Saleep Shrestha

Professor Chen

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How Traditional news and Twitter influences the stock market

**Abstract**

This paper investigates the influence of traditional financial news outlets and Twitter on stock market behavior, focusing on Tesla, Inc., throughout 2022. Utilizing sentiment analysis, I analyzed both financial news articles and tweets by Elon Musk related to Tesla. I also conducted a survey to assess investor perceptions regarding the impact of news sources and social media on investment decisions. The results revealed a complex relationship between media sentiment and stock performance. While traditional news outlets tended to convey positive sentiment, sentiment in Elon Musk's tweets did not consistently align with Tesla's stock price movements. The survey also indicated a higher level of trust in traditional news sources compared to social media for making investment decisions. My study highlights the potential of sentiment analysis tools in understanding market sentiment trends and offers insights for further research in predictive modelling for stock market movements.

**Keywords:** Sentiment analysis, Stock market, Traditional news, Non-traditional news (Twitter)

**Introduction**

Traditionally, financial news outlets such as CNBC, Bloomberg, and The Wall Street Journal have been the primary sources of information for investors on Wall Street and around the world. These media outlets are proven and trusted to provide quick market announcements, in-depth analysis, company reports, and other indicators among the investor's community (Kolakowski).

With the development of media and technology, there has also been popularity of new media among public, social media. In fact, social media has given rise to a new class of influencers who shape the market sentiments through unconventional means. Generally, these influencers lack formal training in finance but command a large followings of retail investors across platforms like Twitter and Reddit. Many of the influencers rely on emotion manipulation creating hype and Fear of Missing Out (FOMO) effect among audience, rather than relying on expertise and knowledge. For example, Kylie Jenner's tweet expressing dissatisfaction with a Snapchat update resulted in a $1.3 billion loss in Snapchat's market capitalization overnight (Smith and O’Hare). Similarly, a single tweet from Elon Musk expressing his opinion that Tesla's stock price was too high led to a $15 billion loss in Tesla's market valuation within a day (Smith and O’Hare). Tweets from influential figures, such as former President Trump, have been shown to sudden short-term fluctuations in stock prices (Smith and O’Hare).

In this paper, I will analyze and compare the sentiment of traditional and non-traditional (social media) news sources using natural language processing (NLP) models. My main aim of this study is to find whether traditional news sources and social media have influence in the investor’s behavior and stock market movement. I believe the relationship between these media and their influence on financial markets has been a topic of increasing interest in recent years as well.

**Methodology**

**Financial news**

In this paper, I closely monitored the news articles released over the period of one year (January 2022 – December 2022), from media houses such as CNBC and The Wall Street Journal, and the stock performance of Tesla, Inc. (TSLA) simultaneously. Mainly, I analyzed the news articles using sentiment analysis and their predictive relationship to stock market movement using a library of the Python programming language, Arabica. A library in any programming language is a collection of related modules and bundles of code that can be used repeatedly in different programs (GeeksforGeeks). Arabica is a part of a Python library that is popularly used for exploratory data analysis and specifically designed for sentiment analysis, which I used to accurately trace graphs based on the dataset in my research. While conducting my study, finding datasets for financial news related to Tesla, Elon Musk and stock market was challenging for me because there wasn’t any freely available dataset on the internet. So, I decided to scrape the news articles related to Tesla, Elon Musk and stock market using the Python programming language. Scraping is just a technical term that simply means extracting or rearranging the filtered data in a simple spreadsheet form. For this research, I chose ProQuest to scrape the news articles related to Tesla, Elon Musk, and the stock market. ProQuest is a popular database website containing all the news and is easily accessible without any fee or cost and was recommended by one of the honors professors and USM libraries’ staff, Professor Hali Black as well. After going through ProQuest, I filtered all the news articles related to just Tesla, Elon Musk, and the stock market for the year 2022 using the simple filter option on the website. I chose to extract only the news for the year 2022 because I found a dataset containing tweets of Elon Musk for that specific year only, which I will be using in the later part of my research. After a while of Python coding, I was able to create a dataset containing all the news sources related to Tesla, Elon Musk, and the stock market, with their date of publication, source, title of the article, links, and content of the article. I then exported the dataset into a .csv file. CSV files are a simple file format popular for saving files having tabular data (numbers and texts) and are accessible by spreadsheet software such as MS Excel. After I saved my dataset on my local computer, I then fed the data into Arabica to graph the sentiment of news articles using sentiment analysis (by using pre-defined code, Arabica gives us the sentiment score for each month or different time frame from any texts or articles given to it).

**Tweets by Elon Musk**

To understand the impact of social media, especially Elon Musk's tweets, I also utilized machine learning and sentiment analysis tools (Arabica) to closely monitor its influence on Tesla’s stock price throughout the year 2022. Initially, I collected a dataset containing all of Elon Musk's tweets for 2022 from Kaggle (a popular database for web scraping). In simple terms, a dataset is a set or collection of data. Then, I utilized a library of the Python programming language, Arabica, for sentiment analysis of Elon Musk's tweets. Arabica implements two models for sentiment analysis: VADER and the FinVADER method. VADER is a lexicon and rule-based sentiment classifier explicitly designed for sentiments expressed in social media and works best with general language texts. Meanwhile, FinVADER improves VADER’s classification accuracy by including financial lexicons (Readthedocs.io). Arabica performs sentiment analysis by taking text data as input, cleaning digits and punctuation, and providing time series sentiment analysis with a pre-trained sentiment classifier. Coffee\_break, a component of Arabica specifically designed for sentiment analysis, calculates sentiment in each row of the dataset, aggregates it over a specified period, and returns a plot and a data frame with a corresponding time series. I specifically chose the VADER model from the Arabica library in Python for this research because it is fast, requires no additional training to analyze the sentiment of data, and is trained on social media data, making it useful for analyzing tweets more accurately. Arabica returns sentiment scores based on the given data on a scale of -1 to 1, with -1 representing very negative sentiment and 1 representing very positive sentiment.

**Survey**

To understand the impact of traditional news media and social media from different perspectives and more accurately, I also decided to conduct a survey regarding investment decisions based on traditional news and Twitter among general participants. My survey questions mostly revolved around the influence of traditional news sources such as online news articles, newspapers, earnings reports, and Elon Musk’s tweets related to Tesla. Through my survey, I aim to find if people are influenced by news sources and social media in making financial decisions or not, and if so, to what extent they are influenced by the medias. I also included a direct question asking participants which sources they are more likely to rely on (news or social media) when making long-term investment decisions.

**Findings**

After analyzing Tesla's stock price for the entire year of 2022, we can observe that there was an overall downtrend in the price of Tesla's stock. The stock price peaked during March of 2022, reaching a high of 359.2 and a low of 123.18 during December.

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Fig - 3

Fig - 2

**Financial news**

After analyzing the results from Arabica, I can see that the financial news related to Tesla and Elon Musk had a positive sentiment score (above 0) throughout 2022. The sentiment score for January 2022 was 0.84, whereas for February it was 0.53. The sentiment score for the news in March skyrocketed from 0.53 to 0.94. In April, the sentiment score was 0.79. For May and June, the sentiment scores were 0.5 and 0.78, respectively. There was a clear drop from 0.78 to 0.17 between June and July. The sentiment scores for August, September, and October were 0.22, 0.13, and 0.49, respectively, while those for November and December were 0.53 and 0.57, respectively, on a scale of -1 to 1.

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Fig - 1

**Tweets**

The sentiment of the tweets I used in my study was Elon's general tweets, and similar to the sentiment score of financial news, Elon's tweets were positive all year. From January to March, we can see sentiment increasing from 0.13 to 0.16 to 0.17. However, Elon's sentiment decreased from March to April, from 0.17 to 0.14. Musk's sentiment then increased from 0.14 to 0.15 to 0.19, peaking in the month of June. Elon's tweets mostly hovered around 0.16 to 0.13 for the later months after June, throughout the year 2022. Later in my research, I also used Tesla-related tweets by Elon to study the influence of these tweets. However, the data of Elon's Tesla-related Tesla and all the tweets were similar to each other, fluctuating between a maximum of 0.156 and a minimum of 0.114, and both graphs exhibited a similar pattern.

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Fig - 4

A graph with green line and numbers

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Fig - 5

**Survey**

The survey showed that, on average, people would be less likely (with a score of 4.22 on a scale of 1-10, with 10 being the most likely) to buy Tesla stock if Elon tweets to buy it. The survey also found that, on average, participants would be more likely to buy Tesla if they see a news article mentioning Tesla introducing an upgraded version of Full Self-Driving (FSD), with a score of 5.11 out of 10. The result also indicates that, on a scale of 1 to 10 (with 10 being the most credible), participants found the news source to be above average credible, with an average score of 5.85. When it comes to the credibility of news obtained from social media, they found the news to be less credible than average, with a credibility score of 3.6. The research survey also showed that 71.4% of the participants found traditional news sources (Newspapers, News Channels, and earning reports) more credible for making long-term investment decisions in the stock market.

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Fig – 6

A graph with purple rectangles and numbers

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Fig – 7

A graph of a financial news outlets

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Fig – 8

A graph with purple bars

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Fig – 9

A blue and red pie chart

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Fig - 10

**Discussion**

**Financial news**

The graph for the sentiment analysis of news articles and the stock price of Tesla were kind of similar to each other. The stock price of Tesla was increasing (fig 2) when the sentiment of the news articles was increasing (fig 1), and conversely, the stock price of Tesla was decreasing when the sentiment of the news article was decreasing. This data can be attributed in two ways: financial news media have a relation with the stock market; when the news’s sentiment related to certain stocks is positive, then we can see the price of that stock increasing. However, the second theory is that news reflects the performance of the particular stock. This idea may be more likely to be true because the media houses report what the stocks are performing in the financial market in the overall economy, reflecting their current value of their company. One of a researcher’s studies on the influence of social media and traditional media also uses this concept and terms it as time-lagged cross-correlation (Smith and O’Hare 5). However, based on my data, I could also analyze the irregular relation with the sentiment graph and the movement of Tesla stock during the time frame of November 2022 and beyond, which shows a different result. According to the sentiment analysis of financial news, during the period of September to November, we can see a spike increase in news sentiment (fig 1), but the stock price was still decreasing until 2022 December (fig 2). However, after January of 2023, Tesla stock skyrocketed from $113 to $208 gaining over 84% in the short span of a month (fig 3). This data can be analyzed that the news and stock market have some kind of relation in them not only for the short time frame but also influencing the stock market in the long run. The result and graph obtained from the research also further support my initial claim that traditional news articles such as financial news, news articles, and earning reports not only influence the stock market but also long-term investment strategies in the US stock market.

**Tweets by Elon Musk**

The end result from my study was not what I expected, or rather what I expected before the start of this research essay. For the year 2022, my data showed that there is no relation between the tweets of Elon Musk and Tesla stock price. My initial assumption was that any company's CEO has a strong correlation with what they say on the internet or public media and their stock price, and also that tweets have a strong positive influence on the short-term stock performance of the company. However, my data shows that there is not any clear connection between them. While for some time periods, the graphs for the sentiment analysis of Elon’s tweets and Tesla’s stock performance were related, for example, from February 2022 to March and from August 2022 to October 2022, I believe that those correlations didn’t have any relation with the overall result, as most of the time during 2022, the graphs showed an inverse relation. I think that the sentiment graph of Elon’s tweets and Tesla’s stock price didn’t have any relation or had mixed relations because I didn’t have enough data related to Elon’s tweets for the months of November and December of 2022 at the time when I was training the model. The dataset was also only limited to the period from January 2022 to October 2022. I also think my result was not related because my model was trained on the dataset for all of Elon Musk's tweets, while in the case of news, I filtered out just the financial news related to Tesla and Elon Musk. But even though, I later used the sentiment score of tweets of Elon Musk relating to Tesla only, the end result had no correlation with the Tesla’s stock price, rather had similar properties as Elon’s general tweets sentiment data.

**Survey**

After getting the data from sentiment analysis of tweets from Elon Musk, the result from the survey didn’t surprise me. Even though the result showed completely different from what I initially assumed for the influence of social media, it had similar result with that of the graph that I got from sentiment analysis through using Machine Learning. The survey showed that on average, the people would less likely, 4.22 (on a scale of 1-10, 10 being most likely) buy Tesla stock if Elon tweets to buy it. Initially, I assumed that people would buy a stock if that company CEO tweeted to buy it or showed positive sentiment through social media posts, which is also not completely false because an article from Harvard Business Review also claims a similar argument, “CEOs’ observed personality traits do have important consequences for their firms’ stock volatility (i.e., risk) and shareholder returns” (Harrison et al.). Which also claims that CEO’s sentiment in the social media influence the stock market. But the other result from the survey, about the traditional news media, was also supporting my claim that news does influence the stock market long-term performance of the stock market and have a positive relation with the stock price, where the participant voted 5.11 (on a scale of 1-10, 10 being most likely) for the question of how likely are you to buy Tesla stock if you see some news article mentioning Tesla introducing an upgraded version of Full Self-Driving (FSD). This data shows that on average, the participant is more likely to buy Tesla stock based on the positive sentiment of the news related to Tesla. The data from the sentiment analysis and survey narrows down to the same argument that traditional news media does influence the stock market in making investment decisions. In my survey, I also asked the participant to rate the credibility of financial news outlets such as The Wall Street Journal, New York Times, CNBC, and social media such as Twitter and Reddit. The result shows that on a scale of 1 to 10 (10 being most credible), on average, the participant found the news source to be above average credible being 5.85. Whereas, in case of the credibility of news obtained from social media, they found the news less credible than average with a credibility score of 3.6. The research survey also showed that 71.4% of the participants found the traditional news sources (Newspaper, News Channels, and earning reports) more information for making long-term investment decisions in the stock market.

**Results**

There is a complex and uncertain relation between tweets on Twitter and stock market performance. My data shows that there is some sort of relation between financial news and stock market performance, but no relation between tweet sentiment and stock price. A research by Smith and O’Hare also finds out that there is no relation between tweets and stock market performance; rather, there is significant dependence between Twitter’s sentiment and abnormal return in the stock price (Smith and O’Hare 3). Researchers also found out that if they could analyze the behavior and sentiment of people from the tweet, then they could somewhat accurately predict or analyze the impact of it on the financial market. They also added that when the sentiment among the Twitter users was calm, then the data could help predict the stock market changes accurately for 2-6 days (Smith and O’Hare 3). The researchers also claim that the dataset they are taking to train their models will also largely impact the result of the overall performance (Smith and O’Hare 3). The dataset that I have used to train the model is not complete and accurate, which might also cause my end result to contradict with my initial argument. However, the world's most powerful asset management company, JP Morgan, claims that the market reacts to tweets containing certain keywords, such as ‘China’, ‘Billion’, and ‘Democrats’ (Smith and O’Hare 4). This statement claims that by analyzing the collective sentiment of users, it is possible to gain valuable insights into the potential impact on the stock market. JP Morgan also claims that the custom-built financial models perform better than pre-defined models (Smith and O’Hare 4). In my study, I have used a pre-defined model, Arabica, which might have also affected the result of my research. However, the use of machine learning models and sentiment analysis has the potential to provide investors and financial analysts with valuable tools to predict stock market movements more accurately and respond proactively.

**Conclusion**

Narrowing down everything, this research highlights the complex interplay between news media, social media, and the financial market, revealing the influences they exert on investor behavior and stock market performance, with a focus on Tesla’s stock. Throughout the study, the sophisticated sentiment analysis tool, Arabica, was used to calculate the sentiment trend in both news articles and tweets, with the aim of finding any correlational pattern with Tesla’s stock performance.

The findings show that financial news outlets, with their focus on in-depth analysis and market fundamentals, mostly conveyed positive sentiment throughout the year 2022. Whereas the influence of social media on stock market performance wasn’t related to each other. A survey conducted during the study showed that most people trust traditional news sources more than social media when making investment decisions. However, investors, especially retail traders, should be able to differentiate credible information from hype and misinformation created in the news and social media to make informed financial decisions in the stock market. The application of sentiment analysis in this research demonstrates its potential as a valuable tool for analyzing market sentiment and predicting potential trends in the stock market. While the relationship between news sentiment, social media sentiment, and stock performance is not always corresponding and true, the data from sentiment analysis can be coupled with other indicators to potentially develop an accurate stock predictive model and enhance our understanding of the stock market soon. I believe this because after completing of this research, I was also able to create a dataset containing scrapped data of financial news related to Tesla and Elon Musk and publish in one of the most popular open-source platforms for data science community, Kaggle. I also hope to refine and retrain the data using new and complete latest dataset and hopefully publish my research paper to entire Finance, Data Science and Machine Learning community in near future.

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