The effect of news and public mood on stock movements

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A B S T R A C T

With technological advancements that cultivate vibrant creation, sharing, and collaboration among Web users, investors can rapidly obtain more valuable and timely information. Meanwhile, the adaption of user engagement in media effectively magnifies the information in the news. With such rapid information influx, investor decisions tend to be influenced by peer and public emotions. An effective methodology to quantitatively analyze the mechanism of information percolation and its degree of impact on stock markets has yet to be explored. In this article, we propose a quantitative media-aware trading strategy to investigate the media impact on stock markets. Our main findings are that (1) fundamental information of firm-specific news articles can enrich the knowledge of investors and affect their trading activities; (2) public sentiments cause emotional fluctuations in investors and intervene in their decision making; and (3) the media impact on firms varies according to firm characteristics and article content.

1. Introduction

To prove the efficient market hypothesis (EMH) [14], many researchers have been devoted to studying the impact of the information on the movement of stock markets [2, 3, 6, 16, 21, 23, 28, 29, 38, 41, 48]. One of the earliest reports, that by Cutler et al. [10], found that macroeconomic performance news could explain approximately one-third of the variance in stock returns. Tetlock et al. [40, 41] then showed that general financial news has limited and short-lived predictive power on future stock prices. Recent theoretical studies in behavioral finance have demonstrated that emotion influences investment decisions [11, 39]. Such an inference was further confirmed by the findings of Li [23] and Schumaker et al. [36]. The authors discovered that the sentiments contained in financial reports or news articles affect stock returns. To systematically investigate the relationship between Web media and the stock market, we propose an effective methodology to quantitatively analyze the mechanism of information percolation on stocks.

In particular, we first testify that the fundamental information in firm-specific news articles affects the trading activities of investors. This correlation is achieved by representing online financial news that is related with the companies listed in China Securities Index (CSI 100) as weighted term vectors, and by applying a predictive model to analyze the impact of the news on stock movements.
Second, we study the sentiment impact on stocks, especially the emotions that the news evokes in the public. In fact, the wide adaption of social media allows readers to have easy access to the opinions or feelings of others via discussion, votes, comments, and similar means. With such a rapid influx of information, investor decisions tend to be influenced by the emotions of peers and the public. Thus, investigating such sentiment percolation and its degree of impact on stocks is important.

A unique contribution of this work is unveiling the black box of the internal functions of sentiments, firm characteristics, and news content on the relationship of Web media and stock markets. To the best of our knowledge, this is the first work to systematically investigate the determinants of Web media on stock markets in a quantitative manner.

The remaining content of this article is organized as follows. We first briefly describe related research in Section 2. The design details for our media-aware quantitative trading strategy are presented in Section 3. We then implement a trader with such principles and test the trading performance using real stock market data from the Shanghai and Shenzhen Stock Exchanges (Section 4). This paper is concluded with speculation on how the current prototype can be further improved in Section 5.

2. Related work

Researchers have explored the power of verbal information on stock markets due to the observation of stock price fluctuations with news feed. Empirical pilot studies have correlated news and stocks. For instance, [44] demonstrated that stock prices overreact to bad news in good times and under-react to good news in bad times using a rational expectations equilibrium model of asset prices. Chan [7] empirically examined monthly stock returns following public news and found that stocks with bad public news display a negative drift for up to 12 months; less drift was correlated with stocks with good news. Vega [43] further investigated media influence, reporting that stocks associated with private information experience low or insignificant drifts and that stocks associated with public news only experience significant drifts. By investigating the relationship between “risk sentiment” and stocks, Li [23] discovered that the risk sentiment has a negative prediction on stock returns, i.e., firms with a large increase in risk sentiment suffer negative returns, and vice versa.

With technological advancements facilitating vibrant creations, sharing, and collaborations among Web users, the adaptation of user engagements in social media effectively magnifies the influential power of Web media. Some researchers have focused on predicting the financial performances of the listed firms that utilize social media. For example, Bollen et al. [6] captured the public mood from tweets to forecast stock movements. Luo et al. [27] reported that social media is a significant leading indicator of a number of firm equity values based on the software and hardware industries. Yu et al. [49] suggested that social media attributes have a stronger relationship with stock performances than do conventional media attributes.

Different from empirical studies, experimental economists generate a laboratory-based financial market to explore information availability and trader effectiveness [2]. In particular, [31] created five markets to address the dissemination and aggregation of information, concluding that markets follow rational expectation equilibrium model predictions. Alfarano et al. [2] argued that if the quality of private information is not good, public information has a major effect on stock prices.

Table 1 summarizes some representative research on the influence of news on stock markets. For each study, the table summarizes its focus (firm), media source, and experiment. The firm column compares the selection of equity value, value scale, and focusing market. The media column presents the media source and its metric, i.e., whether the media is quantifiably measured (e.g., number of news articles) or via textual analyses. The experiment column compares the experimental data period and method. The empirical study and laboratory simulation in this research prove the existence of media influence on stock markets. However, a detailed analysis of information percolation and its degree of impact on stock markets has yet to be performed.

How to capture media influence on stocks and bridge such connections remains challenging. Artificial intelligence and natural language processing techniques have been utilized to address these challenges [21,28,33–35,48]. In particular, Wang et al. [45] presented a news article as a term vector using full words and studied the link of news to stocks using a hybrid predictive model. Schumaker and Chen [35] experimented with several textual representative approaches, including bag of words, noun phrases, proper nouns, and name entities, and found that representing news with proper nouns was most efficient. Tetlock et al. [41] analyze the sentiment of news articles and show that the fraction of negative words in firm-specific news stories forecasts low firm earnings. Frank and Antweiler [15] extracted the bullish and bearish sentiments of Yahoo! Finance postings, concluding that the effect of financial discussion boards on stocks is statistically significant. Gilbert and Karahalios [18] reported that an increase of anxiety, worry, and fear emotions produces downward pressure on the S&P 500 index. Table 2 summarizes these studies on media-aware stock analyses, reviewing textual representation, emotion extraction, and analysis model. How each research report relates to the issues that we aim to address in this article (i.e., quantifying the influence of public mood and news to study the impact of Web media on stock markets) is also summarized.

The sentiment analyses presented in previous studies rely on open-domain opinion analyses. The general sentiment word categorization, however, cannot translate effectively into a discipline with its own dialect [1,25]. In this article, to successfully measure news sentiments and capture public moods regarding investments, we propose an innovative algorithm that automatically extracts finance-oriented sentiment words from the Web. Furthermore, a media-aware trading strategy that utilizes finance-oriented sentiments is presented to study the combined effect of Web news and social media on stock...

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