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COVID-19 PANDEMIC AND STOCK MARKET RESPONSE: THE ROLE OF COVID-INDUCED FEAR, INVESTOR ATTENTION, AND FIRM-SPECIFIC CHARACTERISTICS

Sahil Narang[1*], Savita[2], Rudra P. Pradhan[1], and Bhanwar Singh[3]

[1]Vinod Gupta School of Management, Indian Institute of Technology Kharagpur, Kharagpur-721302, India
[2]Indian Institute of Management Calcutta, Diamond Harbour Rd, Joka, Kolkata, West Bengal 700104, India
[3]University School of Management, Kurukshetra University, Kurukshetra-136119, India

*Corresponding author: narang.sahil@iitkgp.ac.in

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ABSTRACT

The study examines the reaction of S&P BSE 500 companies to the outbreak of the 2019 novel coronavirus (COVID-19). The impact of COVID-19 induced fear of volatility index (VIX) on stock market returns and the role of pre-pandemic firm-specific characteristics in intensifying/reducing the effect of fear on stock returns are analysed. Event study methodology and panel data approach with firm and industry-time fixed effects are employed. The results show fear of VIX plays a significant role in the downfall and subsequent recovery of the stock market. It is witnessed the role of pre-pandemic firm-specific characteristics is heterogeneous in intensifying/reducing the effect of fear on stock returns. Investor attention (Google search volume) and the growth of COVID-19 cases are also crucial to the stock market movements during the study period.

Keywords: COVID-19 pandemic, stock market reaction and recovery, investor attention, fear, VIX

INTRODUCTION

On 30 January 2020, the World Health Organisation (WHO) declared the outbreak of COVID-19 a public health emergency. The pandemic resulted in enormous human (WHO, 2021) and economic costs (Szmigiera, 2021). International Monetary Fund (IMF) stated the lockdown as the worst economic downturn since the Great Depression. The US stock market has recorded the worst ever response to any pandemic since 1918 (Baker et al., 2020). Stock markets worldwide nosedived as the news of the contagious pandemic spread (Baker et al., 2020; Contessi & De Pace, 2021; Fernandez-Perez et al., 2021). The volatility index (VIX), popularly known as "fear index" or "fear gauge," rose markedly from late February, peaked in mid-March, and fell back by late March when the markets started recovering. The COVID-19 caused VIX to spike to levels above those of the 2007−2008 financial crisis. Investor attention toward coronavirus also rose around the same period, as shown in Figure 1.

The issue of the pandemic and its impact on the stock market is now well pronounced. Recently, numerous studies have examined the impact of COVID-19 on the stock markets (Ali et al., 2020; Gormsen & Koijen, 2020; Liu, Manzoor et al., 2020; Liu, Wang et al., 2020; Ramelli & Wagner, 2020; Zhang et al., 2020), the socio-economic impact of COVID-19 (Evans, 2020), the global macroeconomic implications of pandemic (Fernandez-Perez et al., 2021), and increased financial vulnerability resulted from pandemic (Mogaji, 2020). The response of the various stock markets to COVID-19 has been heterogeneous (Fernandez-Perez et al., 2021; Singh et al., 2020). The current study choose the Indian setting for three reasons. First, India is an immediate neighbour of China, widely believed to give birth to COVID-19. Second, India is the second-most populous country in the world (WorldoMeter, 2021). It ranks 145 among 195 countries in the global healthcare access and quality (HAQ) index (Fullman et al., 2018). This reflects its vulnerability to the contagious disease. Third, in the second pandemic wave, India was the second most affected country in terms of its human cost (Elflein, 2021) and economic losses (Statista, 2021). The Indian stocks declined the most in the first wave. Hence, the first wave is the focus of our study. The stock market plunged when the increase in cases was negligible, and recovered when the cases increased at a faster pace. This creates a puzzle among investors and market professionals, and provides the current research an opportunity to conduct an empirical investigation.

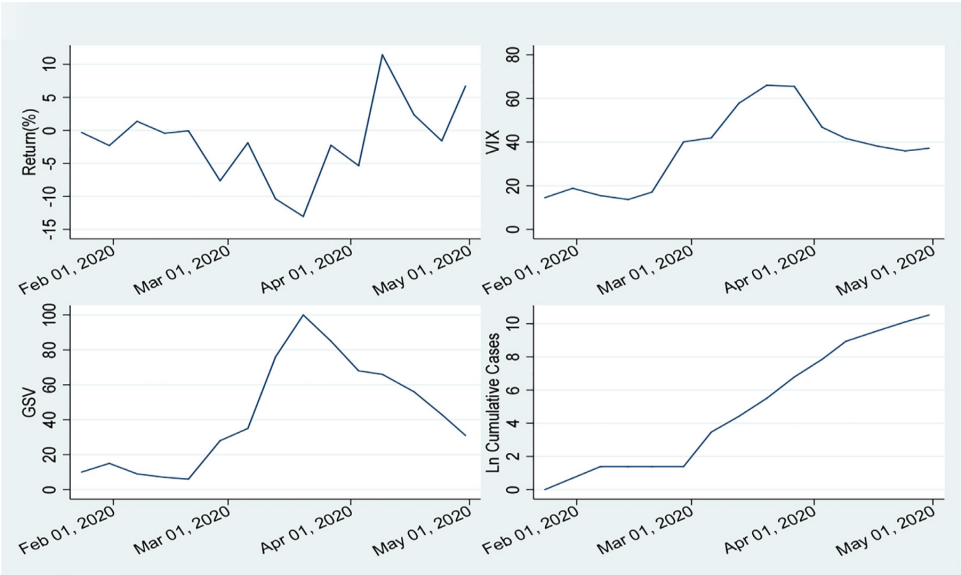

Figure 1. Time-series plot of weekly series S&P BSE 500 returns, VIX, Google Search Volume (GSV), and Ln (cumulative cases)

The purpose of the study is two-fold. First, the study examined and quantified the stock market reaction during COVID-19 pandemic for S&P BSE 500 index constituents. The study period was between 21 January and 30 April 2020. On 21 January 2020, WHO released the first situation report for COVID-19. By end-April, the primary recovery, post-the-downfall, around the world stock markets had taken place to a certain extent (Capelle-Blancard & Desroziers, 2020). For robustness check, the study period was extended to 30 May; although the results remained qualitatively similar.

Second, this study examined the impact of COVID-19 induced uncertainty of VIX on stock market returns and the role of pre-pandemic firm-specific characteristics in intensifying/reducing the effect of COVID-19 induced tension on stock returns. For this purpose, a panel data approach is employed with firm and industry-time fixed effects to explain the variation in stock returns. Here, firm and industry time fixed effects capture the impact of time-invariant firm factors and time-variant industry characteristics on stock market returns. The impact of GSV Index–a proxy for investor attention and growth in cumulative confirmed coronavirus cases on stock market returns, as recent literature documents the effect of these factors on stock market returns during the pandemic.

The stock market took a nosedive between 19 February and 23 March 2020 when the number of cases increased marginally. However, investor attention to coronavirus and increased uncertainty peaked end of that period. In the later stage, markets start recovering between 24 March and 30 April 2020 after a significant dip. The number of cases during the latter period was increasing faster, but investor uncertainty and attention to COVID-19 were low relative to the first-stage period. Panel regression results confirmed the hypothesis that initial downfall is caused by increased investor uncertainty and attention to COVID-19. The current study also examines the role of pre-pandemic firm fundamentals in explaining stock market returns during the pandemic. However, it is discovered that firm-specific characteristics such as size, cash reserves, riskiness, profitability, and book-to-market ratio play only a small part.

The findings contribute to growing literature in understanding stock market behaviour during the crisis period in an emerging country context. The results help us understand the behaviour of one of the largest investor communities worldwide during the pandemic. Additionally, the study helps in understanding how some companies are more resilient to COVID-19 induced uncertainty than the rest. This is the only study to the best of the current researcher's knowledge that has investigated the impact of pre-pandemic firm-specific characteristics on stock market returns in India.

LITERATURE REVIEW

The COVID-19 pandemic has resulted in enormous human costs (WHO, 2021). Losses due to health crises are not limited to humans, it also affected the financial stability of the world economies (Szmigiera, 2021). On 30 January 2020, WHO declared the outbreak of novel coronavirus to be a public health emergency. The virus affected 219 countries and territories worldwide and its outbreak forced governments worldwide to take restrictive measures over the movement of citizens. Strict lockdowns were implemented to prevent the outspread of the contagious viruses causing respiratory illness. Stock markets were not untouched by the effect of this health crisis (Baker et al., 2020). Fear and uncertainty among stock market investors prevailed (Baig et al., 2021; Cepoi, 2020; Iyke & Ho, 2021; Smales, 2021).

In the early phase of the COVID-19 outbreak, the markets around the world experienced a substantial increase in stock market volatility and a decrease in stock return (Bai et al., 2021; Baig et al., 2021; Liu et al, Wang et al., 2020; Rahman et al., 2021). The biggest decline in most stock markets across the world

happened when the increase in COVID-19 positive cases was negligible. They recovered when the number of positive cases worldwide increased substantially (Capelle-Blancard & Desroziers, 2020). This strange behaviour has puzzled the investor community. However, recent studies offer a plausible explanation that crash was caused by increased investor attention to COVID-19 (Bashir & Kumar, 2021; Smales, 2021), which fuelled fear among the investor community (Albulescu, 2020). The subsequent recovery was a result of overreaction and discounting the information during the decline (Iyke & Ho, 2021; Smales, 2020; 2021). Some researchers argue that the recovery is associated with the actions of the policymakers, which subsequently decreased investor uncertainty (Anh & Gan, 2020; Cox et al., 2020; Rahman et al., 2021; Smales, 2021). This study contributes to existing literature by supporting the investor-attention and investor-fear hypotheses. In the initial phase, an event study was conducted to quantify the loss in the stock market due to COVID-19 outbreak. In the second phase, a panel data regression model was used to capture the impact of VIX, COVID-19 cases, and investor attention on the stock returns.

The response of the stock markets has been heterogeneous across the countries (Phan & Narayan, 2020), firms (Harjoto et al., 2021; Kolaric & Schiereck, 2016; Rahman et al., 2021), and the industries (Anh & Gan, 2020; Bashir & Kumar, 2021; Mazur et al., 2021). A closer look helps one to understand that stock markets have heavily discounted more vulnerable class of stocks. In understanding this phenomenon, pre-pandemic firm-specific characteristics were analysed, such as firm size, age, book-to-market ratio, and other variables related to financial and operational flexibility (Ding et al., 2021; Rahman et al., 2021). The aim is to understand if more resilient firms could handle the crisis better than the less resilient ones. The panel regression model supports these hypotheses.

There is a growing number of studies on COVID-19 (see Table 1 for recent studies on stock markets and COVID-19). The current study however, to the best of the researchers' knowledge, is the first to examine the V-shaped trajectory of the Indian stock market, as discussed in Capelle-Blancard and Desroziers (2020) and Economic Survey (2021).

Table1
Recent studies published on impact of COVID-19 outbreak on financial markets

No.	Study	Sample Country	Research Objectives	Findings
1.	Mazur et al. (2021)	US	To study differential stock price reaction of the S&P 1500 firms and industries to COVID-19. To investigate the impact of the pandemic on the stock price volatility.	Food software, natural gas, and healthcare industries stocks earn high positive returns. Entertainment, petroleum, real estate, and hospitality stocks suffered the most due to the pandemic. Loser firms exhibit asymmetric volatility of extreme levels.
2.	Yoshino et al. (2021)	Theoretical Modelling (Global)	To theoretically indicate that the current allocation of investors by considering SDG based on various consulting companies will lead to distortion in the investment portfolio.	Global pollution taxation facilitates the desired allocation of the assets in portfolios.
3.	Engelhardt et al. (2021)	Multiple	To look into the association between stock market volatility and the trust of citizens.	Trust of citizens in the government and the other fellow citizens is associated with lower market volatility.
4.	Bai et al. (2021)	Multiple	To investigate the impact of the pandemic on the volatility of the US, China, UK, and Japan stock markets.	Pandemic positively impacts the stock market volatility. The least impact of the pandemic is on the Chinese stock market.
5.	Contessi & De Pace (2021)	Multiple	To investigate instability transmission, caused by pandemic, from Chinese to the other stock markets.	Pandemic resulted in the transmission of instability from the Chinese stock market to the other stock markets.
6.	Ciner (2021)	US	To study the predictability of the US stock market returns during the pandemic.	Corporate bonds have significant predictive ability for US stock market returns during the pandemic period.
7.	Baig et al. (2021)	US	Impact of COVID-19 induced uncertainty on stock market volatility and liquidity.	The number of COVID-19 cases, deaths due to coronavirus and reduced mobility due to lockdowns resulted in increased volatility and illiquidity of the stock markets. Negative sentiment due to coronavirus increased volatility and illiquidity.

(*continued on next page*)

Table 1: (*continued*)

No.	Study	Sample Country	Research Objectives	Findings
8.	Cox et al. (2020)	US	To answer what explains the sharp V-shaped trajectory of the US. stock market that took place over a matter of weeks in the early stages of COVID-19?	Stock market movements are explained more by the sentiment, resulting from federal reserve announcements than the substance.
9.	Al-Awadhi et al. (2020)	China	To study the impact of coronavirus confirmed cases and deaths on the stock market returns.	The results suggest that stock returns are significantly negatively correlated to both the daily growth in total confirmed cases and the daily growth in total cases of death caused by the novel coronavirus.
10.	Harjoto et al. (2021)	US	To analyse the impact of COVID-19 shock on the US stock market.	The magnitude of the negative abnormal returns is larger for the small-cap firms than the large-cap index. Larger firms experience more positive returns during recovery compared with smaller firms.
11.	Liu, Wang et al. (2020)	Multiple	To examine the negative impact of coronavirus shock on Chinese and Asian stock markets.	Both Chinese and Asian stock markets took a tumble down due to COVID-19 shocks.
12.	Rahman et al. (2021)	Australia	To document stock market response to the pandemic and stimulus package announcement.	The stock market negatively reacted to the pandemic and positively reacted to only one of the two stimulus packages. Smallest, least profitable, and value portfolios suffered the worse. Financial leverage and liquidity explain abnormal returns.
14.	Fernandez-Perez et al. (2021)	Multiple	To study the differential impact, based on cultural values, of the pandemic on the stock markets.	Larger declines and greater volatilities for stock markets in countries with lower individualism and higher uncertainty avoidance during the first three weeks of COVID-19 first case.
15.	Anh & Gan (2020)	Vietnam	To measure the impact of coronavirus pre- and post-lockdown on stock returns in Vietnam's stock market.	COVID-19 pre-lockdown had a significant, negative impact on the stock returns of Vietnam. The lockdown period is associated with a rebound in the stock returns. The financial sector performed worst.

(*continued on next page*)

Table 1: (*continued*)

No.	Study	Sample Country	Research Objectives	Findings
16.	Smales (2021)	G7 and G20	To measure the impact of retail investor attention on stock index returns, amid the COVID-19 pandemic.	GSV sharply rose in late-February and peaked in mid-March 2020. Stock index returns in G20 and G7 markets are negatively associated with global GSV.
17.	Smales (2020)	US	To study the impact of GSV on US stock returns.	GSV increase is associated with a plunge in the stock market returns.
18.	Cepoi (2020)	Multiple	Study the impact of media coverage, fake news, and COVID-19 Turmoil on stock returns,	Returns in middle and upper quantiles are negatively associated with media coverage. Superior quantiles of returns, during turmoil, show a negative dependence on past performance.
19.	Iyke & Ho (2021)	Multiple	To measure the impact of investor attention to coronavirus on returns in African stock markets.	Some countries experience negative returns with increased investor attention to coronavirus. In contrast, some stock markets experience gains due to diversification opportunities in less connected economies during the pandemic.
20.	Bashir & Kumar (2021)	Multiple	To examine the impact of investor attention on travel and leisure stock returns during the COVID-19 pandemic.	Travel and leisure stock returns are more sensitive to coronavirus-related investor attention.
21.	Papadamou et al. (2020)	Multiple	To measure the impact of COVID-19 related GSV on market volatility and stock returns.	COVID-19 anxiety, measured by GSV, results in increased stock market risk-aversion.

METHODOLOGY

The study is conducted in two stages. In the first, event study methodology is employed to quantify and assess market reaction, utilising the abnormal returns, to the current crisis. The S&P BSE 500 firms are divided into sub-samples based on industry classification and firm-specific factors to investigate the financial impact from diverse facets, and understand the investor decision-making process. In the second stage, regression analysis is performed to understand the role of firm-specific factors in explaining the variation in stock returns.

Event Study Methodology

The event study method is used to assess the impact of coronavirus on the stock markets (See: Brown & Warner, 1985; Fama et al., 1969). A market model can control for the systematic risk in the study of firm-specific events (Strong, 1992). However, a pandemic outbreak is not a firm-specific event. The market models may lead to inaccurate predictions during a systemic trauma, such as the novel coronavirus. In systemic shocks, a market model may produce highly positive abnormal returns for stocks that experience an economically significant negative return, especially when compared with the stock's previous period mean return. Therefore, the mean adjusted returns model are used to generate expected returns (Dyckman et al., 1984). The mean-adjusted returns model often gives similar results to market models and other more sophisticated models (Brown & Warner, 1980; 1985).

Event window

The event window covers the V-shaped trajectory of Indian stock markets during the first wave of COVID-19. It comprises 68 trading days between 21 January and 30 April 2020. This period was chosen because 21 January 2020 was the day when WHO released its first situation report, and 30 April was determined as the last day of the recovery period.[2] We find two critical sub-periods during the 68–day study period. The first period comprises 22 trading days, from 19 February[3] to 23 March, that included the major crash of the Indian stock market on 23 March (coinciding with the Janta curfew and announcement of the nationwide lockdown in India). The market showed signs of recovery after 23 March. The second period therefore, covers the 24 trading days of stock market recovery. These two periods comprehensively cover the major downfall and recovery of the Indian stock market. Additionally, we divide the 68 days into sub-periods for a more robust analysis.[4]

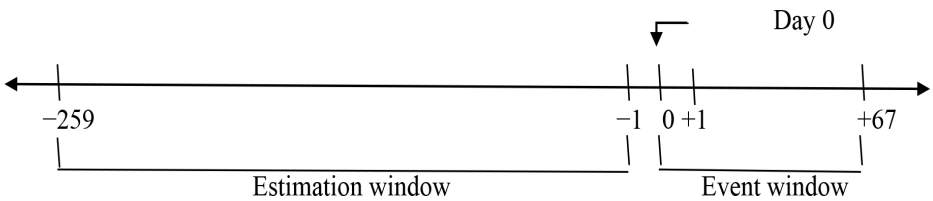

Figure 2. Timeline for the event study (in days)

EVENT STUDY CALCULATIONS

The log return[5] is calculated as ln $(p_t/p_{t-1}) \times 100$; where p_t is the daily closing price of stock i on day t and p_{t-1} is the closing price of a day before t, and ln is the natural logarithm. The daily frequency of stock returns is used to conduct event study analysis during the crisis. Daily data are more information efficient than the other less frequent datasets (Bannigidadmath & Narayan, 2016; MacKinlay, 1997). Daily data allows us to efficiently capture the effect of any specific positive/negative announcements during the event window (see Appendix 2). It also allows us to conduct robustness checks controlling for the effect of confounding events.

Equation 1 shows the calculation of abnormal return[6] (AR) for stock i, on day t.

$$AR_{it} = R_{it} - \overline{R_i} \tag{1}$$

R_{it} is the actual return for security i, on the day t. $\overline{R_i}$ is mean return for security i during the estimation window (−259, −1).

Equation 2 shows the calculation of average abnormal return on day t.

$$AAR_t = 1/N \sum_{i=1}^{N} AR_{it} \tag{2}$$

AAR_t is the arithmetic mean of abnormal return (AR_{it}), for N securities in the sample/sub-sample, on the day t.

Equation 3 describes the calculation of cumulative average abnormal return (CAAR) between days t_1 and t_0.

$$CAAR_{(t_0, t_1)} = \sum_{t=t_0}^{t_1} AAR_t \tag{3}$$

CAARs are tested using a one-sample t-test. Equation 4 indicates the test statistic employed to determine the significance of CAAR.

$$t_{CAAR} = \frac{CAAR_{(t_1, t_2)}}{\sigma(AAR_{est.pd}) \times (t_2 - t_1 + 1)^{1/2}} \tag{4}$$

Econometric model

In order to examine how firm-specific characteristics shape stock price reaction in response to COVID-19 induced financial uncertainty, the following regression model is adopted:

$$R_{it} = \alpha_0 + \beta \times VIX_t + \sum \gamma \times VIX_t + Firm.character_i + \sum Controls_t + \eta_i + \eta_{jt} + \varepsilon_{it}$$

Where i, t, j subscripts denote firm, week, and industry, respectively. The dependent variable, R_{it}, is weekly stock returns[7] of firm i during week t, measured as follows:

$$R_{it} = \{\ln(Price_{\text{last trading day, } t-1}) - \ln(Price_{\text{last trading day, } t})\} * 100$$

VIX_t is a forward-looking indicator of financial volatility that measures the expected level of uncertainty/fear in the market (Altig et al., 2020; Caggiano et al., 2020; Just & Echaust, 2020). Chicago Board Options Exchange (CBOE) VIX is adopted to gauge fear and panic among the investors. It is calculated from S&P 500 index option prices. Several studies document the role of enhanced volatility in the March 2020 stock market crash (Just & Echaust, 2020; Onali, 2020). In the current study, β captures the effect of volatility on stock returns. *Firm.character* indicates various firm-specific characteristics. The equation includes an array of interactions between firm characteristics ($Firm.character_i$) and volatility (VIX_t). γ captures how firm-specific characteristic reduces/intensify stock price reaction to COVID-19 induced financial uncertainty.

$Controls_t$ includes GSV index for "Coronavirus"[8] which proxies for investor attention and growth in cumulative confirmed cases of COVID-19 (*COVID.GROW*) in India. Investor attention and spread of COVID-19 are also found to drive stock market behaviour during the pandemic (Al-Awadhi et al., 2020; Ashraf, 2020; Onali, 2020; Smales, 2020; 2021).

η_i and η_{jt} capture firm and industry-time fixed effects, respectively. The inclusion of the firm fixed effect helps us to incorporate the effect of any time-invariant factors across the firms. Industry-time dummies incorporate the effect of any common shocks (i.e., WHO announcement of COVID-19 as pandemic or announcement of nation-wide lockdown) during each period. Any time preference for any particular industry over time would also be captured through these dummies. Robust standard errors (Eicker-Huber-White standard errors) clustered

at the firm level to account for non-constant error variance, auto-correlation, and cross-sectional dependence are undertaken. Table 2 presents the variable specification and measurement.

Table 2
Variable specification and measurement

Variables	Description	Source
Dependent Variable		
Returns (*Rit*)	Weekly stock returns of firm *i* in week *t*	Prowess Database
Firm-specific characteristics		
Size (*Size*)	Natural log of market capitalisation	Prowess Database
Beta (*Beta*)	Firm's riskiness measured through regression coefficient of stock returns on market returns	Prowess Database
Book-to-market ratio (BM ratio)	The ratio of book equity to market equity	Prowess Database
Illiquidity (*Illiquid*)	Amihud measure of illiquidity $\text{illiquity}_i = \frac{1}{n}\sum_{m=1}^{mi}\frac{\lvert R_{im}\rvert}{Vol_{im}}$	Prowess Database
Momentum (*MOM*)	Cumulative return over t-12 to t-2 period	Prowess Database
Profitability (*ROA*)	Ratio of net profit to total assets	Prowess Database
Cash (*Cash*)	Ratio of cash flow to total assets	Prowess Database
Leverage (*Lev*)	Ratio of Debt to total assets	Prowess Database
Age (*Age*)	Difference between the current year and incorporation year	Prowess Database
Macro variables		
Financial Volatility (*VIX*)	Indicator of the volatility of S&P 500 index	Chicago Board Options Exchange (CBOE) volatility index (VIX) (http://www.cboe.com/vix)
Investor Attention (*GSV*)	Investor attention measured through Google search volume for keyword "Coronavirus"	Google Search Volume Index (https://trends.google.com)
COVID19 Cases (*COVID.GROW*)	Weekly growth in cumulative confirmed cases of COVID-19	Coronavirus Resource Center, Johns Hopkins University (https://coronavirus.jhu.edu/map.html)

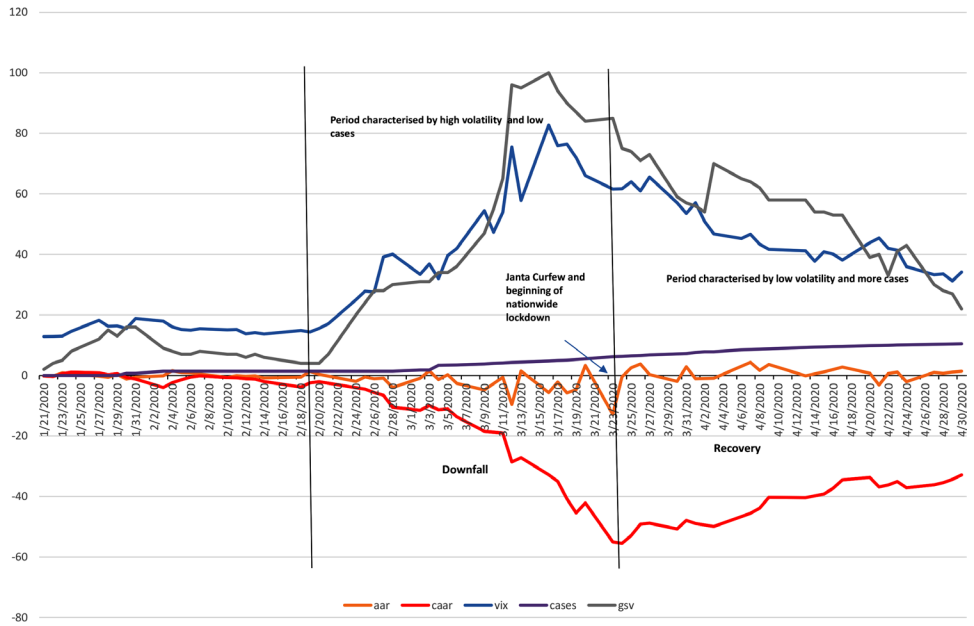

Figure 3. Indian stock market during COVID-19 pandemic

Database and sample selection

The sample of our study is based on S&P BSE 500 companies. They are considered to be the most representative sample of Indian stock markets. The sample constitutes companies that represent all major industries. The firm-specific characteristics data from the Prowess database, maintained by the Centre for Monitoring Indian Economy (CMIE), is supplemented with information the websites of the Bombay Stock Exchange (BSE) and the Securities Exchange Board of India (SEBI). The firms without complete financial information are excluded. The final sample size consists of 366 firms. Further, data on coronavirus cases from Coronavirus Resource Center, John Hopkins University,[9] GSV index from google trends[10], and VIX index data from CBOE Global Markets website are retrieved[11].

Descriptive Statistics

Table 3 presents the descriptive statistics of key variables for sample firms. All the firm-specific variables are winsorised at the 1% and 99% levels. It can be observed that the minimum weekly stock return during the pandemic is −64.03% and the maximum is 53.12%. The VIX assumes a mean value of 36.72 with minimum and maximum values of 13.68 and 66.04, respectively indicating enhanced investor

Table 3
Summary statistics

Variables	Mean	SD	Skewness	Kurtosis	*p*25	*p*50	*p*75	Min	Max
Mktcap	264,258.70	571,976.80	4.32	23.57	32,014.46	72,366.55	222,781.90	7,433.23	3,824,420.00
Beta	1.08	0.54	0.38	3.33	0.72	1.03	1.40	−0.16	2.70
Book-to-market	0.59	0.70	2.66	11.30	0.19	0.34	0.71	0.00	4.08
Illiquid	5.42	10.68	4.14	23.80	0.25	1.52	5.87	0.02	74.70
Mom	−0.08	0.33	0.24	3.69	−0.29	−0.09	0.12	−0.93	0.98
ROA	0.07	0.08	0.33	4.27	0.02	0.05	0.11	−0.17	0.31
Cash	0.11	0.14	1.69	5.26	0.02	0.06	0.16	0.00	0.58
Lev	0.22	0.22	1.10	3.65	0.03	0.17	0.35	0.00	0.86
Age	42.15	25.46	1.18	4.35	25.00	35.00	58.00	2.00	157.00
COVID.GROW	0.70	0.57	0.58	3.09	0.00	0.69	1.08	0.00	2.08
VIX	36.72	17.29	0.18	1.95	17.08	38.15	46.80	13.68	66.04
GSV	42.33	30.05	0.37	1.85	10.00	35.00	68.00	6.00	100.00
Weekly stock returns	−2.31	9.97	−0.46	5.48	−7.07	−1.68	2.93	−64.03	53.12

Notes: SD = standard deviation *p*25, *p*50, and *p*75 denote 25th, 50th, and 75th percentiles respectively; Min and Max show minimum and maximum values.

fear/uncertainty during COVID-19. Similarly, the GSV index for COVID-19 related terms also shows a rise in investor attention during the pandemic. It assumes mean value of 42.33 with minimum and maximum values of 6 and 100, respectively. COVID.GROW shows growth in weekly cumulative confirmed cases of coronavirus in India. The mean value of COVID.GROW is around 0.70 with a standard deviation of 0.57.

For sample firms, the mean value of market capitalisation is INR264,259 million with a standard deviation of INR571,977 million. Sample firms, on average, turn out to be aggressive as the average beta (1.08) is more than one with a standard deviation of 0.54. The average firm has a book to market ratio of 0.59, and Amihud's illiquidity of 5.42. The sample firm has an average momentum value of –0.08 suggesting that the average firm was a loser firm in the past. The average profitability of the sample firms is around 7% and their cash flow to asset ratio of about 11%, and the debt to total asset ratio stands at 22%. The mean age of sample firms is 42.15 years, with a standard deviation of 25.46 years.

EMPIRICAL RESULTS

Stock Market Response to COVID-19 Outbreak

This section presents and discusses the results of the event study quantifying the reaction of the stock market to COVID-19. Figure 4 plots the time series of average abnormal returns and cumulative average abnormal returns during the 68 trading days. The study period is between 21 January and 30 April 2020. The robustness of the results is checked. Figure 4 shows that in the early days, after the first situation report of COVID-19 released by WHO, the Indian stock market did not react to the shock. However, we see that the market declined from mid-February and touch the lowest point on 23 March 2020. After a major decline, it began to recover until April end. The graph indicates that the stock market documented a V-shaped trajectory of downfall and recovery in the first 68 days of the COVID-19 pandemic (Capelle-Blancard & Desroziers, 2020).

In order to quantify the impact, an event study of the entire 68 days is conducted. CAAR for 68-days is –32.94%, which is significantly different than zero at 1% level. The event window was later divided into smaller parts for testing the intermediate impact during the smaller periods. Window [0,6] covers the period after 21 January but before 30 January, the day of the first COVID-19 case in India. This shows that WHO's first situation report does not cause any major change in the stock market, as the *t*-statistic value is 0.23. It shows that the market initially

undermined the gravity of the situation. However, the next three sub-windows markedly show different responses. Sub-windows [7,28], [29,49], and [50, 67] show the CAARs for February, March, and April respectively. It is evident from Table 4 that negative abnormal returns occurred in February but March was the worst. This is the period when the news of COVID-19 related events (namely COVID-19 outbreak and lockdown restrictions in Italy,[12] WHO announcement of COVID-19 as a pandemic) began to induce fear and panic among the investor community across the world. This uncertainty resulted in a huge sell-off in the markets across the world. However, April showed signs of recovery with a positive CAAR of 14.28% for the month. In order to measure the short-term price reaction of several announcements, announcement-wise event studies were conducted (see the appendix section for a detailed analysis).

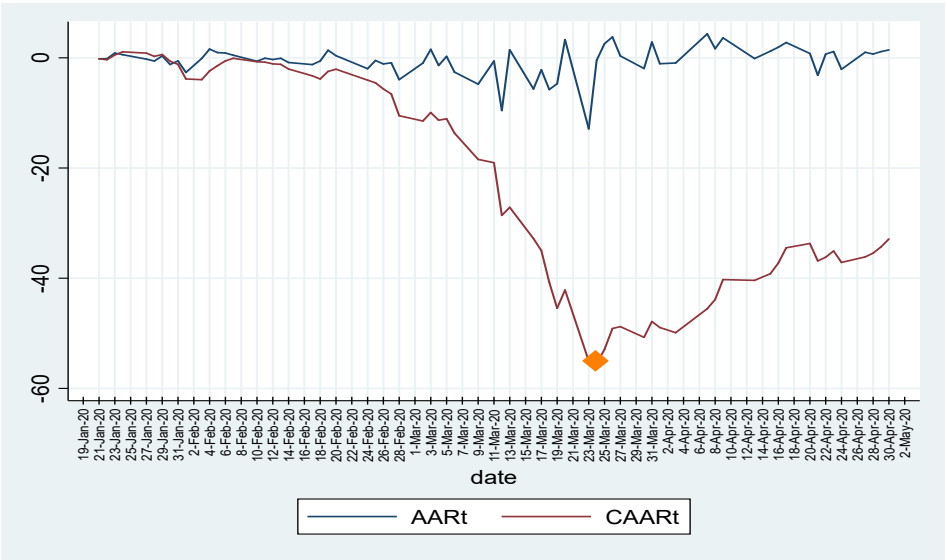

Figure 4. AARs and CAARs in Event Window (0, 67) for the S&P BSE 500 companies

An experiment was conducted that show the affected period in two windows, namely downfall window and the recovery windows. The downfall window is days with significantly negative CAAR, between 19 February and 23 March. Results of event study show that the market experienced a substantial decline in the stock price and CAAR is recorded at –51.69%. Downfall period is characterised by increased investor fear, and more people searching for coronavirus on google search engine. However, increase in the cases had been negligible. Recovery took place from 24 March onwards, since the announcement of nation-wide lockdown in India. The CAAR during the recovery period was from 24 March to 30 April, recorded

at 22.59% which is statistically significant at 1% level. Recovery period is characterised by relative lower fear among the investors (VIX), lower investor attention (GSV for coronavirus), and increasing number of the cases (See Figure 3). This phenomenon suggests that stock returns are driven by fear and uncertainty to a large extent. We confirm these conjectures through results of multiple regression.

Table 4
CAARs during different event windows

Event Windows	CAAR	*t*-statistic
68-days event window		
(0, 67)	–32.94***	–4.15
Sub-windows		
(0, 6)	0.59	0.23
(7, 28)	–11.10**	–2.46
(29, 49)	–37.41***	–8.49
(50, 67)	14.98***	3.67
Downfall window		
(23, 44)	–51.69***	–11.21
Recovery window		
(45, 67)	22.59***	4.90

Note: 68-days event window represents the total study period. Sub-windows represent the parts of the major event window. The downfall window is from 19 February to 23 March 2020. This documents the major downfall in the Indian stock market. The recovery window is from 24 March 2020, since the announcement of lockdown, to 30 April. The last day of the major window and the recovery window is 30 April 2020, as most of the recovery takes place during this period. Our study period and classification of the event windows is in line with Capelle-Blancard & Desroziers (2020). Significance: *** $p < 0.01$; ** $p < 0.05$; and * $p < 0.1$

Sectoral Analysis

Figure 5 and Table 5 present the response of different sectors to COVID-19 pandemic. A closer look at Figure 5 suggests that all the industries experienced disruptions due to COVID-19 induced uncertainty. The majority of the industries began to experience price decline from mid-February, recorded severe fall in late March, and then started to recover until April end. Industry patterns are similar to those observed for the overall market. Effort was made to quantify this response as shown in Table 5. It points to industry-wise CAARs in different event windows. The CAARs for all the industries are statistically significant in the event window (0, 67), except for the agriculture, forestry, and fishing industry (13) and electricity, gas, steam, and air conditioning supply industry (15). The CAARs for both industries are negative but not statistically significant.

Further, CAARs for all industries, except the mining and quarrying industry (12), are non-significant in the event window (0, 6) indicating that industries initially did not appear to react to news of WHO first situation report of COVID-19. However, in February, a different picture emerged. As shown in the event window (7, 28), all industries experience significant negative CAARs except human health and social work (6), accommodation and food services (10), and agriculture, forestry, and fishing (13). Similarly, the downturn continued until March, however, this time, negative returns were much larger than those recorded in February. In event window (29, 49), all industries experience statistically significant negative CAARs ranging from −21.59% to 69.94%. As outlined earlier, these windows cover the period when negative news of COVID-19 related events emerged and captured the investor attention. All industries in the event window (50, 67) experienced positive CAARs except accommodation and food service industries (10).

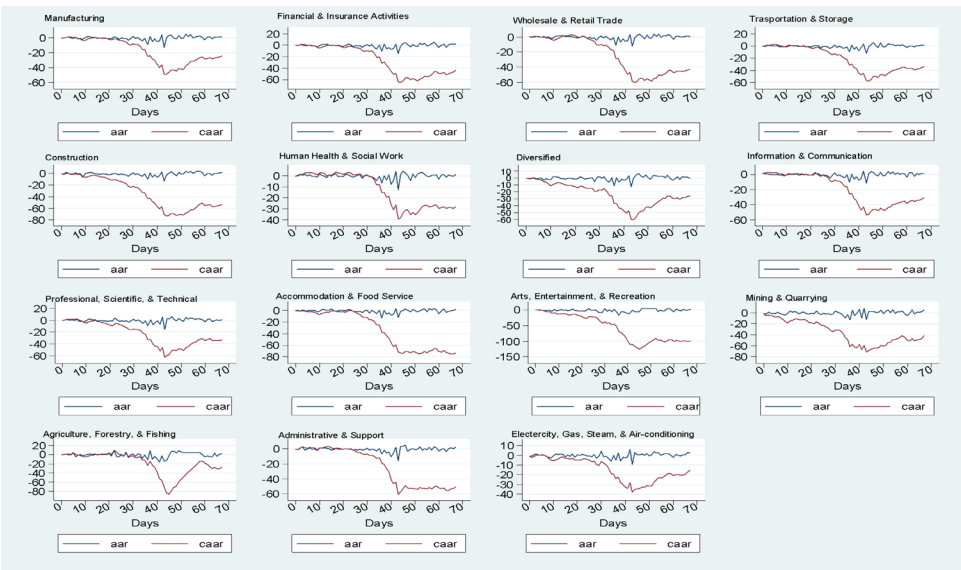

Figure 5. Industry-wise AAR and CAAR

Both downfall period event window (23, 44) and recovery period event window (45, 67) are reported respectively in the last two columns of Table 5. All industries experience a heavy fall in prices during the downfall period event window (23, 44). Furthermore, the arts, entertainment, and recreation industry (11) experience the largest CAARs of −94.92%, followed by the agriculture, forestry, and fishing industry (13), and accommodation and food services industry (10) with CAARs of −83.93% and −70.06%, respectively. In the recovery period event

Table 5
Industry-wise CAAR in different event windows

Industry	EW (0, 67)	*t*-stat	EW (0, 6)	*t*-stat	EW (7, 28)	*t*-stat	EW (29, 49)	*t*-stat	EW (50, 67)	*t*-stat	EW (23, 44)	*t*-stat	EW (45, 67)	*t*-stat
1	−24.44***	−3.15	0.62	0.23	−9.46**	−2.14	−32.17***	−7.46	16.57***	4.15	−46.37***	−10.27	24.77***	5.49
2	−44.27***	−4.26	0.55	0.15	−10.16*	−1.72	−48.76***	−8.45	14.09***	2.64	−61.25***	−10.14	21.07***	3.49
3	−43.08***	−5.01	−0.19	−0.06	−10.10**	−2.07	−44.79***	−9.38	12.01***	2.72	−59.22***	−11.85	17.22***	3.45
4	−33.56***	−4.16	2.64	0.96	−15.14***	−3.30	−33.58***	−7.49	12.51***	3.01	−53.55***	−11.41	23.50***	5.01
5	−53.47***	−5.14	−0.32	−0.09	−21.87***	−3.70	−48.49***	−8.39	17.21***	3.22	−61.75***	−10.21	19.56***	3.23
6	−28.31***	−3.46	3.14	1.12	−3.82	−0.82	−32.74***	−7.20	5.11	1.21	−40.30***	−8.46	9.82**	2.06
7	−26.97**	−2.45	−2.16	−0.57	−17.48***	−2.79	−22.69***	−3.70	15.36***	2.71	−46.65***	−7.27	33.65***	5.24
8	−31.15***	−4.42	2.12	0.88	−10.70***	−2.67	−36.46***	−9.31	13.89***	3.83	−51.48***	−12.56	21.39***	5.22
9	−33.28***	−3.39	2.09	0.62	−17.88***	−3.20	−32.29***	−5.92	14.79***	2.93	−49.91***	−8.75	25.63***	4.49
10	−72.77***	−6.84	−2.08	−0.57	−9.37	−1.55	−59.24***	−10.01	−2.08	−0.38	−70.06***	−11.32	0.25	0.04
11	−98.69***	−3.92	−6.00	−0.70	−29.58**	−2.07	−69.94***	−5.00	6.82	0.53	−94.92***	−6.49	21.55	1.47
12	−41.89***	−4.00	−7.09**	−1.97	−24.93***	−4.19	−26.62***	−4.58	16.74***	3.11	−48.26***	−7.93	26.50***	4.35
13	−28.03	−1.54	0.63	0.10	−3.99	−0.39	−55.12***	−5.46	30.45***	3.26	−83.93***	−7.95	54.97***	5.20
14	−51.11***	−5.76	2.20	0.72	−9.06*	−1.79	−45.61***	−9.24	1.37	0.30	−57.26***	−11.09	5.86	1.14
15	−15.26	−1.54	0.36	0.11	−9.75*	−1.73	−21.59***	−3.92	15.72***	3.08	−30.10***	−5.22	20.05***	3.48

Notes: Industry codes range from 1 to 15. The industry classification for S&P BSE 500 companies is done based on the NIC industry classification code (2008). See Appendix for industry codes. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. EW = event window.

window (45, 67), all industries experience significant positive CAARs ranging from 54.97% to 17.22% except accommodation and food service activities (10), arts, entertainment, and recreation (11), and administrative and support service activities (14) industries.

Further, the intra-industry correlation between the time series of CAARs in the downfall period event window (23, 44) with the recovery period event window (45, 67) is checked. All industries that experience fall in prices see a similar recovery pattern except accommodation and food services (10), arts, entertainment, and recreation (11), and administrative and support service activities (14). These three industries have also recovered, but the recovery is not statistically significant. The findings for accommodation and food services (10) and arts, entertainment, and recreation (11) are consistent with those of Chen et al. (2007). They find that the hotel and tourism industry in Taiwan suffered the most during the SARS outbreak. The highest recovery is witnessed in the agriculture, forestry, and fishing industry (13), followed by diversified (7) and mining and quarrying (12) industries.

Role of firm-specific characteristics in explaining the stock returns during the COVID-19 pandemic period

The weekly stock returns on firm-specific characteristics along with other important control variables are regressed to understand the role of firm specific characteristics in shaping the stock market reaction to COVID-19. Firm-fixed effects and industry-time effects for reasons outlined earlier are also included. Robust standard errors, clustered at the firm level, are reported in parentheses. Table 6 presents regression results.

The coefficient on *VIX* is negative indicating that higher financial volatility leads to lower stock returns due to fear and panic in the market (Just & Echaust, 2020; Onali, 2020). One standard deviation increase in *VIX* leads to 13.947 (=0.8068*17.288) percentage lower stock returns during the pandemic. The sign and magnitude of the *VIX* coefficient have both statistical and economic significance.

Further, VIX is interacted with other firm-specific characteristics to examine which characteristics make a firm more resilient or vulnerable to COVID-19 negative effects. Negative events are found to greatly influence smaller-sized and riskier firms than their counterparts (Kaplanski & Levy, 2010). Given the negative impact of COVID-19 on firm liquidity and operations, big firms are expected to be

more resilient than small-sized firms are, as they are less financially constrained and more financially flexible and they have the capacity to maintain stable and substantial cash flows (Beck et al., 2005; Ding et al., 2021). The interaction coefficient on *VIX*Size* shows that a one standard deviation increase in market capitalisation reduces negative stock price reaction to covid-19-induced financial uncertainty by 0.02 (=0.0146*1.372) percentage points. It indicates that large-sized firms tend to experience lesser stock price decline during the pandemic (Harjoto et al., 2021; Rahman et al., 2021; Xiong et al., 2020).

Similarly, the interaction coefficient on *VIX*Beta* shows that one standard deviation increase in firm beta would intensify negative stock price reaction to covid-19 induced financial uncertainty by 0.0105 (=0.0196*0.539) percentage points. This implies that high beta/riskier firms are more vulnerable to COVID-19 pandemic effects than low beta firms due to enhanced uncertainty in future cash flows (Rahman et al., 2021). Value firms are more compromised compared with growth firms, as indicated by the interaction coefficient on *VIX*BM ratio*. One standard deviation increase in book to market ratio would reduce negative stock price reaction by 0.0362 (=0.0515*0.704) percentage points.

We also consider the effect of cash flow to asset ratio, debt ratio, and firm's profitability to examine the role of a firm's financial condition on stock market returns (Ding et al., 2021). Statistically and economically significant interaction coefficients on *VIX*Cash* and *VIX*ROA* are noted. Positive interaction coefficient on Cash suggests that a one standard deviation increase in firm cash would reduce the negative stock price reaction to covid induced uncertainty by 0.027 (=0.2022*0.135) percentage points. The result highlights that cash as a buffer of liquidity plays a significant role for firm value during the crisis period (Almeida et al., 2004; Bates & Kahle, 2009; Campello et al., 2010). Similarly, a one standard deviation increase in profitability would reduce the negative stock price reaction to covid induced uncertainty 0.012 (=0.1602*0.078) percentage points. This can be attributed to the fact that firms with higher profits relative to book equity are more likely to have greater access to credit at favourable terms and are likely to experience a lower decline in stock prices (Ding et al., 2021). It implies that the firm that maintained more cash and higher profitability faced smaller erosion in their market value during the peak of enhanced volatility. Ding et al. (2021), Fahlenbrach et al. (2021), and Ramelli & Wagner (2020) also show that firms with good financial condition are more resilient than firms with the poor financial condition during the pandemic. No significant results for illiquidity, momentum, age, and leverage are observed.

Table 6
Effect of firm-specific characteristics on stock market returns during COVID-19 pandemic

Variables	Dependent Variable
	Weekly stock return (21 Jan-30 April)
VIX	−0.8068***
	(0.0699)
*VIX*Size*	0.0146***
	(0.005)
*VIX*Beta*	−0.0196*
	(0.0126)
*VIX*Book-to-market ratio*	0.0515***
	(0.0152)
*VIX*Illiquid*	−0.001
	(0.0007)
*VIX*MOM*	0.0076
	(0.0295)
*VIX*Cash*	0.2022***
	(0.0389)
*VIX*Lev*	−0.0088
	(0.0404)
*VIX*ROA*	0.1602*
	(0.0919)
*VIX*Age*	0.0004
	(0.0003)
GSV	−0.1517***
	(0.0201)
COVID.GROW	11.8738***
	(0.0552)
Constant	13.2774***
	(0.5348)
Firm FE	Yes
Industry-time FE	Yes
Observations	5,490
Number of Id	366
Adj R-squared	0.4929

Note: The table presents how firm-specific characteristics shape stock price reaction in response to Covid-19 induced financial uncertainty. The dependent variable is the weekly stock return (%) of a firm in a particular week. The key explanatory variables are financial volatility captured through VIX and its interactions with various firm-specific characteristics. Firm and industry-time fixed effects are also included. Robust standard errors, clustered at the firm level, are reported in parentheses. ***, ** and * indicate 1%, 5% and 10% significance levels respectively.

The study also includes investor attention and growth in confirmed cumulative coronavirus cases as these factors also shape stock market reaction during the pandemic. Increased investor attention is associated with lower stock returns (Smales, 2020; 2021). The coefficient on *GSV* suggests that one standard deviation increase in search volume leads to 4.558% (=0.1517*30.052) lower returns. On the other hand, growth in COVID-19 confirmed cases are associated with higher weekly stock returns, as indicated by the coefficient on *COVID.GROW*. A one standard deviation increase in *COVID.GROW* leads to 6.723% (=11.8738*0.566) higher returns. This positive relationship is observed because the Indian stock market plummeted in a period marked by high volatility and fewer corona cases and started recovering in late March, a period characterised by low volatility and more COVID-19 cases in India.

Overall, the findings suggest that COVID-19 induced fear caused the stock market to decline. However, the effect is far from homogenous. The firm characteristics and financial conditions play a crucial role in intensifying/reducing the effect of volatility on firm valuation during the pandemic (Ding et al., 2021; Ramelli & Wagner, 2020).

Robustness testing

Choice of Event study model

The mean-adjusted returns model for computing estimated returns is applied. This model often gives similar results compared with other sophisticated models, such as CAPM and market-model (Brown & Warner, 1980, 1985). The mean-adjusted returns model is better for this study that examines turbulence like the COVID-19 pandemic as market indices (a proxy for benchmark) are also affected by the event.

Robust test mechanisms and controlling confounding events

cofounding events can bias the event study results, especially in longer event windows (McWilliams & Siegel, 1997). However, the shorter event windows can help minimise this effect (McWilliams et al., 1999).[13] Several smaller event windows are created to capture the impact of COVID-19 fall out (public health emergency, pandemic, and nationwide lockdown announcements) and positive events (fiscal policy and monetary policy announcements). As expected, the stock market experienced a major downfall in response to these negative events, notably, pandemic and nationwide lockdown announcements. After the 11th March announcement, the market reacted very sharply and reported significant

negative returns ranging from −14.932% in CAR (−1, +1) to −39.256 in CAR (−1, +10). No statistically significant reaction was observed to the announcement related to fiscal policy measures. However, the market appeared to have reacted positively to monetary policy announcements as indicated by *t*-stats value of CAR (−1, +5), (−1, +7) and (−1, +10) windows. These results complement the main findings reported in the event study section.

The Z's proportion test on the probability of getting a negative average abnormal return on a particular day is conducted and results show negative AAR in the estimation period is 0.481.[14] However, the probability of earning a negative AAR in the downfall and recovery period is 0.73 and 0.29, respectively. This signifies that a particular event (including the confounding events) doesn't change the economic sense of aggregate event study results.

Extension of the study period

The study period is extended to end of May to include the effects of the announcement of several fiscal and monetary policy measures. In Appendix 3, estimated coefficients are equivalent to the coefficients reported in Table 6 in terms of their signs and statistical significance. However, the magnitude of the estimated coefficient on VIX in Appendix 3 is smaller than the coefficients reported earlier. In Table 6, we find that 1% standard deviation increase in VIX is associated with 13.947% lower stock returns. On the contrary, the coefficient in Appendix 3 suggests that a 1% standard deviation increase in VIX implies −8.134% stock returns.

An increase in count of "Coronavirus"[15] internet searches during the crisis resulted in a widespread negative stock market reaction, indicating a faster flow of information into stock markets. An increase in "Coronavirus" internet searches has led to 6.195% lower returns during an extended period than 4.558% lower returns in main regression. Growth in COVID-19 cases appears to have lesser effects on stock returns in the extended period sample. Factors, such as Size, BM ratio, Beta, Cash, and ROA, have statistically significant interaction coefficients similar to those reported in main regression. Economically and statistically significant results are reported after incorporating industry-time dummies that capture the effect of any macroeconomic events/specific announcements on different industries over different periods.

Event study robustness checks

The random walk properties of price and return time series are checked. It is well established in the finance literature that stock prices follow a random walk. However, the return may be stationary (Brooks, 2019). The augmented-dickey-fuller test is undertaken to check for the random walk properties of stock returns in the estimation and the event window. It shows stock returns are stationary in the estimation window with the inclusion of a drift-only model. However, a few stock returns are non-stationary in the event window with a drift-only model but stationary with optimum lag-length based on BIC criteria.

All usual assumptions for event study variables are checked. Therefore, non-parametric tests, including the Sign and Wilcoxon signed-rank tests, are used to support the t-test results (Field & Hanka, 2001). The study also used Z's proportion test (see Brooks, 2019), which supports the results of the event study.

CONCLUSION AND MANAGERIAL IMPLICATIONS

COVID-19-induced financial uncertainty has wreaked havoc for stock markets around the world. The Indian stock market also experienced significant losses during the first wave of COVID-19. Using a sample of BSE 500 firms, the market response is assessed through event study methodology and regression analysis. The findings reveal the prevalence of COVID-19 induced fear caused the Indian stock market to perform poorly and earn negative returns. However, the stock prices gradually recovered, as revealed by positive returns (CAAR), resulting from the initial COVID-19 announcements. Therefore, the results are supported by Capelle-Blancard and Desroziers (2020) and Just and Echaust, (2020), namely that COVID-19 induced uncertainty resulted in significantly negative stock market returns. Results of the event study reveal that stock markets experienced a significant decline during the period when the coronavirus threat in India was negligible. Hence, the study speculates that heightened fear and uncertainty caused this steep decline. Event study results show that the crash is followed by subsequent recovery in the later period. Growth of positive COVID-19 cases during this period was much faster than in the downfall. It is believed the markets had already discounted the information during the downfall. Investor fear in the latter period is low as government announcements, and preventive measures may have reduced investor fear. These two conjectures are tested using the panel data regression model. The study finds market crash was driven by increased investor attention towards COVID-19 (measured by google search volume for coronavirus) and an increased expected uncertainty

(measured by VIX). Additionally, it is noted that firm-specific characteristics explain part of the stock return's variation during the V-shape trajectory.

The results have practical implications for stakeholders in the capital markets, such as investors, stock market regulators, central banks, and government authorities. It is discovered that firms with better fundamentals can help investors reduce their losses during tough times like COVID-19 outbreak (Ding et al., 2021; Rahman et al., 2021). As social distancing became a norm, industries related to entertainment, leisure and travel became more vulnerable (Bashir & Kumar, 2021; Chen et al., 2007; Ding et al., 2021; Rao et al., 2021). However, industries such as FMCG and essentials may do better. These findings can be useful for retail investors.

The findings are helpful for investors, namely that trading is done rationally, and panic selling can be avoided because markets recover after an initial overreaction (Phan & Narayan, 2020). This study aids regulators in increasing the efficiency and reducing volatility in the stock markets during the crisis. In the event of infectious disease outbreaks like the COVID-19 pandemic, the market regulator can take various measures, for instance, ensuring orderly trading and settlement, restrictions of positions, and increased margin requirements for volatile stocks.

NOTES

1. This period is important because it is called a "V-shape" trajectory for the global stock markets (Capelle-Blancard & Desroziers, 2020; Economic Survey, 2021)
2. Many researchers limit their study window to the end of April, 2020. It can be justified as the stock markets around the world, including India, had recovered substantially (Capelle-Blancard & Desroziers, 2020)
3. The date 23 February 2020 was the day lockdown was announced in Italy and the stock markets started responding to the pandemic (Capelle-Blancard & Desroziers, 2020). We take 19 February 2020 as market response.
4. We divide our entire event period in small sub-windows. This is done to ensure that results in our larger windows do not suffer from the specification problem (Brooks, 2019; Kothari & Warner, 2007).
5. Log returns are considered to be better than the arithmetic returns as the former can be interpreted as continuously compounded returns. This allows for cross asset comparison. Moreover, log returns are time-additive. See Brooks (2019) for a detailed discussion.
6. See Brown and Warner (1985).

7. When entire market is affected, market return based models may not produce accurate expected returns. Often, mean adjusted returns model produce equivalently accurate results when compared the sophisticated models (Brown & Warner, 1980; 1985). Use of unadjusted actual returns may also produce good results, in case of small event windows (Brooks, 2019). We use weekly returns instead of the CARs as it allows accounting for time-series variability in the returns as well as providing validity to the notion that results from event study and regression model are qualitatively supportive to each other. Moreover, taking daily returns in the regression results does not increase the degrees of freedom as fundamental factors are fixed at the pre-pandemic level. However, including industry-time effects consumes such a high degrees of freedom in such daily data setting that software package shows error due to too many categories. Therefore, weekly frequency remains a feasible option in the regression analysis with industry-time effects.
8. We chose the term "coronavirus" for the purpose of our study. This term is widely used in other studies and it considered an efficient measure to account for investor attention to coronavirus (Smales, 2021).
9. Link to the website: https://coronavirus.jhu.edu/map.html
10. GSV is a relative measure of investor attention which ranges between 0 to 100. Data on GSV can be accessed through: https://trends.google.com/
11. Link to the CBOE Global Markets website: http://www.cboe.com/vix
12. Just and Echaust (2020) shows that Italy played a unique role in fear and crisis transmission.
13. Market adjusted model can also isolate the effect of confounding events, however, it has limitations when events are clustered (Henderson Jr, 1990).
14. A value close to 0.5 signifies the equal chance of earning positive AAR vs. the positive AAR on a particular day.
15. Our regression results are identical to the choice of GSV India-specific and GSV Global.

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APPENDIX

APPENDIX 1
NIC Two-digit Industry Classification

Code	Industry	NIC Codes
1	Manufacturing	10,11,12,13,14,15,16,17, 19,20,21,22,23,24,25,26, 27,28,29,30,32
2	Financial and insurance activities	64,65,66
3	Wholesale and retail trade; repair of motor vehicles and motorcycles	46,47
4	Transportation and storage	49,50,51,52
5	Construction	41,42
6	Human health and social work activities	86
7	Diversified	34
8	Information and communication	58,59,60,61,62,63
9	Professional, scientific and technical activities	70,71,72,73
10	Accommodation and food service activities	55
11	Arts, entertainment, and recreation	93
12	Mining and quarrying	5,6,7
13	Agriculture, forestry, and fishing	1
14	Administrative and support service activities	77,78,80,82
15	Electricity, gas, steam, and air conditioning supply	35

Notes: This table presents the 15 major industry classifications for S&P BSE 500 companies. The classification is based on the NIC code (2008).

APPENDIX 2

Stock market reaction to various COVID-19 related announcements

	Event windows				
	(−1,+1)	(−1,+3)	(−1,+5)	(−1,+7)	(−1,+10)
Negative events					
1. WHO announcement of COVID-19 as public health emergency & first case (30th Jan 2020)					
CAAR	−1.446	−4.228	−1.693	−0.350	−1.355
t-stats	−0.868	−1.966**	−0.666	−0.121	−0.407
2. WHO announcement of COVID-19 as pandemic (11th Mar 2020)					
CAAR	−14.932	−19.140	−27.081	−28.482	−39.256
t-stats	−8.966***	−8.902***	−10.645***	−9.874***	−11.786***
3. Announcement of Janta curfew and beginning of nationwide lockdown in India (23rd March 2020)					
CAAR	−10.036	−3.680	−5.284	−3.497	1.570
t-stats	−6.026***	−1.712***	−2.077***	−1.212	0.471
Positive events					
1. Fiscal policy measure (13th-17th May 2020)					
CAAR	0.859	−2.974	−1.981	−1.803	1.380
t-stats	0.516	−1.383	−0.779	−0.625	0.414
2. Monetary policy measure (22nd May 2020)					
CAAR	0.692	3.361	7.619	11.131	15.697
t-stats	0.415	1.563	2.995***	3.858***	4.712***

APPENDIX 3

Results of panel regression model with study period extended to May 31, 2020

Effect of firm-specific characteristics on stock market returns during COVID-19 pandemic

	Dependent Variable
VARIABLES	**Weekly stock return (20 Jan-29 May)**
VIX	−0.5178***
	(0.0665)
*VIX*Size*	0.0135***
	(0.005)
*VIX*Beta*	−0.0214*
	(0.0123)
*VIX*Book-to-market ratio*	0.0523***
	(0.0139)
*VIX*Illiquid*	−0.0008
	(0.0007)
*VIX*MOM*	0.0163
	(0.0279)
*VIX*Cash*	0.2060***
	(0.0368)
*VIX*Lev*	−0.0086
	(0.0395)
*VIX*ROA*	0.1694*
	(0.0886)
*VIX*Age*	0.0004
	(0.0003)
GSV	−0.2204***
	(0.0195)
COVID.GROW	2.4886***
	(0.0536)
Constant	10.2338***
	(0.5562)
Firm FE	Yes
Industry-time FE	Yes
Observations	6954
Number of Id	366
Adj R-squared	0.4588

The table presents how firm specific characteristics shape stock price reaction in response to covid-19 induced financial uncertainty. The dependent variable is weekly stock return (%) of a firm in a particular week. The key explanatory variables is financial volatility captured through VIX and its interactions with various firm-specific characteristics. We also include firm and industry-time fixed effects. Robust standard errors, clustered at firm level, are reported in parentheses. ***, **, and * indicate 1%, 5% and 10% significance levels, respectively.