

The Analysis of Relationship Between Emotional Factors and Stock Price

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Abstract. This study compares the relationship between the emotion factors catching from twitter and the price of five top companies in the US throughout five years from 01/01/2016 to 12/31/2020. According to the analysis, the sentiment score (from negative to positive) of comments of a company from twitter have strong and positive relationship with the stock price of companies in most of the situation. It proves the fact that social sentiment and people's comment on one company do have great possibility to affect the stock price of a company. Besides, it is necessary to be considered as an important factor when analyzing a company or the whole stock market. The research value of this paper is that people might use emotional factors as a parameter that is helpful to predict the price of stock in the future. On the other hand, investors might better understand the stock market and trading stocks because sometimes the price might not fully reflect the real situation of the company but also reflects the emotional factors. These results shed light on guiding further exploration of finding the rule of stock market by introducing a new factor that make the analysis more comprehensive.

Keywords: Stock Price; Top Company in US; Twitter; Emotional factors.

1. Introduction

With the development of technology and increasing of time people using electronic devices, people get to know about the information much faster than before. Investors who buy stock would be more sensitive to every information that might have negative or positive effect on the company they own stock or the whole market. One of the most important resources that people can obtain emotional factor is social media. To start the introduction, it is necessary to introduce the background of emotional factors. In traditional stock market theory people make decision completely by rational and objective data. However, that theory is unreliable in the real world because the emotional factors would play an important role on stock price. This effect can be seen in boom times, when positive sentiment and expectations drive prices to astronomical heights and eventually, they must fall [1]. The emotional impact is also evident in times of economic turmoil, when investors stand on the sidelines, reluctant to take advantage of obvious opportunities due to negative emotions associated with recent experiences [2].

The phenomenon of investors following the trend is serious, and stock price fluctuations are greatly affected by "noise" [3]. When the stock price is biased due to the negative sentiment of investors. Because of the widespread existence of "noise" transactions, it is difficult for arbitrageurs to predict the trading direction of noise traders in the short term. In addition, it is difficult to reduce stock price fluctuations through arbitrage behaviors and achieve market efficiency. Alexander provides new evidence that emotions expressed in Twitter contain valuable information and can enhance explanations of the dynamics of indexes and stocks [4]. The current research in Chinese Stock market found that, individual investors who did not have much experience are much more sensitive (98%) to the market's fluctuation than the professional investors or institutions [5]. This result proves the fact that the stock market is emotional. Additionally, five mood including disgust, joy, sadness, and fear can be used to predict the price and volume of the stock market. A research on 2013 found that for small company and company that have few returns of stock would like to be more vulnerable to people's sentiment about the stock market.

Contemporarily, scholars found that the emotion of investors in the stock market also have period. The research of Daniel present that a positive of positive emotion period will always follow by a negative emotion period [7]. Here are 1/3 of time shows that the people's sentiment is greater or

below the reasonable scope [8]; Wang found that before the Holidays and Festivals people would like to be in a good mood, the stock market would tend to show a better trend than that in usual [9]. Ten carried out a 40 year data research and showed that from 1971 to 2011, Taiwan Stock Market shows that the return of stock at a date before a festival or holiday is 0.43% while for US Stock Market the number is 0.3% [7]. It further proves the fact that people's mood could affect stock market since they often have a positive emotion before the holiday.

For the comments the wrote by social media users, that information are all sentences, articles but not numbers. It would be difficult to compare it to another group of numbers, which is stock price of a company directly. To represent a clear view, it is necessary to transfer those characters to numbers. According to Recognition and Classification of Emotions in the Chinese Microblog, the author mentioned that the emotional factors can be divided into several parts including emotional words, mood phrases, punctuations, and emoji. With the help of data training each element of a sentence or article could be score as negative, even, or positive, and finally provide overall scores. The rest part of the paper is organized as follows. The Sec. 2 will cover the resource of including comments on twitter and how to generate emotional factors. The Sec. 3 will show the result of emotional factors, correlation analysis between stock price between companies and sentiment of twitter and conclude with limitations and expectations.

2. Data & Method

2.1 Data

All the data from this report is collected from Kaggle and did further combination for an easier visualization of the correlation [10]. For the comments of the Twitter, the report collected around 3.7 million of comments with twitter's ID; writer; postdate; body of posts; number of comments, retweets, and likes about Five top companies in the US including Apple, Tesla, Amazon, Google, and Microsoft. The next step is to combine it with the symbol of the post and recognize the different comments is correlated to different companies. Here, Output 61; 62; 63 represent the ticker symbol, tweet id and posts, and output 64 represent the combination of those data. To compare the stock price of the company directly to the stock price, the next step is to divide the dataset with the help of ticker-symbol and drop the unnecessary data. The most important information in the dataset would be the comments, postdates and which company the posts or comments are about. For the stock price of the five companies, this report imports data of five years of stocks (from 01/01/2016 to 12/31/2020) including open price and close price of the five companies from Yahoo finance to make sure that the score of. Fig.1 shows the close price of apple throughout the five years.



Fig. 1 The price trend of Apple.

2.2 Emotional Factors Generation

For sentiment analysis of the comments and posts of twitter, this report uses AFINN package from python to score those languages. AFINN is a developed package that could transfer the input information to a digit output, there are three kinds of results, which are ‘-’ represent negative mood; ‘0’ represent even mood and ‘+’ represent positive mood). For example, if the input is “I am happy today.”, the output would be +3; for inputting “It would be a little unlucky today”, the output would be -2. If the input is “I will take a bus to school”, the output would be 0.

2.3 Procedures

With the help of preparation of the former steps, now we have the intact data for the score of posts for five years of five companies and the stock price. The next step is to combine the scores and the stock price in one graph and represent the correlation of trend for five years. To visualize the correlation, this report defines the sentiment overtime by setting Y1 axis which shows the average sentiment score for a day for the company (blue line) and Y2 axis which shows the closed stock price during the five years of the target company (yellow line). The X axis represent the 5-years period. The report also uses spearman statistics and would like to calculate the correlation between Y1 and Y2 and P value to make sure that the correlation have enough confidence to be valid.

3. Results & Discussion

3.1 Emotional Factors

In total, this study collects 1096868 comments about Tesla; 1425013 comments about Apple; 718715 comments about Amazon; 375711 comments about Microsoft; and 392569 comments from Google. Each comment has been scored, and the frequency of the score of comments for each company has been showing below. For the company, the posts or comments that be scored at 0 is around 50%, and the largest part beside 0; would be 1 to 3, which cause the fact that all average score of sentiments of each company on each day is above 0. For most of company, the highest score is 10 and the lowest score is -8, while for Tesla the lowest score is -10. The statistics histograms are showing in Fig. 2.

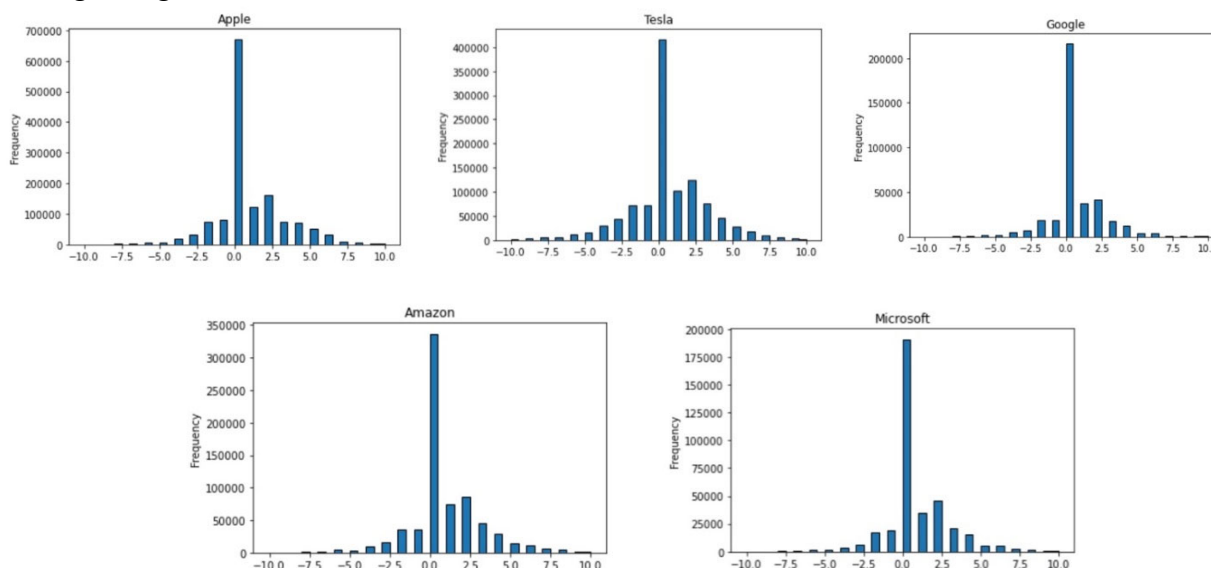


Fig. 2 Statistics histograms of different companies.

3.2 Correlation analysis

According to the analysis for individual companies, the research found that the difference of the intensity of correlation between Twitter’s sentiment and Share price varies much but most of the

companies shows strong confidence that there is correlation between the prices and the emotion scores. For Google (seen from Fig. 3), there is a huge difference between the Tweets sentiment and share price at the first half years of 2015, but after that, the graph represents a strong correlation between the price and sentiments.

For Amazon, Microsoft and Apple as illustrated in Figs. 4-6, the output shows that the correlation between tweets sentiment and share price are all above 0.6 which proves the fact that for these three companies, the mood comments and posts have significant effect on the stock price in the five years of research period. However, there is one outlier among five companies, which is Tesla (as depicted in Fig.7). According to the information presenting in the graph below, there is only 0.01 correlation between tweets sentiment and share price. The P value is around 0.65, which shows the fact that there might not have any relation between the comments of Tesla in twitter and its Stock Price.

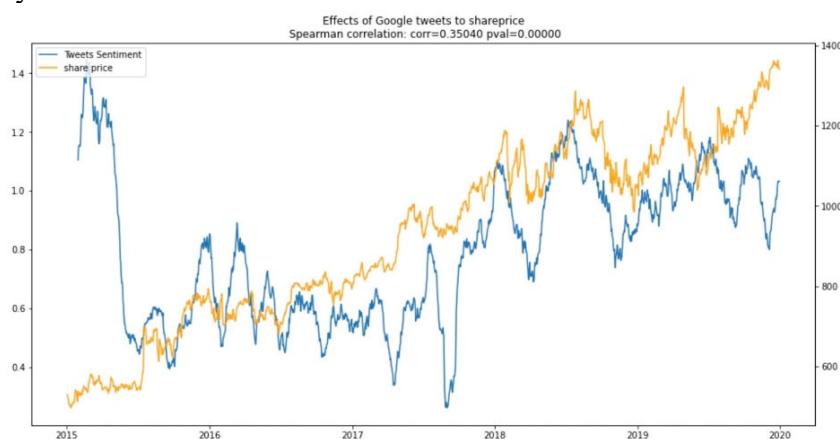


Fig. 3 Effects of Google tweets to share price.

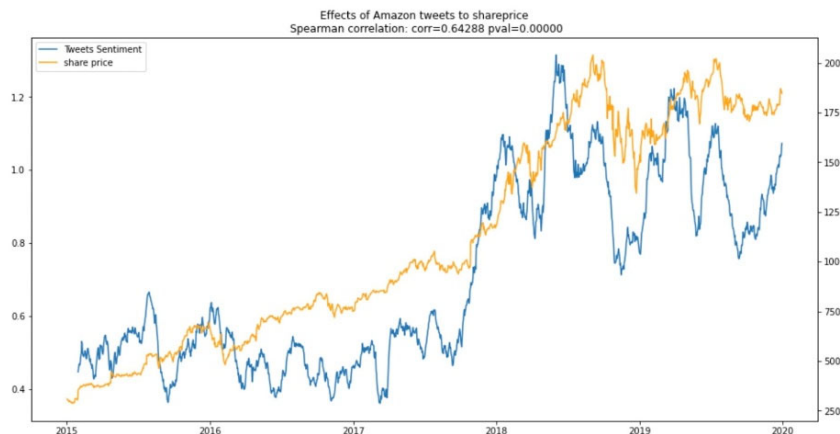


Fig. 4 Effects of tweets to share price.

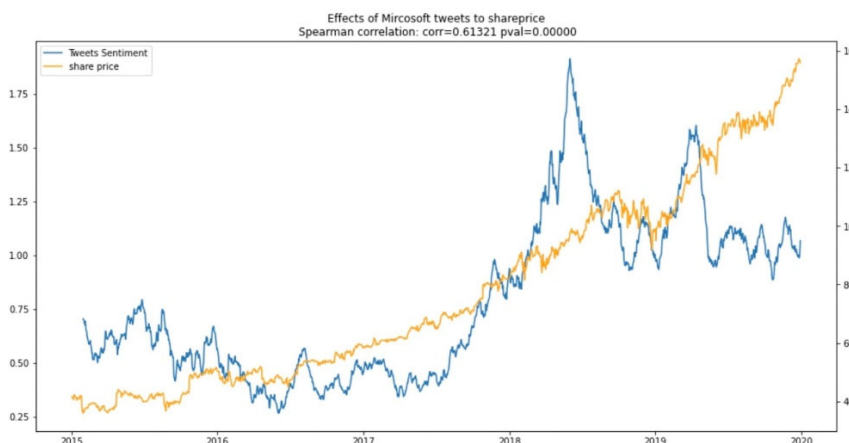


Fig. 5 Effects of Microsoft tweets to share price.

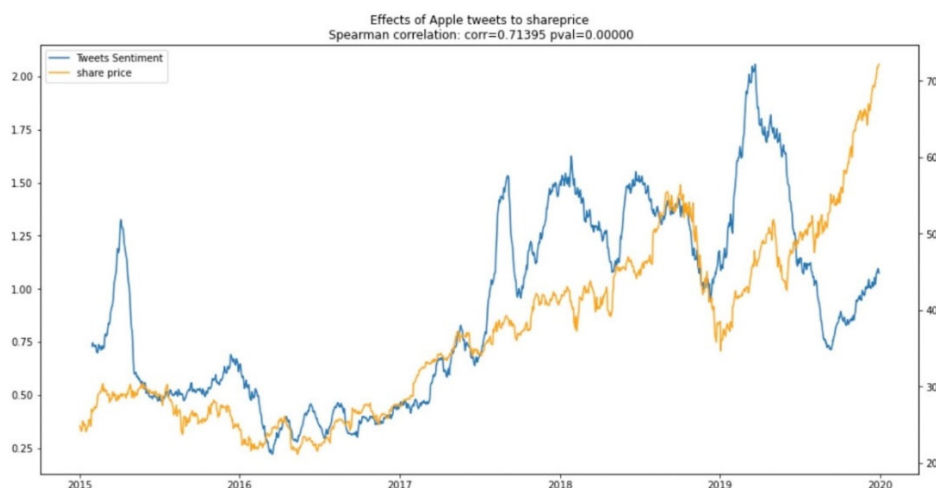


Fig. 6 Effects of Apple tweets to share price.

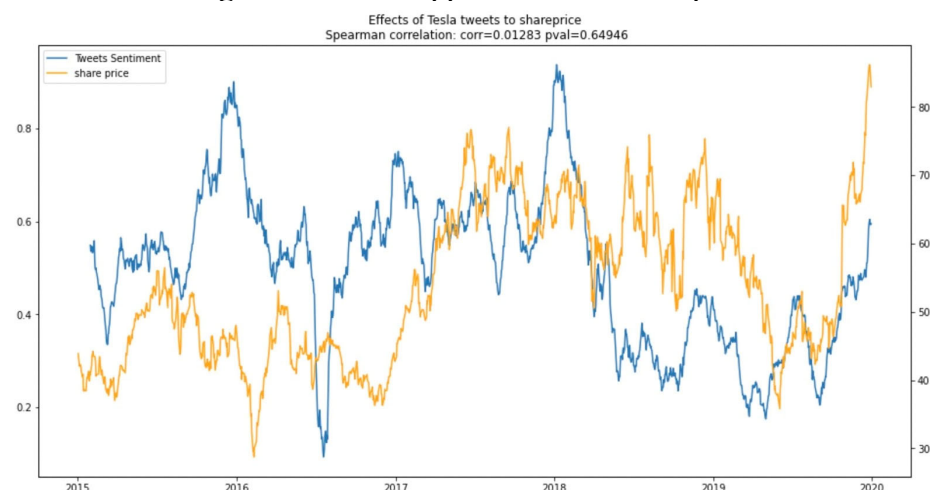


Fig. 7 Effects of Tesla tweets to share price.

3.3 Explanation

From the results showing above, it is summarized that there is one company have relatively low effects of tweets to share prices, three companies have strong relationships while the other one has almost no relationships between the sentiment of comments and its stock price. One might conclude from these result that in most of time, it is necessary for people to add sentiment analysis when they would like to appraise or predict the stock. In general, the people's attitude toward the stock market could be reflect by twitter and those posts could affect the share prices of the markets lightly or heavily.

3.4 Limitations

Nevertheless, the results presnted in this study have some drawbacks and shortcomings. This paper only analyzed five large and representative companies in the US, it might not reflect the precise correlation between the emotional factors and stock prices for all companies. Besides, the companies chose in the research are all one of the most famous companies in the world, which means that it is easy to get huge amount of information and data that is related to them and are useful for data analysis. On the contrary, though some companies are in the stock market, they are not as famous as the sample companies and might not attract too many people to make comments on twitter. Shortage of useful data will cause difficulties to score the sentiment and compare itself to the stock price. As an application of the analysis of this paper, it will be useful for analyzing the combination of emotional factors and stock price for the company that is known by large population but not companies that are not attract many people to have conversation about.

4. Conclusion

In conclusion, this research uses stock price of five top company in the US and compare those to the emotional factors of those companies from twitter. According to the analysis, three of the companies the paper choose shows strong correlation between the sentiment of comments and post and the price of stock, which are Microsoft, Amazon, and Apple. one shows relative low correlation which google, and one which is Tesla shows almost 0 correlation and one which is Tesla. However, the graph from 2018 to 2020 of Tesla also shows strong correlation. The limitation of the paper is the too less experimental subjects which might not represent all companies in the market. In the future, people would not only use K-line and financial report as the only reference when they try to do investment on a specific company or market. The results prove the fact that in most of time, the emotional factors in social medias do affect the stock price in the stock market. Investors could use sentiment analysis as a tool for evaluating a stock. Overall, these results offer a guideline for Investors and Institution that they should utilize emotional factors as important information when trying to investigating the market.

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