

CAN GOOGLE TREND SEARCH PREDICT STOCK MARKET? EVIDENCE FROM BSE

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ABSTRACT

Behavioural Finance find that stock markets across the world can-be driven by a person's emotional reactions to business changes. In recent surveys, social media has been measured in terms of its utility in measuring financial market movements. This paper aims to evaluate these results by Google Trends. A quantitative method to investigate the relationship between Google search patterns and the stock indexes has been tried in the analysis to determine the strength of Sensex. This analysis has been based on a secondary sequence, covering the time frame from 01.01.2015 to 31.12.2020. The descriptive statistics findings showed that the data on Google and the stock market index were normally distributed. The correlation analysis showed that there was a positive relationship between the variables, namely, Google search and stock index. The results of the analysis were considered to be useful to the investors and other participants of stock market, by understanding the influence of Google Trends Search on the stock market.

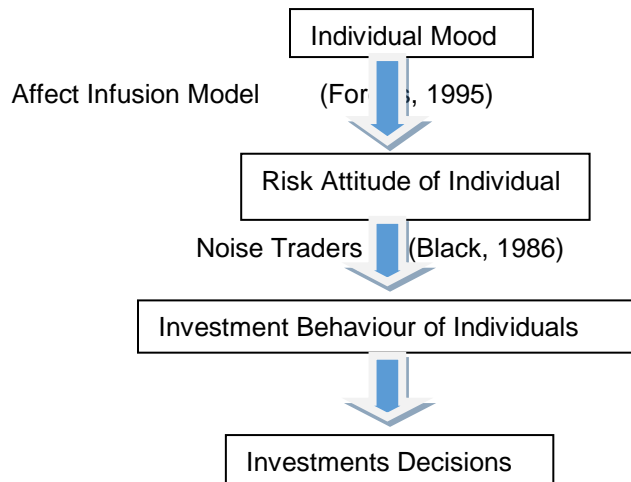
Keywords: Stock index; Stock Volume; Stock Volatility; Google Trends Search

1. INTRODUCTION

Many people in the world use Google's search engine as a resource for knowledge collecting information. It is found that Google accounted for close to 90% of searches, as the Google search engine is primarily managed by the search engine on a global scale. Firms learned to appreciate the presence of the internet platform's organic search results and now they are using it to draw in their target customers (Harford, 2017). These trends can be obtained from Google's search engine, which keeps track of statistics for different questions posed on their system. The Google network has drawn the information analytics community, which is, in turn, used to detect stock price patterns or market dynamics. In previous years, Google's Trends Search (GTS) was a valuable measure of investors' interest. The investors' sentiment is a good indicator of traditional trading in stock markets. With the advent of the internet and easy availability of information, the stock market sentiment has recently been observed online, where the investors' sentiments are studied based on the search keywords about companies. Now-a-days, the prospective investment decisions are usually taken with the help of technology. Searching through Google is an invaluable research platform for obtaining valuable information. A search on Google gives details of the information gathered from Google search, which is publicly available and aggregated as a Trends, which is searchable. According to the Google archives of all search keywords, their historical search indexes are easily available via the Google Trends tool. Hence, as Google is the most common searchable of the internet, it is considered a Google search engine. Several scholars acknowledged Google Searchers to gather information about company and stock returns for their research (Laurens Bijl, et al, 2016). The keyword 'buy' is usually used, along with a company name, in websites like google.com when a person searches for information, indicating an interest in buying stocks of that company. By using the search keyword 'buy', along with the company name, the required data could be extracted from Google Trends, for a specific period. Testing any possible relationships between the word 'buy' and BSE stocks is the subject of current research. Hence this study. BSE is a broad-based index, representing 30 large stocks on the Bombay Stock Exchange Ltd, India. BSE Sensex stocks were chosen for this study because it represents more than 55% of free float market capitalization in the exchange.

Analysts also discovered that investors' emotional states impair their perceptions of risk and security's (Lerner and Keltner, 2000; Han, Lerner and Keltner, 2007). Researchers in behavioural finance have revealed that the economy is heavily influenced by investor psychology over the long term. It is inherent in investors' nature to be emotional and vulnerable to mistakes. Unreasonable market moves do challenge the efficient market theorem (Fama's 1970), which states that investors should not make emotional errors because the markets have all the facts. Two types of investors have an important role in behavioural finance: first-time investors, who participate in a transaction for the first time and second-time investors, who execute it (Vittengl and Holt, 1998). Saunders (1993) describes arbitrageurs as investors who are well-informed and not easily manipulated by emotion. This investing party is also referred as "smart money" (De Long et al. 1990). From the other side, unrealistic traders are entirely dependent on knowledge that does not serve the needs of their rational traders (Black 1986). In certain ways, these traders are trend-following investors, or on the other hand, their style of investing responds to or continue to lag the market patterns. Calendar irregularities encompass price swings in one direction, from higher to lower. Here in late January, the total returns are on top of all other months (Thaler 1987). The Monday impact indicates that the long-term returns are lower on Mondays (Jaffe et al. 1989). As emotional states fluctuate, predisposed to investing in things that fluctuate, such as stocks. The results of earlier behavioural finance research supported this relationship. Figure 1 implies a change in the market participants' emotions can have a significant impact on investment decisions. The investment decisions affect the stock price and return in the market.

Figure 1: Theoretical Framework, showing Individual Mood, Risk Attitude of Individual, Investment Behavior, and Investment Decision.



Source: Developed from M. Nofer, O. Hinz, 2015; Forgas 1995 and Black 1986.

2. REVIEW OF LITERATURE

Fumiko Takeda et al, (2014) analysed that in the Japanese economy, there is a strong correlation between search activity and stock trading behaviour. The search volume was tracked by Google Trends, which calculated how many keywords had been applied by the search firm. Consistency suggested that even as search rates increased, trade activity also increased. Laurens Bijl et al, (2016) investigated the analysts should consider whether to incorporate Google Trends data into their forecasts. Previous studies show that the greater the search volume, the more profitable it is an individual site is, but this one showed the opposite for the first two weeks.

A more recent study conducted for Google searches found a lower return on investment. The stock sale approach revolves around a correlation between market search volumes and stock performance, and an infrequent Google search. Neri Kim et al, (2018) who headed up the study, decided to figure out how Google searches could clarify current and future stock exchange volume and volatility including listing

those in OSLO Stock Exchange. Analysis found that Google searches were not predictive of increased returns in most cases. However, a high number of searches on Google raised our uncertainty. In other terms, in Google's view, the stock market data are more representative of potential operations. Myrthe van Dieijen .et al, (2018) claims that both complexity and risk are critical for firm management, as well as investors. Volatility in User-Generated Content (UGC) could lead to general market volatility. Contributors of User-Generated Content, such as tweets, blog posts, come from search engines, social media, and YouTube videos. In another study, Hari Krishnan.A. V. et al, (2018) examined the association between individual returns of the stocks in NIFTY50 and Google Trends data for the word, 'buy'. To explore the relationship between Google search data and person returns, the researchers employed the Granger Causality Test. Stefan Lyoca et al, (2020) viewed that the international economies have been under immense strain since the onset of the COVID-19 pandemic. Google usage has increased as a result of the use of the privacy crisis. It has been observed that when a pandemic is present, apprehension of the coronavirus represents a good data on the world stock market's movement.

According to Smales (2021), Google Search Trends captured the attention of retail investors unlike the institutional investors who utilize a variety of professional sources such as Bloomberg. Vasileiou, E. (2021) using EGARCH (1,1,1) model, found that the Google Search index enabled the users to draw statistically significant information about the impact of the COVID-19 on the performance of the stock markets. Poutachidou, Nikoletta, et al (2021) investigated the fluctuations of the returns of US stock indices when there was an increase in the volume of Google Internet searches. Ming-Hung Wu, et al (2022) found the impact of Google search volume on stock prices and trading volume in the Taiwan stock market. Said Imene Ben El Hadj et al (2022) forecasted the realized volatility for fourteen international stock markets, using Google Trends data and devised an augmented empirical similarity model. Jan Jakub Szczygielski, et al (2023) demonstrated how Google Searchers Trends (GST) is used to isolate the impact of specific events. The COVID-19 had a disproportionate impact on the commodity price volatility. It is found that energy, livestock, and precious metals were increasingly integrated with stock markets. Stephanos Papadamou, et al (2023) investigated the relationship between investors' attention, as measured by Google search queries, and equity implied volatility during the COVID-19 outbreak. Chaivuth padungsaksawasd, et al (2023) studied the intraday five-minute stock market indices and found the causal relationship between global stock market volatility and investors' attention as measured by the Google search volume index during the COVID-19 pandemic. Pedro Latoeiro, et al (2023) analysed whether web search queries predict the stock market activity in respect of sample of the largest European stocks. There was evidence that an increase in web searches for stocks on Google engine is followed by a temporary increase in volatility and volume and a drop in cumulative returns.

According to the literature review, it was found that only a subset of research has investigated the relationship between Google Trends searches and stock markets worldwide. There has yet to be an attempt to do a systematic analysis in India. Therefore, the present report aims to make progress by implementing Google search queries and stock market activities into Google Trends.

3. OBJECTIVE OF THE STUDY. HYPOTHESIS AND METHODOLOGY

The aim of this research was to find out the evidence for Google Trends Search in the BSE Sensex. For this study, the following three hypotheses were developed and tested in this analysis: **H1**. There is normality in the predictive relationship between the Google Trends Searches and BSE Sensex; **H2**. There is stationarity among the Google Trends Search and BSE Sensex, and **H3**. There is relationship between the Google Trends Search and BSE Sensex

There are two main indices used in the Indian stock exchange, the BSE 500 and the NSE Nifty. But the BSE Sensex is famous, most dynamic, modern, with efficient indices in India. Hence this study focused on one index, namely, BSE Sensex. Besides, the information floated in all the Google Trends Search, regarding the stock market operations, was selected and used for this study.

The current research was based entirely on data derived from secondary sources, related to stock index and Google Trends Search response data. As far as this investigation is concerned, the results were

drawn from a website on the BSE index. The market information like share price were collected from yahoo finance.com (<https://in.finance.yahoo.com>). The required data, about Google Trends Search feed, were collected using Google's patterns to analyse search term popularity (<https://trends.google.com/trends>). The data, collected from above sources, were analysed through SPSS 20.0 version and E-views 7 version. The study uses data from 01.01.2015 to 12.06.06 to predict future results.

For testing the three-above hypothesis, we used:

- **Descriptive Statistics** (data is used to determine the standard distribution of search on Google Search Engine or B-Sensex)
- **Unit Root Test** (to keep track of Google trends)
- **Correlation Analysis** (to find out the correlation between Google Trends Search and BSE Sensex)

It should be also noted that this study has several constraints, namely we used one index (Sensex of BSE), and the time period is only six years.

4. ANALYSIS OF RELATIONSHIP BETWEEN GOOGLE TRENDS SEARCH AND BSE SENSEX

The analysis of Google Search and BSE Sensex is presented as follows.

- A) Normality (Descriptive Statistics) of Google Trends Search and Stock Index (Sensex)
- B) Stationarity for Google Trends Search and Stock Index (Sensex),
- C) Correlation among Google Trends Search and Stock Index (Sensex), and
- D) Movements of Google Trends Search and Stock Index (Sensex)

A) Normality (Descriptive Statistics) of the Google Trends Search and Stock Index Sensex.

From Table 1 the Google's data shows the above average amount of search queries was done for 01.01.2015 to 31.12.2020. It is evident that the summary statistics, namely, minimum, maximum, mean, standard deviation, skewness and kurtosis were used to analyse the sample variables during the study period. For the purpose of this study, GTS was taken as the independent variable while Sensex (return), Sensex (volume) and Sensex (volatility) were considered as dependent variables. The table clearly shows that the GTS (14.27), trading volume (0.001832), and volatility (4.740074), scored positive mean values over the period of the study. In addition, the volatility of Sensex (54.7271) exhibited the highest values, of standard deviation. The variables were skewed towards one extreme of the normal distribution, except GTS (4.177), stock return (2.971) and volatility (16.812), which were negative, with a value of -2.323 for volume, over the period of study. The way an index's trading behaviour is characterized by both excess kurtosis and skewness and Google Trends search showed that there was non-symmetric note that all delivery issues will be addressed in the returned data (Sensex). Hence **H1-There is normality in the predictive relationship between the Google Trends Search and BSE Sensex**, was accepted.

B) Stationarity (Unite Root Test) for Google Trends Search and Stock Market Index

Augmented Dickey-Fuller (ADF) Test and Phillips-Perron (PP) tests was performed to confirm the stationarity of the samples (Google trends Search) and three dependent variables (Sensex (return), Sensex (volume) and Sensex (Volatility)). Table 2 shows to learn about stock price change and search, we conducted the Augmented Dickey Fuller Test and Phillips Perron test for daily stock prices even during period of study from 01.01.2015 to 31.12.2020. Google Trends Search and stock index (Sensex) were analysed in India using ADP, at substantial levels of 1%, 5% and 10%, as well as by using PP significant levels, at 1%, 5% and 10%. The P-values were close to zero for all the observed variables. The other characteristic (unique) feature of the statistical values, using ADF test, for all the sample variables, were -19.00948 for Google Trends Search, -15.64497 for Sensex (return), -15.77346 for Sensex (Volume), and -5.312639 for Sensex (Volatility). Standard sample values of the Phillips Perron

test were -5.139579 for Google Trends Search, -15.66656 for Sensex (return), -15.79087 for Sensex (Volume) and -9.003365 for Sensex (Volatility). These estimators had variances of less than 1% to 5% and 10% relative mean differences. With the statistical analyses of the results, ADF and PP, it was clear that all variables attained stationarity. In accordance with Hypothesis H2, Google Trends finds that the term "stationary" is distributed in both Google Search and the BSE Sensex.

C) Correlation between the Google Trends Search and Sensex

A correlation matrix was computed to figure out how search and stock indexes were linked (Sensex). During the study era, the association between Google search results and stock market activity was high, meaning that market movements significantly affected stock market fluctuations in Google's stock price from 01.01.2015 to 31.12.2020, were given in Table 3. For the purpose of this study, the Google Trends Search (GTS) was considered the independent variable while three indicators, namely, BSE Sensex Returns, Sensex Volatility, and Sensex Volume were used as the dependent variables.

According to the results of the Table, there was a positive correlation between Google Trends Search and Stock Index (Sensex) since GTS had recorded a significant value of Sensex return (0.00), Sensex volume (0.03) and volatility (0.04), at 99% confidence level. The overall analysis found that the Google Search Volume Index had maintained a relationship with three variables of the stock index (Sensex return, Sensex Volume and Sensex volatility) out of four dependent variables. Therefore, hypothesis H3, The collaboration between Google and stock trading is agreed by the majority of the investors.

D) Movements of Google Trends Search and Stock Index (Sensex)

To study the movements of the independent variable (Google Trends Search) and three dependent variables (Sensex return, Sensex volume, and Sensex Volatility), the line chart was used. **Figure-2** shows the line for Google Trends Search, **over the duration** from 01-01-2015 to 31-12-2020. Besides, it is clearly understood that the line of GTS recorded ups and downs throughout the study period. But the movement of changes was high in between 200 to 225 observations. The graphical representation of BSE-Sensex showed substantially better returns, which is illustrated in **Figure-3**. The graph clearly shows that the magnitude of changes (return) was high in between 250 and 275 observations. Volatility demonstrated by high returns tended to coincide with large movements and small movements.

Figure 4 presents the line for Sensex volume over the period of study. It is understood that the line of Sensex volume recorded high degrees of ups and downs throughout the study period. The daily volatility of BSE Sensex, during the study period, is exhibited in Figure 5. It is clear that the magnitude of changes (volatility) was high in between 250 and 275 observations while the remaining observations showed normal levels of changes. The analysis of Figures 2 to 5 clearly exhibited that there was a large movement of changes in respect of Google Trends Search, Sensex return, Sensex volume, and Sensex volatility, during the observations from 250 to 300. In other words, Google Trends Search contributed to the stock market, particularly in BSE of India.

5. CONCLUSION AND SCOPE FOR FURTHER RESEARCH

This study proposed to whether find out Google Search activity could explain and predict the movement of Sensex of Bombay Stock Exchange Ltd in India. The study clearly established that Google Search could explain and predict the movement of Sensex in three dimensions: Sensex return, Sensex volume and Sensex volatility. Additional information such as Google and other sources can be used for making investment decisions (Da et al, 2011). During the time in which Google was searching for information on BSE, the index of the stock market was influenced. According to the descriptive statistics, the Google and stock market index data were normally distributed. Based on the study, it was determined that there was a strong association between Google and the stock market index.

This paper demonstrated that Google Search data, at different intervals of time, could be used for predicting the stock market index movements. the findings have far and could impact the whole economy

as well as investors. Mood analysis, combined with proven capital market models, promises an exciting place to go next investigation. However, the interpretation of feelings and moods using social media is a young field of study but shows remarkable promise. Academia and industry, though, need to be more aware of the substantial role of social media in the rise and fall of new businesses.

There are some difficulties in evaluating how the mood of individuals would change the financial industry. The network framework should be factored into research about the balance between people's moods and stock return statistics. Study findings suggest that the number of creative and intuitive alternatives in solving problems in the area of mood analysis is infinite and numerous novel research projects, over the next few years, are expected to come.

In the future, researchers will try to predict stock indices like the sector-based BSE and NSE by looking at Google's search volume. Also, A secondary effort should be made to index DJIA, the American Stock Market, Nikkei 225, and the UK's FTSE. Finally, it could also include global indexes, such as the Standard & Poor's and Mid Cap, and the Indian indices, by adding the Google search index.

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Table 1: Normality Test (Descriptive Statistics) for Google Trends Search and BSE Sensex, from 01.01.2015 to 31.12.2020.

Variables	Min	Max	Mean	Std. Dev.	Skewness	Kurtosis
Independent Variable	2.00	100.00	14.27	11.505	4.177	24.726
GTS						
Dependent variables	-0.0734	0.236	-0.001538	0.024	2.971	27.358
Sensex (return)						
Sensex (Volume)	-0.2123	0.076	0.001832	0.024	-2.323	20.169
Sensex (Volatility)	0.0026	951.250	4.740074	54.7271	16.812	28.729

Sources: Data collected from <http://finance.yahoo.com/> & <https://trends.google.com/trends> and Computed SPSS 20.0. **Note:** GTS= Google Trends Search

Table 2: Stationarity (Unite Root Test) for Google Trends Search and BSE Sensex from 01.01.2015 to 31.12.2020.

Variables	Level	ADF		PP	
		t-statistic	Prob*	t-statistic	Prob*
Google Trends Search		-19.00948	0.0000	-5.139579	0.0000
	1%	-3.455486		-3.455387	
	5%	-2.872499		-2.872455	
	10%	-2.572684		-2.572660	
Sensex (return)		-15.64497	0.0000	-15.66656	0.0000
	1%	-3.451146		-3.451146	
	5%	-2.870591		-2.870591	
	10%	-2.571663		-2.571663	
Sensex (Volume)		-15.77346	0.0000	-15.79087	0.0000
	1%	-3.451146		-3.451146	
	5%	-2.870591		-2.870591	
	10%	-2.571663		-2.571663	
Sensex (Volatilit y)		-5.312639	0.0000	-9.003365	0.0000
	1%	-3.451561		-3.451078	
	5%	-2.870774		-2.870561	
	10%	-2.571761		-2.571647	

Sources: Data collected from <http://finance.yahoo.com/> & <https://trends.google.com/trends> and Computed using E-views.

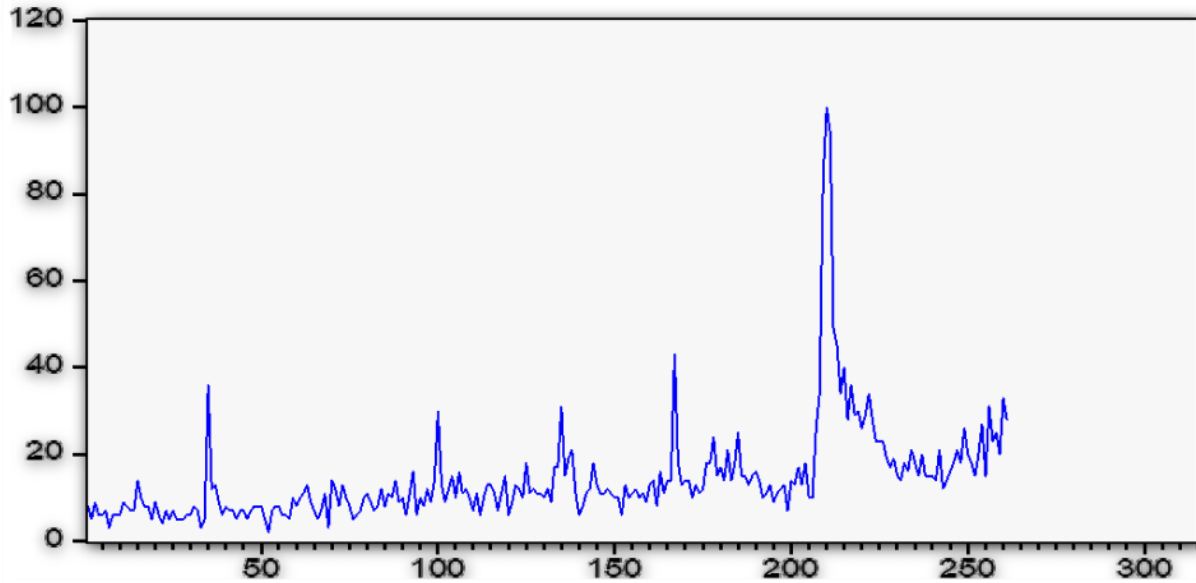
Table 3: The Results of Correlation between Google Trends Search and BSE Sensex from 01.01.2015 to 31.12.2020.

Variables	GSVI	Sensex (Return)	Sensex (Volume)	Sensex (Volatility)
Independent Variable GTS	1	0.00	0.03	0.04
Dependent Variables Sensex (return)	0.00	1	-0.17	0.06
Sensex (Volume)	0.03	-0.17	1	-0.03
Sensex (Volatility)	0.04	0.06	-0.03	1

** . Correlation is significant at the 0.01 level (2-tailed).

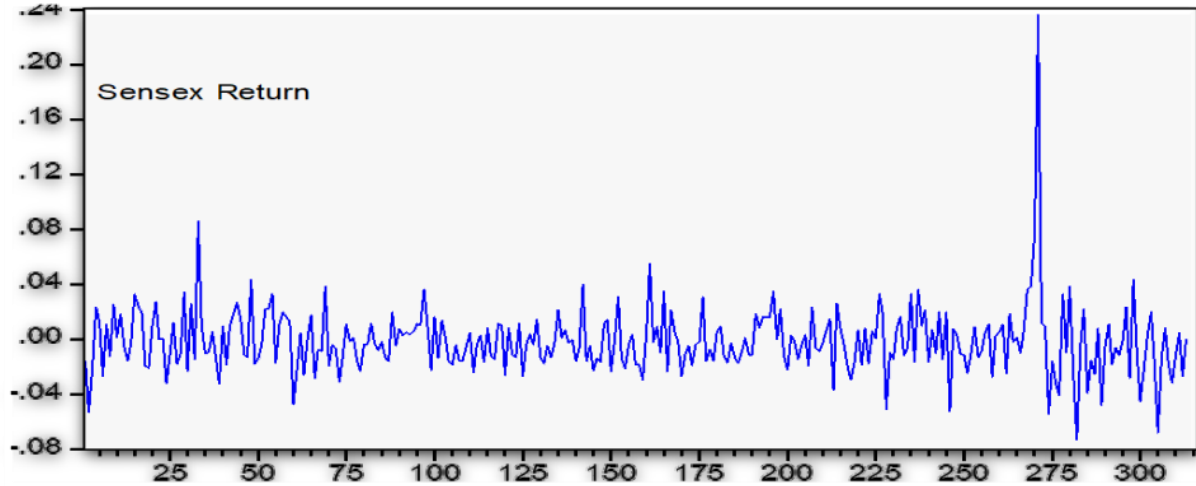
Sources: Data collected from <http://finance.yahoo.com/> & <https://trends.google.com/trends> and Computed SPSS 20.0. **Note:** GTS = Google Trends Search

Figure 2. Line chart for Google Trends Search from 01.01.2015 to 31.12.2020.



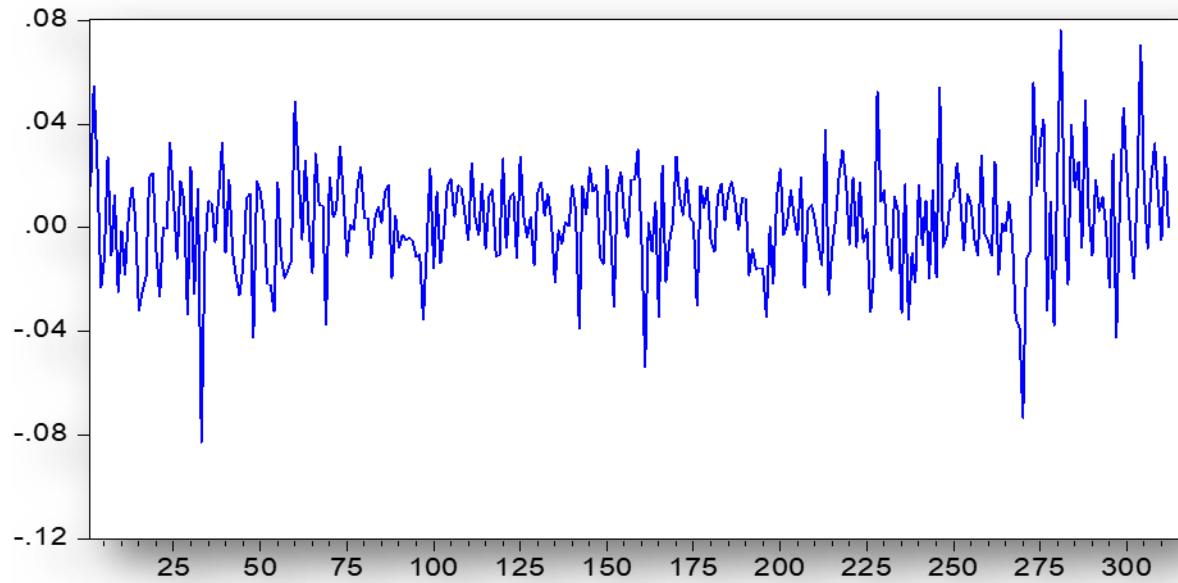
Sources: Data collected from Google trends (<https://trends.google.com/trends>) and Computed using E-views 7 version.

Figure 3. Line chart for BSE Sensex Return from 01.01.2015 to 31.12.2020.



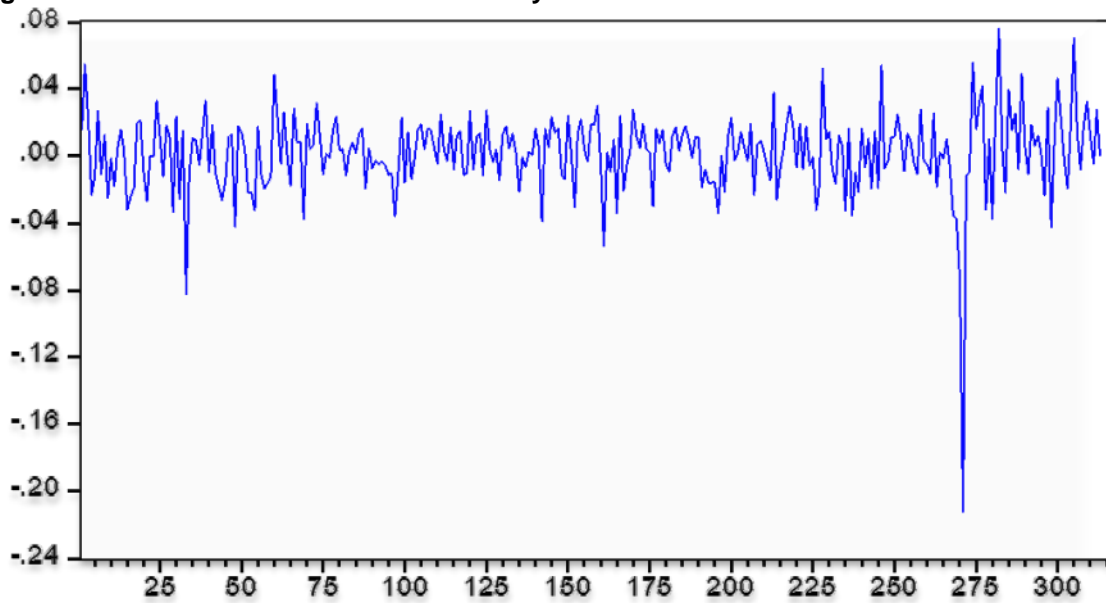
Sources: Data collected from BSE Sensex (<http://finance.yahoo.com/>) and Computed using E-views 7 version

Figure 4. Line chart for BSE Sensex Volume from 01.01.2015 to 31.12.2020



Sources: Data collected from BSE Sensex <http://finance.yahoo.com/> and Computed using E-views 7 version

Figure 5. Line chart for BSE Sensex Volatility from 01.01.2015 to 31.12.2020



Sources: Data collected from BSE Sensex <http://finance.yahoo.com/> and Computed using E-views 7 version