	151392	151164	150024
R2	0.2444	0.2440	0.2421	0.2409	0.2396	0.2384	0.2360
F	16393.03	12249.07	12106.65	12008.26	11906.37	11810.80	11564.94
prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level. The value of t is significant when *p < 0.1,**p < 0.05,***p < 0.0

to think about whether there was an "overreaction" phenomenon, so they decided to avoid it, and there was a reversal of trading volume. From the lag coefficient of Netizens' attention and public opinion attention, the positive impact of each period of attention on trading volume shows a significant persistence, and it gradually weakens at first, and the influence begins to increase after the fifth period. This is because: first of all, the oversold behavior of investors will cause the stock price to fall, and trading volume, as a liquidity indicator of the stock market, can cause changes in trading volume as long as it is bought or sold.

D. EMPIRICAL ANALYSIS OF DIFFERENT SUBJECT ATTENTION ON STOCK VOLATILITY

1) DESCRIPTIVE STATISTICS OF DATA

Take stock sh600192 as an example, according to the description of figure.3, the fluctuation of logarithmic return of sh600192 shows obvious time-varying and agglomeration characteristics. Fluctuations change with the change of time, and larger fluctuations will cause relatively large fluctuations.

The logarithmic rate of return of sh600192 is 0.0005, the variance is 0.0012, the skewness is -.6229, the kurtosis is 5.032, which is significantly higher than the kurtosis 3

TABLE 19. Dynamic analysis results of Netizens' attention and trading volume in the late lag period.

Model	(25)	(32)-(1)	(32)-(2)	(32)-(3)	(32)-(4)	(32)-(5)	(33)
lnWg	0.299***						
	(112.700)						
$lnWg_{t-1}$		0.286***					
		(107.408)					
$lnWg_{t-2}$			0.274***				
			(102.574)				
$lnWg_{t-3}$				0.263***			
				(97.944)			
$lnWg_{t-4}$					0.258***		
					(96.217)		
$lnWg_{t-5}$						0.249***	
						(92.461)	
$\sum_{J=5}^{10} \ln Wg_{t-j}$							0.380***
							(113.885)
Rm	0.771***	0.672***	0.583***	0.634***	0.794***	0.721***	0.880***
	(8.298)	(7.209)	(6.237)	(6.768)	(8.478)	(7.685)	(9.538)
Bp	0.301***	0.292***	0.284***	0.276***	0.270***	0.261***	0.282***
	(40.396)	(39.035)	(37.790)	(36.517)	(35.613)	(34.390)	(37.181)
.lnTmv	-2.706***	-2.725***	-2.745***	-2.759***	-2.771***	-2.786***	-2.711***
	(-136.324)	(-136.643)	(-136.960)	(-137.106)	(-137.354)	(-137.604)	(-134.087)
_cons	9.587***	9.845***	10.081***	10.324***	10.488***	10.723***	9.748***
	(53.415)	(54.580)	(55.628)	(56.726)	(57.485)	(58.572)	(53.141)
N	152304	152076	151848	151620	151392	151164	150024
R2	0.3026	0.2966	0.2913	0.2859	0.2831	0.2786	0.2940
F	16496.85	16009.82	15577.00	15154.38	14925.22	14572.14	15593.75
prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level. The value of t is significant when *p < 0.1,**p < 0.05,***p < 0.0

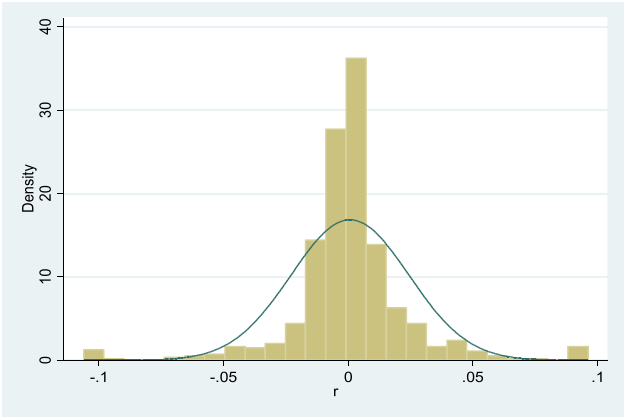

FIGURE 3. Sh600192 yield histogram.

of normal distribution. According to the results of J-b test, the original hypothesis is also rejected, and the data are consistent with this characteristic.One stock of each industry was randomly selected, and a total of 22 stocks were analyzed for stock volatility. Table 21 shows the descriptive statistics.

2) MODEL CHECKING

Before establishing the model, in order to ensure the effect of the model, because the stock return is the data of time series type, the stationarity test is carried out. The ADF test results of this paper are shown in the following table 22.

According to the description of Table 22, the logarithmic returns of each stock have a significant P value of 0, so we reject the original hypothesis and think that the return series are stable. Similarly, the logarithmic sequence of the attention degree of each stock is tested by ADF test, and the results also show that the sequence is stable.

Because the return series shows obvious volatility agglomeration phenomenon, it needs to be tested by ARCH. There are two test methods to test the common equation, namely, ARCH-LM test and residual square test. The test step is to first put forward the original hypothesis, H0: assume that there is no ARCH effect in the original model.

The ARCH test results are shown in table 23, the F statistics of each stock is 3.683543, and the P values are all less than 5%. So it is considered that the original hypothesis can be rejected. It shows that there is ARCH effect in the residual series of the time series. Therefore, the GARCH model can be established.

3) ANALYSIS OF EMPIRICAL RESULTS

In the mean value equation of the model, we assume that there are no variables to explain the rate of return, so there

TABLE 20. Dynamic analysis results of public opinion attention and trading volume in lag period.

Model	(26)	(34)-(1)	(34)-(2)	(34)-(3)	(34)-(4)	(34)-(5)	(35)
lnYg	0.428***						
	(101.748)						
$lnYg_{t-1}$		0.379***					
		(89.350)					
$lnYg_{t-2}$			0.332***				
			(77.784)				
$lnYg_{t-3}$				0.297***			
				(69.418)			
$lnYg_{t-4}$					0.284***		
					(66.101)		
$lnYg_{t-5}$						0.266***	
						(62.012)	
$\sum_{j=5}^{10} \ln Yg_{t-j}$							0.406***
							(72.444)
Rm	0.736***	0.696***	0.661***	0.641***	0.736***	0.733***	0.831***
	(7.860)	(7.389)	(6.976)	(6.745)	(7.733)	(7.694)	(8.788)
Bp	0.210***	0.206***	0.202***	0.197***	0.192***	0.187***	0.170***
	(28.165)	(27.334)	(26.620)	(25.856)	(25.149)	(24.437)	(22.080)
.lnTmv	-2.846***	-2.868***	-2.890***	-2.905***	-2.916***	-2.926***	-2.927***
	(-143.097)	(-142.937)	(-142.933)	(-142.908)	(-143.041)	(-143.094)	(-142.275)
_cons	11.415***	11.688***	11.940***	12.170***	12.333***	12.508***	12.456***
	(63.759)	(64.719)	(65.604)	(66.514)	(67.210)	(67.957)	(67.231)
N	152304	152076	151848	151620	151392	151164	150024
R2	0.2925	0.2810	0.2712	0.2641	0.2606	0.2567	0.2588
F	15719.86	14836.15	14102.21	13582.58	13318.82	13029.49	13077.35
prob	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: the t statistics in parentheses have been adjusted by agglomeration and White heteroscedasticity at the company level.The value of t is significant when*p < 0.1,**p < 0.05,***p < 0.01.

are only constant terms and residual terms in the mean equation, while in the variance equation, in order to observe the influence of attention on the return of individual stocks, in the model, attention is added as one of the explanatory variables. Take stock sh600192 as an example. The fitting results of sh600192 volatility of individual stocks by using the set GARCH (1,l) model are shown in the table 24, table 25, table 26, table 27, table 28 and table 29.

According to the regression results of the variance equation of the above GARCH model, the coefficients of the ARCH term and the GARCH term are both greater than zero, and the addition of the coefficients of the ARCH term and the GARCH term of each GARCH model is close to 1, which meets the requirements of the stationarity of the GARCH model. Through GARCH regression for all stocks in various industries, it is found that the equation regression coefficients established by all stocks are full of the stationarity requirements of the model.

The GARCH model of attention is established to fit the residual sequence, and the variance equation of GARCH model with attention is obtained as follows:

$$h_t = -9.9886 + 0.0852\varepsilon_{t-1}^2 + 0.8925h_{t-1}^2 - 0.2745 \ln mg_t \tag{42}$$

$$h_t = -15.2876 + 0.0707\varepsilon_{t-1}^2 + 0.8872h_{t-1}^2 + 1.4415 \ln wg_t \tag{43}$$

$$h_t = -17.8198 + 0.0759\varepsilon_{t-1}^2 + 0.8921h_{t-1}^2 + 2.3527 \ln yg_t \tag{44}$$

The results of the GARCH model with the variation of attention added to the variance equation are as follows:

$$h_t = -10.6563 + 0.0902\varepsilon_{t-1}^2 + 0.8740\, h_{t-1}^2 + 1.0262 \text{Delta}\_mg_t \tag{45}$$

$$h_t = -11.6795 + 0.0852\varepsilon_{t-1}^2 + 0.8925\, h_{t-1}^2 - 0.0400 \text{Delta}\_wg_t \tag{46}$$

$$h_t = -11.4971 + 0.0790\varepsilon_{t-1}^2 + 0.8947\, h_{t-1}^2 - 0.0476 \text{Delta}\_yg_t \tag{47}$$

The analysis of the results of the model shows that in model 42, only the coefficient of media attention is not significant, and the coefficients of other variables are significant to a certain extent, indicating that except media attention, all variables have good explanatory significance. However, although the introduction of media attention into the variance model as an exogenous variable is not significant, the large coefficient indicates that it also has an impact on volatility. Because the

TABLE 21. Descriptive statistics of individual stocks.

	Mean	Variance	Skewness	Kurtosis	J-Bera	P
sh600123	.0006	.00085	-.6658	6.619	413.9	0.000
sz000830	.0007	.0009	-.8347	6.38	395.5	0.000
sh600459	.0003	.0014	-.9441	8.995	1100	0.000
sh600888	.0007	.0012	-.5973	5.223	177.3	0.000
sh600183	.0012	.0010	-.6426	5.62	237	0.000
sh600261	-.0010	.0011	-3.82	41.21	42257	0.000
sh600854	.0008	.0010	-.6343	5.681	244.8	0.000
sz000423	.0008	.0005	-.1992	6.587	362.5	0.000
sz002083	.0008	.0008	-.7133	6.296	359	0.000
sh600235	.0011	.0013	-.5199	4.764	116.7	0.000
sh600011	.0004	.0007	-.5705	7.678	645.3	0.000
sz000088	.0005	.0011	-.468	5.642	218.7	0.000
sz000402	.0008	.0010	-.3546	5.274	157.9	0.000
sz002365	.0013	.0013	-.4677	4.575	93.35	0.000
sz000419	.0006	.0012	-.5145	5.171	160.7	0.000
sh600805	-.0000	.0009	-.6815	5.988	300.2	0.000
sh600248	.0001	.0013	-1.13	10.06	1528	0.000
sh600192	.0005	.0012	-.6229	5.032	158.1	0.000
sh600320	.0007	.0010	-.3424	5.65	208.6	0.000
sh600118	.0009	.0013	-.2801	4.959	115.6	0.000
sz002232	.0005	.0016	-.3549	4.155	51.15	0.000
sh600050	.0011	.0009	-.0209	5.694	202.1	0.000

TABLE 22. The stationarity test value of individual stocks.

Code	F Statistic	Prob-F(10,647)	obs*R-square
sh600123	3.72	0.0001	142.090
sz000830	4.00	0.0000	197.550
sh600459	2.40	0.0085	97.655
sh600888	2.86	0.0017	168.675
sh600183	1.60	0.1016	170.543
sh600261	3.21	0.0005	20.058
sh600854	2.36	0.0095	145.176
sz000423	3.48	0.0002	98.863
sz002083	2.97	0.0012	200.762
sh600235	4.94	0.0000	145.376
sh600011	5.42	0.0000	135.648
sz000088	2.79	0.0022	126.600
sz000402	2.32	0.0111	113.389
sz002365	2.99	0.0011	106.564
sz000419	1.64	0.0924	168.027
sh600805	3.27	0.0004	148.435
sh600248	2.78	0.0023	29.652
sh600192	4.17	0.0000	131.339
sh600320	2.77	0.0023	123.416
sh600118	2.71	0.0028	198.404
sz002232	3.02	0.0010	150.684
sh600050	1.58	0.1080	77.420

sum of the coefficients of ARCH and GARCH is 0.9224, close to 1, to a certain extent, the impact of information will cause a relatively lasting impact, and this effect is irreversible; at the same time, ARCH represents the degree of reflection of new information, and the coefficient of ARCH is smaller, reflecting that the market reacts slowly to new information; the coefficient of GARCH is larger, indicating that the old information can have a lasting impact on the volatility of individual stocks.

When Netizens' attention and public opinion attention are introduced into the GARCH model as variables, it is significant at 1% level. It can be inferred that Netizens' attention and public opinion attention have a significant impact on the volatility of individual stocks. The influence coefficient of media attention on earnings volatility is −0.2745, indicating that the increase of media attention will reduce the volatility of individual stocks, and the media reports have been increased the transparency of individual stock information. As a result, high attention reduces the volatility of individual stocks. The coefficients of the influence of Netizens' attention and public opinion attention on the volatility of individual stocks are 1.4415 and 2.3527 respectively, indicating that the increase of Netizens' attention and public opinion attention will increase the volatility of individual stocks. This can be explained by the theory of limited attention and cognitive resources. Investors' ability to process information is limited, and investors are also bounded rational. Retail investors account for nearly half of the Chinese stock market. On the other hand, the irrational factors of ordinary investors are large, and it is easy to produce short-term trading behavior, so the high attention of investors has brought about an increase in the volatility of individual stocks.

By adding the change value of attention to the model to see the impact of the change of attention on the volatility of stock returns, the results show that the results of the model such as media attention, Netizens' attention and public opinion attention are significant at 5% level, and the explanation of the model is good. From the perspective of the direction of influence, the change of media attention increases, which increases the fluctuation of individual stocks, which is consistent with the agenda setting characteristics of media reports, which shows that media reports make investors pay too much attention to weakness and excessive trading, causing fluctuations in earnings; On the other hand, the increase in the degree of attention of Netizens's and public opinion reduces the fluctuation of stock returns, which is explained by the psychology and anchoring effect of investors. Investors are greatly affected by the initial value, and once the initial decision value is determined, it is not easy to change.Therefore, investors' attention causes the determination of the initial

TABLE 23. ARCH-LM test results of individual stocks.

Code	F Statistic	Prob-F	obs*R-square	P-Chi-square
sh600123	3.72	0.0001	142.090	0.0000
sz000830	4.00	0.0000	197.550	0.0000
sh600459	2.40	0.0085	97.655	0.0000
sh600888	2.86	0.0017	168.675	0.0000
sh600183	1.60	0.0016	170.543	0.0000
sh600261	3.21	0.0005	20.058	0.0287
sh600854	2.36	0.0095	145.176	0.0000
sz000423	3.48	0.0002	98.863	0.0000
sz002083	2.97	0.0012	200.762	0.0000
sh600235	4.94	0.0000	145.376	0.0000
sh600011	5.42	0.0000	135.648	0.0000
sz000088	2.79	0.0022	126.600	0.0000
sz000402	2.32	0.0111	113.389	0.0000
sz002365	2.99	0.0011	106.564	0.0000
sz000419	2.64	0.0092	168.027	0.0000
sh600805	3.27	0.0004	148.435	0.0000
sh600248	2.78	0.0023	29.652	0.0000
sh600192	4.17	0.0000	131.339	0.0000
sh600320	2.77	0.0023	123.416	0.0000
sh600118	2.71	0.0028	198.404	0.0000
sz002232	3.02	0.0010	150.684	0.0000
sh600050	2.58	0.0080	77.420	0.0000

TABLE 24. Garch model of media attention (36) results.

Variable	Coefficient	Standard deviation	Z statistics	P
lnmg	-.2745	.2601	-1.06	0.2906
L1.ARCH	.0852	.0156	5.44	0.0000
L1.GARCH	.8925	.0173	51.55	0.0000
_CONS	-9.9886	.7310	-13.66	0.0000

TABLE 25. The results of garch model of Netizens' attention (37).

Variable	Coefficient	Standard deviation	Z statistics	P
lnwg	1.4415	.1455	9.91	0.0000
L1.ARCH	.0707	.0165	4.28	0.0000
L1.GARCH	.8872	.0182	48.58	0.0000
_CONS	-15.2876	.5553	-27.53	0.0000

TABLE 26. The result of garch model (38) of public opinion attention.

Variable	Coefficient	Standard deviatio	Z statistics	P
lnyg	2.3517	.3305	7.11	0.0000
L1.ARCH	.0759	.0173	4.37	0.0000
L1.GARCH	.8921	.0176	50.67	0.0009
_CONS	-17.8198	1.1574	-15.40	0.0000

value of investors, so the later decisions change around the initial value, so the change of Netizens' attention and public opinion attention increases. On the contrary, the volatility of stock returns has decreased.

TABLE 27. The regression results of garch model (39) for the change of media attention.

Variable	Coefficient	Standard deviatio	Z statistics	P value
Delta_mg	1.0262	.1771	5.79	0.0000
L1.ARCH	.0902	.0174	5.16	0.0000
L1.GARCH	.8740	.0201	43.46	0.0000
_CONS	-10.6536	.2470	-43.12	0.0000

TABLE 28. The regression results of garch model (40) for the change of Netizens' attention

Variable	Coefficient	Standard deviatio	Z statistics	P value
Delta_wg	-.0400	.0046	-8.59	0.0000
L1.ARCH	.0852	.0156	5.44	0.0000
L1.GARCH	.8925	.0173	51.55	0.0000
_CONS	-11.6795	.2530	-46.15	0.0000

TABLE 29. Regression results of garch model (41) for the change of public opinion concern.

Variable	Coefficient	Standard deviatio	Z statistics	P value
Delta_yg	-.0476	.0170	-2.79	0.0050
L1.ARCH	.0790	.0159	4.94	0.0000
L1.GARCH	.8947	.0154	57.85	0.0000
_CONS	-11.4971	.4169	-27.58	0.0000

IV. CONCLUSIONS

The current media attention is positively correlated with stock returns, and the research results of abnormal media attention on stock returns show that it also has a positive impact on stock returns. The empirical results of Netizens' attention and public opinion attention are similar to those of media attention. Abnormal attention has a greater impact on stock returns, indicating that investors should pay more attention to the impact of this change of attention. From the analysis of the above results, we know that the media has played its role as an information medium in the market and increased the transparency of the market, but at the same time, investors' attention to information has made investors confident, and information has played a stimulating role, resulting in positive buying pressure. So high attention brings high returns. The results of dynamic regression analysis of the lag period of each attention degree show that the lag period of the attention degree is the negative relationship between the performance and the stock return. According to the limited attention theory and cognitive resource theory, information has to be screened by similar "filters" before it reaches investors, and only the information passed can be processed by the brain, and some of the information will also be processed because it is induced by experience. The attention of investors to this information can easily lead to overconfidence or anchoring, resulting in overreaction, resulting in price deviation, and then these price deviations are gradually corrected by the market. However, some investors have not had time to react, so there is a reversal

of returns, and we find that this reversal effect is persistent. According to the prospect theory, investors are risk-averse when they gain and they prefer risk when they lose. It shows that the reversal effect is sustained.

Selecting the index that the trading volume represents the stock liquidity, the empirical results show that the high media attention in the current period brings high trading volume, and the dynamic analysis of the lag period shows that the positive relationship between attention and trading volume lasts for three periods. In the fourth lag period, media attention and trading volume have a negative impact, which may be because, first of all, buying and selling behavior will lead to an increase in trading volume. Investors find that withdrawing from trading after overreaction will also increase trading volume. Secondly, media attention is an indirect indicator, and media reports are repetitive according to the theory of agenda setting, so as to stimulate investors and arouse investors' attention. On the other hand, the limited attention of investors makes them pay attention to one thing at the expense of their attention to other things, and after several periods, this phenomenon of excessive attention decays. There will be a redistribution of attention, so there will be a reversal in trading volume. The impact of current Netizens' attention and current public opinion attention on stock trading volume is positive, and in the lag period, there is still a positive relationship between attention and trading volume. Under limited cognition, investors receive information, and after filtering, some of the information will stimulate investors, thus promoting trading behavior, that is, attention-driven trading, while retail investors account for a large proportion in the Chinese stock market, while retail investors are irrational. The psychology of overconfidence caused by the influence of information overestimates the importance of information, resulting in buying and selling trading behavior, leading to the positive impact of attention on trading volume.

Through the establishment of GARCH model to analyze the volatility of individual stocks, by adding attention variables to the variance equation, it is found that attention can have an impact on the volatility of individual stocks. The empirical results of adding the media attention model show that the variables in the model have a large coefficients, and the sum of the coefficients of ARCH and GARCH is close to 1, and the model has long memory, but the media attention coefficient in the model is not significant at the 5% significant level, while the rest are significant. In terms of coefficient, the increase in media attention reduces the income volatility of individual stocks, indicating that the media information is recognized by investors. Expand the transparency of information and reduce the fluctuation. However, with the addition of the change in media attention, it is found that the coefficients of the model are still large, and all are significant at the 1% level, but the results show that the change in media attention in the current period increases the fluctuation of individual stock earnings. This and the change in attention reduce the impact of individual differences in attention, and investors have different degrees of attention distribution, resulting in overreaction, resulting in overtrading. Lead to an increase in the volatility of individual stock earnings. The analysis of the model that introduces Netizens' attention and public opinion attention shows that the model also has a long memory, and all the coefficients in the model are significant at the 1% significant level, and the high attention brings a high fluctuation of individual stock returns. The information that passes through the investor's brain is selected, so the investor allocates the attention, but the investor's attention is limited and pays too much attention to the selected information. Therefore, investors are easy to produce overconfident information, resulting in irrational investment decisions and aggravating the income volatility of individual stocks. However, by adding the change of the attention of individual stock Netizens's and the change of public opinion into the model, it is found that the influence of the change of attention on the volatility of individual stocks is negative and significant. The attention produces the initial value of anchoring effect, and the decision is produced around the initial value, so the change of Netizens's and public opinion increases, but reduces the fluctuation of stock returns, and once again explains the trading strategy that pays attention to investors, thus affecting the volatility of individual stocks.

Summing up the above conclusions, we know that in China's securities market, media reports and investors' attention to relevant information are closely related to the performance of individual stocks. All kinds of media play the role of information media in the market, but investors have different degrees of acceptance and processing of information, which will produce different attention, but the attention is limited, so the concerned information is easy to magnify the cognition of investors. Thus resulting in overconfidence and other psychology, investors can get excess returns through attention, but they should also be on guard against risks such as overreaction and over-trading.

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YOUWEI CHEN (Member, IEEE) was born in Ankang, Shaanxi, China, in 1976. He received the B.S. degree in computer application from Xidian University, in 1999, and the M.S. degree in software engineering from Xi'an Jiaotong University, in 2005. He is currently pursuing the Ph.D. degree in management science and engineering with the School of Economics and Management, Xidian University. Since 2011, he has been a Researcher at the Research Center for Computational Finance and Risk Management, Xi'an University of Posts and Telecommunications. His research interests include financial engineering, computational finance and risk management, quantitative investment and high-frequency trading, and rough set theory and its applications.

PENGWEI ZHAO was born in Hebei, China, in 1958. He received the B.S. degree in engineering and the M.S. degree in computer organization and system structure from Xidian University, in 1982 and 1988, respectively, and the Ph.D. degree in mechanical manufacturing and automation, in 2005. Since 1999, he has been a Professor at the School of Economics and Management, Xidian University. His research interests include information organization and retrieval, information resource management, digital library, and IT project management.

YING LIU was born in Dalian, Liaoning, China, in 1993. She received the B.S. degree in logistics management and the M.S. degree in finance from the Xi'an University of Posts and Telecommunications, in 2015 and 2018, respectively. Since 2018, she has been an Assistant Engineer with the Xi'an Eurasia University and a Research Assistant with the Research Center for Computational Finance and Risk Management, Xi'an University of Posts and Telecommunications. Her research interests include Internet finance, computational finance, and risk management.