An Assessment of Correlation between Twitter Sentiments Indicators and Stock Market Indicators, with Reference to BSE and NSE in India

S. Santhoshkumar*, Murugesan Selvam**, Chinnadurai Kathiravan***, Dhamotharan Dhanasekar****

Abstract

The study aims to reveal the relationship between Twitter sentiments indicators and stock market indicators, with reference to BSE and NSE in India. This study used secondary daily time series data, for a period of two years, from 01.01.2018 to 31.12.2019. Statistical tools, such as Descriptive Statistics and Correlation Matrix, were employed to perform the analysis. It was found from the correlation analysis that there was a relationship between Twitter sentiments indicators and stock market indicators. The findings of the study would be useful to the investors and other participants in the stock market, as they seek to understand the influence of Twitter on stock returns.

Keywords: Stock Returns, Social Media, Tweets

JEL Classification: G15, G17, N25, P34

Introduction

Earlier research studies on stock market prediction across the globe were mainly based on historical stock prices. The prices in the stock market have been largely fluctuating. The Efficient Market Hypothesis (EMH) states that the movements of financial market depend on the information content of news, current events, products released by firms, and other related information; all these factors could have a significant impact on the stock prices of firms in the market. There is a high degree of unpredictability in the news of current corporate and economic events. Hence the stock prices follow a random walk pattern and stock price could not be predicted with more than 50% accuracy (Venkata Sasank Pagolu et al., 2016). Social media is widely used by the public, and it supplies abundant information on public issues. Social media, the perfect platform, shares public emotions about any topic and, in turn, it has also created a significant impact on overall public opinion. Twitter, a social media platform, has also received a lot of attention from people, particularly researchers, in the recent times. Twitter, a micro-blogging application, allows the users to follow and post comments on other users' thoughts or views, and share their opinions on anything, including corporate and economic activities, in real time. More than a million users post over 500 million tweets every day (Bhardwaj et al., 2015). Thus, Twitter functions like a corpus, with valuable data for researchers. Each tweet is 500 characters long and shares public opinion on any topic concisely. It is believed that information generated by tweets affects individual life and feelings, and ultimately people's decisions too. In short, Twitter affects all economic activities, directly or indirectly. Besides, the information from tweets are very useful for making prediction about economic activities, including the prices in the stock market.

Sentiment analysis is the task of judging an opinion in a piece of text, as positive or negative. Indian stock markets (both BSE and NSE) have gained the interest

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* Ph.D Research Scholar, Department of Commerce and Financial Studies, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India. Email: sakthisanthoshkumar04@gmail.com

** Professor and Head, Department of Commerce and Financial Studies, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India. Email: drmselvan@yahoo.com

*** Ph.D Research Scholar, Department of Commerce and Financial Studies, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India. Email: kathirnba@gmail.com

**** Ph.D Research Scholar, Department of Commerce and Financial Studies, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India. Email:dhanasekarprof@gmail.com

of a large number of investors. High levels of risks are assumed by the investors because of the complexity of the stock market. The Sensex and Nifty are the two prominent market indices of India, which represent the stocks for BSE (Bombay Stock Exchange Ltd.) and NSE (National Stock Exchange Ltd.), respectively. There are 30 top companies stocks for Sensex, while there are 50 top companies stocks for Nifty. There is need to predict the price of stock market status by using these two most important indices (i.e. Sensex and Nifty), for the benefit of the investors.

Review of Literature

Zhang et al. (2011) analysed stock market indicators such as Dow Jones, NASDAQ, and S&P 500, by analysing Twitter posts. The study analysed the correlation between the sample indices and the stock market indicators. Mao et al. (2012) investigated whether the daily number of tweets about Standard & Poor's 500 (S&P 500) stocks are correlated with S&P 500 stock indicators (stock price and traded volume), at three different levels. Sprenger et al. (2013) studied the association between tweet sentiment and stock returns, message volume and trading volume, as well as disagreement and volatility. It was found that stock market microblogs did contain valuable information, which was not fully incorporated in current market indicators. Bhardwaj et al. (2015) pointed out that in the Indian scenario, the Sensex and Nifty are two major indicators for the prediction of stock market condition. The study demonstrated the sentiment analysis for stock market, using Sensex and Nifty, to predict the price of stocks. The study used python script, with sleep count time interval of one second. It was found that at particular time intervals, the fetched values of Sensex and Nifty remained constant. Fan et al. (2019) examined the link between information spread by social media bots and stock trading. There was a significant relationship between bot tweets and stock returns, volatility and trading volume, at both daily and intraday levels. Ge et al. (2019) analysed the impact of tweets from President Donald J. Trump's official Twitter accounts, from November 9, 2016, to December 31, 2017, that included names of publicly traded companies. It was found that his tweets moved with company stock prices and increased trading volume, volatility, and institutional investors' attention, with a stronger impact before the presidential inauguration. Besides, there was some evidence that the initial impact of the presidential tweets on the stock prices was reversed in the next few trading days.

Audrino et al. (2019) analysed the impact of sentiment and attention variables on the stock market volatility, by using a novel and extensive dataset that combined social media, news articles, information consumption, and search engine data. Groß-Klußmann et al. (2019) examined the long-term relationship between signals derived from nine years of unstructured social media microblog text data and financial market developments in five major economic regions. It was found that experts and users were the main drivers behind the interdependence between Twitter sentiment and financial markets. Fan et al. (2020) proposed new measures of firm-level uncertainty exposure around important political events. The study also analysed the relationship between (dis) agreement measure and individual stock features. The results suggested that the increased disagreement among such tweets was associated with heightened stock price, volatility, and trading volume. From the above literature, it is clear that there are few studies that analysed the impact of Twitter activities and investors' sentiment across the globe. Hence, the present study was undertaken.

Statement of the Problem

The prediction of stock prices and indices movements is one of the classic problems of the stock market behaviour. Minimising the risk and maximising stock returns on investment are some of the issues, which engage the attention of all investors in the capital market. There are a number of studies that forecasted the movement of stock indices and assessed stock returns of various stock markets in the world economies, for different time horizons. It is a known fact that investors normally find it difficult to earn the expected returns by buying and selling of shares. The investors frequently lose their hard-earned money in the stock market, due to lack of adequate financial literacy and knowledge about the stock market movements, which are highly non-linear in nature (Boyacioglu & Avci, 2010). However, forecasting stock indices, especially the prediction of highly stochastic key stock indices of the ever-growing Indian economy, like BSE-Sensex and NSE-Nifty, has become a daunting task, since only a few studies focused on the prediction of Indian stock indices by using the proven forecasting techniques. The absence of proven forecasting techniques, to exactly predict the

movement of stock index values, signifies the magnitude of the issue.

The stock exchange is a subject that is highly affected by economic, social, and political factors. There are several external and internal factors, which affect the movement of the stock markets. The stock prices rise and fall, every second, due to variations in supply and demand, and socio economic factors. Various data mining techniques are frequently used to predict the future movements of stock prices. Few studies have demonstrated that Twitter is connected to the movements of prices in the stock market. This study looks at answering the question, "what is the impact of Twitter activity and investors' sentiments on the stock market in India?" Against this background, an attempt has been made in this study to assess the relationship between Twitter sentiment indicators and stock market indicators, with reference to BSE and NSE in India.

Need for the Study

Accuracy in forecasting stock price and index movement is the prime motive, from the point of view of investors interested in maximising their wealth by making investments in financial assets like equity shares, preference shares, bonds, and debentures, which are normally traded in the stock exchanges. This study would help stock market investors to take well-informed investment decisions, based on scientific thinking and a rational approach. Besides, this study would be useful to develop an approach, based on proper assessment of investors' sentiments. In the light of the study, investors could probably reap a higher rate of returns on their capital market investment. In view of the findings of this study, the traders could earn better returns, by leveraging the high growth rate-driven stock market environment.

Hypotheses of the Study

For the purpose of this study, the following two null hypotheses were developed and tested.

- NH1 – There is no normality in the predictive relationship between Twitter sentiment indicators and stock market indicators.
- NH2 – There is no correlation between Twitter sentiment indicators and stock market indicators.

Methodology of the Study

Sample Selection

There are two major stock market indicators, namely Sensex of BSE and Nifty of NSE in India. Hence, this study covered these two market indicators. The information floated in all the tweets regarding stock market operations was selected and used for this study.

Sources of Data

The present study fully depended on secondary data regarding stock indices and Twitter response data. For the purpose of this study, the data regarding stock market indicators, Sensex of BSE and Nifty of NSE, were used in this study. Market information, like share price, was collected from yahoofinance.com (http://finance.yahoo.com/). The required data about Twitter news feeds were collected from the Twitter database (https://www.kaggle.com/).

Period of the Study

This study covered a period of two years from 01.01.2018 to 31.12.2019.

Tools used in the Study

For the purpose of achieving the above objectives, the following tools were used for the analysis.

- *Descriptive Statistics* (to find out the normal distribution of Twitter sentiment and stock market indicators).
- *Correlation Analysis* (to find out the correlation between Twitter sentiment and stock market indicators).

Limitations of the Study

The study suffered from the following limitations:

- The present study considered only two indices of India (NSE and BSE).
- The period of study was limited to two years only.

- All the limitations associated with statistical tools used were also applicable to this study.

Results and Discussion

The sentiment analysis of Twitter streaming data and market indicators is presented as follows:

- Normality (Descriptive Statistics) of Twitter Sentiment and Stock Market Indicators.
- Correlation among Twitter Sentiment and Stock Market Indicators.

Normality (Descriptive Statistics) of the Twitter Sentiment Indicators and Stock Market Indicators

Table 1 shows the results of descriptive statistics, for Twitter sentiment data and stock market indicators, during the study period 01.01.2018 to 31.12.2019. It is evident that the summary statistics, namely minimum, maximum, mean, standard deviation, skewness, and kurtosis, was used to analyse the sample variables during the study period. It is clear from the table that positive tweets (0.690) and trading volume of NSE (0.655) scored a positive mean value during the study period. Similarly, the NSE index return (1.398) exhibited the highest standard deviation in daily returns. The analysis of skewness revealed that values for all sample variables, except BSE return (1.802), NSE return (1.782), and Volume NSE (5.817), were negative during the study period. The analysis of skewness and kurtosis of the stock market indices and Twitter sentiment indicated that there was non-symmetric distribution of data, with fat tails, compared to normal distribution. In short, the distribution of return data for all the sample indices was normal. Hence NH1 – there is no normality in the predictive relationship between Twitter sentiments indicators and stock market indicators – was rejected.

Table 1: Normality Test (Descriptive Statistics) for Twitter Sentiment Data and Stock Market Indicators during the Study Period 01.01.2018 to 31.12.2019

	Minimum	*Maximum*	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
POS	0.000	1.000	0.690	0.461	−0.844	−1.292
NEG	−1.000	1.000	−0.300	0.467	−0.767	−1.087
Ret. BSE	−8.400	13.903	−0.014	1.379	1.802	22.552
Ret. NSE	−8.594	14.101	−0.0209	1.398	1.782	22.931
Vol. NSE	0.123	8.593	0.655	0.595	5.817	55.310
Vol. BSE	−5.393	0.000	−0.266	0.410	−6.209	57.176

Sources: Data collected from http://finance.yahoo.com/ & https://www.kaggle.com/ and Computed SPSS 20.0.

Note: POS – Positive Tweets, NEG – Negative Tweets, Ret. BSE – Return for Stock in BSE, Ret. NSE – Return for NSE, Vol. BSE – Volume of BSE, and Vol. NSE – Volume of NSE.

Correlation between the Twitter Sentiment Data and Stock Market Indicators

The general indicator of market (correlation matrix) was used to find out the relationship between Twitter sentiment and stock market indicators. The results of correlation analysis, for Twitter sentiments indicators and stock market indicators, during the study period 01.01.2018 to 31.12.2019, are given in Table 2. For the purpose of this study, two variables of Twitter sentiments (positive comments and negative comments) were considered as independent variables, while four indicators, namely NSE Returns, BSE Returns, Volume of NSE, and Volume of BSE, the stock market indicators, were the dependent variables. According to the results of the table, it was revealed that there was a positive correlation between Twitter sentiment indicators and stock market indicators, since positive comments had recorded the significant values of 0.055 with NSE R, 0.049 with BSE R, 0.001 with volume of NSE, and 0.025 with volume of BSE, during the study period. Similarly, the variable called the negative comment of Twitter sentiment, had reported significant values of 0.057 with BSE R, 0.001 with volume of NSE, and 0.022 with volume of BSE, at 95% confidence level. It is worth noting that NSE R did not register any relationship with positive and negative comments of Twitter sentiments, at the expected confidence level, during the study period. The overall analysis

found that Twitter sentiment indicators had maintained a relationship with three stock market indicator variables, out of the four dependent variables. Therefore, the Null Hypothesis, NH-2 – there is no relationship between Twitter sentiment and stock market indicators – was partially rejected.

Table 2: **Results of Correlation between Twitter Sentiments and Stock Market Indicators during the Study Period 01.01.2018 to 31.12.2019**

Variables		Twitter Sentiments Indicators		Stock Market Indicators			
		Positive Comment	*Negative Comment*	*NSE R*	*BSE R*	*Volume NSE*	*Volume BSE*
Twitter Sentiments Indicators	**Positive**	1					
	Negative	0.963	1				
Stock Market Indicators	**NSE R**	0.055	0.062	1			
	BSE R	0.049	0.057	0.993	1		
	Volume NSE	0.001	0.001	0.489	0.553	1	
	Volume BSE	0.025	0.022	−0.027	−0.028	−0.074	1

Sources: Data collected from http://finance.yahoo.com/ & https://www.kaggle.com/ and Computed SPSS 20.0.

Note: POS – Positive Tweets, NEG – Negative Tweets, Ret. BSE – Return for Stock in BSE, Ret. NSE – Return for NSE, Vol. BSE – Volume of BSE, and Vol. NSE – Volume of NSE.

Conclusion

There were many ups and downs in the Indian stock market over the study period. In order to invest hard-earned money in the stock market for purchasing shares, it is essential for the investors to predict the stock market movements. In India, the Sensex and Nifty are two major indicators for prediction of stock market condition. For BSE (Bombay Stock Exchange) listed companies and for NSE (National Stock Exchange) listed companies, the Sensex and the Nifty, respectively, are used as indicators of stock market prediction. However, the major problem for the investors is to predict the stock market condition, which depends on regular checking and testing of Sensex and Nifty prediction values (Bhardwaj et al., 2015). It has been proved that the social media could seriously affect investors' mood and thus may affect investors' decision-making behaviour in the stock market. This study investigated the effect of Twitter sentiment and stock market indicators (BSE and NSE) during the study period. As per the descriptive statistics, the data on Twitter and stock market indicators were normally distributed. The correlation analysis showed that there was a positive relationship between variables of Twitter sentiment and stock market indicators. The stock sentiment analysis for the stock market, by employing Sensex and Nifty live server data values, at different intervals of time, could be used for predicting the stock market by investors.

Scope for Further Research

- Researchers could attempt to forecast sectorial in-dices of BSE and NSE with Twitter formation and sentiment.

- Efforts could be made to study the movements of stock indices of developed economies – DJIA, S&P-500 (USA), Nikkei-225 (Japan), and FTSE-100 (UK), with Twitter formation and sentiment.

- A comparative analysis of global stock indices, with the Indian stock indices, could also be made, by ap-plying the Twitter information and sentiment.

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