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Social media usage vs. stock prices: an analysis of Indian firms

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Abstract

This paper is designed to investigate in detail the way top traded firms of India use social media (SM) and how it influences their stock prices. The purpose of this paper is to observe whether there exists any relationship between the SM usage and the company's stock price. This paper relates NSE stock price trends of each firm with its SM usage and SM popularity, using tools such as correlation, regression and ANOVA. For the database, SM activities of NIFTY 51 firms, such as monthly number of posts and monthly number of replies to users, were recorded on the four SM platforms: Facebook, Youtube, Twitter and LinkedIn. This paper draws a conclusion with an assertion about the extent to which a firm should give importance to investing money in SM adoption strategies, SM marketing strategies, SM customer care strategies and so on.

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Keywords: social media (SM); stock prices; social media usage; social media popularity; NIFTY 51 firms; India

1. Introduction

Social media (SM) has impacted the world extensively. It has reduced the communication barriers to a great extent. It represents a piece of information technology that can affect business both outside and inside a firm. Today, Facebook's daily number of active users is an incredible 1.3 billion worldwide. SM is revolutionizing today's world [1]. These SM platforms today have a very widespread reach to potential customers for a vast variety of businesses. More importantly, this widespread reach has increased exponentially over the years and is expected to grow in a similar fashion in future [2]. This fact has fundamentally altered business strategies in the past decade [3]. Businesses have discovered this platform of SM to market their products [4], to communicate with their customers and work upon their queries efficiently, thereby enhancing product design, to build relationships with customers and introduce loyalty programs and to implement e-commerce platforms mutually beneficial for both customers and businesses themselves. Literature is rich with papers discussing the

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role of SM in several aspects of a business. However, there are inadequate studies focusing on how a firm's sole effort on SM strategies can directly affect its stock prices. This perspective is important for businesses to plan judicious investment in SM activities. This paper addresses the relationship between SM adoption of a firm and its stock price.

The analysis in this paper reflects whether stock prices are affected by the SM activities of the leading firms in India. Some of the examples where well-reported SM events had affected stock prices of companies include the following: United Breaks Guitars: Musician Dave Carroll's guitar broke during a trip with United Airlines in 2008. He claimed for the compensation several times but was declined persistently. After this, Dave recorded songs titled "United Breaks Guitars" and uploaded on Youtube. This SM activity created a huge loss for the company [5]. The stock price fell by 10% costing \$180 million to the shareholders. United Express Flight 3411 Incident: On 9th April 2017, a passenger was thrown out by the airport security. Later, a video recorded by one of the passengers went viral, recording 6.8 million views in less than a day. The stock prices were reduced by 0.2% due to negative publicity [6]. Getaway Industries: Robert F.X. Sillerman bought Getaway Industries in 2011. He stated in SM that the new company would work as a launching pad for his new venture. The company's stock increased from 2 cents to nearly 3\$ in one day [7]. This sudden 25000% spike in the stock price of the company can be well attributed to SM. Under Armour: In 2015, the sports apparel company Under Armour was endorsed by famous golfer Jordan Speith. In a matter of months, Jordan Speith won the Masters Tournament and the U.S. Open [8]. This should have merely increased the product sales for a while. However, later the golfer also went on to claim his trophies and his green jacket in upcoming months. His activities indirectly marketed Under Armour and started influencing the stock prices soon, rising from \$64.22 in early 2015 to \$104 in September 2015.

2. Review of literature

SM is a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0 and that allow the creation and exchange of user-generated content [9-11]. Some authors including Culnan et al. [12] and Ilavarasan and Rathore [13] laid out systematic guidelines for fruitful implementation of SM strategies for businesses. They identified different functional blocks of SM and their efficiency for a variety of SM platforms. They highlighted the differences in ideal SM strategies for different industry sectors. They concentrated on the importance of 'mindful adoption' and 'community-building'. Regardless, they did not directly put up concrete quantitative studies of direct and sole impact of SM activities on stock prices. Oh and Sheng [14] investigated only stock microblogging platforms and came out with the result that the investors are strongly influenced by trending sentiment on stock microblogging platforms. Zhang et al. [15] dealt with correlating the emotional outbursts of audiences on twitter with the next-day stock prices of firms. However, stock microblogging activities and emotional outbursts on twitter cannot be controlled by firms themselves, hence there is a need to study those SM platforms and activities which are sensitive to firms' strategies.

Ruiz et al. [16] addressed correlation of traded volume change and stock price change of a company with the company's twitter activity. They were able to find out a convincing correlation between the same-day traded volume and a feature which quantified the number of connected posts on twitter. However, correlation with stock prices came out inconclusive. Finding out a relationship with stock prices has wide implications. This paper will deal with deep SM analysis and specifically relate stock price changes.

Paniagua and Sapena [17] elaborated on how SM can outsource information regarding new promising products, initiatives and policies announced by firms. They argued that anticipation of a good product drives investment in stocks, hence having a positive impact on stock prices. This process is enhanced by SM nowadays. This does not necessarily mean that the concerned company has improved its SM strategies. Maybe there is no change in SM activities of the company but the new product is good, hence people are investing

money in stocks and the stock prices are rising. SM should not be given the direct credit of enhancing the stock prices in such cases.

The issue of whether improved SM efforts by a company can pull stock prices up will be addressed in this paper. The crucial argument would be that if the new product is not impressive, does improving SM standards still boost stock prices? The answer to this question will help the companies decide how important it is for them to invest in SM adoption, because in this situation only the sole SM effort will be responsible to improve the stock prices if they rise.

3. Method

The SM activities of all the NIFTY 51 firms on Facebook, Twitter, Youtube and LinkedIn were monitored for the entire month of January 2017; their stock prices[†] and 365 days' percentage change in stock prices, as on 7th February 2017, 16:00, were considered as the mother data for all our analysis and observations.

The research started out with considering SM platforms such as Facebook, Twitter, Google+, LinkedIn, YouTube, Instagram, Pinterest, Reddit and Quora and firms' websites, blogs, wikis and so on. Online newspapers, journals and magazines were also considered. All these platforms have their bit of influence on the overall concerned customer base, but the need was only for those SM platforms on which the firms fully control their own accounts and activities and are themselves solely responsible for how they are getting projected to the SM users. Second, only those SM platforms were needed where the customers or users have a voice and they can interact with the respective firm. Third, only those SM platforms were needed which can provide extensive data, like posts/tweets being put very frequently and so on. So that their detailed activity can be thoroughly analyzed. Finally, only the most popular SM platforms such as Facebook and YouTube were needed, as they have a very large user base and deep market penetration. All the platforms were filtered with the above-mentioned criteria, and as a result only these four SM platforms came out eligible for the study: Facebook, Twitter, LinkedIn and YouTube. Table 1 displays the different SM parameters regarding which data were accumulated.

Among other things, the data about the age of the firm, its headquarter location and age of their accounts present on the four SM platforms were also collected. A couple of freely available online SM analytics tools were used, which ran scripts on the SM websites through dummy accounts on Facebook and Twitter. Those scripts gathered large data like counting the number of posts or tweets or user comments/replies for us, when it was very tedious and erroneous to count them manually. Namely, Sociograph (<https://sociograph.io>) for Facebook and Tweekchup (<https://tweekchup.com/>) for Twitter were used.

For conducting analysis and see whether there is any relationship between SM usage and stock prices change, we needed to define some indices. This helped us in allocating SM scores for each firm depending on their SM usage. Table 2 displays the scale/maximum score of the indices with the corresponding SM parameters mentioned in Table 1.

Many different parameters have been scaled equally so that there is no biasing in the input when we apply a few mathematical models later, such as regression. For each parameter, the scale was decided based on the cluster formed which was generally the top 25% followed by another 50% and the remaining. The top 25% firms were given a score of 3, middle 50% were given a score of 2 and the remaining 25% were given a score of 1. If any firm did not have an account on a particular SM platform, then all scores regarding that platform would be 0. If user interaction was found for a firm, it was given a score of 1 for each SM platform. Similarly,

[†] (https://www.nseindia.com/live_market/dynaContent/live_watch/equities_stock_watch.htm)

for each digitally integrated SM platform, the firm was given a score of 1. Scores were also awarded for the number of employees on LinkedIn. So incorporating this parameter, the total SM score would be out of 35.

Table 1. The parameters for data collection

S. No.	Facebook	Twitter	LinkedIn	YouTube
1.	Account availability (yes/no)	Account availability (yes/no)	Account availability (yes/no)	Account availability (yes/no)
2.	Digital integration ^a (yes/no)	Digital integration ^a (yes/no)	Digital integration ^a (yes/no)	Digital integration ^a (yes/no)
3.	No. of followers	No. of followers	No. of followers and no. of employees	No. of subscribers
4.	No. of posts monthly ^b	No. of posts monthly ^b	No. of posts monthly ^b	No. of posts monthly ^b
5.	Responses to users' comments	Responses to users' comments	Responses to users' comments	Responses to users' comments

^aDigital integration: does the firm have appropriate contact emails and other SM website links to official accounts; all this is given on the official webpage of the firm or not. This attribute may be called digital integration. ^bHere monthly refers to the data collected for the entire month of January 2017.

Table 2. Each index with its scale

Parameter	Index	Facebook	Twitter	LinkedIn	Youtube	Total scale
Digital integration (yes/no)	Digital integration score	1	1	1	1	4
No. of followers/subscribers	SM popularity score	3	3	3	3	12
No. of posts/tweets/video uploads/monthly	SM activity score	3	3	3	3	12
User interaction (yes/no)	SM user interaction score	1	1	1	1	4

Based on these data of various SM scores and 365 days' percentage change in stock price, correlation and regression analyses were performed. Also, single-factor analysis of variance (ANOVA) for sector versus SM scores was performed after figuring out differences in SM adoption strategies for different sectors. ANOVA for growth versus SM scores and age versus SM scores was also carried out. For growth versus SM scores analysis, all the firms were divided into three categories specifically as declining, low-growth and high-growth firms again based on 365 days' change in their stock prices.

4. Findings

According to the study, the most advanced SM score is held by financial services and IT industries, followed by telecom, automobile and consumer goods industries. The industries of different sectors adopt different SM strategies according to the nature of their work. Fig. 1 shows graphically the SM score of each of the NIFTY 51 firms, arranged in descending order. Some of the sector-wise intricacies of different industries are observed. Financial services sector: People trust only themselves when it comes to managing their money [18]. So financial services firms need to project themselves as trustworthy to the customer. That is why they need to be very interactive on SM. IT sector: The IT consulting firms help other firms technically. So a common man does not need to approach them that frequently. Therefore, they need to market themselves desperately on SM, showing their importance to potential customers. The automobile sector: On the same grounds of marketing their product efficiently, the automobile industries need to carry out several campaigns on SM platforms to promote the newly released car. The consumer goods sector: The consumer goods industry

has a need to keenly monitor the consumer behavior, trends and micro-trends precisely since they change rapidly [19]. They need to incorporate consumer reviews of different cultures and different consumer segments into their R&D and marketing. The metals and mining sector and the cements sector: These sectors do not seem to care about reaching out to the common man. There are a couple of simple reasons for this seemingly negligent behavior. First, they have no direct business with a common man. Second, these industries rule their market, due to monopoly or oligopoly, so the reputation of these firms’ SM profiles is given little importance.

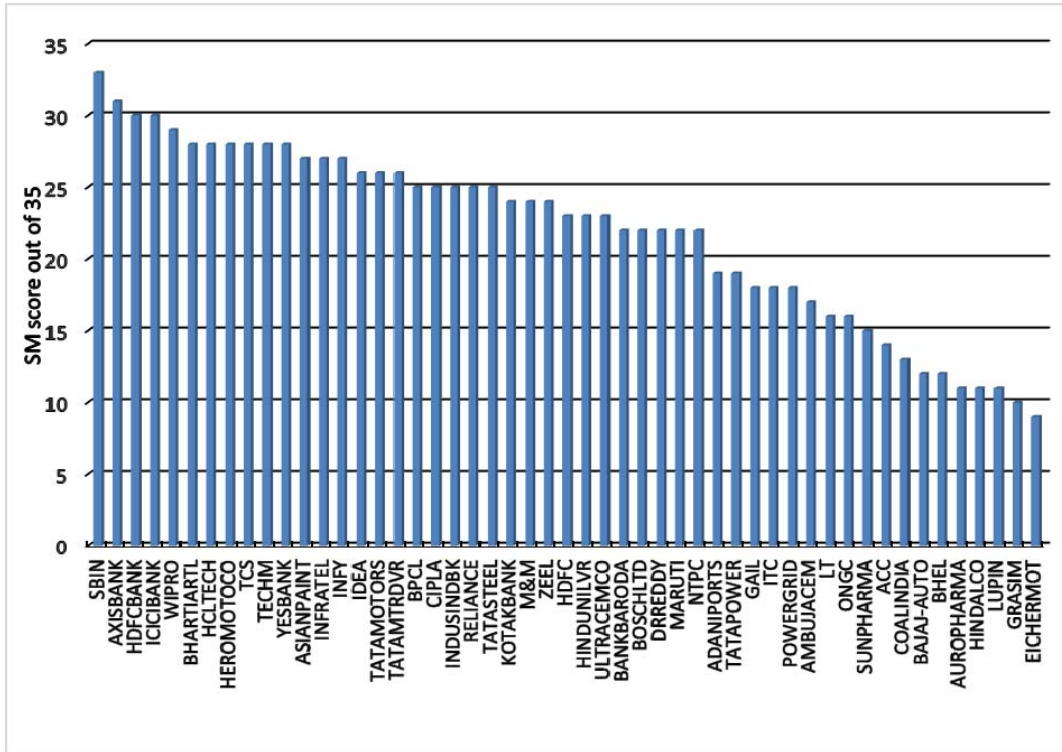


Fig. 1. Total SM score vs firm

ANOVA is a tool for checking whether a parameter follows similar distribution for different groups. In this context, the parameter is SM score and the groups are different industry sectors. Categorizing the NIFTY 51 firms into namely automobile, energy, financial services, IT, pharmaceuticals and so on sectors, a one-way ANOVA was conducted to compare the effect of industry sector on its SM regarding the following indices – total SM score, SM popularity score and SM activity score. Very small groups were neglected for better accuracy.

An ANOVA showed that the effect of type of sector on (i) total SM score, (ii) SM popularity score and (iii) SM activity score was significant, for (i) $F(4,28) = 5.988$, $p = 0.0013$, $F\text{-critical} = 2.71$, (ii) $F(4,28) = 7.377$, $p = 0.00034$, $F\text{-critical} = 2.71$ and (iii) $F(4,28) = 3.229$, $p = 0.026$, $F\text{-critical} = 2.71$, respectively [20] (Table 3).

Table 3. Sector versus SM score ANOVA

Index	F(4,28)	P-value	F-critical
Total SM score	5.988	0.0013	2.71
SM popularity score	7.377	0.00034	
SM activity score	3.229	0.026	

The F-critical value is considered for 95% confidence interval. In each of the above three cases, the F-value is larger than F-critical value, and the p-value is low, indicating that the SM scores of firms do not follow similar distribution for different sectors of industries. So the companies of different sectors essentially have different presence and different behavior on SM platforms. The following analysis was carried out to find whether any relationship exists between 365 days’ stock price change and the different SM parameters that we have introduced such as popularity score, activity score, user interaction score and user integration score.

In the subsequent analysis, the data are given in tabulated form after calculating the relationship between 365 days’ stock price change and the following indices: Total SM score (out of 35); SM popularity score (out of 12); SM activity score (out of 12); SM user interaction score (out of 4); and Digital integration score (out of 4).

Here, total SM score is the sum of SM popularity score, SM activity score, SM interaction score, digital interaction and LinkedIn employees score. SM popularity score and total SM score were the only parameters which had a significant relationship with 365 days’ stock price change.

Correlation is a statistical technique to figure out the strength of relationship between two variables. Weakly related couple has correlation coefficient near to zero and a strong relation is represented by a correlation coefficient approaching 1 or -1.

The correlation coefficients are $r = -0.13$, $r = -0.20$ and $r = -0.031$ for the total SM score, the SM popularity score and the SM activity score, respectively (Table 4). The criteria were $p < 0.05$ [20]. Instead of giving a positive correlation coefficient, we observe a very low negative relationship. However, the coefficient is very close to zero, so there does not exist any significant relationship between the firms’ SM usage and its stock price. To check the authenticity of our relationship, we carried out regression test.

Table 4. SM scores versus 365 days’ percentage change in stock prices

	Total SM score	SM popularity score	SM activity score
Correlation coefficient	-0.13	-0.20	0.031

Linear regression is a mathematical model to develop a relationship between dependent and independent variables. It can be used to predict unknown relationships or to verify assumed relationships. A simple linear regression was calculated to predict stock price change based on the (i) total SM score, (ii) SM popularity score and (iii) SM activity score. Regression equations were found for (i) $(F(1,49) = 0.827, p < 0.367)$, with an R^2 of 0.016; (ii) $(F(1,49) = 2.045, p < 0.159)$, with an R^2 of 0.040 and (iii) $(F(1,49) = 0.047, p < 0.827)$, with an R^2 of 0.0009, respectively. Firm’s predicted 365 day stock price percentage change is equal to:

(i) $35.09 - 0.55*$ (total SM score) when the total SM score is measured on a scale of 35, (ii) $41.89 - 2.36*$ (SM popularity score) when SM popularity score is measured on a scale of 12 and (iii) $26.08 - 0.389*$ (SM activity score) when SM activity score is measured on a scale of 12 [20] (Table 5).

It appears from regression analysis that SM popularity is more momentous among others. Still the low R^2 values and other values represent underwhelming nature of the results. Compiling this analysis with negative correlation, it is implied that SM usage does not really affect stock prices, and even if it does indirectly, its influence is very feeble.

Table 5. Regression with stock price change as dependent variable

Independent variable	R ² value	F-value	Significance F-value
Total SM score	0.016	0.827	0.367
SM popularity score	0.040	2.045	0.159
SM activity score	0.0009	0.047	0.828

Dividing the NIFTY 51 firms into three categories – high-growth, low-growth and declining firms – a one-way ANOVA was conducted to compare the effect of category of the firm on the SM usage using the following parameters – total SM score, SM popularity score and SM activity score. Declining firms are those which had negative change in their stock price, whereas high-growth firms are the ones with more than 48% positive change in their stock price over the past 1 year. The remaining firms were all low-growth firms. An ANOVA showed that the effect of category of firm on (i) total SM score, (ii) SM popularity score and (iii) SM activity score was insignificant, for (i) $F(2,48) = 0.315$, $p = 0.731$, $F\text{-critical} = 3.19$, (ii) $F(2,48) = 1.145$, $p = 0.326$, $F\text{-critical} = 3.19$ and (iii) $F(2,48) = 0.183$, $p = 0.832$, $F\text{-critical} = 3.19$ [20] (Table 6).

Table 6. Sector versus SM score ANOVA

Index	F(2,48)	P-value	F-critical
Total SM score	0.315	0.731	3.19
SM popularity score	1.145	0.326	
SM activity score	0.183	0.832	

The F-critical value is considered for 95% confidence interval. In each of the above three cases, the F-value is less than F-critical value, and the p-value is significantly large. This suggests the three groups: high growth in stock price firms, low growth in stock price firms and declining stock price firms; these three groups of firms are essentially similar when it comes to SM presence and SM behavior. The amount of variation is insignificant.

A simple linear regression was calculated to predict SM usage of firms based on the company's age. A significant regression equation was found for $F(1,49) = 2.168$, $p < 0.147$, with an R^2 of 0.0423. Firm's predicted total SM score is equal to $24.26 - 0.048 * (\text{age of company})$ on a scale of 35 when company's age is measured in years [20]. The results come out to be inconclusive, hence there is no satisfactory relationship between the age of the company and the SM parameters.

According to the analyses done so far, different sectors of the industries have different levels of popularity, activity and interaction on SM. The correlation coefficient between SM popularity and 365 days' percentage stock price change is -0.20 , which is insignificant. The R^2 value (regression coefficient) and significant F-value are 0.04 and 0.15, respectively, which are inconclusive. The other regressions performed were even more inconclusive. So according to the above study, there is no mathematically expressible relationship between a company's SM activities and its stock prices. The three groups of firms, namely, high growth, low growth and declining growth, come out to be similar when their SM presence is compared. Finally, there is no satisfactory relationship between the age of the company and the SM score.

5. Implications and conclusion

The conclusion that can be drawn from all the above observations and analyses is that there is no satisfactorily explainable or mathematically expressible relationship between the stock prices of firms and their

respective SM activities. Previous papers did not note the influence of SM on stock prices from the firm's point of view, most of them either correlated SM outbursts not in a firm's control with its stock prices, or they gave the credit for changing stock prices to SM adoption strategies the firm had undertaken, when it actually went to the underlying well-marketed new venture of the firm rather than only SM. It can now be asserted that although SM has sometimes proven to be very crucial in the changes occurring to stock prices, the firms should not worry too much about how they are handling their SM accounts on Facebook, Twitter, LinkedIn and YouTube. They should only carry out the mandatory practices, essential awareness and marketing schemes that nowadays every firm does. The probability is slight that the firm investing a large portion of its money into SM will get a spike in its stock prices because of its sole SM effort.

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