

Impact of COVID-19 Pandemic on Stock Market: Evidence from Bombay Stock Exchange

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ABSTRACT

The present study attempts to examine the behavior of the Indian stock market during the COVID 19 pandemic. In the study, a systemic approach is undertaken, where three significant events, namely declaration of COVID 19 as a pandemic, first death in India by COVID 19 and imposition of the nationwide lockdown, have been considered and the market reaction around the events is studied. The study employed event study methodology with daily return series of hundred and one firms, constituting the BSE 100 index. The study observed that the investors did not provide much attention to the announcement of the COVID 19 as a pandemic. However, the investors started panicking after the first death by the pandemic was reported, as witnessed from the negative abnormal returns—the return further declined on the announcement of nationwide lockdown. However, the sectors like FMCG, Health and Technology earned an abnormal positive return on the announcement of the nationwide lockdown. The study further employed GARCH Model and observed high volatility in the return series during the events. Overall, the study concludes that the events have a significant negative impact on the Indian stock market.

Keywords: COVID 19 Pandemic, Indian Stock Market, Event Study Methodology, GARCH

Mathematics Subject Classification: 91-10, 91-11, 62M10, 91B84

JEL Classification: E44, G1, G14, G18.

1. INTRODUCTION

The COVID-19 pandemic as a global health risk has disrupted human civilization to its worst stage. Nations around the world at the initial stage restricted travel as a protective against the COVID 19, and gradually restrictive measures reached its peak when every nations of the world imposed nationwide lockdown, restricting the public to walk out from their home. For several months, a worldwide lockdown was imposed by the respective nation's government as a protective measure against the pandemic which led to the faltering and breaking of the global supply chain, that inflated the global economy brutally. In the first quarter of 2020, China's GDP crashed by 36.6 percent, while the GDP of France, Italy, Spain dropped by 21.3 percent, 17.5 percent and 19.2 percent, respectively (The Indian Express, 2020).

Stock market, one of the indicators of the wealth of the people, saw a significant downfall during the outbreak of the COVID 19 pandemic. CSI 300 (china) fell by -12.1 percent, whereas NASDAQ (US) declined by -12.4 percent; similarly, SMI (Switzerland), MSCI world index, Nikkei 225 (Japan), and Stoxx 600 (Europe) fell by -14.4 percent, -17.5 percent, -19.4 percent and -23.8 percent respectively (Statista, 2021).

India, with a robust stock market, reacts and responds well to the global and national situation (Alam et al., 2020). As WHO declared COVID 19 as a pandemic, NSE Nifty50 and BSE Sensex tumbled around 8.2 percent and 8.3 percent, respectively. The market also witnessed volatility as the first death by COVID 19 was reported, and India's government imposed the nationwide lockdown. Although the market has shown an overview of the pandemic's impact, the specific and exact effect is hard to predict. Also, the results of the studies conducted so far are contradictory to each other and are limited in numbers. Alam et al. (2020), Mittal & Sharma (2020) found a positive impact of the pandemic on the Indian stock market, whereas Mishra et al. (2020) and Chaudhary et al. (2020) found a negative effect of the pandemic on the Indian stock market.

Considering these points, the present study has been initiated, where the declaration of a pandemic, first death and the imposition of the nationwide lockdown has been considered because these announcements demonstrate the ghastly nature of the virus and the government of India's effort to prevent the spread of the virus among the population. The study has employed event study methodology to examine the impact of the COVID 19 on hundred and one (101) firms comprising the BSE 100 index. Further, the firms have also been classified into sector/industry, and the sectoral and the overall impact has been studied.

2. REVIEW OF LITERATURE

Since the outbreak of the COVID-19, it has been causing a devastating impact on human life, but there has been a dearth of studies on COVID-19 and its impact on the economy and the stock market. Though some researches have been carried out to analyze the implications of COVID-19 on different economies, the number is still tiny.

Mazur et al. (2020) examined the performance of the US stock market during the crash of March 2020 triggered by COVID-19 and found that natural gas, food, healthcare, and software stocks earned high positive returns, whereas equity values in petroleum, real estate, entertainment, and hospitality sectors dropped dramatically. Moreover, loser stocks exhibit extreme asymmetric volatility that correlates negatively with stock returns. Similarly, Topcu & Gulal (2020) investigated the impact of COVID-19 on emerging stock markets and found that the pandemic's negative impact on emerging stock markets has gradually fallen and begun to lessen gradually by mid-April. In terms of regional classification, the outbreak's impact is the highest in Asian emerging markets, whereas it is the lowest in emerging European markets. The study also found that response time and the size of the governments' stimulus package have a significant influence in offsetting the effects of the pandemic. In another study, Ashraf (2020) examined the stock markets' response to the confirmed covid 19 cases and deaths for 64 countries and found that stock markets responded negatively to the growth in COVID-19 confirmed

cases; however, the markets reacted more proactively to the number of confirmed cases than the growth in the number of deaths. In a country-specific study, Al-Awadhi et al. (2020) analyzed the Chinese stock market and found that the daily shift in total confirmed cases and total cases of death caused by COVID-19 have significant adverse effects on stock returns. Similarly, Mishra et al. (2020) examined the impact of COVID-19 on the Indian financial market and compared it with the effects of the demonetization and the Goods and Services Tax (GST) and found negative stock returns for all the indices during the COVID19 outbreak. The study further showed that the COVID-19 has a severe impact compared to that of demonetization and the GST. In another study, Chaudhary et al. (2020) attempted to analyze the impact of COVID-19 on the Indian stock market (BSE 500 and BSE Sensex) and eight sectoral indices of the Bombay Stock Exchange (BSE) and compared the outcome with global indexes S&P 500, Nikkei 225, and FTSE 100. All indices in the crisis period showed negative returns compared to the pre-crisis period. The market depicted roughly the same standard deviation as the global markets; however, the market has higher negative skewness and higher positive kurtosis of returns, making the market seem more volatile. However, Alam et al. (2020) observed that the market reacted positively during the lockdown period, whereas negative AARs were reflected in the pre-lockdown period. A similar pattern was witnessed by Mittal & Sharma (2020) on examining the impact of the COVID 19 on the healthcare and pharma stocks on the Indian Stock Market. However, Maneenop & Kotcharin (2020), on examining the short-term impact of the COVID-19 outbreak on airline companies worldwide, found that airline stock returns decline more significantly than the market returns and the traders in Western countries are more responsive to recent information than the rest of the world.

From the review of relevant literature, it is evident that the COVID 19 pandemic has a significant impact on the stock market. However, the magnitude and direction (positive/negative) of the impact vary depending on the government's timing, type of market, number of confirmed cases, and death toll. In the Indian stock market context, the impact varies based on the factors mentioned above. Also, contrary views exist among the researchers regarding the impact of the pandemic. Researchers like Mishra et al. (2020) and Chaudhary et al. (2020) found a negative impact of the pandemic, whereas Alam et al. (2020) and Mittal & Sharma (2020) found a positive impact of the pandemic on sectoral indices of the Indian stock market. Considering the pandemic's varying impact and a limited number of studies, the present study has been undertaken. In the study, the pandemic's impact has been examined on the firms constituting BSE 100 index. Further, the firms have been classified into sectors, and the sector-specific and the overall impact have been studied.

The paper further divided as follows: in part three, the details of the methodology are discussed; the result is elaborately explained in part four, and finally, the conclusion is drawn.

3. DATA AND METHODOLOGY

3.1. Sample and Event Date(s)

The study has considered the hundred and one (101) securities constituting BSE 100 index, and the daily prices of the concern securities have been collected from the official website of BSE India. In the

study, three major announcements have been considered to examine the phase-wise impact of the events pertaining to the pandemic. These are:

Table No. 1: Name of events and their announcement date	
Event	Date
Declaration of Pandemic by WHO	March 11, 2020
First death reported in India	March 12, 2020
First LockDown imposed	March 24, 2020

Source: World Health Organisation (2020), India Today (2020), Business Today (2020), (Compiled by Author)

3.2. Sample with their respective sectors

Table No. 2: Samples with respective sectors	
Automobile	Bajaj Holdings & Investment Ltd.
Ashok Leyland Ltd.	Federal Bank Ltd.
Bajaj Auto Ltd	HDFC Bank Ltd.
Bharat Forge Ltd.	HDFC Life Insurance Co Ltd.
Bosch Ltd.	Housing Development Finance Corpn. Ltd.
Eicher Motors Ltd.	ICICI Bank Ltd.
Exide Industries Ltd	ICICI Prudential Life Insurance Company Ltd.
Hero Motocorp Ltd.	Indusind Bank Ltd.
Mahindra & Mahindra Ltd.	Kotak Mahindra Bank Ltd.
Maruti Suzuki India Ltd.	LIC Housing Finance Ltd.
Motherson Sumi Systems Ltd.	Power Finance Corpn. Ltd.
MRF Ltd.	REC Ltd.
Tata Motors DVR	SBI Life Insurance Company Ltd.
Tata Motors Ltd.	Shriram Transport Finance Co. Ltd.
TVS Motor Co. Ltd.	State Bank of India
Chemicals	FMCG
Asian Paints Ltd.	Britannia Industries Ltd.
Berger Paints India Ltd.	Colgate-Palmolive (India) Ltd.
Pidilite Industries Ltd.	Dabur India Ltd.
UPL Ltd.	Godrej Consumer Products Ltd.
Communication	Hindustan Unilever Ltd.
Bharti Airtel Ltd.	ITC Ltd.
Cons Durable	Marico Ltd.
Crompton Greaves Consumer Electricals Ltd.	Nestle India Ltd.
Titan Company Ltd.	Tata Consumer Products Ltd.
Voltas Ltd.	Healthcare
Construction	Apollo Hospitals Enterprise Ltd.
ACC Ltd.	Aurobindo Pharma Ltd.
Ambuja Cements Ltd.	Biocon Ltd.
DLF Ltd.	Cipla Ltd.
Grasim Industries Ltd.	Divi's Laboratories Ltd.

Larsen & Toubro Ltd.	Dr. Reddy's Laboratories Ltd.
Shree Cement Ltd.	Lupin Ltd.
Ultratech Cement Ltd.	Piramal Enterprises Ltd.
Energy	Sun Pharmaceutical Inds. Ltd.
Bharat Petroleum Corpn. Ltd.	Metals
Coal India Ltd.	Hindalco Industries Ltd.
GAIL (India) Ltd.	JSW Steel Ltd.
Hindustan Petroleum Corpn. Ltd.	Tata Steel Ltd.
Indian Oil Corpn. Ltd.	Vedanta Ltd.
Indraprastha Gas Ltd.	Services
NTPC Ltd	Adani Ports and Special Economic Zone Ltd.
Oil & Natural Gas Corpn. Ltd.	Avenue Supermarts Ltd.
Petronet LNG Ltd.	Bharti Infratel Ltd.
Power Grid Corporation of India Ltd.	Container Corpn. Of India Ltd.
Reliance Industries Ltd.	Info Edge (India) Ltd.
Tata Power Co. Ltd.	Interglobe Aviation Ltd.
Engineering	Zee Entertainment Enterprises Ltd.
Havells India Ltd.	Technology
Siemens Ltd.	HCL Technologies Ltd.
Financial	Infosys Ltd.
RBL Bank Ltd	Tata Consultancy Services Ltd.
Indiabulls Housing Finance Limited	Tech Mahindra Ltd.
Mahindra & Mahindra Financial Services Ltd	Wipro Ltd.
Bank of Baroda_Return	Textiles
Axis Bank Ltd.	Page Industries Ltd.
Bajaj Finance Ltd.	Mining & Minerals
Bajaj Finserv Ltd.	NMDC Ltd

Source: BSE India (Compiled by Author)

3.3. Event Study Methodology

The event study methodology developed by Fama (1969) is used to examine the impact of events on the stock market. In this method, abnormal returns around the event announcement are estimated, and its significance is tested using T – statistics.

3.3.1. Terminologies used in Event Studies

Event Day: It is the day on which the event has occurred. It is denoted as day '0'. In the present study, the declaration of COVID 19 as a pandemic has been taken as event day. For the sake of simplicity, in the present study, it has been denoted as event 1. The first death by COVID 19 in India has been denoted as event 2, and the declaration of the nationwide lock as event 3.

Estimation Period: It is the period during which parameters such as alpha (α) and beta (β) shall be estimated. The standard length of this period is 120 days starting before the event window (Peterson,

1989), and (Dahal & Das, 2021). In the present study the estimation period considered, range from August 1, 2019 to January 28, 2020.

Event Window: This is the period during which the impact of an event is examined. The length of this window varies depending upon the viability of the event. In the present study single day event window is considered i.e., the impact the event is observed on the announcement day only. It is so because during the pandemic numerous news/informations were reported in daily basis, that might possibly impacts the stock market. And also to mitigate the problem of clustering of the event, the single day event window has been considered in the present study.

3.3.2.Calculation of the return series

The return for a particular stock is calculated as under

$$R_{j,t} = \ln(P_{j,t} / P_{j-1,t}) * 100 \dots\dots\dots 1$$

Here, $R_{j,t}$ = Return of the security 'j' on time 't'.

$P_{j,t}$ = price of the security 'j' on time 't'.

$P_{j,t-1}$ = price of the security 'j' on time 't-1'.

A log return series minimizes the skewness and correlation effect, and improves the normality of the data.

3.3.3.Calculation of the Abnormal Return

The difference between the stock's actual return and the expected return is known as an abnormal return. The widely used method for calculating the expected return is the OLS market model developed by Sharpe (1963). The rationale behind using the model is that it is the best among the existing models (Brown & Warner, 1980). It is calculated as under:

$$\text{Expected Return, } E(R) = \alpha + \beta * R_{mt} \dots\dots\dots 2$$

Here, $E(R)$ = Expected Return

α, β are calculated in the estimation period. In the present study, an estimation period of 120 days prior to the event window has been considered.

R_{mt} = Market Return. Here, the BSE Sensex return has been taken as a proxy to the market return.

$$\text{Abnormal Return (AR)} = E(R) - R_{jt} \dots\dots\dots 3$$

3.3.4.Calculation of Cumulative Abnormal Returns (CARs)

Once the abnormal return is calculated, it becomes possible to calculate CARs. It is calculated to observe the impact of the event on multiple days. The following method is used to calculate the CARs:

$$CAR_j(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_j, t \dots\dots\dots 4$$

Here, CAR for security 'j' is calculated by aggregating the abnormal return (AR) the period from t_1 to t_2 . It is to be noted here that the period t_1 and t_2 should be within the event window period.

3.3.5.Calculation of Average Abnormal Return (AARs)

The cross-sectional aggregation of the abnormal return is done to examine the impact of the event on the pool of firms. It is calculated as under:

$$AAR_t = \frac{1}{N} \sum_{j=1}^N AR_{j,t} \dots\dots\dots 5$$

Here, AAR_t = Average Abnormal Return on time 't'

N = Numbers of securities.

$AR_{j,t}$ = Abnormal Return of security 'j' on time 't' calculated by equation 3.

3.3.6.Calculation of Cumulative Average Abnormal Return (CAARs)

It is calculated to observe the average effect of the event over multiple days. It is calculated by summing up all the AARs over a time period as follows:

$$CAAR_{(t1, t2)} = \sum_{t=t1}^{t2} AAR_t \dots\dots\dots 6$$

Here, $CAAR_{(t1, t2)}$ = cumulative average abnormal return over a period of t1 to t2.

AAR_t = Average abnormal return on time 't' calculated through equation 5.

3.3.7.Parametric T-Test for Significance Testing

Once CARs, AARs and CAARs are computed, it becomes utmost necessary to examine their statistical significance, that is, whether they are statistically different from zero, must be verified to assume economic relevance. The following formula is used for the same:

$$T - CARs = CARs / [SD(CARs) / \sqrt{N}] \dots\dots\dots 7$$

$$T - AARs = AARs / [SD(AARs) / \sqrt{N}] \dots\dots\dots 8$$

$$T - CAARs = CAARs / [SD(CAARs) / \sqrt{N}] \dots\dots\dots 9$$

4. RESULTS AND DISCUSSION

4.1.Cumulative Abnormal Returns of Individual Stock

In table no. 3, the abnormal return of the entire sample is depicted during the different events. All three events have been perceived differently by the different stocks. However, it can be said that the events have caused volatility in the share price. The first event, i.e., the declaration of the COVID 19 as a pandemic by WHO, seems to be underestimated by the Indian stock market as the effect of the event is minimal, implying that the investors did not pay much attention to the event's announcement. Out of the total firms, only 20 firms have been significantly impacted by the first event; and the impact is negative. Observing the impact of the second event, i.e., the first death caused by COVID 19 in India, it is evident that the investors have started panicking about the pandemic. On the outbreak of the second

event, 37 firms out of total firms have been significantly impacted, and the majority of them have significant negative abnormal returns. The market further declined when the Government of India declared nationwide lockdown on March 24, 2020. There was uncertainty, fear, and the problem of migrant labor further raised the risk of the spread of the pandemic. This created hues and cry among the people, and it was further boosted by misinformation and rumors. All this caused turbulence in the stock market, making it unfavorable for the investment. Out of the total firms under study, 46 firms have been significantly impacted by the nationwide lockdown announcement. And out of 46 firms 12 firms have been positively impact and rest have been negatively impacted by the announcement.

Table No.3: Abnormal Returns of Individual Stock

Stock	Event 1 (March 11, 2020)	P-value	Event 2 (March 13,2020)	P- value	Event 3 (Mar 24,2020)	P-value
ACC Ltd	-2.591*	0.032	-2.419	0.061	-8.958*	0.000
Adani Ports and Special Economic Zone	-0.832	0.545	-2.248	0.126	8.559*	0.000
Ambuja Cements Ltd	-1.860	0.159	-0.313	0.824	-6.699*	0.000
Apollo Hospitals Enterprise Ltd	-1.051	0.574	-2.164	0.279	-1.978	0.305
Ashok Leyland Ltd	-0.389	0.854	-4.023	0.076	-7.014*	0.001
Asian Paints Ltd	0.466	0.682	-6.756*	0.000	-1.099	0.348
Aurobindo Pharma Ltd	-4.437	0.115	7.597*	0.011	8.308*	0.004
Avenue Supermarts Ltd	-1.024	0.515	-0.234	0.889	-4.051*	0.012
Axis Bank Ltd	-1.002	0.394	-1.282	0.307	-5.569*	0.000
Bajaj Auto Ltd	0.264	0.804	-2.252*	0.047	-2.412*	0.027
Bajaj Finance Ltd	-0.124	0.915	-0.976	0.431	4.835*	0.000
Bajaj Finserv Ltd	0.118	0.920	-1.831	0.144	-6.322*	0.000
Bajaj Holdings and Investment Ltd	5.464*	0.000	-0.210	0.895	-21.064*	0.000
Bank of Baroda	-4.533*	0.011	7.830*	0.000	-1.539	0.403
Berger Paints India Ltd	-5.317*	0.001	-8.063*	0.000	-0.861	0.598
Bharat Forge Ltd	-2.770	0.085	-3.949*	0.021	-4.095*	0.013
Bharat Petroleum Corp Ltd	-4.996*	0.032	3.284	0.186	-6.278*	0.009
Bharti Airtel Ltd	-0.946	0.689	2.640	0.296	-2.828	0.245
Bharti Infratel Ltd.	6.132	0.079	0.446	0.905	-1.791	0.618
Biocon Ltd	-1.756	0.349	2.776	0.165	4.465*	0.021
Bosch Ltd	1.587	0.360	-3.903*	0.035	-2.957	0.098
Britannia Industries Ltd.	1.710	0.258	-5.802*	0.000	7.467*	0.000
Cipla Ltd/India	-1.842	0.230	5.881*	0.000	-0.955	0.545
Coal India Ltd	6.303*	0.001	-4.136*	0.041	-1.893	0.331
Colgate-Palmolive India Ltd	-1.285	0.349	-3.599*	0.014	0.272	0.847
Container Corp Of India	-5.720*	0.001	-0.099	0.959	-9.062*	0.000
Crompton Greaves Consumer Electricals Ltd	-4.081*	0.004	-3.662*	0.017	-2.318	0.116
Dabur India Ltd	1.001	0.410	-2.260	0.082	0.276	0.826
Divi's Laboratories Ltd	-1.638	0.259	-0.300	0.847	2.076	0.165
DLF Ltd	-2.727	0.265	-0.937	0.720	-9.229*	0.000
Dr Reddy's Laboratories Ltd	-2.312	0.066	-0.211	0.875	2.303	0.075
Eicher Motors Ltd	-1.221	0.544	-3.342	0.120	-1.098	0.596

Exide Industries Ltd	-1.352	0.394	-1.939	0.253	-0.912	0.577
Federal Bank Ltd	-2.137	0.162	1.570	0.336	-10.453*	0.000
Gail India Ltd	-10.500*	0.000	2.750	0.164	-4.144*	0.030
Godrej Consumer Products Ltd	-1.009	0.504	-3.447*	0.033	1.551	0.319
Grasim Industries Ltd	-1.536	0.381	2.503	0.181	-11.430*	0.000
Havells India Ltd	0.371	0.797	-1.293	0.401	-5.542*	0.000
HCL Technologies Ltd	-0.308	0.963	-1.028	0.883	5.144	0.445
HDFC Bank Ltd	1.425	0.818	-2.896	0.661	-5.488	0.389
HDFC Life Insurance Company Ltd	-0.938	0.576	5.558*	0.002	11.785*	0.000
Hero MotoCorp Ltd	3.857*	0.015	-5.273*	0.002	-2.278	0.162
Hindalco Industries Ltd	-3.834*	0.012	1.705	0.295	-1.783	0.256
Hindustan Petroleum Corp Ltd	-1.185	0.541	0.850	0.682	-3.652	0.068
Hindustan Unilever Ltd	1.234	0.243	-4.308*	0.000	5.970*	0.000
Housing Development Finance Corp	0.135	0.903	5.095*	0.000	-4.890*	0.000
ICICI Bank Ltd	1.448	0.272	-0.860	0.541	0.361	0.790
ICICI Prudential Life Insurance Company Ltd	2.458	0.101	1.362	0.395	4.431*	0.004
Indiabulls Housing Finance Limited	-8.668	0.196	-8.793	0.219	-12.248	0.076
Indian Oil Corp Ltd	-2.416	0.132	0.373	0.828	-4.389*	0.008
Indraprastha Gas Ltd	-0.696	0.654	3.509*	0.034	2.621	0.101
IndusInd Bank Ltd	-6.065*	0.002	-4.390*	0.040	-12.119*	0.000
Info Edge (India) Ltd.	0.346	0.882	-5.509*	0.027	4.124	0.087
Infosys Ltd	-2.709	0.225	0.612	0.798	11.258*	0.000
InterGlobe Aviation Ltd	-5.017*	0.021	-4.789*	0.040	5.919*	0.008
ITC Ltd	-0.806	0.499	0.912	0.474	-5.095*	0.000
JSW Steel Ltd	-2.662	0.154	-0.255	0.898	-1.852	0.335
Kotak Mahindra Bank Ltd	0.456	0.695	-3.930*	0.002	1.516	0.206
Larsen & Toubro Ltd	1.227	0.255	-1.594	0.166	-5.716*	0.000
LIC Housing Finance Ltd	1.282	0.528	2.177	0.315	-4.111*	0.049
Lupin Ltd	-1.990	0.160	0.662	0.661	-0.811	0.578
Mahindra & Mahindra Financial Services Ltd	0.112	0.955	-7.067*	0.001	2.896	0.158
Mahindra & Mahindra Ltd	-2.490	0.108	-4.617*	0.005	-12.534*	0.000
Marico Ltd	1.391	0.284	-0.677	0.625	2.256	0.091
Maruti Suzuki India Ltd	-1.253	0.408	-2.577	0.111	2.213	0.156
Motherson Sumi Systems Ltd	-2.009	0.396	-12.588*	0.000	2.341	0.337
MRF Ltd	-1.495	0.210	3.763*	0.003	-2.129	0.083
Nestle India Ltd	-0.299	0.812	-6.981*	0.000	2.778*	0.032
NMDC Ltd	-2.850	0.309	-0.316	0.916	-3.015	0.296
NTPC Ltd	0.2518	0.864	3.170*	0.044	0.716	0.636
Oil & Natural Gas Corp Ltd	-4.056*	0.016	1.372	0.445	0.909	0.600
Page Industries Ltd	-3.186	0.105	-3.255	0.121	-2.974	0.142
Petronet LNG Ltd	-0.614	0.646	4.551*	0.001	-8.109*	0.000
Pidilite Industries Ltd	3.580*	0.005	-8.287*	0.000	-2.955*	0.024
Piramal Enterprises Ltd	1.155	0.673	-5.403	0.064	-5.561*	0.048
Power Finance Corp Ltd	-1.582	0.419	7.746*	0.000	-5.972*	0.003
Power Grid Corp of India Ltd	0.348	0.803	1.207	0.418	-3.810*	0.008
RBL Bank Ltd	8.576*	0.015	-10.642*	0.005	2.606	0.471

REC Ltd	-2.911	0.120	3.285	0.100	-2.594	0.178
Reliance Industries Ltd	3.251*	0.046	1.046	0.548	4.356*	0.009
SBI Life Insurance Company Ltd	-1.533	0.374	-0.907	0.623	0.733	0.680
Shree Cement Ltd	-0.796	0.549	0.689	0.627	-2.811*	0.040
Shriram Transport Finance Co Ltd	-0.101	0.954	-7.632*	0.000	3.462	0.055
Siemens India Ltd	-0.516	0.689	-3.043*	0.027	-0.216	0.871
State Bank of India	-3.553	0.052	5.536*	0.005	-3.922*	0.037
Sun Pharmaceutical Industries Ltd	-2.280	0.166	6.999*	0.000	2.674	0.114
Tata Consultancy Services Ltd	-0.890	0.533	1.914	0.209	2.276	0.121
Tata Consumer Products Ltd	-0.707	0.712	2.757	0.178	7.028*	0.000
Tata Motors Ltd	-7.075*	0.036	-5.645	0.117	-6.679	0.054
Tata Motors Ltd DVR	-5.922	0.079	-2.139	0.553	-2.023	0.560
Tata Power Co Ltd	-4.478*	0.021	0.176	0.933	1.943	0.332
Tata Steel Ltd	-7.587*	0.000	6.183*	0.004	-4.043	0.053
Tech Mahindra Ltd	0.494	0.713	-0.588	0.681	1.692	0.220
Titan Co Ltd	-1.383	0.416	-3.237	0.075	-0.271	0.877
TVS Motor Co Ltd	0.678	0.716	-3.050	0.126	-1.949	0.310
UltraTech Cement Ltd	-2.654	0.058	-2.072	0.166	-5.104*	0.000
UPL Ltd	0.496	0.776	-10.603*	0.000	0.244	0.892
Vedanta Ltd	-3.183	0.127	-1.724	0.439	-4.057	0.059
Voltas Ltd	-1.013	0.464	2.666	0.071	-4.277*	0.003
Wipro Ltd	-0.468	0.686	-1.611	0.193	3.136*	0.009
Zee Entertainment Enterprises Ltd	7.588	0.069	-6.173	0.167	-4.239	0.325

Source: Author's calculation

* $P < 0.05$, significance at 5 % significant level

4.2.Cumulative Average Abnormal Returns (CAARs) of Sector-based on Firms Constituents'

BSE 100 Index

Table No.4: Cumulative Average Abnormal Returns of Sector-based on Firms Constituents' BSE 100 Index

Sectors	Event 1 (March 11, 2020)	P-Value	Event 2 (March 13,2020)	P-Value	Event 3 (Mar 24,2020)	P-Value
Automobile	-1.399*	0.010	-3.681*	0.000	-2.966*	0.000
Chemicals	-0.194	0.789	-8.427*	0.00	-1.168	0.118
Consumer Durables	-2.159*	0.013	-1.411	0.130	-2.289*	0.011
Construction	-1.563*	0.008	-0.592	0.349	-7.136*	0.000
Energy	-1.566*	0.002	1.513*	0.005	-1.811*	0.000
Engineering	-0.072	0.940	-2.168*	0.036	-2.879*	0.004
Financial	-0.531	0.333	-0.512	0.382	-2.894*	0.000
FMCG	0.137	0.768	-2.600*	0.000	2.500*	0.000
Health	-1.795*	0.005	1.760*	0.010	1.169	0.076

Metals	-4.316*	0.000	1.477	0.143	-2.934*	0.003
Services	0.210	0.831	-2.658*	0.011	-0.077	0.939
Technology	-0.776	0.594	-0.140	0.928	4.701*	0.002

Source: Author's calculation

* $P < 0.05$, significant at 5 % significance level

In table no. 4, the impact of the events on the sectors has been examined. It is to be noted that the Textile and Mining & Minerals sectors have not been considered as only single security fell under both the sectors, which would likely to possess the methodological issues.

Observing the impact of the events on the sectors, it can be interpreted that the market has perceived negative information from all the events concerned. Particularly concerning event 1, it is evident that all the other sectors have a negative abnormal return except for the FMCG and Service sector. Moreover, six sectors have significantly impacted by event 1. Among them, Metals sector is the worst sufferer with returns of -4.316%. In the second event, the scenario began to change as the pandemic started spreading; this was when confirmed cases number were in double digits, and the first death by COVID-19 was reported in India. This further brought decline in the Indian stock market, as the sectors, Automobile, Chemicals Engineering, FMCG and Services sectors saw a further decline. However, the sectors like Energy and Health saw a significant rise with positive abnormal returns and the Metals sector that was the worst sufferer in event one also recovered though it is insignificant. Considering the rising COVID 19 cases and deaths, India's government took one of the significant steps, perhaps the first-ever in Indian history, to contain the human-to-human transmission of the government-imposed nationwide lockdown on March 24, 2020. This nationwide lockdown acted as a significant setback for the Indian market. This announcement degraded investors' hope and confidence in the market. After this announcement, basic needs, especially daily used products and pharma products, became a significant concern. With the announcement, the 'work from home' concept got boosted. This phenomenon is evident from the market; the FMCG sector that was in the declining stage in event two suddenly saw a rise with 2.5% of the abnormal return. Similarly, the Technological sector, having negative returns though insignificant, was also boosted by this announcement as the sector witnessed a rise of 4.701% of the abnormal return.

5. ROBUSTNESS OF THE RESULTS

The robustness of the results is checked by applying Multi-Factor Model in calculating expected returns. The study employed returns of the NSE Nifty 50 index in addition to the returns of the BSE Sensex index.

Table No. 5: Robustness Check Cumulative Average Abnormal Returns of Sector-based on Firms Constituents' BSE 100 Index						
Sectors	Event 1 (March 11, 2020)	P-Value	Event 2 (March 13, 2020)	P-Value	Event 3 (Mar 24, 2020)	P-Value
Automobile	-1.105*	0.040	-3.079*	0.000	-2.561*	0.000

Chemicals	0.090	0.897	-7.846*	0.000	-0.777	0.264
Consumer Durables	-1.712*	0.042	-0.497	0.555	-1.673*	0.047
Construction	-1.057	0.061	0.442	0.433	-6.439*	0.000
Energy	-0.907	0.052	2.860*	0.000	-0.903	0.053
Engineering	0.077	0.936	-1.863	0.052	-2.673*	0.005
Financial	-0.309	0.569	-0.058	0.915	-2.588*	0.000
FMCG	0.291	0.525	-2.285*	0.000	2.713*	0.000
Health	-1.428*	0.022	2.508*	0.000	1.673*	0.007
Metals	-3.628*	0.000	2.885*	0.001	-1.985*	0.028
Services	0.844	0.373	-1.363	0.150	0.796	0.401
Technology	-1.079	0.454	-0.759	0.598	4.284*	0.003

Source: Author's calculation

* $P < 0.05$, significant at 5 % significance level

Comparing the outcomes of the table no. 4 and table no.5, it can be rightly said that both the model's results resemble each other, providing robustness to the results.

6. GARCH (1,1) MODEL

Further, the study has applied the GARCH (1, 1) model to examine the volatility in price series caused by the outbreak of the pandemic and related events under study.

Table No.6: GARCH Estimates				
Stock	ARCH (1)	p-value	GARCH (1)	P-value
ACC Ltd	0.125*	0.006	0.843*	0.000
Adani Ports and Special Economic Zone	0.269*	0.000	0.734*	0.000
Ambuja Cements Ltd	0.181*	0.020	0.741*	0.000
Apollo Hospitals Enterprise Ltd	0.233*	0.007	0.629*	0.000
Ashok Leyland Ltd	0.293*	0.019	0.782*	0.000
Asian Paints Ltd	0.428*	0.000	0.342*	0.001
Aurobindo Pharma Ltd	0.539*	0.000	0.615*	0.000
Avenue Supermarts Ltd	0.238*	0.033	0.576*	0.000
Axis Bank Ltd	0.200*	0.000	0.827*	0.000
Bajaj Auto Ltd	0.245*	0.000	0.789*	0.000
Bajaj Finance Ltd	0.277*	0.001	0.726*	0.000
Bajaj Finserv Ltd	0.710*	0.000	0.509*	0.000
Bajaj Holdings and Investment Ltd	0.477*	0.000	0.650*	0.000
Bank of Baroda	0.108*	0.002	0.837*	0.000
Berger Paints India Ltd	0.530*	0.005	0.146	0.382
Bharat Forge Ltd	0.106*	0.000	0.874*	0.000
Bharat Petroleum Corp Ltd	0.318*	0.000	0.682*	0.000
Bharti Airtel Ltd	0.171*	0.018	0.704*	0.000

Bharti Infratel Ltd.	0.4208	0.000	0.471*	0.000
Biocon Ltd	0.126*	0.035	0.823*	0.000
Bosch Ltd	0.099*	0.001	0.885*	0.000
Britannia Industries Ltd.	0.416*	0.000	0.6048	0.000
Cipla Ltd/India	0.184*	0.000	0.788*	0.000
Coal India Ltd	0.129*	0.025	0.835*	0.000
Colgate-Palmolive India Ltd	0.183*	0.001	0.798*	0.000
Container Corp Of India	0.188*	0.000	0.811*	0.000
Crompton Greaves Consumer Electricals Ltd	0.203*	0.003	0.762*	0.000
Dabur India Ltd	0.192*	0.001	0.779*	0.000
Divi's Laboratories Ltd	0.279*	0.000	0.756*	0.000
DLF Ltd	0.730*	0.000	0.378*	0.000
Dr Reddy's Laboratories Ltd	0.073*	0.005	0.921*	0.000
Eicher Motors Ltd	0.070*	0.003	0.908*	0.000
Exide Industries Ltd	0.153*	0.002	0.807*	0.000
Federal Bank Ltd	0.148*	0.002	0.844*	0.000
Gail India Ltd	0.141*	0.011	0.824*	0.000
Godrej Consumer Products Ltd	0.115*	0.015	0.841*	0.000
Grasim Industries Ltd	0.168*	0.000	0.777*	0.000
Havells India Ltd	0.111*	0.040	0.866*	0.000
HCL Technologies Ltd	-0.009	0.594	0.588	0.352
HDFC Bank Ltd	-0.009	0.418	0.619	0.212
HDFC Life Insurance Company Ltd	0.166*	0.001	0.795*	0.000
Hero MotoCorp Ltd	0.207*	0.000	0.808*	0.000
Hindalco Industries Ltd	0.147*	0.009	0.849*	0.000
Hindustan Petroleum Corp Ltd	0.168*	0.000	0.784*	0.000
Hindustan Unilever Ltd	0.210*	0.001	0.733*	0.000
Housing Development Finance Corp	0.155*	0.003	0.834*	0.000
ICICI Bank Ltd	0.202*	0.000	0.808*	0.000
ICICI Prudential Life Insurance Company Ltd	0.819*	0.000	0.315*	0.000
Indiabulls Housing Finance Limited	0.557*	0.000	-0.015	0.782
Indian Oil Corp Ltd	0.123*	0.012	0.846*	0.000
Indraprastha Gas Ltd	0.158*	0.017	0.720*	0.000
IndusInd Bank Ltd	0.312*	0.000	0.723*	0.000
Info Edge (India) Ltd.	0.148*	0.025	0.838*	0.000
Infosys Ltd	0.220*	0.007	0.792*	0.000
InterGlobe Aviation Ltd	0.067*	0.044	0.882*	0.000
ITC Ltd	0.324*	0.003	0.638*	0.000
JSW Steel Ltd	0.097*	0.001	0.880*	0.000
Kotak Mahindra Bank Ltd	0.201*	0.000	0.793*	0.000
Larsen & Toubro Ltd	0.235*	0.000	0.738*	0.000
LIC Housing Finance Ltd	0.057*	0.024	0.907*	0.000
Lupin Ltd	0.152*	0.021	0.819*	0.000
Mahindra & Mahindra Financial Services Ltd	0.155*	0.000	0.851*	0.000
Mahindra & Mahindra Ltd	0.130*	0.005	0.857*	0.000
Marico Ltd	0.142*	0.019	0.760*	0.000

Maruti Suzuki India Ltd	0.192*	0.000	0.802*	0.000
Motherson Sumi Systems Ltd	0.151*	0.000	0.850*	0.000
MRF Ltd	0.183*	0.019	0.737*	0.000
Nestle India Ltd	0.134*	0.014	0.792*	0.000
NMDC Ltd	0.078*	0.046	0.840*	0.000
NTPC Ltd	0.1378	0.005	0.851*	0.000
Oil & Natural Gas Corp Ltd	0.224*	0.000	0.815*	0.000
Page Industries Ltd	0.032	0.541	0.742	0.063
Petronet LNG Ltd	0.178*	0.001	0.802*	0.000
Pidilite Industries Ltd	0.387*	0.000	0.656*	0.000
Piramal Enterprises Ltd	0.204*	0.011	0.763*	0.000
Power Finance Corp Ltd	0.051*	0.002	0.927*	0.000
Power Grid Corp of India Ltd	0.206*	0.002	0.721*	0.000
RBL Bank Ltd	0.126*	0.002	0.830*	0.000
REC Ltd	0.104*	0.004	0.880*	0.000
Reliance Industries Ltd	0.255*	0.000	0.758*	0.000
SBI Life Insurance Company Ltd	0.178*	0.000	0.760*	0.000
Shree Cement Ltd	0.328*	0.001	0.579*	0.000
Shriram Transport Finance Co Ltd	0.233*	0.001	0.744*	0.000
Siemens India Ltd	0.493*	0.000	0.221*	0.041
State Bank of India	0.182*	0.006	0.756*	0.000
Sun Pharmaceutical Industries Ltd	0.203*	0.003	0.794*	0.000
Tata Consultancy Services Ltd	0.188*	0.008	0.791*	0.000
Tata Consumer Products Ltd	0.377*	0.000	0.510*	0.000
Tata Motors Ltd	0.152*	0.041	-0.137	0.700
Tata Motors Ltd DVR	0.155*	0.038	-0.021	0.925
Tata Power Co Ltd	0.144*	0.007	0.841*	0.000
Tata Steel Ltd	0.103*	0.014	0.851*	0.000
Tech Mahindra Ltd	0.263*	0.023	0.690*	0.000
Titan Co Ltd	0.081*	0.005	0.869*	0.000
TVS Motor Co Ltd	0.120*	0.000	0.862*	0.000
UltraTech Cement Ltd	0.193*	0.004	0.745*	0.000
UPL Ltd	0.093*	0.009	0.903*	0.000
Vedanta Ltd	0.105*	0.000	0.857*	0.000
Voltas Ltd	0.078*	0.000	0.932*	0.000
Wipro Ltd	0.126*	0.000	0.874*	0.000
Zee Entertainment Enterprises Ltd	0.439*	0.000	0.269*	0.042

Source: Author's calculation

* $P < 0.05$, significant at 5 % significance level

The GARCH estimates, as shown in Table 6, are highly significant across all the firms under study except for HCL Technological Ltd., Berger Paints India Ltd., HDFC Bank Ltd., India Bulls Housing Finance Limited, Page Industries and Tata Motors Ltd. DVR. It is observed that the sum of ARCH (1) and GARCH (1) coefficients are one or close to unity which, signifies that all the series are highly volatile. The highly significant values of the sum of ARCH (1) and GARCH (1) coefficients indicate a

widening of arbitrage opportunity and extreme mispricing. Among the firms with no significant ARCH and GARCH except Berger paints India Ltd. are those firms that are not impacted by any of the events under study. Thus, the result of the GARCH further provides robustness to the study.

7. CONCLUSION

In the present study, the Indian stock market's behavior around the COVID 19 pandemic is examined using event study methodology. The study used firms constituting the BSE 100 index and considered BSE Sensex return as market return. The study is broken down into two-stage; at first, the individual firms' behavior is studied in three different events, and at the second stage, the firms are categorized into sectors, and their behavior is studied. The study also checked the result's robustness by employing Multi-Factor Model, and the GARCH model is also employed to check the volatility of the return series around the events under study.

From the analysis of the individual firms, it is evident that the first event's effect is minimal, implying that the investor did not pay much attention to the event's announcement. However, the investors had started panicking about the pandemic when the first death by COVID 19 was reported in India. The situation further degraded and saw a deep decline as the government imposed a nationwide lockdown as a protective measure against the pandemic. Similar results are observed by examining the sectoral behavior. The market had perceived negative information from all the events concerned. Concerning event 1, it can be concluded that the event has negatively impacted the majority of the sectors. Among all, the Metals sector is the worst sufferer with returns of -4.316 percent. However, on the announcement of the second event, the sectors like Energy and Health saw a significant rise with positive abnormal returns and the Metals sector that was the worst sufferer in event one also recovered though it was insignificant. Considering the rising COVID 19 cases and deaths, India's government took one of the significant steps to contain the human-to-human transmission of the pandemic, the government-imposed nationwide lockdown on March 24, 2020. This nationwide lockdown acted as a significant setback for the Indian market. After the announcement, basic needs, especially daily used products and pharma products, became a significant concern. With the announcement, the 'work from home' concept also got boosted. This phenomenon is evident from the market; the FMCG sector that was in the declining stage in event two suddenly saw a rise with 2.5% of the abnormal return.

Similarly, the Technological sector, having negative returns though insignificant, was also boosted by this announcement as the sector witnessed a rise of 4.701% of the abnormal return. The study also employed GARCH Model, and evident that the GARCH estimates are highly significant across all the firms under study except for HCL Technological Ltd., Berger Paints India Ltd., HDFC Bank Ltd., India Bulls Housing Finance Limited, Page Industries and Tata Motors Ltd. DVR. It is observed that the sum of ARCH (1) and GARCH (1) coefficients are one or close to unity which, signifies that all the series are highly volatile. The highly significant values of the sum of ARCH (1) and GARCH (1) coefficients indicate a widening of arbitrage opportunity and extreme mispricing. Among the firms with no significant ARCH and GARCH except Berger paints India Ltd. are those firms that are not impacted by any of the events under study.

Overall, the study concludes that the events have a significant negative impact on the Indian stock market. The study further observed that the events had widened the arbitrage opportunity by bringing extreme mispricing through volatility in the stock market.

8. REFERENCES

- Alam, M. N., Alam, M., & Chavali, K. (2020). Stock Market Response during COVID-19 Lockdown Period in India: An Event Study. *Journal of Asian Finance, Economics and Business*, 7(7), 131 – 137.
- Al-Awadhi, A. M., Alsaifi, K., Al-Awadhi, A., & Alhammadi, S. (2020). Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance*, 27, 1-5.
- Ashraf, B. N. (2020). Stock markets' reaction to COVID-19: cases or fatalities? *Research in International Business and Finance*. doi:<https://doi.org/10.1016/j.ribaf.2020.101249>
- Baker, S. R., Bloom, N., Davis, S. J., Kost, K., Sammon, M., & Viratyosin, T. (2020). The Unprecedented Stock Market Reaction to COVID-19. *The Review of Asset Pricing Studies*, 10, 742–758. doi:[doi:10.1093/rapstu/raaa008](https://doi.org/10.1093/rapstu/raaa008)
- Brown, S. J., & Warner, J. B. (1980). Measuring security price performance. *Journal of financial economics*, 8(3), 205-258. doi:[https://doi.org/10.1016/0304-405X\(80\)90002-1](https://doi.org/10.1016/0304-405X(80)90002-1)
- Business Today. (2020, March 25). *Coronavirus in India: 21-day lockdown begins; key highlights of PM Modi's speech*. Retrieved from [www.businesstoday.in: https://www.businesstoday.in/current/economy-politics/coronavirus-in-india-21-day-lockdown-begins-key-highlights-of-pm-modi-speech/story/399154.html](https://www.businesstoday.in/current/economy-politics/coronavirus-in-india-21-day-lockdown-begins-key-highlights-of-pm-modi-speech/story/399154.html)
- Chaudhary, R., Bakhshi, P., & Gupta, H. (2020). The performance of the Indian stock market during COVID-19. *Investment Management and Financial Innovations*, 17(3), 133-147. doi:[10.21511/imfi.17\(3\).2020.11](https://doi.org/10.21511/imfi.17(3).2020.11)
- Dahal, M., & Das, J. (2021). Impact of Dividend Announcements on Share Price of Indian Banking Sector Companies. *NMIMS Journal of Economics and Public Policy*, VI(1), 65-78.
- India Today. (2020, March 12). *First coronavirus death in India: 76-year-old who died in Karnataka had Covid-19, says state govt*. Retrieved from [www.indiatoday.in: https://www.indiatoday.in/india/story/first-coronavirus-death-in-india-karnataka-man-1654953-2020-03-12](https://www.indiatoday.in/india/story/first-coronavirus-death-in-india-karnataka-man-1654953-2020-03-12)
- Maneenop, S., & Kotcharin, S. (2020). The impacts of COVID-19 on the global airline industry: An event study approach. *Journal of Air Transport Management*, 89, 1-6. doi:<https://doi.org/10.1016/j.jairtraman.2020.101920>
- Mazur, M., Dang, M., & Vega, M. (2020). COVID-19 and the March 2020 Stock Market Crash. Evidence from S&P1500. *Finance Research Letters*. doi:<https://doi.org/10.1016/j.frl.2020.101690>
- Mishra, A. K., Rath, B. N., & Dash, A. K. (2020). Does the Indian Financial Market Nosedive because of the COVID-19 outbreak, in comparison to after Demonetisation and the GST? *Emerging Markets Finance and Trade*, 56(10), 2162–2180 . doi:<https://doi.org/10.1080/1540496X.2020.1785425>
- Mittal, S., & Sharma, D. (2020). The Impact of COVID-19 on Stock Returns of the Indian Healthcare and Pharmaceutical Sector . *Australasian Accounting, Business and Finance Journal*, 15(1), 5-21. doi:[10.14453/aabfj.v15i1.2](https://doi.org/10.14453/aabfj.v15i1.2)
- Peterson, P. P. (1989). Event Studies: A Review of Issues and Methodology. *Quarterly Journal of Business and Economics*, 28(3), 36-66.
- Sharpe, W. F. (1963). A Simplified Model for Portfolio Analysis. *Management Science*, 9(2), 277-293. doi:<https://doi.org/10.1287/mnsc.9.2.277>

- Statista. (2021). *Change in value during coronavirus outbreak of selected stock market indices worldwide from January 1 to March 18, 2020*. Retrieved 2021, from Statista: <https://www.statista.com/statistics/1105021/coronavirus-outbreak-stock-market-change/>
- The Indian Express. (2020, May 16). *Explained: How Covid-19 has affected the global economy*. Retrieved from indianexpress.com: <https://indianexpress.com/article/explained/explained-how-has-covid-19-affected-the-global-economy-6410494/>
- Topcu, M., & Gulal, O. S. (2020). The impact of COVID-19 on emerging stock markets. *Finance Research Letters*. doi:<https://doi.org/10.1016/j.frl.2020.101691>
- World Health Organisation . (2020, March 11). *WHO Director-General's opening remarks at the media briefing on COVID-19 - March 11 2020*. Retrieved from who.int: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>