

The Impact of News and Social Media on the Stock Market

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Abstract: In the information age, the impact of news media and social media on the stock market is becoming increasingly significant. This paper analyzes the influence of news and social media on the stock market from the perspectives of the information transmission chain, emotional differences, sentiment analysis techniques, and AI applications. Through a review of the literature, it is proved that the investors' behavior will be influenced by their emotions, which will be easily affected by the information they receive from the news and social media. It is found that by utilizing AI models and sentiment analysis techniques, emotions can be transformed into quantifiable data, which can be applied to more accurate stock price prediction systems, resulting in more precise stock price and trend forecasts. However, there are still many issues, such as information overload and overreaction to information, which can influence investors' behavior and cause redundancy in the accuracy of predictions. It is suggested that future research can focus on mitigating these factors and improving prediction accuracy.

Keywords: News and social media, information influence, stock market, stock prediction, sentiment analysis technology.

1. Introduction

In the context of the evolving era of big data, the significant impact of news and social media on the stock market has garnered widespread attention. News media and social media have become important forces influencing the stock market. The influence of news and social media on the stock market is a complex and multidimensional process, involving multiple aspects such as information overload, differential emotional expression, sentiment analysis techniques and the application of AI.

This paper will comprehensively refer theories from behavioral finance, behavioral psychology and advanced technological methods to delve into the impact mechanisms of news and social media on the stock market. By comparing the conclusions, methodologies, and limitations of existing research, this study aims to provide valuable references for investors and market participants.

This paper first elucidates the information transmission chain in the stock market and analyzes emotional differences and their performances in the stock market. Subsequently, sentiment analysis techniques are utilized to quantify emotions, obtaining structured information that can be integrated with AI models for application in stock market prediction.

2. Theoretical analysis of the impact of news and social media on the stock market

2.1. The transmission chain of information influence

In the traditional Efficient Market Hypothesis (EMH), stock prices are believed to fully reflect all available market information. Economics theory also posits that human behavior is rational. However, the abnormal fluctuations observed in stock prices contradict the EMH and not align with the random walk theory, which suggests that price movements are unpredictable.

Drawing on behavioral finance theory, this paper explores how the textual content of news and social media influences investors' decision-making and the dynamic factors that drive stock market movements. It concludes that individuals often make investment choices influenced by emotions. Subsequent in-depth research on investor characteristics and their emotional inclinations reveals that these are often affected by various social factors, such as social norms [1], social interactions [2] and information cascades [3]. Investors tend to exhibit various psychological biases, primarily in the areas of overconfidence, loss aversion, and mental accounting.

Yung-Shun highlights that overconfidence is a significant area of study in irrational behavior research [4]. Investors are more likely to exhibit overconfidence during bull markets compared to bear markets, particularly in high-risk stock investments. Loss aversion, as a factor connecting experiential openness and affinity, can influence individual investment decisions [5]. Moreover, Qian notes that information disseminated through online news and social media significantly impacts investor behavior and stock market dynamics [6]. In the data era, social media platforms and mainstream news media have become crucial channels for information dissemination. News information, as a primary carrier of information, often conveys macroeconomic performance and trends. People, influenced by this information, experience emotional fluctuations that lead to different decision-making judgments in the stock market. Social media, as a main platform for public expression, reflects the emotional inclinations of the masses through the information shared on these platforms. The simultaneity and rapidity of concentrated information can have a significant impact on investment markets [7].

2.2. Differential manifestation of emotions

2.2.1. Positive vs negation emotions

Wang and Vergeer reveal that negative information on social media can lead to investor panic, which in turn may trigger a decline in the stock market, while positive information is likely to result in a stock price increase [8]. Behavioral psychology research indicates that investors' positive and negative emotions can be primarily categorized into two types: enthusiastic investors driven by "optimism" and "greed," and panic-stricken investors caused by "pessimistic" emotions. Fengmin measured the pessimism embedded in The Wall Street Journal and demonstrated that such media pessimism can predict the downside pressure that market prices will face. Moreover, positive and frequently reported information has a more pronounced impact [9].

Fengmin found that investors are influenced by media public opinion, by altering their attitudes and behaviors towards companies, and that positive media coverage of companies also increases their exposure and public attention [9]. Information dissemination on social media and news platforms is characterized by its speed and wide reach. Social media, with its features of immediacy, interactivity, and extensive coverage, has become an important platform for investors to obtain information and exchange views [10,11]. This also implies that, to some extent, investors are able to make investment decisions more swiftly. However, their rapid decision-making leaves them with little time to ponder the textual information. Based on herd behavior in behavioral psychology, traditional financial markets are imbued with numerous informational assumptions. Moreover, trading information in

today's financial markets is not complete. Thus, when investors receive certain information, they may engage in blind following behavior [12]. This herding behavior directly affects investors' decision-making.

2.2.2. Temporal differences in the impact of emotions

Based on the Fama-French five-factor model, this study compares the impact of social media and news sentiment on stock returns at both daily and monthly frequencies. It is found that at the daily level, the social media sentiment factor exhibits a more significant excess return and stronger pricing power compared to the news sentiment factor and is capable of explaining market anomalies [13]. However, at the monthly level, the explanatory power of the news sentiment factor for anomalies is enhanced, particularly in volatility-related anomalies, while the explanatory power of the social media sentiment factor declines significantly [13]. In the long run, daily information is more fully absorbed by the market.

3. News and social media integration with the stock market

3.1. Differential manifestations of emotions in the stock market

Investors are influenced emotionally when making financial investment decisions [14]. Sashikala and Chitramani found that emotions such as happiness and anxiety can affect investment decisions, thereby influencing the performance of investments [15]. Investors with investment enthusiasm are able to make appropriate choices in financial decisions [16]. Scholars have emphasized the impact of distinct emotional responses, such as fear and selfishness, which may lead to unfavorable decision-making performance [17].

Firstly, starting from the differences in emotions, it is evident that when investors are in a state of panic, the market typically experiences a sharp decline. During periods of greed, investors' excessive optimism and greed drive the stock market upward. The main difference is reflected in the fluctuation of stock prices. Investors' panic leads them to sell stocks in fear of losses, causing prices to plummet rapidly. However, investors in a state of greed may ignore fundamental risks and blindly chase high prices, leading to the formation of market bubbles.

Secondly, there are differences in the general psychology of investors across different markets. In a bull market, investor sentiment is usually more optimistic, with higher expected returns and risk tolerance, leading to more buying behavior and market increases [18]. Conversely, in a bear market, investor sentiment is more negative, with lower expected returns and reduced risk tolerance, resulting in more selling behavior and market declines [18].

Both negative and positive emotions can affect the stock market. Negative emotions can trigger strong market reactions, often not reflected in prices but leading to information bias. Positive emotions, on the other hand, can lead to excessive trading. In 2001, Daniel et al. proposed the DHS model, which categorizes investors into two types based on their aversion to risk "risk-neutral informed traders" and "risk-averse uninformed traders." When informed traders reveal that future news is consistent with their private information, overconfidence can lead to an overreaction, causing stock prices to exhibit a reversal effect in the medium to long term. In 2021, Gong Rukai found that an increase in the proportion of overconfident investors in the market and the degree of investor overconfidence can have an asymmetric impact on stock market depth. Moreover, investors' optimistic sentiment can influence stock returns, with this effect having a clear inflection point. That is, as optimism increases, stock returns also increase. Optimistic sentiment can moderate the impact of pessimistic sentiment on stock returns [19]. In 2009, Zhang Qiang and Yang Shue used market indicators such as fund discount/premium rates, turnover rates, and investor account growth rates to quantify investor sentiment. They found that the impact of investor optimism and pessimism on stock

prices is asymmetric, and fluctuations in sentiment may lead to the possibility of risk premia in stock prices. Emotions are differentiated and should not be measured too narrowly by a single indicator for the stock market. Instead, a comprehensive analysis using multiple composite indicators is recommended, such as the BW index developed by Baker and Wurgler in 2006 [20].

3.2. Overview of sentiment analysis technology

To achieve more accurate predictions and analyses of stock prices, it is necessary to employ more precise quantitative sentiment data. Sentiment analysis technology is capable of transforming qualitative emotions into quantitative sentiment variables, which can be utilized in predictive models to enhance our analytical capabilities. Therefore, it is necessary to leverage sentiment analysis technology to quantify emotions in text, thereby aiding in the prediction of stock prices. Sentiment analysis technology is one of the key tools for studying the impact of news and social media information on the stock market. It is a subfield of Natural Language Processing (NLP) and primarily functions to identify, extract, and quantify subjective emotions in text. This technology preprocesses the text, extracts feature from the processed text, and then uses hybrid models for sentiment classification and quantification to predict indicators.

In the past, sentiment analysis technology has already been applied to some extent. For example, Baker and Wurgler synthesized various indicators such as closed-end fund discounts, stock trading volumes, and initial public offering (IPO) first-day returns to analyze sentiment indices, using search engines to search for related terms to gauge changes in market sentiment [20]. Xiao and Lin also proposed a sentiment analysis method that combines a financial phrase dictionary and weighted ending paragraphs, which can address the domain dependency issue of sentiment dictionary analysis methods and effectively improve the accuracy of sentiment analysis [21].

However, with the continuous advancement of sentiment analysis technology, Artificial Intelligence (AI), and Natural Language Processing (NLP) techniques, Zhang proposed a stock price prediction model based on deep ensemble learning [22]. This model integrates deep learning technologies such as Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM) networks, and self-attention models. By combining the strengths of different models, it enhances the model's generalization ability and predictive performance. This hybrid model not only leverages the combination of multiple models to achieve complementary advantages but also utilizes quantitative sentiment data from sentiment analysis to transform unstructured data into structured data. It employs models to conduct deep learning on the data, providing more accurate predictions of stock market fluctuations and stock price predictions. AI models can effectively integrate such models for deep learning, using these models as the underlying logic to offer more accurate suggestions for stock market analysis, stock price fluctuations, and stock predictions.

3.3. AI applications in the stock market

The application of Artificial Intelligence (AI) in the stock market has become a significant research direction and a hot topic in the financial field. AI technologies, especially Machine Learning (ML) and Natural Language Processing (NLP), have provided powerful support for sentiment data analysis and stock price prediction in the stock market.

From the perspective of stock price prediction, although large AI models are not specifically designed for the stock market, existing research has already drawn some conclusions regarding the use of AI models for stock market prediction. For instance, a study from the University of Florida found that integrating ChatGPT into investment models can predict stock market trends by analyzing a large volume of news headlines and content. Another experiment by Lopez-Lira demonstrated that ChatGPT's judgments based on news data were significantly more accurate than random predictions

[23]. However, when comparing the performance of Deepseek and ChatGPT in predicting stock market trends for companies like Microsoft and Google, Deepseek's accuracy was found to be lower than that of ChatGPT, possibly due to the latter's multilingual training compared to Deepseek's bilingual training [13]. Despite the moderate accuracy, AI models' performance notably surpasses that of traditional random prediction models. ChatGPT not only has the ability to identify positive news but also possesses predictive capabilities for the market. Moreover, Large Language Models (LLMs) can be applied to various financial markets to analyze how investors process information differently and to assess the impact of investors' behavior.

ChatGPT's capabilities extend beyond stock market prediction. In the realm of sentiment data analysis and extraction, ChatGPT, relying on advanced language models, demonstrates excellent performance in handling data. However, AI's feedback can be influenced by investors' preferences. In the market, investors tend to focus more on negative news than positive news, a phenomenon supported by the Wall Street adage "The market takes the stairs up and the elevator down" and by index options trading. This implies that AI models, when trained on information, may receive more negative news, thus reacting more swiftly to negative information. When faced with ambiguous news, ChatGPT, with its strong multilingual analysis capabilities, can still process the news as neutral, thereby preventing excessive emotional reactions from influencing investors' decisions. This suggests that using ChatGPT to process information can yield more balanced advice, avoiding overreactions caused by individual emotional biases.

3.4. Summary

The differential manifestations of emotions, sentiment analysis technology, and AI models exhibit synergistic effects in the stock market. Research on emotional differences provides the theoretical foundation for sentiment analysis technology and AI models, while sentiment analysis technology and AI models offer tools and methodologies for the study of emotional differences. Sentiment analysis technology can supply AI models with more accurate emotional data, and in turn, AI models can further enhance the predictive capabilities of sentiment analysis technology. Both AI models and sentiment analysis technology can be further optimized to provide investors with real-time market predictions and decision-making support. By conducting a comprehensive analysis of the applications of emotional differences, sentiment analysis technology, and AI models in the stock market, a better understanding of market dynamics and optimized investment strategies can be accessed.

4. Integration of research conclusions and analysis of academic value

This paper focuses on the impact of news and social media on the stock market, conducting a literature review on their significance in this context, as well as sentiment analysis, emotional analysis, and applied research. It reveals that the influence of textual information from news and social media on the stock market essentially forms an information-psychology-behavior-price transmission chain. The core aspect lies in how information affects market expectations through content, dissemination speed, and collective psychology.

Current research indicates that multimodal deep learning approaches are employed for financial market predictions, with each method utilizing different techniques and data types. These multimodal methods address various challenges posed by online data sources related to news and social media. While integrating price data with sentiment metrics to enhance trading decisions. A multimodal stock price prediction approach that combines news headlines and source articles with percentage change data in stock prices. Their study primarily examines how percentage changes compare to original price values regarding effectiveness while also investigating how different combinations of these data types can improve predictive accuracy.

Farimani proposed an adaptive multimodal learning model for predicting market prices by leveraging diverse data modalities to tackle financial time series challenges [24]. Their model draws upon sources such as news content, sentiments from professional news groups, and technical indicators [25]. With technological advancements, research in this field is gradually shifting from qualitative analyses toward quantitative modeling.

However, two issues remain unresolved, including information overload and overreaction to Information. From the information overload aspect, the deluge of information mainly relies on the optimization of technology, making use of more advanced machine learning algorithms and natural language processing techniques to enhance the accuracy of information filtering and help users more efficiently screen out valuable information. According to users' different needs and scenarios, more personalized attention management solutions should be provided to meet users' diverse information demands. Excessive influence can lead to the amplification of negative news and affect individuals' behavioral judgments. In the face of excessive influence, it is not only necessary for the government and platforms to control negative information and introduce relevant policies for constraints, but also for the public to improve their information literacy, enhance their ability to distinguish and process information, and more effectively screen, evaluate and utilize information. Additionally, it is necessary to optimize technical tools and develop more intelligent information management tools, such as intelligent assistants and data analysis platforms, to help users better distinguish information and eliminate useless information.

In the overreaction to information part, regarding excessive reactions to information, investors should avoid following the crowd and make their own subjective judgments while considering the information. Evaluate the reliability of the information, use software, and leverage AI to limit the excessive exposure of information that affects investors' emotions. Cultivate critical thinking and set priorities for information processing.

5. Future prospects

From the information aspect, Information is primarily based on extensive data from highly developed financial markets in Europe and the United States. Their capital markets, having matured earlier, offer high-quality data that yields more accurate results. However, developing countries' capital markets lack well-established systems, where lower data quality and pronounced market volatility lead to significant predictive errors in model applications. Furthermore, stock price characteristics encompass return volatility and crash risk, yet the impact of industry-specific news media on these aspects remains under-researched. Additionally, big data from news and media contains substantial noise that interferes with information measurement, making it crucial to filter out such noise and employ novel encoding rules to accurately capture the true informational essence.

In the technical part, a series of unstructured data on media platforms, including images, audio and video, can be converted into structured data sets using advanced processing means, which can implement multidimensional and multi-perspective accurate measurement. The model measure is adjusted more accurately, and multi-model and multi-variable analysis is adopted. Further improvement on multimodal models.

Whether it is online media or traditional newspapers, or the social media that has emerged, it has attracted the attention of investors due to the diversity of data and wide audience. However, media big data contains a lot of noise information which interferes with measurement information. Therefore, it is an important topic to eliminate noise and apply new coding rules to measure information. In addition, a series of unstructured data on media platforms are converted into structured data sets by more advanced means. In the era of rapid information integration and flow, mass media plays more of a one-way "supply" role of information, while social media, as a two-way "interactive" medium, studies mass media (for example, The flow of information between online media, newspapers,

periodicals and social media is also a potential topic). The efficient flow of information between them is essential for the stable development of capital markets. Information is the "black box" of the stock market, and the trend and fluctuation of the stock market are closely related to information. Misinterpretation, exaggeration and over-interpretation of news information are easy to cause unnecessary impact on the stock market, which not only damages the interests of investors but also causes potential hidden dangers to the stable development of the stock market. Therefore, it is of theoretical value and practical significance to study the influence of media information on stock market development from the perspective of information flow and media governance.

6. Conclusion

Emotions triggered by news and social media information have a significant impact on the stock market. However, the rapid spread of information in the information age inevitably affects investors' decisions, leading to overreactions and further influencing stock market volatility. The diversity of emotions causes investors to make irrational decisions. Nevertheless, human language model artificial intelligence can extract text sentiment, thereby assisting investors in making investment decisions. Currently, multiple studies have combined large model artificial intelligence-related technologies to transform unstructured data from news and social media into structured data, making the data more accurate and providing a strong reference for investors' decisions. However, the capital markets in developing countries lack a complete system. The decline in data quality and the differences in market volatility changes result in significant prediction errors when applying models. Additionally, the massive amount of information leads to overreactions by investors. Therefore, eliminating noise, applying new coding rules to measure the most genuine information content, and establishing more precise information screening model methods are particularly crucial.

Authors contribution

All the authors contributed equally and their names were listed in alphabetical order.

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