





“The impact of the COVID-19 outbreak on the Indian stock market – A sectoral analysis”

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THE IMPACT OF THE COVID-19 OUTBREAK ON THE INDIAN STOCK MARKET – A SECTORAL ANALYSIS

Abstract

This paper aims to examine the impact of the COVID-19 outbreak on Indian firms listed on the NSE and analyze its impact on various sectors. In addition, a sub-sample analysis based on market capitalization was performed to understand the effect of size during extreme events. The sample consisted of 1,335 firms listed on the NSE India. A standard event study outlined by Brown and Warner (1985) was employed to analyze the price impact on the COVID-19 outbreak. The event windows from -10 days to +10 days were selected. The estimation window is 250 days. The Nifty 50 has been chosen as a proxy for market return. The sample firms witnessed a negative impact of the COVID-19 outbreak with a negative CAAR in different event windows. In addition, various sectors are classified according to their responsiveness towards the COVID-19 outbreak into three groups: highly negatively affected, moderately negatively affected, and slightly negatively affected. The paper also points out that the pandemic substantially affects the above-median market capitalized firms than the below-median market capitalized firms, which contradicts the size effect phenomenon. The results assist shareholders in managing their portfolios and mitigate the systematic risk of their investments during extreme events such as a pandemic, wars, and others. This study is the first comprehensive analysis of the impact of the COVID-19 outbreak on different sectors in India. It is also the first study to investigate the size effect anomalies during extreme events.

Keywords

event studies, price effect, India, extreme events, industry analysis, investor behavior

JEL Classification

G01, G10, G14, G32

INTRODUCTION

The world is witnessing an unrecoverable loss due to the outbreak of the novel coronavirus, which has shuddered the entire world's economic and social terrain. The consequences of the pandemic are devastating as millions of lives are falling into poverty, ventures are facing existential threats, the workforce is at risk of losing jobs, and society is undergoing a paradigm shift. The crisis and its impact are also reflected in the stock market. Hence, the COVID-19 outbreak event is critical to examine stock price volatility.

Stock prices are the pertinent measure of a firm's performance and return to stakeholders. The financial theories and theory of behavioral finance on the capital market suggest that stock price movement is the function of the market and firm-based factors. Any economic or environmental event has an impact on the investors' perception, which in turn affects stock prices. According to Lee and Jiang (2002), investor optimism condenses the return volatility, whereas a pessimist attitude intensifies the earnings volatility. The COVID-19 pandemic is also fetching an impact on different industries and potentially destroying some of the industries around the world. Most industries are

withering away due to the crises. At the same time, the situation has also provided an opportunity for various industries to flourish, such as manufacturing and logistics. According to the International Labour Organisation (ILO) report on various sectors, the pandemic has become a tight spot for the automobile industry. The catastrophic crisis is also reflected in the intense volatility of the global financial market, where emerging markets have observed an outflow of \$90 billion investment¹. The capital markets are the best indicators of the investor's perception regarding future trends, and they can reflect on what lies ahead. Viewing the investors' movement, the impact of outbreaks on stock prices portrays the sentiments of the investors.

The consequences of COVID-19 are not restricted to only selected domains but apparent in all spheres of society, which is anticipated to have a prolonged effect on the economy. However, the degree of the impact may vary from sector to sector and from country to country. In response to the slow economic activities, the stock markets around the world have reacted noticeably. The possible explanation for the reactions is attributed to government restrictions on mobilities and commercial activities, which have impacted the service sector (Baker et al., 2020). Adopting an event study approach, considering the lockdown announcement as an event, the study intends to examine the impact of the COVID-19 outbreak on stock prices of various Indian industries. Therefore, the stock prices of those industries that react to the pandemic of Novel Coronavirus (COVID-19) have been analyzed.

1. LITERATURE REVIEW

The aberrant circumstances typically hit the capital market by disturbing the investors' sentiment, consequently affecting stock prices. Thus, it can be argued that the stock market reacts to major events. For instance, catastrophe (Kalra et al., 1993), calamities (Kowalewski & Śpiewanowski, 2020), sports (Buhagiar et al., 2018), tragic news (Nikkinen et al., 2008; Li, 2018), environmental issues (Alsaifi et al., 2020; Guo et al., 2020) and political events (Bash & Alsaifi, 2019; Shanaev & Ghimire, 2019). The stock market volatility has been studied extensively with reference to various major events. Aggarwal et al. (1999), in their study of volatility in emerging stock markets, examined various types of events such as local or global that lead to stock market volatility. They investigated the market reaction due to the returns in local currency and dollar-adjusted return during 1985–1995 and found significant volatility in the global stock markets. Another widely studied event in the literature is the terrorist activities and stock market reactions. Essaddam and Karagianis (2014) suggested that terrorism is a significant affair in explaining the volatility of stock returns. They investigated the American firms targeted by terrorist attacks and found that volatility increases on the day of the attack and persists for fifteen days following the attack. Similarly, Arin et al. (2008),

Aslam and Kang (2015), and Chaudhry et al. (2018) also found a significant association between terrorist activities and volatility in stock markets. There is another global issue of oil price shock that has been observed to be reflected in the stock markets. For instance, Degiannakis et al. (2014) examine the effects of oil price shocks on stock market volatility in Europe, where the supply and demand-side shocks do not impact volatility. However, stock market volatility is affected by changes in the oil price, which lead by aggregate demand shocks. On a similar line, Broadstock and Filis (2014) and Kang et al. (2015) also found a relationship between oil prices and stock market returns. Some of the studies have analyzed that local or global political activities impact the different industries at a different rate. Thus, a diverse degree of reaction is observed in various industries. Kaplanski and Levy (2010) examined that aviation accidents impact stock prices and proved that unstable stock prices are more susceptible. Carter and Simkins (2004) also investigated the repercussions of the September 11th incident on the stock price of the air-transport industry. Their finding suggests that the market reacted differently towards the large and small airlines due to the financial distress and impact on the cash reserve of individual airline firms. Ragin and Halek (2016) studied 43 major disasters and their impact on stock returns of firms of the insurance indus-

1 The impact of COVID-19 on capital markets | McKinsey.

try and observed abnormal returns on the day of the event. Other studies are based on the events such as financial crisis (Al Rjoub, 2009; Kontonikas et al., 2013); natural disasters (Worthington & Valadkhani, 2004; Wang & Kutan, 2013; Bourdeau-Brien & Kryzanowski, 2017), rare events like consumption disasters (Wachter, 2013), and others.

Research on stock market volatility has been gaining momentum since COVID-19 affected the world with its consequences. Although research already exists on past pandemics such as influenza and SARS (Mei-Ping et al., 2018), Mctier et al. (2011), in their study of the US stock market and its volatility, saw a decrease in trade activities and returns due to the spread of flu.

Table 1 summarizes recent studies on the impact of the COVID-19 pandemic on stock markets around the world.

The purpose of the study is to analyze the association between the COVID-19 outbreak and stock market price volatility. The analysis is conducted

on Indian firms listed on the NSE, and also the impact of the COVID-19 outbreak on various sectors is investigated. The prime novelty of the paper is to examine the size effect during extreme events. Therefore, a sub-sample analysis based on market capitalization is performed.

An event-based methodology is extensively used in finance to study the market reactions to certain events. Therefore, in this paper, an event study method proposed by Fama et al. (1969) is used to study the impact of the pandemic on various industries. The paper substantiates the stock market reaction based on the prevailing literature on the relationship between crises and stock price fluctuations.

2. DATA

Since the end of December 2019, news of the COVID-19 outbreak in Wuhan, China, circulated on an online platform. However, India saw an increase in the spread of COVID-19 in March 2020.

Table 1. Recent research on the impact of COVID-19 on stock markets

Authors	Context	Findings
Choi and Jung, 2021	Korean stock market	The finding suggests that a rise in confirmed cases increases volatility of returns and negatively affects stock returns The result is substantiated by the observation of a further decrease in return during the second wave, mainly hitting the food & beverage sector
Onali, 2020	US stock market	The study finds no evidence of the impact of COVID-19 on market returns
Baker et al., 2020	US stock market	The study concluded that the US stock market reacted forcefully to COVID-19 The possible explanation is attributed to the government restrictions on commercial activity, mobility, and social distancing
He et al., 2020	Chinese stock market (sectoral study)	The sectoral study concluded that all the sectors did not show an equal reaction The transportation, mining, electricity & heating, and environment industries experienced the adverse impact of COVID-19 Manufacturing, information technology, education, and healthcare industries did not show a significant reaction
Al-Awadhi et al., 2020	Chinese stock market	The findings suggest that the increase in the number of daily confirmed cases and demises caused by COVID-19 has a significant and negative impact on stock returns
Ashraf, 2020	Global (64 countries)	The rise in confirmed cases negatively responded to the stock market return Further investigation suggests that markets reacted more proactively to an increase in confirmed cases as compared to the growth in the number of deaths
Liu et al., 2020	Global	The outcome of the pandemic considerably and directly affects stock markets globally The Asian countries have been impacted more and observed greater negative abnormal returns as compared to other countries
Verma et al., 2020	Indian stock market (NSE)	The opposite result shows that the increase in the number of COVID cases does not significantly affect stock market returns
Singh et al., 2020	G-20 countries	The result suggests that since the COVID-19 pandemic, stock markets around the world have shown a grave performance and negative returns However, the stocks seem to recover gradually over a period of time
Topcu and Gulal, 2020	Emerging stock markets	The results indicate a negative impact, but markets recovered gradually Also, the highest impact is observed in Asian markets and low in European emerging markets

Thus, this paper considers the announcement of lockdown in India by the government as the event day. The sample firms selected for the study are taken from the National Stock Exchange (NSE), where 1,949 companies are listed. The firms whose price data were unavailable or partially available during the study period were excluded. The final sample consists of 1,335 National Stock Exchange (NSE)-listed firms. The individual securities price data in daily frequency related to these firms were gathered from the *Centre for Monitoring Indian Economy* (CMIE) Prowess database for this study. Data is gathered for the time interval from January 2018 to December 2020. To capture market movements for the study, the Nifty 50 index was used. A holistic event study was conducted using all of the 1,335 firms. Further, industry wise event studies were conducted, where 19 major industries were chosen for study (more than 10 firms), namely textile (64 firms), media (22 firms), financial services (128 firms), healthcare services (11 firms), drugs and pharma (65 firms), plastic (31 firms), banking (31 firms), metal (98 firms), agriculture (46 firms), automobile (67 firms), electrical goods (49 firms), chemical (109 firms), tourism (19 firms), transportation services (26 firms), computers (60 firms), FMCG (51 firms), paper (21 firms), construction (131 firms), and electricity (17 firms).

3. METHODOLOGY

To explore the effect of the COVID-19 outbreak on the Indian stock market, this paper applies an event study methodology. The event study methodology is used to capture the short-term price effect that occurred after a specific event. There are mainly three methods for calculating the abnormal price effect, namely average adjusted return rate method, market model, and market index adjusted return rate models. Dyckman et al. (1984) investigated all the above three models and concluded that the OLS-based market model gives improved results. Hence, the OLS market model is used for calculating the normal return. The event study methodology outlined by Brown and Warner (1985) was employed, which uses the market model method. To know the significance of the results, the parametric test, a cross-sectional t-test proposed by Brown and Warner (1980) is conducted.

Before conducting an event study, it is essential to determine the event window, event date, estimation period, and event of interest. The event studied in this paper is the impact of the COVID-19 outbreak in India on the Indian stock market. A 250-day estimation window is considered, and the period starts from 260 days before the event day to 10 days before the event day. An event window of 21 days is used for the study. The event window comprises an event day, twenty days a pre-event day, and twenty days post-event day. The following are the steps for calculating the abnormal return.

Estimate the normal market return:

$$ER_{it} = \alpha + \beta R_{mt}, \quad (1)$$

where α and β are the intercept and slope coefficients obtained from the OLS regression, R_{mt} is the return of the Nifty 50 index on trading day t .

Estimate abnormal return: To calculate abnormal returns, the normal market return is deducted from the stock's actual return on trading day t . The abnormal return is calculated as follows:

$$AR_{it} = R_{it} - ER_{it}, \quad (2)$$

where ER_{it} is the normal market return, and R_{it} is the i actual stock return on trading day t . The following formula calculates the actual return:

$$R_{it} = \ln \frac{P_{it}}{P_{it-1}}, \quad (3)$$

where R_{it} is the stock return for firm i on day t and P_{it} is the share price for day t .

Estimate the cumulative abnormal return (CAR): the CAR is calculated to know the total abnormal return observed during the event window. The formula to calculate CAR is:

$$CAR_{(-10,+10)} = \sum_{i=-10}^{10} AR_{it}, \quad (4)$$

Estimate the cumulative average abnormal return (CAAR): the CAAR is calculated to determine the time-series aggregation observed during the event window. The formula to calculate CAR is:

$$CAAR_p = \sum_{i=1}^p AAR_{it}, \quad (5)$$

where p is the number of days used to cumulate the average abnormal return. AAR_{it} is an average abnormal return. The formula to calculate average abnormal return (AAR) is:

$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it}. \quad (6)$$

4. EMPIRICAL RESULTS AND FINDINGS

4.1. Impact of COVID-19 on the NSE-listed firms

Table 2 shows the impact of COVID-19 on the NSE-listed firms in India. The table shows that firms witnessed a negative impact of COVID-19 with a negative AAR of 1.67%, 2.86%, and 3.26% in event day, one-day, three-day events windows, respectively. The results are significant in parametric tests in all event windows. However, after five-day event windows, the share prices started to recover. The ten-day event window shows a negative CAAR of 6% approximately, and the results are significant in parametric tests. The results documented daily negative returns in terms of CAAR

and AAR in the pre-event days, event days, and post-event days.

Table 2 shows the day-wise cumulative average abnormal returns (CAAR) and average abnormal returns (AAR) for the NSE-listed firms to show the impact of the COVID-19 outbreak.

Figure 1 summarizes the results presented in Table.

4.2. Impact of COVID-19 on various sectors

With the rapid increase in the spread of the COVID-19 virus in India, the government had to take strict quarantine measures such as a lockdown. To explore the sector-wise impact of COVID-19, the sector wise event study was conducted separately. A total of 19 sectors are used to explore the sectoral implications of COVID-19 to find out which sectors are most affected by the COVID-19 outbreak.

Table 3 shows the cumulative average abnormal returns (CAAR) for the textile, media, financial services, healthcare services, and drug and pharma sectors due to the announcement lockdown in India.

Table 2. Day-wise AAR and CAAR for the NSE-listed firms to show the impact of the COVID-19 outbreak

Event window	N	AAR	t-stat	P-value	CAAR	t-stat	P-value
-10	1335	-1.53	-16.62	0.00	-1.53	-5.01	0.00
-9	1335	0.10	1.03	0.23	-1.44	-4.93	0.00
-8	1335	-0.75	-8.18	0.00	-2.19	-7.92	0.00
-7	1335	-0.52	-5.62	0.00	-2.71	-10.39	0.00
-6	1335	-0.20	-2.22	0.03	-2.91	-11.95	0.00
-5	1335	-1.55	-16.85	0.00	-4.46	-19.78	0.00
-4	1335	-2.43	-26.41	0.00	-6.90	-33.48	0.00
-3	1335	1.79	19.47	0.00	-5.10	-27.70	0.00
-2	1335	0.50	5.45	0.00	-4.60	-28.84	0.00
-1	1335	-0.19	-2.08	0.05	-4.79	-36.79	0.00
0	1335	-1.67	-18.16	0.00	-6.47	-70.18	0.00
1	1335	-2.86	-31.04	0.00	-9.33	-71.57	0.00
2	1335	1.42	15.39	0.00	-7.91	-49.55	0.00
3	1335	-3.26	-35.34	0.00	-11.16	-60.58	0.00
4	1335	-3.92	-42.49	0.00	-15.08	-73.19	0.00
5	1335	0.12	1.28	0.17	-14.96	-66.29	0.00
6	1335	0.40	4.31	0.00	-14.56	-59.74	0.00
7	1335	2.59	28.10	0.00	-11.98	-45.95	0.00
8	1335	-0.35	-3.75	0.00	-12.32	-44.57	0.00
9	1335	3.97	43.09	0.00	-8.35	-28.66	0.00
10	1335	2.19	23.78	0.00	-6.16	-20.15	0.00

Note: N stands for the sample size, t-stat is the t-statistic for significance.

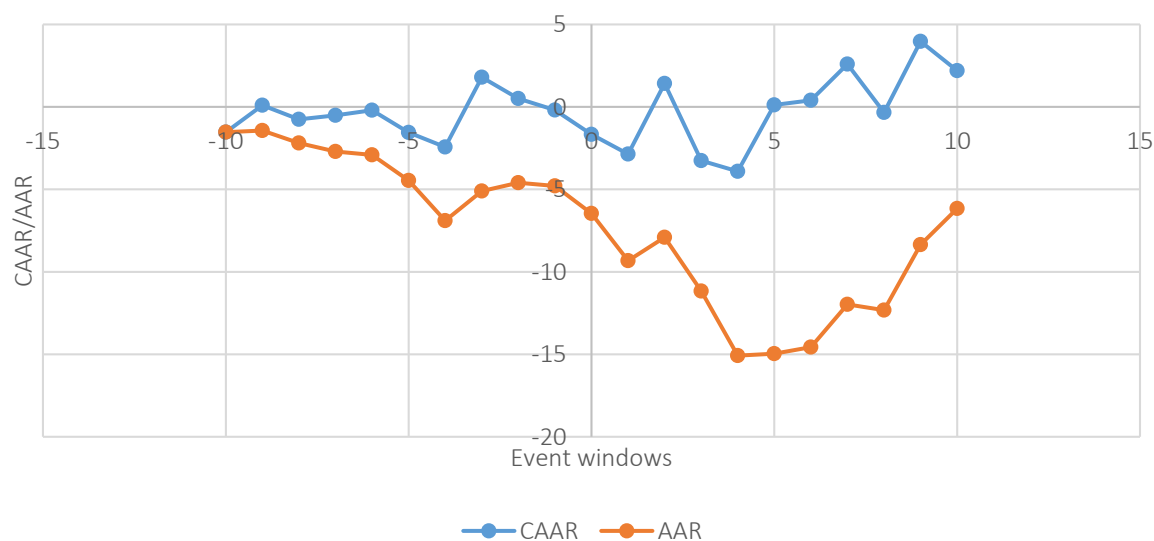


Figure 1. Day-wise AAR and CAAR for the NSE-listed firms to show the impact of the COVID-19 outbreak

Table 3. CAAR for the textile, media, financial services, healthcare services, and drug & pharma sectors to show the impact of the COVID-19 outbreak in different event windows

Event window	Textile			Media			Financial services		
	N	CAAR	t-stats	N	CAAR	t-stats	N	CAAR	t-stats
(-5,0)	64	-1.57	-1.54	22	-4.95	-2.70	128	-6.21	-8.07
(-1,0)	64	-0.73	-1.23	22	-2.88	-2.72	128	-3.48	-7.83
(-1,1)	64	-4.02	-5.58	22	-3.81	-2.94	128	-7.14	-13.12
(0,1)	64	-3.69	-6.27	22	-1.55	-1.46	128	-5.80	-13.06
(0,5)	64	-9.45	-9.28	22	-4.59	-2.50	128	-12.21	-15.86
Event window	Healthcare services			Drug and Pharma					
	N	CAAR	t-stats	N	CAAR	t-stats			
(-5,0)	11	-10.34	-4.96	65	-1.96	-1.76			
(-1,0)	11	-5.93	-4.93	65	-1.29	-2.01			
(-1,1)	11	-7.20	-4.88	65	-2.23	-2.85			
(0,1)	11	-4.33	-3.60	65	-1.31	-2.04			
(0,5)	11	-9.14	-4.39	65	-3.02	-2.73			

Note: N stands for the sample size, t-stats is the t-statistic for significance.

It can be observed from Table 3 that financial services are the most affected sectors with more than 10% negative CAAR in post-event windows. Moreover, textile and healthcare services have seen the moderate impact of COVID-19 with a negative CAAR of less than 10% but more than 5% in the post-event day window. However, the drug & pharma, and media sectors have seen a low impact with less than 5% of the negative CAAR during the post-event period.

Table 4 shows the cumulative average abnormal returns (CAAR) for plastic, banking, metal, agriculture, and automobile sectors on the announcement lockdown in India.

It can be observed from Table 4 that all the sectors are highly affected by the COVID-19 outbreak with a negative CAAR of more than 10%. The results are significant, and in the post-event period, sectors have seen more than 15% negative abnormal returns. The metal sector was worst affected as it has experienced a negative CAAR of more than 18% in the post-event windows.

Table 5 shows the cumulative average abnormal returns (CAAR) for electrical goods, chemical, tourism, transportation services, and computers industries on the announcement lockdown in India.

Table 4. CAAR for the plastic, banking, metal, agriculture, and automobile sectors to show the impact of the COVID-19 outbreak in different event windows

Event window	Plastic			Banking			Metal		
	N	CAAR	t-stats	N	CAAR	t-stats	N	CAAR	t-stats
(-5,0)	31	1.39	1.00	31	22.02	15.61	98	0.04	0.05
(-1,0)	31	0.21	0.27	31	6.99	8.58	98	-0.70	-1.43
(-1,1)	31	-4.82	-4.93	31	-0.73	-0.73	98	-4.52	-7.46
(0,1)	31	-6.44	-8.07	31	-6.04	-7.42	98	-5.18	-10.47
(0,5)	31	-12.53	-9.07	31	-15.69	-11.12	98	-16.26	-18.98
Event window	Agriculture			Automobile					
	N	CAAR	t-stats	N	CAAR	t-stats			
(-5,0)	46	-6.24	-5.43	67	-6.37	-7.02			
(-1,0)	46	-3.52	-5.30	67	-2.84	-5.43			
(-1,1)	46	-5.64	-6.95	67	-5.06	-7.89			
(0,1)	46	-4.78	-7.22	67	-4.22	-8.05			
(0,5)	46	-10.96	-9.54	67	-10.64	-11.72			

Note: N stands for the sample size, t-stat is the t-statistic for significance.

Table 5. CAAR for the electrical goods, chemical, tourism, transportation services, and computers sectors to show the impact of the COVID-19 outbreak in different event windows

Event window	Electrical goods			Chemical			Tourism		
	N	CAAR	t-stats	N	CAAR	t-stats	N	CAAR	t-stats
(-5,0)	49	-4.01	-3.67	109	-5.27	-7.84	19	-11.73	-6.25
(-1,0)	49	-3.47	-5.50	109	-1.77	-4.56	19	-6.31	-5.82
(-1,1)	49	-5.81	-7.52	109	-3.14	-6.61	19	-7.41	-5.58
(0,1)	49	-5.66	-8.99	109	-3.34	-8.61	19	-5.17	-4.77
(0,5)	49	-12.31	-11.28	109	-8.87	-13.21	19	-8.21	-4.37
Event window	Transportation services			Computers					
	N	CAAR	t-stats	N	CAAR	t-stats			
(-5,0)	26	-6.15	-3.71	60	-12.38	-10.29			
(-1,0)	26	-1.72	-1.79	60	-4.44	-6.40			
(-1,1)	26	-6.56	-5.59	60	-5.93	-6.97			
(0,1)	26	-5.75	-6.01	60	-4.78	-6.88			
(0,5)	26	-11.87	-7.16	60	-7.39	-6.14			

Note: N stands for the sample size, t-stat is the t-statistic for significance.

It can be observed from Table 5 that the electrical goods and transportation sectors have witnessed the highest negative impact of COVID-19 with a negative CAAR of more than 10% in the post-event period. Hence, these sectors are significantly affected by COVID-19. To a certain extent, the chemical, computer & its accessories and tourism sectors were also moderately negatively impacted by COVID-19 with a CAAR of more than 5% but less than 10% in post-event windows.

Table 6 shows the cumulative average abnormal returns (CAAR) for FMCG, paper, construction, and electricity sectors on the announcement lockdown in India.

It can be observed from Table 6 that the construction sector has seen the highest impact of COVID-19 with a negative CAAR of more than 10%. Besides the construction sector, FMCG, paper, and the electricity sector have also seen negative CAAR of more than 5% but less than 10% in post-event windows.

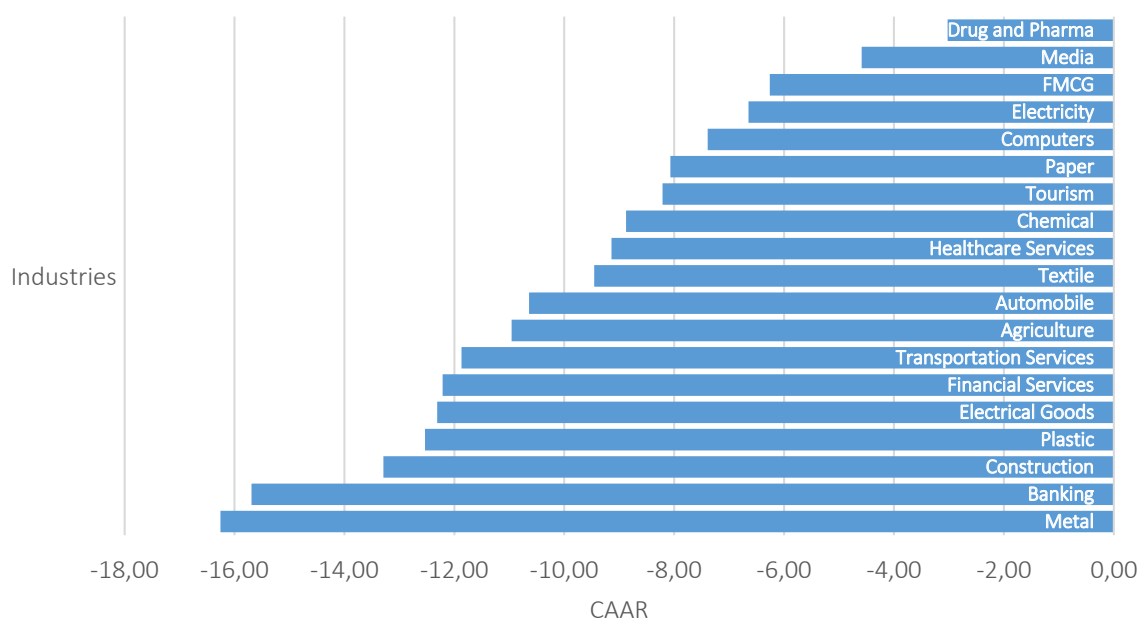
Figure 2 assists in the discussion about the impact of COVID-19 on different sectors. It depicts the impact of COVID-19 on various sectors using CAAR in a ten-day event window. The sector-specific price effect on the event of the COVID-19 outbreak can be classified into three groups: highly negatively affected sectors, moderately negatively affected sectors, and low affected sectors.

Table 6. CAAR for the FMCG, paper, construction, and electricity sectors to show the impact of the COVID-19 outbreak in different event windows

Event window	FMCG			Paper			Construction		
	N	CAAR	t-stats	N	CAAR	t-stats	N	CAAR	t-stats
(-5,0)	51	-5.11	-4.59	21	0.83	0.42	131	-0.93	-1.34
(-1,0)	51	-1.73	-2.69	21	-0.02	-0.02	131	-0.68	-1.70
(-1,1)	51	-3.39	-4.31	21	-2.88	-2.07	131	-4.37	-8.93
(0,1)	51	-2.80	-4.36	21	-3.49	-3.07	131	-4.95	-12.39
(0,5)	51	-6.26	-5.62	21	-8.07	-4.10	131	-13.29	-19.22

Event window	Electricity		
	N	CAAR	t-stats
(-5,0)	17	-4.12	-2.23
(-1,0)	17	-0.82	-0.77
(-1,1)	17	-1.67	-1.28
(0,1)	17	-2.61	-2.44
(0,5)	17	-6.65	-3.60

Note: N stands for the sample size, t-stat is the t-statistic for significance.

**Figure 2.** Impact of COVID-19 on different sectors

The highly negatively affected sectors are financial services, metal, plastic, banking, automobile, electrical goods, transportation services, agriculture, and construction sectors. These sectors witnessed the highest negative impact of COVID-19 with a negative CAAR of more than 10% post-event windows. The prime sector impacted by COVID-19 restrictions during the lockdown period was transportation services. Therefore, the shares of transportation services companies show a negative return in every event window. The share prices of the metal and mining sectors continued to decline as the metal and mining sector is heavily dependent on transportation and logistics sec-

tors. The financial services sector's share prices drop significantly because of high liquidity pressure and the Franklin Templeton fiasco, which triggered the panic selling in debt instruments. At the same time, construction sectors that require significant labor resources were impacted because of the shortage of labor force as labor migrated to their homeland. Hence, share prices declined in the sectors mentioned above.

The moderately negatively affected sectors are textile, chemical, healthcare services, tourism, paper, computer and related accessories, electricity, Fast Moving Consumer Goods (FMCG) sectors.

These sectors witnessed the moderate negative impact of COVID-19 with a negative CAAR between 5% to 10% in post-event windows. India took quarantine measures such as lockdown to restrain against the spread of the virus on the eve of the COVID-19 outbreak. The migrant workers returned to their homeland, which created a scarcity of labor forces, resulting in reduced operations of factories in various sectors such as plastic, chemicals, and textiles. However, these sectors get opportunities to produce masks, sanitizers, personal protective equipment (PPE) kits, face shields, and others that were incentivized by the government of India. Hence, these opportunities lower the impact of the COVID-19 outbreak on the sectors as mentioned above. The pandemic also had a significant effect on the agricultural sectors because of the shortage of labor forces and rural investment, which immediately reflected in the share prices of the concerned sector. The outbreak of COVID-19 moderately affected the electrical goods and FMCG sectors. These sectors faced a demand decline, which resulted in lower sales, and hence, the price of shares declined immediately after quarantine measures were taken by the government of India.

The slightly negatively affected sectors are media and drug & pharma. These sectors witnessed a negative CAAR of less than 5% in post-event windows. Despite the overall crackdown of the stock market on the outbreak of COVID-19 in India, some sectors have shown slightly negative abnormal returns against the trend showing strong resistance against the pandemic. COVID-19 created an opportunity for the drug and pharma sectors. With the increase in patients, the sales continue to grow, translating into share prices in multiple event windows. In the media sector, there is a less negative price effect as there is no impact on print or electronic media, and no quarantine measures are applied to them. They worked as usual. Thus, advertising revenues for media houses have not declined.

4.3. Further study

Companies with different sizes have different abilities to retrain the external shocks. Companies with different sizes often have an asymmetry in their price reactions (Gaunt et al., 2000). Banz (1981) provides evidence that small market capitalization firms have more abnormal returns than high market capitalization firms due to the size ef-

Table 7. Day wise CAAR for both above-median and below-median market capitalization firms on the COVID-19 outbreak in different event windows

Event window	Below median				Above median			
	N	CAAR	t-stat	P-value	N	CAAR	t-stat	P-value
-10	666	-1.95	-3.91	0.00	666	-1.10	-3.09	0.00
-9	666	-1.94	-4.08	0.00	666	-0.90	-2.66	0.01
-8	666	-3.18	-7.05	0.00	666	-1.19	-3.71	0.00
-7	666	-3.92	-9.22	0.00	666	-1.51	-4.98	0.00
-6	666	-3.81	-9.59	0.00	666	-2.02	-7.11	0.00
-5	666	-4.85	-13.19	0.00	666	-4.08	-15.53	0.00
-4	666	-7.50	-22.33	0.00	666	-6.29	-26.21	0.00
-3	666	-5.50	-18.31	0.00	666	-4.70	-21.89	0.00
-2	666	-4.60	-17.70	0.00	666	-4.59	-24.68	0.00
-1	666	-4.41	-20.79	0.00	666	-5.18	-34.13	0.00
0	666	-5.45	-36.31	0.00	666	-7.49	-69.84	0.00
1	666	-9.08	-42.74	0.00	666	-9.58	-63.14	0.00
2	666	-6.11	-23.50	0.00	666	-9.73	-52.37	0.00
3	666	-9.70	-32.30	0.00	666	-12.67	-59.04	0.00
4	666	-14.40	-42.89	0.00	666	-15.81	-65.87	0.00
5	666	-14.60	-39.70	0.00	666	-15.36	-58.45	0.00
6	666	-14.08	-35.44	0.00	666	-15.06	-53.05	0.00
7	666	-11.08	-26.09	0.00	666	-12.86	-42.38	0.00
8	666	-11.36	-25.21	0.00	666	-13.29	-41.28	0.00
9	666	-6.24	-13.15	0.00	666	-10.45	-30.78	0.00
10	666	-2.95	-5.93	0.00	666	-9.38	-26.35	0.00

Note: N stands for the sample size, t-stat is the t-statistic for significance.

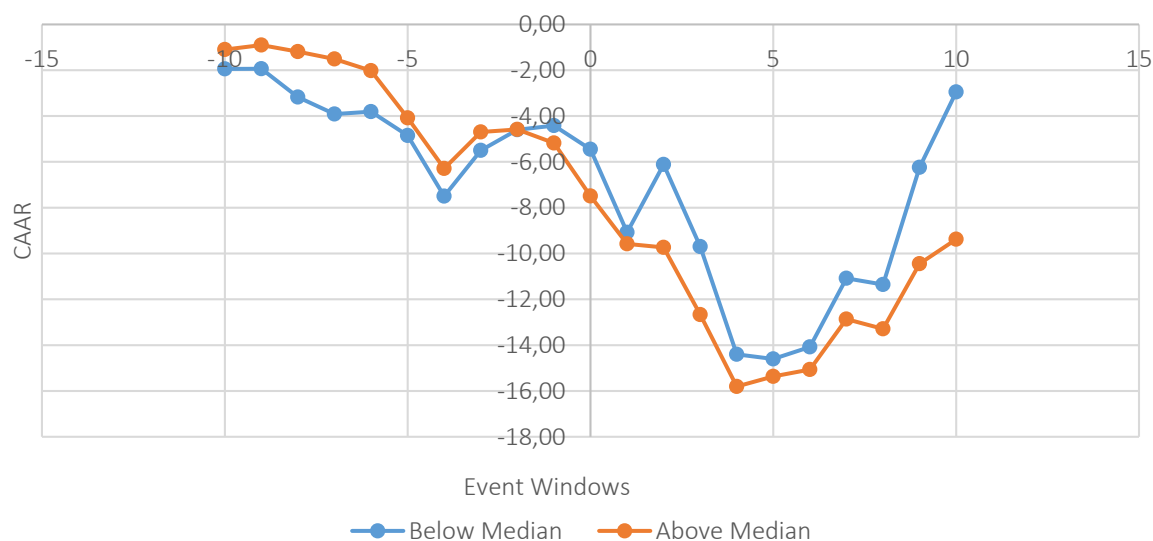


Figure 3. Day wise CAAR for both above-median and below-median market capitalization firms on the COVID-19 outbreak in different event windows

fect phenomenon. To investigate this mechanism in the COVID-19 scenario, a sub-sample study based on market capitalization was conducted. The samples are divided based on the median of the market capitalization into the above-median and below-median companies.

Table 7 shows the cumulative average abnormal returns (CAAR) for both above-median and below-median market capitalization firms on India's announcement lockdown.

Table 7 shows that during the COVID-19 outbreak, abnormal returns of above-median market capitalized firms were significantly negative and showed a greater decline in share prices, while below-median market capitalized firms showed

a comparatively lower negative price reactions. The results contradict the size effect phenomenon as larger firms have more institutional ownership. With the COVID-19 outbreak and Franklin Templeton's fiasco, institutional investors started to liquidate their position, which created panic selling in the capital market. Therefore, firms observed a higher negative impact on larger firms after the COVID-19 outbreak due to liquidity pressures. The situation mentioned above confirms that the COVID-19 outbreak has a significant impact on the above-median market capitalized firms, which indicates that higher-sized firms are more prone to shocks or crash risks. Figure 3 compares the impact of COVID-19 on the above and below median market capitalization firms using CAAR in post-event windows.

CONCLUSION

The study shows that NSE-listed firms negatively responded to the COVID-19 outbreak, with more than 6% negative CAAR in 10-day event windows. Next, the price response of various sectors to the outbreak of the pandemic is analyzed. The highly negatively affected sectors have experienced a negative abnormal return of more than 10% in 10-day event windows, including financial services, metal, automobile, transportation services, construction sectors, and rest. In addition, moderately negatively affected sectors have seen negative CAAR of 5% to 10% in the 10-day event window, including electricity, textile, plastic, chemical, Fast Moving Consumer Goods (FMCG) sectors, and others. However, few sectors are slightly negatively affected with a negative abnormal return of less than 5% in 10-day event windows, and these sectors are media and drug & pharma sectors. Also, the findings revealed that the Covid-19 outbreak impacted larger firms more negatively than smaller firms in each event window, which is contrary to the findings of prior literature.

To a large extent, the stock market reflects the economic condition of a large number of companies, whereas the capital market represents a complete state of a country's economy. Therefore, any fluctuation in economic activities can be analyzed through the movement of the stock market. In India, about 43 percent of the stock market participants are retail investors, which sets India apart from other emerging markets. Hence, this study better reflects investor behavior during extreme events. Thus, the study contributes to the literature on extreme events and investor behavior with some practical implications.

This study also improves understanding of the response of various industries to the pandemic. Furthermore, since the size of a firm acts as a substantial determinant in absorbing the impact of extreme events, this study also helps us understand the impact of the pandemic on firms with varying sizes.

The conclusions drawn in the paper help to understand the stocks' responses to extreme events in the context of emerging countries. The results show the role of information in influencing the stock market in emerging countries such as India. From a practical perspective, the finding suggests that portfolio managers should consider a proper mix of low and high beta stocks with an appropriate mix of sectors. The study has shown that smaller stocks are less impacted by panic selling after extreme events. Hence, it would be prudent for portfolio managers to give due consideration to smaller stocks. These suggestions would help maximize returns and protect investment from capital erosion in extreme events.

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