

Analysis of the Relationship between Media Sentiment and Public Opinion Index and Stock Market Volatility

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Abstract

When major public events occur, the financial "media attention" shifts, and the "media sentiment" contained in news reports indirectly affects the cognition and mood of investors, thus triggering investor behavior and affecting the fluctuation of the stock market. This project builds media sentiment indicators based on the Chinese sentiment dictionary in the financial field. It analyzes the relationship between financial media public opinion and stock market fluctuations from three aspects: information report sentiment, news media sentiment and social media sentiment, and conducts empirical analysis, so that investors can use media sentiment when major events occur. Indicator analysis predicts the trend and investment direction of the stock market and forms an investment strategy. Give full play to the role of social media sentiment indicators in predicting and monitoring the risk of stock market crash of listed companies, and make suggestions for media governance and public opinion management.

Keywords

Emotional Dictionary; Media Sentiment Indicators; Market Impact; Public Opinion Management.

1. Introduction

In the era of big data, more and more financial researches have paid attention to the intonation and emotions contained in the texts of annual reports of listed companies, news media reports and investors' social media posts. Tonation and emotion are the external expressions of the emotional and psychological activities of media workers. Because they affect the behavior of investors, they have become important market indicators to predict the returns, fluctuations and turnover of stocks. The study of the tone and emotion of financial texts is conducive to providing decision-making support for financial market forecasting and supervision activities in the context of the big data era, and serving the development goal of "implementing the national big data strategy and building a digital China" emphasized by General Secretary Xi Jinping.

As a link between the capital market and investors, the third-party independent financial media in the securities market is an important medium and an important gathering place for information when major events occur. After entering the era of mobile Internet, the information provided by financial websites and independent media has also experienced explosive growth. Taking the meltdown of U.S. stocks as an example, the "media sentiment" contained in the policy current affairs reports and negative analysis of the relevant financial media during the epidemic guided investors' investment behavior. As an indirect influencing factor, this sentiment repeatedly triggered the meltdown mechanism and caused a collapse at the opening. It can be seen that the great transformation of some economic events is inextricably linked to "media sentiment". Under the influence of the epidemic and U.S. policies, the negative judgments of the

media on the stock market have been disseminated on the Internet and public opinion has fermented, directly or indirectly affecting the stock market.

Based on the above considerations, this paper builds a Chinese sentiment dictionary for the financial field, and finds that the media sentiment indicators based on the dictionary can effectively predict the changes of stock yield, volatility, turnover and other factors.

Foreign studies have shown that the news reports of financial media on listed companies will attract the attention of investors. The degree of media attention, that is, the number of news reported by the media, will affect the duration and degree of attention of investors, and the news emotions and emotional tendencies reported by the media will change the mood of investors, thus affecting Investors' trading decisions. Based on the theory of behavioral finance, many scholars use the media news of the U.S. capital market to study the relationship between media reports and the U.S. stock market. For example, Carlos and Nicholas studied the impact of false information released by the U.S. stock market media on stock prices, and attributed the reaction of the stock price shock to. Media effect. Tetlock selected the constituent stocks corresponding to the S&P 500 index as a sample, and analyzed the relationship between the emotional tendency of stock comments and stock returns of the paper media Wall Street Journal.

Foreign research on financial news and asset pricing has gradually matured, while the relevant research of Chinese scholars is relatively small and mainly focuses on the research perspective of "media attention" based on the number of news reports. In 2019, Yin Tengfei, a Chinese scholar, used crawler technology to obtain financial news text data from mainstream financial websites and media. Based on the dual perspectives of "media attention" and "media sentiment" in behavioral finance, he deeply explored how the news reports of financial media in China's capital market affect stock trading.

2. Research on the Impact of Media Sentiment on Financial Markets

2.1. Information to Report Emotions

2.1.1. The Impact of Information Reporting Sentiment on Market Yields

In terms of research on the impact of yield, an analyst recommendation index is constructed based on the rating data of individual stocks released by securities analysts released by Sina Finance, and it is found that the rise of the index will lead to a short-term rise in the yield of the stock index. Measuring the tone of the financial text from the company's annual report construction indicators, it is found that the positive sentiment score is positively correlated with stock returns and negatively correlated with IPO price suppression.

2.1.2. The Impact of Information Reporting Sentiment on Market Risk

In the study of the impact on volatility, based on the regression model, it is concluded that financial text sentiment plays an important role in predicting the volatility of U.S. stocks. This link can be used to analyze the company's financial risks and effectively predict the long-term volatility of the market. In terms of stock price crash risk research, analysts predict that the degree of disagreement is significantly negatively related to the risk of stock price crash. Using the management intonation index built with the LSTM model, it is found that a positive management tone can help to resolve the risk of future stock price collapse.

2.1.3. Application of Information Reporting Sentiment in Market Forecasting

Extracting emotional information from Japanese analyst reports involving more than 800 stocks, it is found that subjective analyst opinions have a greater impact on stock prices than objective news reports. After considering analysts' opinions, the asset pricing model's ability to predict stock earnings outside the sample (adjusted R²) has increased by 11.8%.

In summary, there is a correlation between information reporting sentiment and stock yield, volatility and crash risk. Information reporting sentiment can be used to enhance the prediction of the stock market.

2.2. News Media Sentiment

2.2.1. The Impact of News Media Sentiment on Market Earnings

In terms of research on the impact of yield, most scholars believe that positive news media sentiment has a positive impact on individual stock or stock index earnings and can be used for market forecasting. Based on the news sentiment indicators built by China Securities Network, positive news sentiment can effectively predict the rise of stock yields in the coming week. Using Reuters International News to estimate the impact of media sentiment on stock prices, we found that news sentiment can strongly predict daily market returns in both developed and emerging economies. Based on vocabulary matching and manual judgment, a number of subjective and objective indicators to measure media emotions have been constructed. It is found that the optimistic vocabulary ratio and optimistic reporting ratio of media reports will have a positive impact effect on the yield of the Shanghai and Shenzhen 300 index.

2.2.2. The Impact of News Media Sentiment on Market Risk

In terms of stock price crash risk research, the excessive optimism of the media is significantly and positively related to the future stock price crash risk of the company, and the reasonable optimism of the media will not have a significant impact. Research on the GEM found that both positive and negative media sentiment significantly increased the risk of the company's stock price crash in the second year. The divergence between analysts' opinions and media news amplified the impact of news sentiment on the risk of future stock price crash.

2.3. Social Media Emotions

2.3.1. The Impact of Social Media Sentiment on Market Returns

In terms of research on the impact of yield, some studies believe that there is a positive correlation between social media sentiment and yield, and some studies believe that there is a negative correlation. Based on the individual stock research of Shanghai Stock Exchange A-shares, it is found that the stock yield is significantly positively related to the mood of the forum on the day, and the social mood is significantly positively related to the stock market return. When the social mood is low, the stock market return is more sensitive to social mood swings. Based on the online stock review "Publisher-Follower" data, the investor sentiment tendency index and the investor sentiment divergence index are constructed respectively, and it is found that both types of indicators are significantly related to the price and yield of the Shanghai Composite Index.

2.3.2. The Impact of Social Media Sentiment on Market Risk

In terms of the study on the impact of volatility, a study of Shanghai and Shenzhen 300 constituent stocks found that forum sentiment has a significant and asymmetric impact on stock volatility. Collect text emotions on Twitter and StockTwits at two-minute sampling intervals, and empirical research on five U.S. stocks shows that there is also a significant causal relationship between this higher-frequency emotional indicator and stock yield, turnover and volatility. Obtain daily data on positive and negative emotions in 20 international markets from Facebook, and calculate the emotional differences of the day based on positive and negative emotions, and find that the emotional differences are significantly positively correlated with stock price fluctuations.

2.3.3. Application of Social Media Sentiment in Market Forecasting

Numerous studies have shown that social media sentiment has made significant contributions to predicting stock prices, yields and volatility - not only do studies based on quantitative

models give this qualitative conclusion, but some predictive studies based on machine learning models also show quantitative comparison results. A study of Shanghai and Shenzhen 300 component stocks found that the overnight forum text sentiment can significantly predict market returns and show a pattern of "insufficient response - overreaction" within a few months, especially for small market capitalization stocks and growth stocks. Taking individual stocks in the U.S. technology industry as the research object, the OLS model verification shows that Twitter text sentiment is helpful for stock price prediction, especially for companies with high social media coverage. Based on the multi-layer perceptron model to predict the trend of A-share stocks, after including the emotional feature variables in the comment text of Snowball.com, the ACC and AUC values of the model have been improved to varying degrees. Integrate the emotional information of the stock forum and consider the weekly effect when predicting the rise and fall of the stock market, the prediction accuracy of the Shanghai Stock Exchange 50 Index has reached 89.93%, which is 18.6% higher than that without considering emotional variables.

3. Measurement and Analysis of Stock Market Volatility

Stock market volatility is mainly measured by stock turnover rate, stock yield and abnormal trading volume.

3.1. Stock Turnover Rate

The stock turnover rate is the ratio of the number of stocks traded on the day to the number of all tradable shares, and it is also one of the most important technical indicators to reflect the activity of market trading. The high turnover rate reflects the frequent in and outs of funds, and the opinions of the long and short sides are relatively different in the current price range. If the turnover rate increases and the stock price rises, this may indicate that the willingness of funds to enter is strong. For example, the turnover rate of a stock suddenly increases and the trading volume rises at the same time, which indicates that investors buy a lot in the market, and the stock price may rise accordingly. On the other hand, if a stock continues to rise for a period of time and the turnover rate increases, it may mean that some investors have to withdraw, the funds have to leave the market, and the stock price may fall in the future (not necessarily now). Generally speaking, stocks with a turnover rate of less than 1% are absolutely sluggish; stocks with a turnover rate of 1% to 3% are relatively moderate stocks; the turnover rate of 3% to 7% is a relatively active stock; the turnover rate of 7% and above is a very active stock.

3.2. Stock Yield

Stock yield, as the name implies, is an indicator of the level of stock return. It refers to the ratio of the total return obtained from investing in stocks to the amount of original investment, which is an important consideration for investors. The initial motivation for investors to buy stocks is to buy expected future cash dividends. In the dynamic model of logarithmic dividend price ratio, the stock yield is divided into two components: the expected discount rate and the expected dividend growth rate.

3.3. Abnormal Trading Volume

Abnormal trading volume means that the trading volume of the stock market is higher or lower than the average of large samples such as the industry or market. The abnormal trading phenomenon is very likely to occur in the securities market, so the securities market supervision department needs to have a corresponding mechanism to monitor and manage abnormal fluctuations in the securities market in real time. For example, when abnormal stock prices fluctuate on the stock exchange in New York in the United States and cause market sentiment panic, regulators will suspend trading to stabilize market sentiment and require

relevant companies to investigate and explain the situation. The Stock Exchange Trading Rules clearly stipulate that the identification of "abnormal fluctuations" in stocks and closed-end funds mainly includes: stock prices rise or fall by more than 20% in three consecutive trading days; the ratio of the average daily turnover rate to the average daily turnover rate of the first five trading days is greater than 30 for three consecutive trading days; the stock price is cumulative. The difference between rising or falling is 15%; or the cumulative turnover rate of stocks is more than 20% for three consecutive trading days.

4. Construction of Emotional Indicators

The key to building emotional indicators is the emotional dictionary, so it constructs a formal phrase emotion dictionary for analyzing information reports and an informal phrase emotion dictionary for emotional analysis in social media and news media. The construction idea of the dictionary is as follows: In terms of the construction of the formal language emotional dictionary, the cumulative excess rate of return of annual report [0, +3] is selected as the basis for judging the positive and negative annual report. Then the dictionary reorganization method is adopted to integrate the three dictionaries of the emotional vocabulary ontology of Dalian University of Technology, the China Knowledge Network Thesaurus and the praise and derogatory dictionary of Tsinghua University, and add the word segmentation results of the annual report corpus to get the initial dictionary, and then use the punishment mechanism to extract emotional words to The emotional dictionary uses the word bag model to build the intonation index of the annual report. In terms of the construction of informal language emotional dictionaries, considering the widespread use of emojis in social media to express the mood of the poster, posts that use emojis and clearly express emotions have been filtered as training samples to eliminate the deviations caused by artificial classification of social media posts. Then use the deep learning algorithm of the long-term and short-term memory network model to analyze the mood of posts on stock forums, and use the word frequency method with punishment to extract the emotion dictionary.

4.1. Construction of Formal Language Emotion Dictionary Indicators

First of all, based on the cumulative positive and negative returns released in the annual report [0, +3], the annual report is divided into two categories: positive and negative emotions. The sample data covers a total of 19970 annual reports from 2003 to 2015, of which 12,475 have a cumulative yield is positive, and 7383 have a cumulative yield of negative. There are 112 copies with a cumulative yield of zero (suspension), of which the annual report with a return of zero does not enter the data sample extracted from the emotional dictionary. Then, integrating the emotional vocabulary ontology of Dalian University of Technology, thesaurus of China Knowledge Network and the praise and derogatory dictionary of Tsinghua University, filter the words contained in the dictionaries that appear in the annual report, and add the Chinese lexical analysis system of the Chinese Academy of Sciences to reuse the vocabulary segmentation results of the annual report corpus Finally, the word frequency value to be selected in the initial dictionary is calculated according to the word frequency method with punishment mechanism, as shown in the following formula:

$$\text{Adjusted frequency}_n = \frac{w_{n,N}}{\sum_{n=1}^N w_{n,N}} \times \frac{1}{1 + \frac{w_{n,P}}{\sum_{n=1}^P w_{n,P}}}$$

In the formula, $w_{n,N}$ is the number of occurrences of negative words to be selected, n in the annual report set N where the income is negative; $w_{n,P}$ is the number of occurrences of negative

words to be selected in the annual report set p where the income is positive. The frequency of negative emotional words to be selected increases with the proportion of their occurrence in the collection of negative annual reports, and also decreases with the proportion of their occurrence in the collection of positive annual reports. Through the introduction of the punishment mechanism, the word frequency method with the punishment mechanism measures the negative degree of the word to be selected from the overall level. The numerical ranking calculated according to the word frequency method with punishment mechanism is sorted and the negative word list of the formal language sentiment dictionary is generated. Based on the same logic, you can get the positive word list of the formal phrase emotion dictionary.

4.2. Construction of Emotion Indicators in the Emotion Dictionary of Formal Language

On the basis of the informal language emotion dictionary, referring to the methods of Antweiler and Frank, a bullish emotional index and an emotional consistency index are constructed, which are named as the informal language dictionary emotion and non-regular language dictionary sentiment (Agreement), the calculation is as follows:

$$\text{Bullishness}_{it} = \frac{\text{Positive}_{it} - \text{Negative}_{it}}{\text{Total word}_{it}}$$

$$\text{Agreement}_{it} = 1 - \text{Bullishness}_{it}^2$$

$\text{Positive}_{i,t}$ is the proportion of positive words in the total number of words in all posts on the t day of the company i ; $\text{Negative}_{i,t}$ is the proportion of negative words in all posts in the t day of the company i . $\text{Bullishness}_{i,t}$ reflects the bullish sentiment of the stock i on the t day, while the maximum value of $\text{Agreement}_{i,t}$ is 1, that is, uniformly bullish or uniformly bearish, and the minimum value is 0, that is, the maximum emotional divergence.

5. Results of Empirical Analysis

According to the media sentiment indicators constructed in this article, the following conclusions are obtained through empirical tests:

- (1) The text sentiment index based on the formal language emotion dictionary is significantly positively correlated with the trading volume, yield and turnover rate, which shows that the intonation of the information report is related to the performance of the stock market after the release of the report, proves that the formal language sentiment dictionary built in this article, and the tone of the information report formed on this basis. Indicators are effective.
- (2) The bullish sentiment indicators of news media and social media based on informal language sentiment dictionaries are positively correlated with excess returns, transaction volume and volatility, and the constructed emotional consistency indicators are significantly negatively correlated with excess returns, transaction volume and yield volatility, which proves that the informal language sentiment dictionary constructed in this article, and The social media sentiment indicators formed on this basis are effective.
- (3) The intonation and emotional extraction of the existing widely used emotional dictionary in formal and informal text in the financial field cannot achieve the ideal effect, so it is necessary to build a professional emotional dictionary in the study of the financial field.
- (4) As an application of information reports, news media and social media sentiment indicators, the study found that the negative intonation of text information and social media bearish sentiment indicators based on this dictionary can significantly predict the risk of stock price

collapse of listed companies, proving that the sentiment indicators are the management of listed companies and financial media personnel. Accurate reflection of emotional and psychological activities. This type of research is currently in its infancy in China, so the two dictionaries have good application space in Chinese text analysis research in the future financial field.

6. Suggestions

With the continuous development of Internet technology and Internet finance, more individual investors can use financial platforms to invest in stocks, and financial media has gradually become the main channel for them to obtain information. As an active information transmitter, the subjective emotions of financial media people may lead to the irrational behavior of investors, which has a bad impact on the stability of the stock market. Through the research of this article, the following suggestions can be put forward to improve the effectiveness of stock information, media supervision and stabilize the capital market.

6.1. Financial Platform Plays a Regulatory Role and Builds a Professional Platform

As far as financial platforms are concerned, the publication of stock information is supervised to prevent the emergence of disorderly articles. In the current stock market environment, the role of the news media is infinitely amplified, and there are many cases where individual investors rely on news media to determine investment strategies. Because the impact of irrational media sentiment on the yield of stocks is inverted U-shaped, the irrationalization of reducing media sentiment can gradually return to unbiased expectations. In order to give full play to the rational guiding role of stock bar comments, it is particularly important to strengthen media supervision and public opinion governance.

6.2. Standardize the Information Transmission of Financial Media and Enhance Professional Quality

On the one hand, financial media can choose the official platform of the state or government agencies and authoritative institutions to obtain information, be familiar with the content of relevant events, and use their professional knowledge to extract useful information before publishing news. On the other hand, strengthen the professional quality of financial media people and pay attention to the transmission of rational investment concepts. Through the cooperation of relevant government departments, professional institutions, universities and Internet media, a series of lectures are carried out in a combination of online and offline ways to strengthen the popularization of economic and financial knowledge to financial media workers and investors.

6.3. Government Regulators Strengthen the Supervision of Information Disclosure

As far as government regulators are concerned, improve the quality and transparency of information disclosure of listed companies. Because the information released by the company largely determines the investment decisions of investors and the judgment of the stock price trend, improving the quality and transparency of the company's information disclosure can help investors make more rational investment decisions. This requires listed companies to improve their corporate governance structure and improve their legal compliance. In particular, for industries and stocks that are at the core of the stock association network, we should focus on strengthening the supervision of these industries and companies.

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