The impact of Internet media on the stock market

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Abstract. Since mankind has entered the information age, the amount of information has increased exponentially. The Internet has emerged and easily permeated into people's daily lives, influencing the way people obtain information. Information is an important basis for investors' decision-making. Internet information affects the behavior of investors through social media and online news, and then has an impact on the entire stock market. This paper reviews relevant literature and focuses on the impact of Internet media on the stock market.

Keywords: Information dissemination, Stock market, social media, Online news, Investor behavior.

1. Introduction

The Internet has changed the way people collect, process and disseminate information, as well as the way people conduct business. With the popularity of social media, audiences are not only receivers of information but also contributors of comments, blogs and posts. Such user-generated content has become an important source of information for enterprises and plays a role in multiple ways. For example, it can be used to design marketing ideas, advertisements and brand strategies, formulate human resources strategies, attract and serve customers, evaluate the creditworthiness of micro-enterprises, predict the performance of stocks or movies, etc., possessing extremely high commercial value.

The rapid exchange of Internet information has also transformed global capital markets. Research shows that investors are more inclined to refer to the choices of other investors rather than listen to the advice of professionals. Ivkovic and Weisbenner (2007) studied the original data on American households and their neighbors' stock purchases and found that stocks have a strong word-of-mouth effect. Ordanini et al. (2011) found that the social media of project founders can attract more attention, thus helping with project crowdfunding. The visitor traffic and number of comments on corporate social media also have an important relationship with their stock market performance.

The Internet has also completely transformed the news industry. Online media is more convenient, professional and efficient than traditional media. Media organizations must adapt to new technologies to continue to maintain their leading positions. Nowadays, almost all major newspapers and magazines have online versions. Therefore, investors can obtain information on important events around the world at any time and adjust their investment strategies according to the latest news and trends.

To sum up, the Internet affects the behavior of investors through social media and online news, and then has an impact on the entire stock market. This paper reviews relevant literature and focuses on the response of the stock market to Internet information.

2. Theoretical Basis

Based on the Efficient Market Hypothesis, stock prices fully reflect all information from the past, present and future, thus exhibiting completely random movements. Capital markets include three forms: weak-form efficient market, semi-strong-form efficient market and strong-form efficient market. Scholars believe that the stock price trends in weak-form efficient markets and semi-strong-form efficient markets can be predicted to some extent.

The premise of classical economic theory is the assumption of rational people, but in behavioral finance, investment decisions will be affected by investor sentiment and group psychology. Many studies have confirmed that investors often exhibit herd behavior. For example, Scharfstein and Stein (1990) found that when managers make investment decisions, they simply follow the advice of other managers and ignore the existing private information.

To reconcile the conflict between economic theories based on the Efficient Market Hypothesis and behavioral economics, Andrew Lo (2004) proposed the Adaptive Market Hypothesis, which states that the level of market efficiency is related to factors such as the number of competitors, profit opportunities and the adaptability of participants.

3. Review of Research on the Impact of Internet Media on the Stock Market

In recent years, the rise of Internet media has promoted the pace of domestic multimedia integration, that is, effectively combining traditional media such as newspapers, radio stations and television stations with emerging Internet media, making the communication forms more abundant. Meanwhile, it has added new platforms, new tools and new ideas for researching the impact of media on the stock market. Through the Internet, the media can release information more quickly and conveniently, and investors can also choose effective investment decisions in a timelier manner.

3.1. Impact of Social Network Media Platforms

Social network media platforms are one of the representatives of Internet media. Many scholars analyze the impact of media on the stock market based on social networks.

3.1.1. Classification by Social Media

Social media can be classified into: stock message boards, Facebook, Weibo/Twitter, and Internet search volume. The following is an analysis of different types of social media respectively.

(a) Stock Message Boards

Stock message boards provide investors with the opportunity to understand the views of other investors on the stock market, so they are closely watched by investors. Among them, in foreign markets, Yahoo! Finance, Ragingbull.com and Lion.com are the most popular. Wysocki (1998) was the first to notice that the volume of Yahoo! overnight messages could predict the stock trading volume and earnings changes the next day. Tumarkin and Whitelaw (2001) subsequently found that stock returns were related to the content of opinions on stock message boards. Antweiler and Frank (2004) downloaded information from Yahoo! Finance and RagingBull. After controlling for news reports, the information on stock message boards was still helpful in predicting market fluctuations. However, Kim and Kim (2014) believed that the sentiment expressed by retail investors on Yahoo! Finance was the result of past stock performance and had no impact on future stock returns, trading volume and volatility.

In China, the Oriental Fortune stock message board is dominant. Yang Runhe and Zhan Qiong (2020) found that during the Sino-US trade friction, there was a significant long-term equilibrium relationship between investor sentiment and the stock yield of ZTE Corporation. The higher the investor sentiment, the higher the stock yield. Xiong Xiong et al. (2017) used the data of the Oriental Fortune stock message board to study the relationship between China's stock message boards and the individual stock market. They found that there was no difference in investors' attention to posts of different qualities.

To improve the accuracy of predicting stock market trends with information from stock message boards, some scholars have developed sentiment indices by using simple variants of existing algorithms or multiple algorithms to improve the accuracy of classification algorithms (Das and Chen, 2007; Chua et al., 2009; Zhang, Swanson and Prombutr, 2012). Jiang et al. (2014) used clustering methods to identify stakeholder groups and their discussion topics from stock message board messages to predict stock market trends.

Some scholars have explored the impact of stock message boards on investor behavior. For example, stock message boards can be used to boost or dump stocks and manipulate the trading activities of other investors (Sarkar and Zhang, 2011). Zhang and Swanson (2010) used the Maximum Entropy (ME) and Naive Bayes (NB) classification algorithms to analyze the emotional information posted by retail investors on stock message boards. When investors gave a "hold" opinion, other investors usually expressed positive emotions rather than neutral emotions.

(b) Facebook

Facebook is one of the most popular social networking sites. The Facebook Gross National Happiness Index (FGNHI) can be used to explain the predictive ability of investor sentiment on stock market returns. For example, Karabulut (2013) used the Vector Autoregression framework (VAR) and found that FGNHI could predict short-term stock market activities. Siganos, Vagenas-Nanos and Verwijmeren (2017) used the GARCH model and found that the divergence of opinions extracted from Facebook had a significant positive correlation with stock trading volume and return volatility.

(c) Twitter/Weibo

Twitter, as a medium for sharing opinions on investment decisions, has been the subject of many academic studies. The most influential in this field is Bollen et al. (2011). They extracted the public sentiment of Twitter's daily messages through tools such as Opinion Finder and Google-Profile of Mood States (GPOMS) to predict changes in the Dow Jones Industrial Average (DJIA). Risius and Beck (2015) used SVM to classify tweets into positive, negative and neutral emotions, among which negative emotions were significantly related to the company's stock price.

In addition to sentiment analysis through text processing, scholars also use other quantitative methods to extract sentiment. Zhang, Fuehres and Gloor (2011) extracted sentiment by the proportion of sentiment words and found that it was positively correlated with stock fluctuations. Liu et al. (2015) found that homogeneous groups could be identified through social media indicators (the number of fans of the official accounts of enterprises, the proportion of the number of fans to the number of tweets), thus improving the ability to predict the stock trends of companies.

In China, relevant research mainly focuses on Weibo as the main social platform. Xu Wei and Chen Donghua (2016) conducted text analysis with the help of the Weibo of listed companies and found that Weibo disclosures would significantly increase the excess trading volume of the company's stocks. He Xianjie et al. (2018) analyzed the content of Weibo released by listed companies to explore the relationship between the company's stock price and Weibo information disclosure. The empirical results showed that the higher the proportion of information on business activities and strategies in Weibo information, the lower the stock price synchronicity of the company.

(d) Internet Search Volume

Many literatures use Internet search volume as a proxy indicator for information dissemination and investor attention. These include America Online (AOL), Baidu search, Google search, etc. Mondria, Wu and Zhang (2010) were the first to use the AOL search index to measure the attention of American investors. Da, Engelberg and Gao (2011) compared the Google search volume with other indicators of investor attention and found that the Google Search Volume Index (GSVI) was more representative of investor attention.

Nowadays, most studies use GSVI as the Internet search index. An increase in search volume will lead to higher stock trading volume and future returns (ApGwilym, Kita and Wang, 2014), is significantly related to stock volatility (Aouadi, Arouri and Teulon, 2013), and can also reduce information asymmetry and improve market efficiency (Vozlyublennaia, 2014; Tantaopas, Padungsaksawasdi and Treepongkaruna, 2016). Kristoufek (2013) proposed an investment portfolio strategy based on GSVI. Stocks with more search times have higher trading risks. Veiga, Ramos and Latoeiro (2013) believed that although Google search volume would lead to an increase in trading volume and volatility in the short term, stock returns would decline.

3.2. News Media Reports

Compared with social networks, relevant studies based on news media reports are more representative. Domestic and foreign scholars have also conducted corresponding research using news reports.

3.2.1. Classification by Information Extraction Techniques

Many studies extract Internet information in the following two ways: a) Text processing techniques, b) Quantitative techniques.

(a) Text Processing Techniques

Text processing techniques reveal the hidden emotions in text messages through specialized semantic analysis. Wuthrich et al. (1998) were among the first to adopt data mining techniques and the K-Nearest Neighbor algorithm (KNN) to study the text information in articles published on various network resources to predict stock markets in Asia, Europe and the Americas.

Mittermayer (2004) used SVM (Support Vector Machine) to classify news into "good" (causing stock prices to rise by 3%), "bad" (causing stock prices to fall by 3%), and "unchanged" (all the remaining news). Similarly, Antweiler and Frank (2006) used the Naive Bayes classifier (NB) to classify corporate news reports in The Wall Street Journal by topic and used the event study method for each topic. It was observed that the stock market had a positive reaction to good news and a negative reaction to bad news in the short term, but the price reversed in the long term, indicating an overreaction to the news.

There are also studies that directly utilize the "sentiment analysis" or "opinion mining" functions of ready-made software. For example, General Inquirer can classify the words in news into 77 predefined categories, and then use principal component analysis to reduce the 77 categories to one negative word category (Tetlock, 2007). Early studies represented news texts as "bags of words" to classify news articles. Later studies provided other more effective representations, such as "proper noun phrases" used by Schumaker and Chen (2009), Schumaker et al. (2012), "bigram combinations" used by Hagenau et al. (2013), and the Harvard Psychological Dictionary and Loughran-McDonald Financial Sentiment Dictionary used by Li et al. (2014). Wang Xiaodan (2019) et al. studied the impact of Internet media attention and sentiment indicators on the stock market and found that media reports could strengthen the analysis and prediction of stock market trends.

In addition to stock market prediction, news text analysis can also play other roles. Chung (2014) extracted important factors that might affect corporate strategies through news text mining. Ahern and Sosyura (2014) found that companies would reduce the amount of news with negative sentiment during important periods such as mergers and acquisitions. Lillo et al. (2015) investigated the impact of news sentiment on different investors (companies, households, governments, non-governmental organizations) and found that companies and households had a more positive response to positive news.

(b) Quantitative Techniques

Quantitative techniques include counting the number of news articles, the number of times a company's name appears in the news, etc. Many studies use the number of news articles as a measure of information to predict stock returns and trading volume. Mitchell and Mulherin (1994) observed that the number of news articles had a direct relationship with the performance of a company's stocks. Similarly, Alanyali et al. (2013) also found a positive correlation between the number of times a stock's name appeared in financial news articles and the stock's trading volume. Chan (2003) used the headline news database of individual companies to compare investors' reactions to the news. The results showed that stocks with bad news in news reports would experience a large negative drift, while stocks with positive news showed a smaller drift. Fang and Peress (2009) found that stocks with lower media coverage had higher market returns.

There are also some studies that focus on the impact of news on stock return volatility. Berry and Howe (1994) found that although there was a positive correlation between the news flow in the capital market and stock trading volume, there was no significant impact on price volatility. However, Kalev et al. (2004) observed that the number of company-specific news had a significant positive impact on stock market returns. This relationship also exists in the Chinese capital market. Liu Feng (2014) et al. measured media attention and investor attention by the number of media news releases and the amount of user searches for information. Through empirical research, they found that media attention would affect investor decisions and stock returns to some extent. The number of Baidu News in China has a significant positive correlation with stock return volatility (Shen et al., 2016; Zhang et al., 2016).

3.3. Comprehensive Impact of Multiple Information Sources

Some scholars combine Internet search volume and news articles to explore their comprehensive impact on stock trends. For example, the combination of information demand (represented by Google search volume) and information supply (represented by news headlines) has significant predictive ability for stock market trends (Vlastakis and Markellos, 2012; Moussa, Delhoumi and Ouda, 2017). Liu and Ye (2016) believed that spontaneous searches (Baidu Search Volume Index) would create buying pressure in the stock market, while news-driven (Baidu News Quantity) would create selling pressure.

Some literatures focus on the comprehensive impact of information from multiple social media on stock market trends. Yu et al. (2013) extracted data from social media (blogs, forums and Twitter) and traditional media (newspapers, television and magazines) and used the NB algorithm for sentiment analysis. The study found that compared with traditional media, social media had a closer relationship with the company's stock market performance. Luo et al. (2013) believed that compared with Internet search indicators, social media-based indicators could better predict the stock prices of companies.

4. Impact of Internet Media on Investor Behavior

Internet media characterizes investor behavior through investor sentiment, investor attention and the interaction between them, and then has an impact on market asset pricing. Investor sentiment is usually defined as the pessimistic or optimistic expectations formed by investors based on the cash flow and risk status of assets (Baker and Wurgler, 2006). As a mass medium, the media can affect investor sentiment through the sentiment of discourse topics. Huang Hongbin et al. (2017) conducted research from the market level and found that when investor sentiment was low, media sentiment was negatively correlated with it and could not suppress the low investor sentiment; when investor sentiment was high, media sentiment was positively correlated with it and media sentiment would promote investor sentiment; and when investors were rational, media sentiment had no impact on investor sentiment. While the media affects investor sentiment, it also has an impact on the stock market. Lu Qinye and Chen Hao (2021) found through research that the tendency of the media would affect investor sentiment, also have an impact on investors' decisions, and then cause fluctuations in stock prices.

In addition, media attention also has an impact on investor behavior. In terms of investor sentiment, Guan Xiaojin et al. (2022) explored the interaction mechanism among media attention, investor sentiment and stock market volatility in China and found that there was a mutually reinforcing relationship between investor sentiment and media attention.

Due to the existence of the "limited attention" phenomenon, investor attention is more likely to focus on aspects that receive more media attention, thus affecting their own decisions (Rosa & Durand, 2008). Fang and Peress (2009) found through empirical research that after controlling for market variables, momentum indicators and liquidity and other risk factors, due to the influence of excessive media coverage on investors' reaction ability, stocks with high media attention obtained lower expected returns than stocks with low media attention. Domestic scholars have also studied the performance of this phenomenon in the Chinese market. Rao Yulei et al. studied the relationship between media attention and monthly stock returns and concluded that the higher the media's attention to listed companies, the lower the average stock return. Zhang Yahui et al. reached a similar conclusion by studying the events of the rich list and using the event analysis method.

5. Future Research Directions

This paper has discussed how information disseminated through social media and online news will affect the stock market and investor behavior, but there are still some technical challenges and research gaps that need further research in the future.

In terms of technical challenges, few studies use original data to explore the impact of online news and social media on the investment decisions of financial intermediaries and retail investors. Only a small number of studies have compared the success of emerging information dissemination channels (Facebook, Twitter, Weibo, etc.) in disseminating company-specific information. In addition, no studies have focused on the impact of investor sentiment on the stock market combined with the personal characteristics of investors on stock market transactions. Therefore, there are still many new avenues for research in this field.

In terms of research gaps, existing research mainly focuses on improving the predictability of stock market trends and reducing volatility. However, although stock volatility has decreased after considering network information, it still exists. Therefore, future research should try to explain this volatility persistence. Other information channels, such as China's stock message boards, still need to be fully explored. In addition, although the accuracy of stock market return prediction has been significantly improved, it can be further improved by finding newer network information channels.

6. Summary

This paper has sorted out the literature on the impact of Internet information on the stock market and investor behavior. Existing research lacks attention to the stock markets of emerging economies and lacks exploration of how network information affects the investment behavior of retail investors. Further research in this regard will help enterprises understand the impact of network information on stock pricing and thus prompt enterprises on how to manage their online accounts. In addition, existing research has focused on the stock part of the capital market, and future research directions can be further expanded to pension funds, futures markets and foreign exchange markets, etc.

References

[1] Ivković, Z. and Weisbenner, S., Information diffusion effects in individual investors' common stock purchases: Covet thy neighbors' investment choices [J]. Review of Financial Studies, 2007, 20 (4): 1327 - 1357.

[2] Andrea Ordanini et al. Crowd-funding: transforming customers into investors through innovative service platforms [J]. Journal of Service Management, 2011, 22 (4): 443 - 470.

[3] DAVID S SCHARFSTEIN, JEREMY C STEIN. Herd Behavior and Investment [J]. The American Economic Review, 1990, 80 (3): 465 - 479.

[4] Lo, Andrew W. The Adaptive Markets Hypothesis: Market Efficiency from an Evolutionary Perspective [J]. Social Science Electronic Publishing, 2004, 31 (1): 21 - 44.

[5] Zhang Xindong, Yuan Dongliang. Research on the Impact of Investor Sentiment Based on Weibo on the Stock Market [J]. Journal of Intelligence, 2017, 36 (8): 81 - 87.

[6] Yu Lisheng, Wang Chenglong, Wang Yanyan. The Role of Analysts' Social Media in Information Dissemination Efficiency: A Study Based on Analysts' Weibo [J]. Journal of Management Sciences in China, 2019, 22 (7): 107 - 126.

[7] Wysocki, P. D. Cheap talk on the web: The determinants of postings on stock message boards. 1998.

[8] Tumarkin, R. and Whitelaw, R.F., News or noise? Internet postings and stock prices. Financial Analysts Journal, 2001, 10 (6): 41 - 51.

[9] Werner Antweiler, Murray Z. Frank. Is All That Talk Just Noise? The Information Content of Internet Stock Message Boards [J]. Journal of Finance, 2004, 59 (3): 10 - 36.

[10] Soon-Ho Kim and Dongcheol Kim. Investor sentiment from internet message postings and the predictability of stock returns [J]. Journal of Economic Behavior and Organization, 2014, 107: 708 - 729.

[11] Das S R, Chen M Y. Yahoo! for Amazon [J]. Management Science, 2007.

[12] Yang Runhe, He Zhanqiong. Research on the Relationship between Investor Sentiment and Stock Returns—Based on High-Frequency Data during the Sino-US Trade Friction [J]. China Price, 2020, (09): 55 - 57.

[13] Xiong Xiong, Luo Chunchun, Zhang Ye. Stock Message Boards and Trading: Research on the Information Content in Stock Message Boards [J]. Journal of Systems Science and Mathematical Sciences, 2017, 37 (12): 2359 - 2374.

[14] Chew Lian Chua and Sarantis Tsiaplias. Can consumer sentiment and its components forecast Australian GDP and consumption? [J]. Journal of Forecasting, 2009, 28 (8): 698 - 711.

[15] Zhang, Y., Swanson, P. E., and Prombutr, W. Measuring effects on stock returns of sentiment indexes created from stock message boards. [J]. Finan. Res, 2012, 35: 79 – 114.

[16] Cui Qing Jiang et al. Analyzing market performance via social media: a case study of a banking industry crisis [J]. Science China Information Sciences, 2014, 57 (5): 1 - 18.

[17] Sabherwal S, Sarkar S K, Zhang Y. Do Internet Stock Message Boards Influence Trading? Evidence from Heavily Discussed Stocks with No Fundamental News [J]. Journal of Business Finance & Accounting, 2011, 38 (9-10): 1209 - 1237.

[18] Ying Zhang and Peggy E. Swanson. Are day traders bias free? —evidence from internet stock message boards [J]. Journal of Economics and Finance, 2010, 34 (1): 96 - 112.

[19] Abu Bakar, A., Siganos, A., & Vagenas-Nanos, E. Does mood explain the Monday effect? Journal of Forecasting, 2014, 33 (6): 409 – 418.

[20] Siganos A, Vagenas-Nanos E, Verwijmeren P. Divergence of sentiment and stock market trading [J]. Journal of Banking & Finance, 2017, 78 (5): 130 - 141.

[21] BOLLEN J, MAO H, ZENG X, Twitter Mood Predicts the Stock Market [J]. Journal of Computational Science, 2011, 2 (1): 1 - 8.

[22] Risius M, Beck R. Effectiveness of corporate social media activities in increasing relational outcomes [J]. Information & Management, 2015, 52 (7): 824 - 839.

[23] Xue Z, Fuehres H, Gloor P A. Predicting Stock Market Indicators Through Twitter "I hope it is not as bad as I fear"[J]. Procedia - Social and Behavioral Sciences, 2011, 26 (26): 55 - 62.

[24] Liu, L., Wu, J., Li, P. and Li, Q., A social-media-based approach to predicting stock comovement [J]. Expert Systems with Applications, 2015, 42 (8): 3893 - 3901.

[25] Xu Wei, Chen Donghua. The Role of Information Disclosed by We-Media: Empirical Evidence from Sina Weibo [J]. Journal of Financial Research, 2016, (3): 157 - 173.

[26] He Xianjie, Wang Xiaoyu, Sun Shuwei, et al. Research on the Economic Consequences of Information Disclosure by New Online Media: From the Perspective of Stock Price Synchronicity [J]. Journal of Management Sciences in China, 2018, 21 (6): 43 - 59.

[27] Mondria, J., Wu, T., and Zhang, Y. The determinants of international investment and attention allocation: Using internet search query data [J]. Journal of International Economics, 2010, 82 (1): 85 – 95.

[28] Da, Z., Engelberg, J. and Gao, P. In Search of Attention [J]. Journal of Finance, 2011, 66: 1461 - 1499.

[29] Gwilym O A, Kita A, Wang Q. Speculate against speculative demand [J]. International Review of Financial Analysis, 2014, 34 (5): 212 - 221.

[30] Aouadi A, Arouri M, Teulon F. Investor attention and stock market activity: Evidence from France [J]. Economic modelling, 2013, 35 (6): 674 - 681.

[31] Vozlyublennaia, N. Investor attention, index performance, and return predictability [J]. Journal of Banking & Finance, 2014, 41: 17 – 35.

[32] Tantaopas, P., Padungsaksawasdi, C., & Treepongkaruna, S. Attention effect via internet search intensity in Asia-Pacific stock markets [J]. Pacific-Basin Finance Journal, 2016, 38: 107 – 124.

[33] SALHIN A, SHERIF M, JONES E. Managerial sentiment, consumer confidence and sector returns [J]. International Review of Financial Analysis, 2016, 47: 24 - 38.

[34] SIGANOS A, VAGENAS-NANOS E, VERWIJMERENP. Divergence of sentiment and stock market trading [J]. Journal of Banking and Finance, 2017,78 (5): 130 - 141.

[35] Marti R, Wieland C, Beat Wüthrich. Adding Inferencing to a Relational Database Management System [J]. Springer Berlin Heidelberg, 1989.

[36] Mittermayer, M. Forecasting Intraday Stock Price Trends with Text Mining Techniques. Hawaii International Conference on System Sciences, Kailua-Kona, HI. 2004.