

# Firm-level immunity to COVID-19 induced uncertainty

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## Research Article

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## **Firm-level immunity to COVID-19 induced uncertainty**

### **1. Introduction**

The number of confirmed cases of coronavirus disease (COVID-19) has crossed over 5.1 million (5,105,881), and the number of confirmed deaths has reached a level of 333,446 till 24 May 2020. The pandemic has affected 216 countries, areas, or territories across the globe (WHO, 2020). Several countries have adopted the lockdown as an important measure to contain the spread of the contagious virus. The lockdown has brought the world economy to a standstill halting the majority of world economic activities. International Monetary Fund (IMF) has also declared “The Great Lockdown as the worst economic downturn since the great depression” (IMF, 2020). All these incidents have triggered a global sell-off in the world stock markets as well as caused disruption in the world economy indicated by macroeconomic indicators.

COVID-19 has badly impacted financial markets and increased volatility resulted from the loss of investor confidence, increased uncertainty, and fear of global recession due to the pandemic (Zhang, Hu, & Ji, 2020; Baker et al., 2020; Albuлесcu, 2020). In the short run, the COVID-19 pandemic has wreaked havoc for the financial markets vanishing a large proportion of stockholders’ wealth (Ali, Alam, & Rizvi, 2020). The downfall of the stock markets across the world was far from homogenous. Some indices experienced a more significant decline compared to others (Ding, Levine, Lin, & Xie, 2020). Similar, Cross-industry and Cross-firm heterogeneity also exists during the Crisis period which demands the empirical investigation of varying stock price behaviour.

In this study, we investigate the association between pre-COVID firm characteristics and stock price reactions to COVID-19 induced uncertainty using S&P BSE 500 firms. Using corporate finance theories, we consider pre-shock firm-specific characteristics including book-to-market (BM) ratio, beta, size, operating profitability, momentum, investment, liquidity, age, and business group affiliation. Our study is amongst the few ones which assess the link between the firm characteristics and share price reactions to COVID-19.

We follow the stock markets since the first situation report on COVID-19 was published by WHO (21 January 2020) and until the major recovery of the markets (30 April 2020). We employ event-study methodology to capture abnormal stock returns in different event windows and use cross-sectional regression analysis to explain the variations in cumulative abnormal returns (CARs).

Our results show a significant downfall in the market and increased uncertainty during the 68-days of the event window and several sub-windows. However, the market shows signs of recovery in the month of April, as indicated by statistically and economically significant positive cumulative average abnormal returns (CAARs). The reversal can be attributed to the buying activity after a major correction in the markets. For further insights, we examine industry-wise abnormal returns using NIC Code 2008. All industries experience significant price decline; however, the market sees a rebound after the 44<sup>th</sup> day of the 68-days observation period. All industries experience significant negative CAARs with arts, entertainment, and recreation (-98.69%), accommodation and food services (-72.77%), and Construction (-53.47%) experiencing the largest decline during 68-days event window.

We attempt to account for factor differentials for size, momentum, value, stock beta, liquidity, profitability, and investment growth as used in (Amihud & Mendelson, 1986; Fama & French, 1996; Fama & French, 2015), though a simpler version. Using a single-sorting portfolio technique, we group the firms into five quantiles based on firm-specific characteristics. The results of the univariate analysis witness heterogeneity in the financial impact of COVID-19 on S&P BSE 500 firms. Small, value, high beta, loser, and low profitability firms have experienced a greater price decline than big, growth, low beta, winner, and high profitability firms during the pandemic period. We observe the fast recovery in small, value, high beta, loser, and low asset growth firms. OLS regression results also reveal that firm-specific characteristics play an essential role in the investor decision-making process during the pandemic period. The fundamental factors i.e. beta, book-to-market ratio, market capitalization, and age are found to be significant determinants of CARs during the downfall period. In the recovery period, momentum, profit, book-to-market ratio, and size of the firm play a crucial role in explaining cross-sectional variation in CARs. Our results are also robust to different specifications and methodology used.

Studying COVID-19 induced uncertainty has real implications for the business and the economy. Previous theoretical and empirical studies show the impact of the crisis on the firm performance through business and finance channel. However, given the firm heterogeneity, the liquidity constraints and business exposure to the outbreak would have a non-uniform effect on firm performance. The corporate characteristics capture the firm heterogeneity which influences its capacity to access credit and business exposure to the outbreak.

The paper adds to the growing literature on the stock market behaviour during the crisis period. Moreover, we employ a fundamental approach to understand how some firms are more resilient to COVID-19 induced crisis than others?

The remainder of the paper is organized as follows. Section 2 discusses the relevant literature. Section 3 elaborates on the research methodology. In Section 4, we present the empirical results of event study and regression analysis. Section 5 concludes.

## 2. Review of Literature

An extensive body of literature has examined the impact of systemic events on the global economy and the stock markets (Campello, Graham, & Harvey, 2010; Lim, Brooks, & Kim, 2008; Miyajima & Yafeh, 2007; Chen, Jang, & Kim, 2007; Yang, Kolari, & Min, 2003). The world economies bear both real as well as economic costs due to the unprecedented situations followed by systemic events (Claessens, Tong, & Wei, 2012; Keogh-Brown & Smith, 2008; Lee & McKibbin, 2004).

Systemic events also cause a dramatic and unprecedented movement in the stock markets, increases volatility, leads to contagious effect often resulting into increased co-movements of different stock markets as well as a significant loss to national and international economies (Aloui, Aïssa, & Nguyen, 2011; Samarakoon, 2011; McManus, Floyd, Majid, & Kassim, 2009; Keogh-Brown & Smith, 2008; Lee & McKibbin, 2004). Over the past few decades, rising globalization and increased links among the financial markets across the world have made the impact of systemic events more contagious and destructive (Dimitriou et al. 2013; Samarakoon, 2011; Aloui et al., 2011; Lee & McKibbin, 2004; Yang et al., 2003).

### *2.1 COVID-19 Outbreak and Stock Market Response*

COVID-19 is a recent disease outbreak, which has impacted 216 countries, areas, or territories across the globe (WHO, 2020). Initially, China was the epicenter of the COVID-19 outbreak. However, with the rapid spread of the novel virus outside China, soon, the US and Europe emerged as the new epicenters.

On 11 March 2020, WHO declared COVID-19 a “Pandemic” with the total cases crossing 118,000 mark across 114 economies. With such an official announcement, the stock markets around the world were the first ones to respond to the health crisis in a short period. The stock markets have started experiencing huge sell-off due to the loss of confidence, increased uncertainty, and the fear of global recession due to the COVID-19 pandemic (Zhang et al., 2020). As a result, major stock markets have started plummeting, leading to increased volatility

and financial risk (Baker et al., 2020; Albuлесcu, 2020; Akhtaruzzaman, Boubaker, & Sensoy, 2020). The IMF announcement of “The Great Lockdown” as the worst economic downturn has further added to investor woes and fuelled global equity sell-off. Moreover, macroeconomic variables also started indicating the gloomy picture of the future. It is apparent now that the health crisis has transformed into a financial and economic crisis (Ramelli & Wagner, 2020). COVID-19 outbreak is the most recent systemic event causing a significant loss of stockholders’ wealth across the globe. Several studies make efforts to assess such an impact of the COVID-19 disease. For instance, Al-Awadhi et al. (2020) studies Chinese stock markets and report that COVID-19 confirmed cases and confirmed death has significant negative effects on stock returns across all the firms. In a similar cross-country study, Ashraf (2020) reports that the stock markets of 64 affected countries react more proactively to growth in confirmed coronavirus cases than growth in confirmed death. The stock markets were quick to respond to the initial outbreak; however, later on, the response level varied depending upon the different stages of the outbreak. Zhang et al. (2020) study the impact of COVID-19 on the stock markets worldwide, including the worst-hit countries such as Italy, China, and the United States. They find a substantial rise in world financial market risk and report a significant spike in market volatility from 0.0071 in February to 0.0196 in March. Baker et al. (2020) point out that No disease outbreak in the past has triggered such a large and frequent stock price jumps and contributed significantly to the US stock market volatility as strongly as novel coronavirus. Liu et al. (2020) study stock market response of 21 countries across the world, including the US, UK, Japan, Singapore, Italy, and Germany, etc. to COVID-19 pandemic. Using an event study and panel data approach, they report the negative abnormal stock return driven by future uncertainty and pessimistic sentiments. However, the abnormal returns for Asian stock markets have been more negative as compared to other countries.

McKibbin & Fernando (2020) foresee the financial and economic cost of the global pandemic to be huge. They call the monetary authorities and state to implement intensive policy measures in both the long-run and short-run to fight with real and financial challenges of COVID-19. While analyzing the financial markets' reaction to such policy measures, Klose & Tillmann (2020) report that participants in the European financial market distinguish between these measures. Monetary policy support is more effective in calming the market than fiscal policy measures. Countries should also be cautious while using non-conventional policy measures like US unlimited quantitative easing as these measures may lead to a further mismatch in near

& long-term expectations of investors, and lead to the uncertain environment and long-term tensions (Zhang et al., 2020; Gormsen & Koijen, 2020).

Overall, COVID-19 has resulted in exaggerated fear, uncertainty, and selling pressure in the stock markets. Consistent with this, we hypothesize-

H1: Overall, the stock market reacts negatively to COVID-19 induced uncertainty.

Few studies also investigate the effect of corporate characteristics on stock returns during the COVID-19 crisis period. For instance, Ramelli & Wagner (2020) offer important insights about the role of international exposure and firm characteristics as important value drivers for US firms, particularly those with exposure to China. The stock market reacts more feverishly as COVID-19 epicenter shifts from China to the US and Europe. Investors discounts for future uncertainty and react more negatively to high levered and less liquid US firms. The paper provides a typical example of the transformation of non-financial crisis into the financial crisis amplified through corporate financial policies. In a cross-country study, using data of 6,000 firms of 56 countries, Ding, Levine, Lin, & Xie (2020) also report the significant influence of pre-shock firm characteristics on the stock returns during the Pandemic period. Albuquerque, Koskinen, Yang, & Zhang (2020) find that firms with a higher environmental and social rating performed well than firms with lower ratings during the pandemic period. Fahlenbrach, Rageth, & Stulz (2020) confirm the role of financial flexibility in marking the firm more resilient during the crisis period. In an international study, Akhtaruzzaman et al. (2020) point out that financial firms have played an essential role in the transmission of financial contagion than non-financial firms. They report a statistically and economically significant rise in Dynamic Conditional Correlation (DCC) between Chinese and G7 Countries stock returns. These studies highlight the role played by corporate characteristics and corporate policies in the stock market reaction to COVID-19 induced uncertainty.

In addition to the stock market impact, the Financial crisis also has real implications for the business through its effect on firms' liquidity, finances, investment, and operations. Similarly, the COVID-19 outbreak has also resulted in enhanced uncertainty for firms raising concerns for demand collapse, supply chain disruption, cash crunch, and capacity reductions around the world (Vito & Gómez, 2020; Hassan, Hollander, Lent, & Tahoun, 2020). The concern about the reduction in firms' future cash flows is also receiving the attention in corporate communication which is shaping the stock markets' response.

A closer and detailed examination will reveal how heterogeneity in firms' characteristics influence the extent of financial constraint and its access to cash and credit considering the negative impact of COVID-19 on firms' liquidity and operations (Ding et al., 2020; Ramelli & Wagner, 2020). Goodell (2020), in his study COVID-19 and finance, also delineate upon the potential impact of COVID-19 on the cost of capital. COVID-19 will influence the cost of capital due to the resultant increase in country risk across the world due to the global exposure to the pandemic. Buchheim, Doern, Krolage, & Link (2020) find that German firms having stronger pre-crisis health are less likely to get affected by COVID-19 induced uncertainty compared to weaker firms.

Consistent with these studies, in this paper, we investigate the role of the pre-shock firm's financial and non-financial characteristics in shaping the stock market reaction to COVID-19. We make efforts to explain why some firms are more resilient than others during the crisis period. For instance, big-sized and mature firms generally have stable and huge cash flows and hence, are less financially constrained compared to small firms (Beck, Demirgüç-Kunt, & Maksimovic, 2005; Ding et al., 2020). Thus, big and mature firms are less likely to experience negative stock returns compared to small firms. Similarly, Low book-to-market ratio captures the growth opportunities. Firms having higher growth opportunities will be more likely to get affected due to COVID-19 induced uncertainty in future cash flows of the firms & enhanced cost of capital. Beta captures the firm riskiness. The riskier firm will also face similar uncertainty in future cash flows due to the COVID-19 outbreak. Regarding profitability, firms having higher profits relative to book equity are more likely to have greater access to credit at favourable terms and hence, are likely to experience a lower decline in stock prices (Ding et al., 2020).

Further, business group affiliation also influences the firm ability to combat the challenges induced by the COVID-19 outbreak and enhances corporate resilience. The business groups help mutual insurance among affiliated firms. Earlier research on affiliated companies has highlighted the role of the group in sharing risk among member firms (Khanna & Yafeh, 2007). They helping member firms to overcome constraints on raising external capital (Hoshi, Kashyap, & Scharfstein, 1991). Emerging markets have inadequately functioning companies which leading to information and severe agency problems. Loans are the leading observable channel by which groups transfer cash among the member firms (Khanna & Palepu, 2000). The stock prices partly incorporate tunneling. It helps to support financially weaker firms (Gopalan, Nanda, & Seru, 2007). Business groups with free cash-flows tunnel cash to help the

troubled group firms. In the recent, settings of COVID-19, media reports of many deals where business groups buy their own shares from the open market to stabilize group firms' stock prices. For example, according to Economic Times, March 14, 2020, Tata Sons on again acquired shares of its group companies from the open market. According to bulk deal data on the NSE, Tata Group acquired 77.95 lakh shares of Tata Steel worth Rs 234 crore and 82.30 lakh shares of Tata Motors (DVR) worth Rs 39 crore. On Thursday, Tata Sons had bought shares worth a little over Rs 356 crore in Tata Motors DVR, Tata Power and Tata Steel through open market transactions. Additionally, we control for investment, momentum and stock liquidity which are empirically found to explain the stock returns (Amihud & Mendelson, 1986; Fama & French, 1996; Fama & French, 2015). Therefore, we hypothesize that-

H2: The effect of the COVID-19 crisis on stock returns is heterogeneous across the firm fundamental factors- firm size, book-to-market ratio, beta, investment, profitability, age, group affiliation, stock liquidity & momentum.

The most popular stories in the international media and popular press are on stock market volatility and stock price declines due to COVID-19. We investigate the stock prices declines by comparing the stock returns in the pre-COVID-19 periods with the post-COVID 19 periods. Therefore, in the first step, we compute abnormal returns taking a sample of S&P BSE 500 companies and then, make efforts to explain the abnormality through firm-specific factors.

### 3. Methodology

#### *3.1 Database and Sample Selection*

We consider the sample of S&P BSE 500 companies to test our hypotheses. S&P BSE 500 is the most representative sample as it consists of highly liquid companies and represents all major industries. The number of positive COVID-19 cases on 1 March 2020 was only three, which later rose to 1251 as on 31st March 2020 (Roser, Ritchie, Ortiz-Ospina, & Hasell, 2020). 1251 coronavirus cases in a country with over 1.35 billion of the population (World Bank, 2018) is not a big number. Besides, the Indian stock market experienced a huge decline in stock prices (Kansara, 2020) as was an epicenter of the pandemic. This makes the Indian stock market a unique setting to study the COVID-19 impact. We extract the data from the Prowess database of Centre for Monitoring Indian Economy, which is supplemented with the official websites of the Bombay stock exchange (BSE) and securities exchange board of India (SEBI). Table 1 presents the National Industry Classification Codes (NIC, 2008), which is used for industry classification in the study.

Table 1: Major Industries and NIC Codes

| Major Industry | Industry   | NIC Codes  |
|----------------|--|--|
| 1              | Manufacturing  | 10,11,12,13,14,15,16,17,19,20,<br>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   |

Note: Table 1 represents the 15 major industry classifications for S&P BSE 500 companies. The classification is based on the NIC code (2008).

### 3.2 Methodology

The investigation has been conducted in two parts. Firstly, event study methodology is employed to know the market reaction to the current crisis and compute the abnormal returns. 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 to understand the investor decision-making process. Secondly, Regression analysis is performed to understand the role of firm-specific factors in explaining the variation in CARs.

#### 3.2.1 Event Study

We employ a standard event study method (Brown & Warner, 1985 ; Fama, Fisher, Jensen, & Roll, 1969) for assessing the impact of novel coronavirus on the stock market. The comparison

period mean-adjusted returns model is used for the computation of abnormal returns and to examine the financial impact of COVID-19. Event studies are widely applied in testing the impact of firm-specific as well as the macroeconomic announcements on the value of firms (MacKinlay, 1997). The choice of expected return estimation model is a critical decision in the event study. Several models that can be used to compute the expected returns on the securities, such as the comparison period mean adjusted returns model, market-model, market-adjusted returns model, and Fama-French three and five-factor models. Models using market return while computing expected returns such as CAPM control for the systematic risk for event studies of firm-specific events (Strong, 1992). Market models are subject to misspecification problems (Andrew Coutts, Mills, & Roberts, 1995). They may not produce correct results in case of the systemic events when the benchmark ( $R_m$ ) itself is disturbed due to systemic shocks such as novel coronavirus. In this situation, mean adjusted returns models are better compared to any model based on market return for computation of expected returns on security. The mean adjusted returns model assumes that the ex-ante expected return for security  $i$  is constant overtime but can vary over the firms. This would be the case if risk premium, security's risk, and the interest rates are constant over time. However, it is difficult to satisfy the above mentioned assumptions which makes it a weak model in comparison with market model and other sophisticated models. According to Brown & Warner (1980, & 1985) mean adjusted returns model gives often the similar results when compared with market models and other more sophisticated models. Moreover, it is best suited to use mean-adjusted returns model when market benchmark return itself is disturbed- we find this argument true in the robustness tests using the market model, and comparison of market model with mean-adjusted return model.

Our event window starts from the 21 January 2020 (since the first situation report on COVID-19 by WHO) and ends on 30 April 2020 (until major recovery of markets). The event window is long enough for comprehensive testing of the impact of Covid-19 on BSE 500 stock prices. To examine the influence of COVID-19, the entire event window is sub-divided into four-event windows as (0, 6), (7, 28), (29, 49), (50, 67). The first sub-window measures the impact of COVID-19 between 21 January 2020 (day of first COVID-19 situation report by WHO) to 29 January 2020 (a day before the first COVID-19 case in India). The second sub-window measures the impact of coronavirus between 30 January 2020 (since the first case of coronavirus in India) to 28 February 2020 (entire February month). Third and fourth sub-windows consider March and April.

Additionally, we also report abnormal returns on major event days, i.e., day of announcement for the closure of cinema halls, manufacturing units, and educational institutions, and The Janta curfew announced by Prime Minister of India. Through empirical investigation, we divide the 68-days COVID-19 affected event window in major downfall and recovery event windows. CARs from downfall and recovery event windows are used in regression analysis as the dependent variable.

#### Event Study Model

Equation 1 depicts the calculation of abnormal return (AR) for day  $t$  and security  $i$ . See (Ahern, 2009; Brown & Warner, 1985):

$$AR_{i,t} = R_{i,t} - \bar{R}_i \quad (1)$$

$R_{i,t}$  is the actual return for security  $i$  on the day  $t$ .  $\bar{R}_i$  is mean return for security  $i$  during the 259 days estimation period.

Mean return is calculated as follows:

$$\bar{R}_i = \frac{1}{N} (\sum_{t=-259}^{-1} R_{i,t}) \quad (2)$$

Where  $R_{i,t}$  is the daily log return of security  $i$  on the day  $t$  during the estimation window (-259, -1).  $N$  represents the number of trading days in the estimation window.

$AAR_t$  is the arithmetic mean of abnormal return ( $AR_{i,t}$ ) for all the securities in the sample or respective sub-sample on the day  $t$ .  $N$  represents the number of companies in the sample or sub-sample.

$$AAR_t = 1/N \sum_{i=1}^N AR_{i,t} \quad (3)$$

Cumulative average abnormal returns (CAAR) is utilized to account for abnormal returns during a specific event window ( $t_0, t_1$ ). The CAAR for the pre-specified event windows is calculated as follows:

$$CAAR_{(t_0,t_1)} = \sum_{t=t_0}^{t_1} AAR_t \quad (4)$$

CAARs are tested using a one-sample t-test. Where  $CAAR_{(t_0,t_1)}$  is cumulative average abnormal returns between the  $t_0$  and  $t_1$ .  $\sigma_{AAR_t}$  is the standard deviation of  $AAR_t$  over the estimation window (-259, -1).

$$T_{CAAR} = \frac{CAAR(t_1, t_2)}{(t_2 - t_1 + 1)^{1/2} \sigma(AAR_t)} \quad (5)$$

CAR is utilized as dependent variable in the regression analysis. CAR is computed as:

$$CAR_i(t_0, t_1) = \sum_{t=t_0}^{t_1} AR_{i,t} \quad (6)$$

### 3.2.2 Economic Model

We perform the multivariate analysis to explain the variation in CARs. To investigate the role of company-specific characteristics, we run the following OLS regression of CARs on the various firm-specific variables, after controlling for industry effects:

$$CAR_{downfall} = f(BM, size, beta, profit, invest, mom, liq, age, stdaln) \quad (7)$$

$$CAR_{recovery} = f(BM, size, beta, profit, invest, mom, liq, age, stdaln) \quad (8)$$

We run the two regressions- one with CARs in the downfall period and others with CARs in the recovery period. We report the heteroscedasticity consistent robust standard errors (Eicker- Huber-White standard errors) to avoid the problem of non-constant error variance.

Following the prior literature, we incorporate Size, BM ratio, beta, liquidity, momentum, investment, operating profitability, age, and business group to perform the multivariate analysis (Fama & French, 2015; Gopalan et al., 2007; Amihud, 2002; Carhart, 1997; Fama & French, 1993; Fama & French, 1996; Amihud & Mendelson, 1986; Fama & MacBeth, 1973; Sharpe, 1964; Lintner, 1965). All these factors have been found to influence the stock returns and, consequently, the firm value. Table 2 states the variable specification and measurement.

Table 2: Variable Specification and Measurement

| Variables                  | Measurement   |
|----------------------------|---|
| I). Event Study: Variables |   |
| CAAR (0,67)                | Cumulative average abnormal returns on the full sample of S&P BSE 500 companies for a period of 68 days between 21 January 2020, and 30 April 2020.   |
| CAAR (0,6)                 | a sub-event window for the first 7 days in the major COVID-19 event window. The day 0 is 21 January 2020, when the first situation report on COVID-19 was published by world health organization (WHO), and day 6 is the last day of the event window, which is one day before the first positive reported case of COVID-19 in India. |
| CAAR (7,28)                | measures the impact of COVID-19 from 30 January 2020 (date of first positive COVID-19 case in India) to 28 February 2020 (end of the February month)  |
| CAAR (29,49)               | cumulalated average abnormal return for March.  |
| CAAR (50,67)               | cumulalated average abnormal return for April.  |

|                                   |  |
|-----------------------------------|--|
| CAAR (23,44)                      | represents the major downfall during the 68 days COVID-19 event window. This event window is determined on the basis of empirical findings.    |
| CAAR (45,67)                      | represents the major recovery windows during the 68 days COVID-19 event window. Event window is determined on the basis of empirical findings. |
| II). Regression Model: Regressors |  |
| Size                              | Natural log of market capitalization   |
| Book-to-Market Ratio              | Book equity/Market equity  |
| Beta                              | Coefficient of regression of the stock return on market return   |
| Liquidity                         | Amihud measure of illiquidity<br>$illiquidity_i = \frac{1}{n} \sum_{m=1}^{mi} \frac{ R_{im} }{Vol_{im}}$                                       |
| Momentum                          | Cumulative return over t-12 to t-2 period  |
| Investment                        | Total assets growth rate   |
| Profitability                     | Profit before tax/Book equity  |
| Age                               | Current Year - Incorporation Year  |
| Standalone firms                  | Dummy variable equals 1 for the standalone firm, 0 for group affiliated firm   |

### 3.2.3 Descriptive Statistics

Table 3: Descriptive Statistics

| Variables | Mean    | Min     | p25    | p50    | p75     | Max       | sd      |
|-----------|---------|---------|--------|--------|---------|-----------|---------|
| Mktcap    | 292,012 | 3,727   | 32,014 | 72,366 | 222,781 | 9,598,188 | 805,632 |
| Beta      | 0.328   | -21.359 | -3.880 | 0.161  | 4.723   | 24.200    | 7.087   |
| BM ratio  | 0.698   | 0.020   | 0.192  | 0.345  | 0.717   | 20.000    | 1.487   |
| Liquid    | 0.001   | 0.000   | 0.000  | 0.001  | 0.002   | 0.011     | 0.002   |
| Momentum  | -0.079  | -0.987  | -0.293 | -0.092 | 0.115   | 1.729     | 0.338   |
| Invt      | 0.132   | -0.480  | 0.029  | 0.095  | 0.178   | 5.679     | 0.312   |
| Profit    | 0.159   | -1.744  | 0.088  | 0.171  | 0.236   | 2.684     | 0.228   |
| stdalone  | 0.308   | 0       | 0      | 0      | 1       | 1         | 0.462   |
| Age       | 42.150  | 2       | 25     | 35     | 58      | 157       | 25.483  |

Source: Authors' own findings

Table 3 presents the descriptive statistics of key variables for sample firms. The mean value of market capitalization is 292013 million. The sample firms, on average, turn out to be conservative as average beta (.32) is less than 1. However, the maximum beta is 24.20. The average BM ratio is 0.70. Mean Amihud illiquidity is .001 with a standard deviation of .002, indicating highly liquid sample firms. Mean value of momentum is negative suggesting average firms was a loser firm in the past. Sample firm average investment and profitability stand at 13.2 percent and 15.9 percent, respectively. The mean age of sample firms is 42.15 years with

a maximum age of 157 years. 30.8 percent of sample firms are standalone firms, and 69.2 percent of firms are business-group firms.

## 4. Empirical Results

### *4.1 Stock Market Response to COVID-19 outbreak*

This section presents the market reaction to COVID-19. Figure 1 depicts the monthly log returns on the S&P BSE 500 index from January 2019 to April 2020. After a continuous increase in the returns since September 2019, the markets experienced a negative return of 0.11 percent in January 2020. By splitting the January month into two parts, we examine the stock market reaction of the first COVID-19 situation report by WHO. The first part is from 1 January 2020 to 20 January 2020 representing the period unaffected from coronavirus. The second part is from 21 January 2020 to 29 January 2020 (from the first situation report on COVID-19 published by WHO to a day before the first case of Covid-19 in India).

Figure 1 Monthly Returns on the BSE 500 Index

In the first part of January month, the market earned positive returns (2.32 percent), whereas, in the second part, the market earned -0.18 percent return, which could be due to Covid-19. This will be investigated in detail using the event study method. In February, BSE 500 companies earned a negative return of 6.75 percent. March has been the worst with a monthly return of -27.61 percent. These large price declines are attributable to COVID-19 induced uncertainty. April with monthly returns of 13.65 percent, shows recovery in the stock prices after major downward correction resulted from coronavirus. Return for May 2020 is -2.44 percent, and the latest from 1 June to 5 June 2020 is 5.90 percent. Non-significant negative and

positive returns during May and June are signs of recovery in the financial markets. We do not depict the returns for May and June in figure 1 as our study is limited up to 30 April 2020.

Figure 2 represents the AAR and CAAR for a 68-days COVID-19 event window, beginning from 21 January 2020. AAR over time for most of the event days between 19 February 2020 to 30 April 2020 is statistically significant. CAARs started declining after 19 February 2020 and reached a minimum of -55.54 percent on 24 March 2020. After a major setback until 24 March 2020, the market started rebounding and has earned positive abnormal returns up to the last day of the 68-days event window.

Figure 2 Average Abnormal Returns and Cumulative Average Abnormal Returns

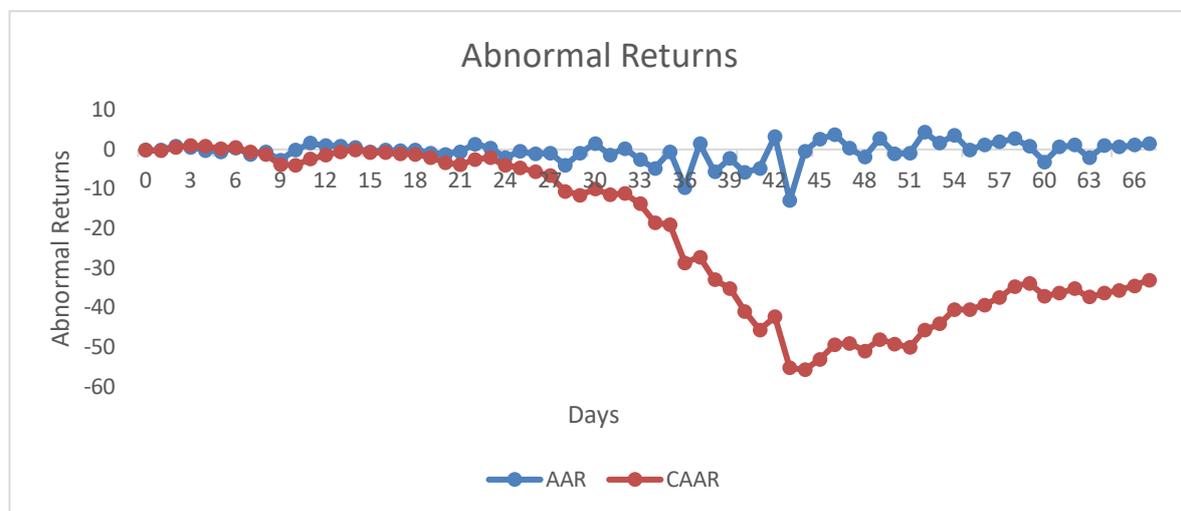


Table 4 reports the cumulative average abnormal return for the S&P BSE 500 companies during the 68 event window. CAAR for 68-days Covid-19 affected period is -32.94 percent, which is significant at 1 percent level. In the first sub-window, from 21 January to 29 January 2020, CAAR is positive (0.59%) and statistically non-significant. Positive CAAR shows no significant impact of the COVID-19 on the Indian stock market during this period. It can be attributed to the absence of any positive confirmed case of novel coronavirus in India up to 29 January. The first Covid-19 case was reported in India on 30 January 2020 in the State of Kerala. CAAR for a 4-days event window, from 30 January to 3 February 2020, is -3.96, which is statistically significant at 5 percent level. This four days event window is not shown in table 4. The second sub-window is from 30 January (since the first positive COVID-19 case reported in India) to 28 February 2020. CAAR for S&P BSE 500 companies during this period is -11.10 percent, which statistically significant at the five percent level.

Similarly, CAARs for March and April months are -37.41% and 14.98%. Indian stock market saw the worst in March with a negative return of 37.41 percent, whereas markets seem to be rebounding in April, earning a positive return of 14.98 percent. Prime Minister of India called for Janta curfew on 22 March 2020 (Sunday). On 23 March 2020, the 20 states and Union Territories implemented lockdown, halting economic as well as social activities (Ghosh, G, & Saxena, 2020). S&P BSE 500 companies experienced -12.88 percent one-day average abnormal return, which is highest during the 68-days.

Table 4 Cumulative Average Abnormal Returns

| Event Windows            | CAAR      | T-Statistic |
|--------------------------|-----------|-------------|
| Overall window<br>(0,67) | -32.94*** | -4.15       |
| Sub-windows<br>(0,6)     | 0.59      | 0.23        |
| (7,28)                   | -11.10**  | -2.46       |
| (29,49)                  | -37.41*** | -8.49       |
| (50,67)                  | 14.98***  | 3.67        |
| (23,44)                  | -51.69*** | -11.21      |
| (45,67)                  | 22.59***  | 4.90        |

Source: Authors' own findings

days window. Day 44 (24 March 2020) in figure two, denotes the lowest CAAR at -55.54 percent.

Based on empirical results, we divide the 68 days post-COVID-19 event window into two major parts. The first period is a downfall period (23,44), which is from 19 February to 24 March 2020. CAAR during downfall is -51.69 percent showing very large price decline in Indian stocks driven by fears of future uncertainty and halt in economic activities due to COVID-19. The second period is a recovery period (45,67), which is from 25 March to 30 April 2020. CAAR during this period is 22.59 percent. Positive CAAR is indicating recovery taking place in the financial markets.

We further analyse the market and report the industry-wise returns. Figure 3 reports Industry-wise AAR and CAAR. It is clear from the industry-wise figures that every industry is affected by coronavirus. Industry-wise CAARs are not correlated with the number of COVID-19 cases but impacted by the phased lockdown and discontinuation of economic activities. Industry-wise CAARs show a nearly similar pattern as depicted in figure 2 representing the CAARs for the overall sample of S&P BSE 500 companies. Every industry experiences a major downward

movement followed subsequent recovery. However, an inter-industry comparison is required for a clearer interpretation.

Figure 3: Industry-wise AAR and CAAR



Table 5 shows Industry-wise CAARs for all the event windows during 68-days COVID-19 period. CAAR for all the industries is statistically significant, except for agriculture, forestry, and fishing industry (13) and electricity, gas, steam, and air conditioning supply industry (15). CAARs for both industries is negative but not statistically significant.

CAARs for all industries, except the mining and quarrying industry, were non-significant during the event window (0,6). All industries experience significant price drop except human health and social work (6), accommodation and food services (10), and agriculture, forestry, and fishing (13) in CAAR (7,28) event window. In the CAAR (29,49) window, all industries experience statistically significant negative returns.

Both first period (Downfall-19feb to 24mar) and the second period (Recovery-25mar to 30apr), are reported in the last two columns of table 4. CAAR (23,44) represents industry-wise

cumulative average abnormal returns for the downfall period. All firms experience heavy fall in prices during the downfall window, irrespective of their major industry. Arts, entertainment, and recreation industry (11) experienced the largest fall in the prices with CAAR of -94.92 percent followed by agriculture, forestry, and fishing industry (13), and accommodation and food services industry (10) with CAAR of -83.93 and -70.06 percent.

CAAR (45,67) represents the recovery period window. We check for intra-industry correlation between the time series of CAAR for 23 days during the downfall with 23 days in recovery windows. All industries experiencing fall in the 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. Our findings for accommodation and food services (10) and arts, entertainment, and recreation (11) are consistent with the findings of (Chen et al., 2007). Highest recovery is seen in agriculture, forestry, and fishing industry (13), followed by diversified (7), and mining and quarrying (12). The overall CAAR is negative for the first period (-51.69 %), but it is positive (22.59%) in the second period. Overall, it appears that all industries have started to recover in the second period.

Table 5: Industry-wise Cumulative Average Abnormal Return (CAAR)

| Industry | CAAR(0,67) | T-stat | CAAR(0,6) | T-stat | CAAR(7,28) | T-stat | CAAR(29,49) | T-stat | CAAR(50,67) | T-stat | CAAR(23,44) | T-stat | CAAR(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   |

Note: Industry codes range from one to fifteen. The industry classification for S&P BSE 500 companies is done based on the NIC industry classification code (2008). See table 1 for industry codes.

Table 6: CAAR Quintiles Based on Fundamental Factors

| Quintiles   | CAAR(0,67) | T-stat | CAAR(0,6) | T-stat | CAAR(7,28) | T-stat | CAAR(29,49) | T-stat | CAAR(50,67) | T-stat | CAAR(23,44) | T-stat | CAAR(45,67) | T-stat |
|---|------------|--------|-----------|--------|------------|--------|-------------|--------|-------------|--------|-------------|--------|-------------|--------|
| Panel A: Quintiles Based on Market Capitalization |            |        |           |        |            |        |             |        |             |        |             |        |             |        |
| 1   | -30.76***  | -2.85  | 0.27      | 0.07   | -13.48**   | -2.20  | -41.18***   | -6.87  | 23.63***    | 4.26   | -56.03***   | -8.93  | 31.90***    | 5.09   |
| 2   | -37.08***  | -4.50  | 1.40      | 0.50   | -9.85**    | -2.10  | -43.15***   | -9.42  | 14.51***    | 3.42   | -57.71***   | -12.04 | 22.00***    | 4.59   |
| 3   | -37.00***  | -4.97  | 0.68      | 0.27   | -10.77**   | -2.54  | -39.16***   | -9.46  | 12.24***    | 3.19   | -52.03***   | -12.01 | 19.11***    | 4.41   |
| 4   | -33.46***  | -4.22  | 0.97      | 0.36   | -10.01**   | -2.22  | -36.09***   | -8.18  | 11.67***    | 2.86   | -48.22***   | -10.45 | 17.58***    | 3.81   |
| 5   | -26.40***  | -3.60  | -0.36     | -0.14  | -11.42***  | -2.73  | -27.49***   | -6.74  | 12.86***    | 3.41   | -44.49***   | -10.42 | 22.38***    | 5.24   |
| Panel B: Book-to-Market                           |            |        |           |        |            |        |             |        |             |        |             |        |             |        |
| 1   | -23.99***  | -3.85  | 1.74      | 0.81   | -6.39*     | -1.80  | -29.38***   | -8.48  | 10.04***    | 3.13   | -43.99***   | -12.14 | 18.67***    | 5.15   |
| 2   | -31.37***  | -4.86  | 0.89      | 0.40   | -6.91*     | -1.88  | -36.65***   | -10.21 | 11.30***    | 3.40   | -47.58***   | -12.67 | 17.23***    | 4.59   |
| 3   | -36.00***  | -4.43  | 1.05      | 0.38   | -11.26**   | -2.44  | -39.86***   | -8.82  | 14.07***    | 3.36   | -54.55***   | -11.54 | 21.51***    | 4.55   |
| 4   | -40.96***  | -4.60  | -0.37     | -0.12  | -13.48***  | -2.66  | -42.92***   | -8.68  | 15.81***    | 3.45   | -59.18***   | -11.43 | 24.72***    | 4.78   |
| 5   | -32.56***  | -2.79  | -0.22     | -0.05  | -16.96**   | -2.55  | -38.88***   | -5.99  | 23.51***    | 3.91   | -52.60***   | -7.74  | 29.44***    | 4.34   |
| Panel C: Beta                                     |            |        |           |        |            |        |             |        |             |        |             |        |             |        |
| 1   | -25.59***  | -3.93  | 1.49      | 0.67   | -7.50**    | -2.02  | -32.17***   | -8.88  | 12.58***    | 3.75   | -45.59***   | -12.03 | 20.09***    | 5.30   |
| 2   | -32.34***  | -4.42  | -0.11     | -0.04  | -9.11**    | -2.19  | -36.11***   | -8.89  | 12.99***    | 3.45   | -49.49***   | -11.64 | 20.48***    | 4.82   |
| 3   | -39.50***  | -4.67  | 0.34      | 0.12   | -12.01**   | -2.50  | -42.33***   | -9.01  | 14.49***    | 3.33   | -55.79***   | -11.35 | 21.79***    | 4.43   |
| 4   | -34.37***  | -4.23  | 0.11      | 0.04   | -13.47***  | -2.92  | -40.25***   | -8.92  | 19.23***    | 4.60   | -55.65***   | -11.79 | 26.82***    | 5.68   |
| 5   | -32.90***  | -3.21  | 1.13      | 0.32   | -13.43**   | -2.30  | -36.21***   | -6.35  | 15.61***    | 2.96   | -51.96***   | -8.71  | 23.79***    | 3.99   |
| Panel D: Liquidity                                |            |        |           |        |            |        |             |        |             |        |             |        |             |        |
| 1   | -30.08***  | -3.57  | 0.00      | 0.00   | -11.61**   | -2.42  | -31.92***   | -6.82  | 13.44***    | 3.10   | -47.61***   | -9.73  | 21.16***    | 4.32   |
| 2   | -32.57***  | -3.50  | 1.56      | 0.49   | -11.64**   | -2.20  | -39.03***   | -7.54  | 16.54***    | 3.45   | -53.14***   | -9.81  | 24.21***    | 4.47   |
| 3   | -32.19***  | -3.85  | -0.17     | -0.06  | -11.42**   | -2.40  | -35.83***   | -7.70  | 15.22***    | 3.53   | -50.86***   | -10.45 | 23.72***    | 4.87   |
| 4   | -33.85***  | -4.23  | 0.82      | 0.30   | -11.69**   | -2.57  | -37.73***   | -8.49  | 14.75***    | 3.58   | -52.63***   | -11.31 | 23.09***    | 4.96   |
| 5   | -34.06***  | -4.46  | 0.90      | 0.34   | -9.25**    | -2.13  | -41.34***   | -9.75  | 15.64***    | 3.98   | -53.07***   | -11.96 | 21.39***    | 4.82   |

| Panel E: Momentum          |           |       |       |       |           |       |           |       |          |      |           |        |          |      |
|----------------------------|-----------|-------|-------|-------|-----------|-------|-----------|-------|----------|------|-----------|--------|----------|------|
| 1                          | -30.39*** | -2.61 | 0.59  | 0.15  | -14.66**  | -2.21 | -43.90*** | -6.78 | 27.58*** | 4.60 | -57.59*** | -8.50  | 33.92*** | 5.00 |
| 2                          | -40.32*** | -4.24 | -0.29 | -0.09 | -14.20*** | -2.63 | -40.97*** | -7.76 | 15.15*** | 3.10 | -56.82*** | -10.28 | 22.97*** | 4.16 |
| 3                          | -30.89*** | -4.58 | 0.42  | 0.18  | -10.34*** | -2.70 | -34.25*** | -9.14 | 13.29*** | 3.83 | -47.00*** | -11.98 | 20.35*** | 5.19 |
| 4                          | -29.26*** | -4.61 | 0.74  | 0.34  | -8.20**   | -2.27 | -31.90*** | -9.05 | 10.10*** | 3.10 | -45.30*** | -12.28 | 17.99*** | 4.88 |
| 5                          | -33.85*** | -4.87 | 1.51  | 0.63  | -8.11**   | -2.05 | -36.04*** | -9.33 | 8.79***  | 2.46 | -51.78*** | -12.81 | 17.74*** | 4.39 |
| Panel F: Investment Growth |           |       |       |       |           |       |           |       |          |      |           |        |          |      |
| 1                          | -29.72*** | -3.06 | 0.22  | -0.62 | -9.38*    | -1.70 | -36.27*** | -6.72 | 15.71*** | 3.14 | -50.60*** | -8.96  | 24.13*** | 4.27 |
| 2                          | -33.92*** | -3.91 | 0.55  | -0.60 | -15.02*** | -3.04 | -35.91*** | -7.45 | 16.45*** | 3.69 | -51.06*** | -10.13 | 23.70*** | 4.70 |
| 3                          | -28.31*** | -3.86 | 0.62  | -0.50 | -8.23**   | -1.97 | -35.36*** | -8.68 | 14.65*** | 3.88 | -47.40*** | -11.13 | 21.75*** | 5.10 |
| 4                          | -33.56*** | -4.62 | 0.56  | -0.49 | -12.20*** | -2.95 | -35.18*** | -8.72 | 13.26*** | 3.55 | -50.88*** | -12.06 | 21.27*** | 5.04 |
| 5                          | -40.01*** | -4.93 | 1.00  | 0.13  | -10.03**  | -2.17 | -45.02*** | -9.98 | 14.04*** | 3.36 | -57.72*** | -12.22 | 20.12*** | 4.26 |
| Panel G: Profitability     |           |       |       |       |           |       |           |       |          |      |           |        |          |      |
| 1                          | -36.72*** | -3.40 | 0.30  | 0.08  | -12.81**  | -2.08 | -40.99*** | -6.83 | 16.78*** | 3.02 | -54.40*** | -8.66  | 22.61*** | 3.60 |
| 2                          | -38.66*** | -4.61 | 0.02  | 0.01  | -11.77**  | -2.47 | -41.46*** | -8.90 | 14.55*** | 3.37 | -54.42*** | -11.16 | 20.60*** | 4.22 |
| 3                          | -36.06*** | -4.80 | 0.86  | 0.33  | -11.12*** | -2.60 | -39.84*** | -9.55 | 14.04*** | 3.64 | -54.24*** | -12.43 | 21.32*** | 4.88 |
| 4                          | -27.93*** | -3.86 | 0.81  | 0.33  | -9.08**   | -2.20 | -33.90*** | -8.43 | 14.24*** | 3.82 | -47.33*** | -11.25 | 22.46*** | 5.34 |
| 5                          | -26.93*** | -3.68 | 0.90  | 0.36  | -10.79*** | -2.59 | -31.66*** | -7.79 | 14.63*** | 3.89 | -47.48*** | -11.16 | 23.87*** | 5.61 |

Note: Each factor is sorted and then divided into the five quantiles using the single-sorting portfolio technique.

## *4.2 Role of firm-specific characteristics in explaining the stock returns during the pandemic period*

### *4.2.1 Univariate Analysis*

To investigate the role of firm characteristics in the investor decision-making process during the pandemic period, we employ a single-sorting technique to cluster firms into several groups and perform multivariate analysis.

Using a single-sorting portfolio technique, we sort and divide the firms into five groups based on BM ratio, firm size, beta, operating profitability, investment, liquidity, and momentum. We compute the CAAR and t-statistics across all the factor groups for different event windows. A cursory glance at the Table 6 reveals that small-cap firms have lost relatively more than large-cap firms in CAAR (29, 49) and CAAR (23, 44) sub-windows. However, these firms have recovered more than large-cap firms, as indicated in CAAR (50, 67) and CAAR (45, 67) sub-windows. Consequently, Small-cap stocks outperformed large-cap stocks. Value stocks (high BM ratio stocks) performed poorly as compared to growth stocks (low BM ratio stocks) indicating the sell-off in CAAR (7,28), CAAR (29,49), and CAAR (23, 44) sub-windows. However, they have also recovered fast as compared to growth stocks indicated by CAAR values in CAAR (50, 67) and CAAR (45, 67) sub-windows indicating the more investment in value stocks.

Similarly, high beta stocks declined and also recovered faster than low beta stocks, as indicated by several sub-windows suggesting the sell-off of risky stocks as the crisis unfolds. In liquidity quantiles, we create portfolios based on Amihud's illiquidity measure. Considering this, any movement from Group 1 to Group 5 indicates the increase in illiquidity. We don't observe any consistent patterns in the CAAR for portfolios created based on liquidity. This may be because most of the BSE 500 firms are liquid. Winner firms lose less and also regained less. Firms with high asset growth or high investment recovered less compared to those with less investment. Firms with low profitability get more affected as compared to firms with high profitability in different sub-windows. Both types of firms show signs of recovery.

In the next sub-section, we perform multivariate analysis to explain the cross-section variation in CARs. We consider several firm characteristics along with firm age, group-affiliation variables to gain more insights.

#### 4.2.2 Multivariate Analysis

Table 7 & 8 present the ordinary least squares (OLS) regressions of CARs, during the downfall and the recovery period, on various firm characteristics with & without industry effects. Extant literature finds the firm-specific characteristics to be significant determinants of stock returns. Panel (A) reports the results for the downfall period and Panel (B) for the recovery period.

Table 7, Panel(A) reports beta, Size, book-to-market equity and age to be significant determinants of CARs during downfall period at 1%, 5% & 10% level of significance in different variants of the empirical model. We report beta to be negative and highly significant during the downfall period indicating higher the beta, higher the negative CAR during the downfall period. The Positive and statistically significant coefficient on Size signifies big-size firms earn lower negative CAR. In other words, small size firms experience a larger decline in price and experience more negative CAR as compared to big size firms. High BM firms offer lower negative CAR during the downfall period. It implies that Value firms experience lower negative returns compared to growth firms. This is in contrast to our univariate findings. We also find age to be a significant determinant of CAR during the downfall period. Old firms experience a lower negative CAR during the COVID-19 period. In the downfall period, investors appear to sell more the younger firms stocks as these firms are riskier compared to old firms. We do not observe investment, profitability, momentum, liquidity, and group affiliation to be significant in different regression models. Overall, high beta, growth, small, and young firms experience more sell-off during the downfall period.

Panel (B) of Table 7 presents the empirical results for CAR during the recovery period. The table reveals Size, BM ratio, profit & momentum to be significant determinants of CAR during the recovery period at various levels of significance. Firms with higher BM ratio and higher operating profitability experience higher positive CAR during the recovery period, as indicated by the positive and statistically significant coefficient of BM ratio and profitability, respectively. The negative size coefficient implies that big-size firms have recovered less as compared to small-sized firms in the recovery period. Similarly, Firms who emerged as winners in the past have gained less compared to loser firms in the recovery period, as indicated by the negative momentum coefficient in different variants. Surprisingly, both profitability and momentum, which were insignificant during the crisis period, have emerged as significant determinants of CAR during the recovery period. Table 8, Panel (A) & Panel (B) provides results with the industry effects in appendix. We consider NIC 2008 for industry controls. Overall, findings are similar to those reported in Table 7.

TABLE 7: Impact of Firm-Characteristics on Cross-sectional CARs

| PANEL A: CARs during the downfall period as a dependent variable |                         |                             |                        |                        |                        |                             |                             |                         |                         |                             |
|--|-------------------------|-----------------------------|------------------------|------------------------|------------------------|-----------------------------|-----------------------------|-------------------------|-------------------------|-----------------------------|
|  | I                       | II                          | III                    | IV                     | V                      | VI                          | VII                         | VIII                    | IX                      | X                           |
| Beta   | -0.353***<br>(-2.613)   | -0.333**<br>(-2.500)        | -0.350**<br>(-2.578)   | -0.340**<br>(-2.492)   | -0.333**<br>(-2.442)   | -0.320**<br>(-2.375)        | -0.334**<br>(-2.500)        | -0.367***<br>(-2.753)   | -0.340**<br>(-2.535)    | -0.337**<br>(-2.505)        |
| Size   | 3.196***<br>4.239       | 3.069***<br>4.025           | 2.773***<br>3.369      | 3.536***<br>3.929      | 3.143***<br>3.315      | 3.053***<br>3.18            | 2.678***<br>3.213           | 2.877***<br>3.795       | 3.129***<br>4.02        | 2.556***<br>2.898           |
| BM ratio   | 1.311**<br>2.074        | 1.255**<br>2.005            | 1.690**<br>2.382       | 1.401**<br>2.16        | 1.818**<br>2.469       | 1.733**<br>2.352            | 1.597**<br>2.27             | 1.062<br>1.507          | 1.229*<br>1.683         | 1.491*<br>1.901             |
| Inv  |                         | 1.806                       |                        |                        |                        | 1.923                       | 1.725                       |                         |                         | 2.716                       |
| Profit   |                         | 0.515<br>-2.811<br>(-0.538) |                        |                        |                        | 0.554<br>-3.123<br>(-0.595) | 0.485<br>-3.159<br>(-0.606) |                         |                         | 0.805<br>-4.076<br>(-0.774) |
| Momentum   |                         |                             | 5.481<br>1.417         |                        | 5.824<br>1.481         | 5.36<br>1.392               | 5.086<br>1.342              |                         |                         | 5.243<br>1.388              |
| Liquid   |                         |                             |                        | 631.608<br>1.088       | 706.453<br>1.229       | 661.69<br>1.105             |                             |                         |                         |                             |
| Age  |                         |                             |                        |                        |                        |                             |                             | 0.121***<br>3.037       | 0.125***<br>3.163       | 0.126***<br>3.186           |
| Stdalone   |                         |                             |                        |                        |                        |                             |                             |                         | 3.189<br>1.456          | 2.547<br>1.125              |
| Constant   | -88.720***<br>(-10.170) | -87.038***<br>(-9.627)      | -83.729***<br>(-8.843) | -93.274***<br>(-8.523) | -88.699***<br>(-7.771) | -87.418***<br>(-7.376)      | -82.355***<br>(-8.447)      | -90.044***<br>(-10.516) | -94.228***<br>(-10.453) | -86.996***<br>(-8.492)      |
| Obs.   | 488                     | 477                         | 488                    | 482                    | 482                    | 472                         | 477                         | 488                     | 488                     | 477                         |
| R-squared  | 0.052                   | 0.048                       | 0.057                  | 0.052                  | 0.057                  | 0.053                       | 0.052                       | 0.07                    | 0.074                   | 0.073                       |

PANEL B: CARs during the recovery period as a dependent variable

|           | I         | II        | III       | IV        | V         | VI         | VII       | VIII      | IX        | X         |
|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|-----------|-----------|
| Beta      | 0.087     | 0.149     | 0.08      | 0.076     | 0.065     | 0.134      | 0.15      | 0.091     | 0.071     | 0.145     |
|           | 0.802     | 1.339     | 0.749     | 0.696     | 0.603     | 1.2        | 1.352     | 0.844     | 0.65      | 1.305     |
| Size      | -1.005*   | -0.984*   | -0.266    | -1.396**  | -0.731    | -0.618     | -0.22     | -0.908*   | -1.096**  | -0.238    |
|           | (-1.939)  | (-1.859)  | (-0.494)  | (-2.157)  | (-1.134)  | (-0.933)   | (-0.401)  | (-1.760)  | (-2.059)  | (-0.425)  |
| BM ratio  | 4.917***  | 5.162***  | 4.254***  | 4.766***  | 4.062***  | 4.303***   | 4.491***  | 4.993***  | 4.868***  | 4.506***  |
|           | 11.259    | 10.722    | 9.608     | 10.669    | 8.753     | 9.041      | 9.844     | 11.893    | 11.819    | 10.427    |
| Invt      |           | 0.544     |           |           |           | 0.507      | 0.703     |           |           | 0.307     |
|           |           | 0.237     |           |           |           | 0.239      | 0.323     |           |           | 0.144     |
| Profit    |           | 8.932*    |           |           |           | 8.882*     | 9.612**   |           |           | 9.943**   |
|           |           | 1.82      |           |           |           | 1.905      | 1.996     |           |           | 2.143     |
| Momentum  |           |           | -9.591*** |           | -9.857*** | -10.113*** | -9.953*** |           |           | -9.866*** |
|           |           |           | (-3.545)  |           | (-3.613)  | (-3.675)   | (-3.644)  |           |           | (-3.635)  |
| Liquid    |           |           |           | -514.491  | -641.175  | -510.02    |           |           |           |           |
|           |           |           |           | (-0.991)  | (-1.268)  | (-0.971)   |           |           |           |           |
| Age       |           |           |           |           |           |            |           | -0.037    | -0.04     | -0.049    |
|           |           |           |           |           |           |            |           | (-1.212)  | (-1.319)  | (-1.612)  |
| Stdalone  |           |           |           |           |           |            |           |           | -2.366    | -1.627    |
|           |           |           |           |           |           |            |           |           | (-1.400)  | (-0.951)  |
| Constant  | 30.274*** | 28.178*** | 21.541*** | 35.622*** | 27.879*** | 24.603***  | 19.013*** | 30.677*** | 33.782*** | 21.808*** |
|           | 4.9       | 4.419     | 3.383     | 4.401     | 3.49      | 2.943      | 2.87      | 4.958     | 5.176     | 3.117     |
| Obs.      | 488       | 477       | 488       | 482       | 482       | 472        | 477       | 488       | 488       | 477       |
| R-squared | 0.19      | 0.205     | 0.213     | 0.195     | 0.219     | 0.233      | 0.23      | 0.193     | 0.196     | 0.236     |

Note: The table provides OLS regression results for the dependent variable- Cumulative Abnormal Return during the downfall period and recovery period. T-statistics are corrected for heteroscedasticity and serial correlation by firm-level clustering. Besides firm-level characteristics, the table also contains the result for age and standalone firms

Robust t-statistics in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

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In summary, firm-specific quantiles and multivariate analysis show that the magnitude of COVID-19 financial impact is not homogenous for all the firms. Rather, firm-specific factors have played a crucial role in shaping investors' beliefs and decision-making during the pandemic period (Ramelli & Wagner, 2020; Ding et al., 2020).

#### *4.3 Robustness Testing*

We use the mean-adjusted returns model for computing estimated returns. The mean-adjusted model often gives similar results when compared to other sophisticated models such as CAPM, market-model, etc. (Brown & Warner, 1980, 1985). Market-model is not suitable for the systemic events when the return on the overall market, the model benchmark, itself is affected by the event. Therefore, when we use a market-model for computation of estimated returns for the different event windows, we do not find any significant abnormal returns. The results do not vary with the choice benchmark index between BSE 500 and Sensex. It proves the mean-adjusted returns model to be a better return estimation model when compared with models controlling for market risk for studying the impact of systemic events. Moreover, we conduct a t-test for testing the significance of CAARs and AARs. Our results are robust when tested using the Wilcoxon sign rank test.

## 5. Conclusion

COVID-19 induced financial uncertainty has wreaked havoc for all stock markets across the world. Indian stock market has also experienced similar shivers. Using a sample of BSE 500 firms, we make efforts to quantify the market response to COVID-19 through event study methodology and regression analysis.

The main conclusions of the study are as follows. First, the Indian stock market sees a huge decline driven by the COVID-19 induced uncertainty, though, the market appears to rebound after the major downfall. It indicates a huge sell-off by the investors during the period, particularly when the confirmed COVID-19 cases in India were limited to 1251 by the end of March. Second, Industry trends are also consistent with the overall market with arts, entertainment, and recreation (-98.69%), accommodation and food services (-72.77%), and Construction (-53.47%) emerging as top losers. Third, the financial impact of COVID-19 is far from homogenous, as some stocks were more affected than others.

The univariate analysis reveals that small, high beta, high BM ratio, low profit & loser firms have experienced more sell-off during the pandemic period. We observe the quick recovery in Small, high beta, high BM ratio, loser, and low investment firms. The univariate findings indicate that fundamentals have the role to play in shaping the investor beliefs during the

pandemic period. Moreover, regression analysis reveals that beta, BM ratio, age, and size are significant determinants of CARs during the downfall period. However, momentum & profitability emerge as the key determinants of CARs in addition to size and book-to-market equity during the recovery period.

Our results have important implications for capital market participants. The study provides insights about the stock market response to disease outbreak and how pre-shock firm-characteristics play an important role in shaping the stock market response to COVID-19 induced crisis.

## **Declaration**

### **Availability of data and material**

Data will be available on the reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

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### **Authors' contributions**

All authors have the same contribution. The authors read and approved the final manuscript.

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TABLE 8: Impact of Firm-Characteristics on Cross-sectional CARs with Industry effects

| PANEL A: CARs during downfall period as a dependent variable |                            |                            |                            |                            |                            |                            |                            |                            |                            |                            |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
|  | I                          | II                         | III                        | IV                         | V                          | VI                         | VII                        | VIII                       | IX                         | X                          |
| Beta   | -0.208<br>(-1.169)         | -0.211*<br>(-1.806)        | -0.206<br>(-1.207)         | -0.207<br>(-1.180)         | -0.201<br>(-1.221)         | -0.210**<br>(-2.150)       | -0.212*<br>(-1.921)        | -0.234<br>(-1.611)         | -0.201<br>(-1.533)         | -0.216**<br>(-2.892)       |
| Size   | 3.297**<br>2.429           | 3.215**<br>2.418           | 2.907**<br>2.461           | 3.707**<br>2.855           | 3.345**<br>2.853           | 3.295**<br>2.599           | 2.840**<br>2.363           | 2.990*<br>2.1              | 3.302**<br>2.225           | 2.826*<br>1.923            |
| BM ratio   | 1.445<br>0.885             | 1.33<br>0.878              | 1.784<br>1.192             | 1.578<br>0.919             | 1.963<br>1.231             | 1.828<br>1.211             | 1.65<br>1.163              | 1.225<br>0.781             | 1.43<br>0.894              | 1.607<br>1.086             |
| Invt   |                            | 2.486<br>1.545             |                            |                            |                            | 2.58<br>1.492              | 2.429<br>1.372             |                            |                            | 3.323**<br>2.195           |
| Profit   |                            | -7.293<br>(-0.861)         |                            |                            |                            | -7.518<br>(-0.870)         | -7.613<br>(-0.872)         |                            |                            | -8.384<br>(-1.052)         |
| Momentum   |                            |                            | 4.956<br>0.973             |                            | 5.367<br>1.081             | 5.015<br>1.225             | 4.782<br>1.162             |                            |                            | 4.691<br>1.594             |
| Liquid   |                            |                            |                            | 699.808<br>1.199           | 779.077<br>1.389           | 722.445<br>1.248           |                            |                            |                            |                            |
| Age  |                            |                            |                            |                            |                            |                            |                            | 0.115*<br>2.055            | 0.119**<br>2.314           | 0.123**<br>2.308           |
| Stdalone   |                            |                            |                            |                            |                            |                            |                            |                            | 4.016*<br>1.926            | 3.621<br>1.706             |
| Constant   | -<br>84.969***<br>(-5.635) | -<br>82.939***<br>(-5.181) | -<br>80.394***<br>(-6.145) | -<br>90.541***<br>(-6.263) | -<br>86.378***<br>(-6.556) | -<br>84.614***<br>(-5.550) | -<br>78.464***<br>(-5.426) | -<br>86.669***<br>(-6.371) | -<br>91.775***<br>(-6.037) | -<br>85.038***<br>(-5.284) |
| Industry effects   | Yes                        |
| Obs.   | 488                        | 477                        | 488                        | 482                        | 482                        | 472                        | 477                        | 488                        | 488                        | 477                        |

| R-squared  | 0.166              | 0.168              | 0.17                  | 0.168                | 0.172                 | 0.175                 | 0.172                 | 0.18               | 0.186               | 0.192                 |
|--|--------------------|--------------------|-----------------------|----------------------|-----------------------|-----------------------|-----------------------|--------------------|---------------------|-----------------------|
| PANEL B: CARs during the recovery period as a dependent variable |                    |                    |                       |                      |                       |                       |                       |                    |                     |                       |
|  | I                  | II                 | III                   | IV                   | V                     | VI                    | VII                   | VIII               | IX                  | X                     |
| Beta   | 0.199***<br>3.787  | 0.243***<br>4.655  | 0.195***<br>3.449     | 0.190***<br>3.75     | 0.180***<br>3.312     | 0.232***<br>4.367     | 0.245***<br>4.463     | 0.212***<br>3.58   | 0.196***<br>3.078   | 0.253***<br>3.466     |
| Size   | -0.476<br>(-0.970) | -0.468<br>(-1.008) | 0.188<br>-0.454       | -0.804<br>(-1.456)   | -0.206<br>(-0.392)    | -0.122<br>(-0.224)    | 0.221<br>-0.514       | -0.32<br>(-0.523)  | -0.467<br>(-0.809)  | 0.292<br>-0.518       |
| BM ratio   | 5.616***<br>20.414 | 5.785***<br>16.066 | 5.038***<br>27.105    | 5.508***<br>25.853   | 4.870***<br>27.884    | 5.049***<br>28.293    | 5.198***<br>26.97     | 5.728***<br>19.441 | 5.631***<br>20.57   | 5.246***<br>26.601    |
| Invnt  |                    | 1.201<br>0.67      |                       |                      |                       | 1.201<br>0.778        | 1.305<br>0.86         |                    |                     | 0.835<br>0.478        |
| Profit   |                    | 6.752<br>1.559     |                       |                      |                       | 6.971<br>1.749        | 7.339*<br>1.813       |                    |                     | 7.765*<br>1.919       |
| Momentum   |                    |                    | -8.435***<br>(-3.213) |                      | -8.880***<br>(-3.471) | -9.046***<br>(-3.776) | -8.777***<br>(-3.560) |                    |                     | -8.861***<br>(-4.065) |
| Liquid   |                    |                    |                       | -484.779<br>(-1.246) | -615.928<br>(-1.707)  | -486.018<br>(-1.271)  |                       |                    |                     |                       |
| Age  |                    |                    |                       |                      |                       |                       |                       | -0.059<br>(-1.194) | -0.06<br>(-1.252)   | -0.067<br>(-1.440)    |
| Stdalone   |                    |                    |                       |                      |                       |                       |                       |                    | -1.894*<br>(-1.997) | -1.335<br>(-1.336)    |
| Constant   | 27.159***<br>4.882 | 25.450***<br>5.17  | 19.373***<br>4.157    | 31.614***<br>4.929   | 24.725***<br>4.038    | 21.927***<br>3.559    | 17.237***<br>3.652    | 28.023***<br>5.737 | 30.431***<br>6.8    | 19.867***<br>4.56     |
| Industry effects   | Yes                | Yes                | Yes                   | Yes                  | Yes                   | Yes                   | Yes                   | Yes                | Yes                 | Yes                   |
| Obs.   | 488                | 477                | 488                   | 482                  | 482                   | 472                   | 477                   | 488                | 488                 | 477                   |
| R-squared  | 0.281              | 0.292              | 0.298                 | 0.278                | 0.297                 | 0.308                 | 0.311                 | 0.286              | 0.288               | 0.319                 |

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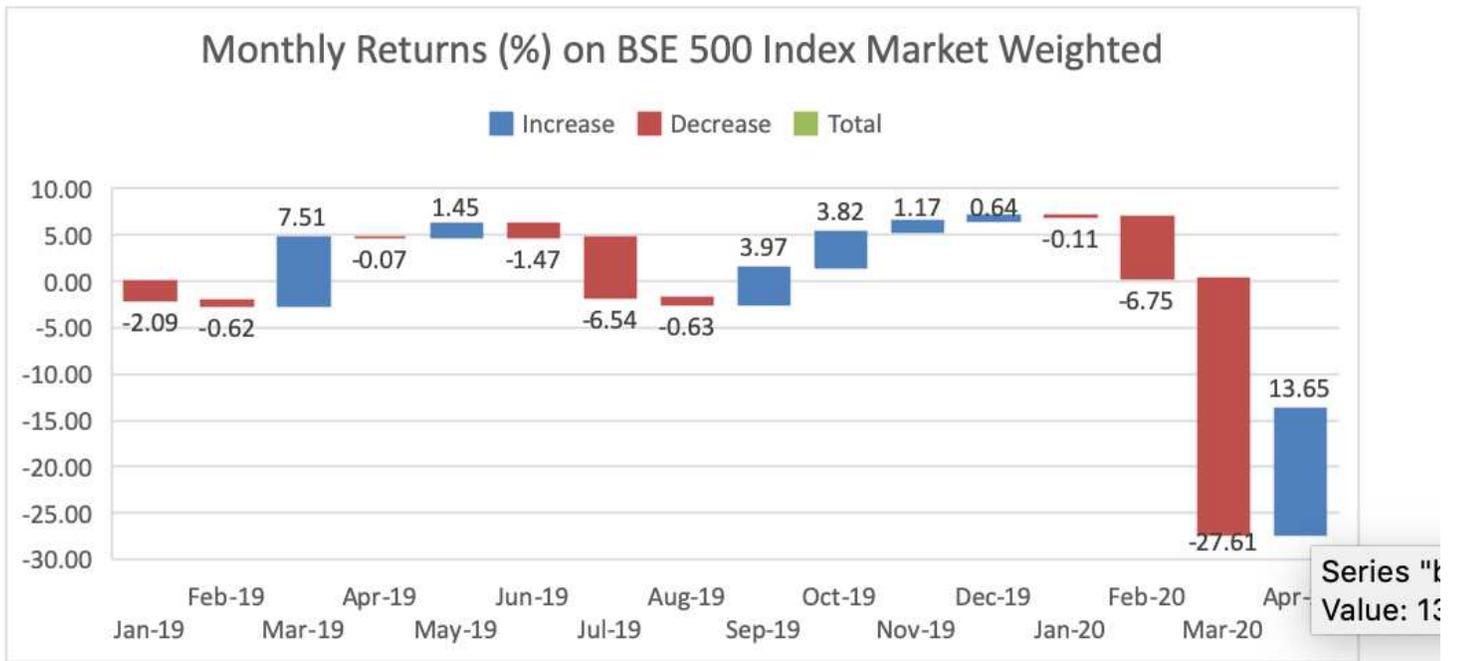
Note: The table provides OLS regression results for the dependent variable- Cumulative Abnormal Return during the downfall period and recovery period. T-statistics are corrected for heteroscedasticity and serial correlation by Industry-level clustering. Besides firm-level characteristics, the table also contains the result for age and standalone firms.

Robust t-statistics in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

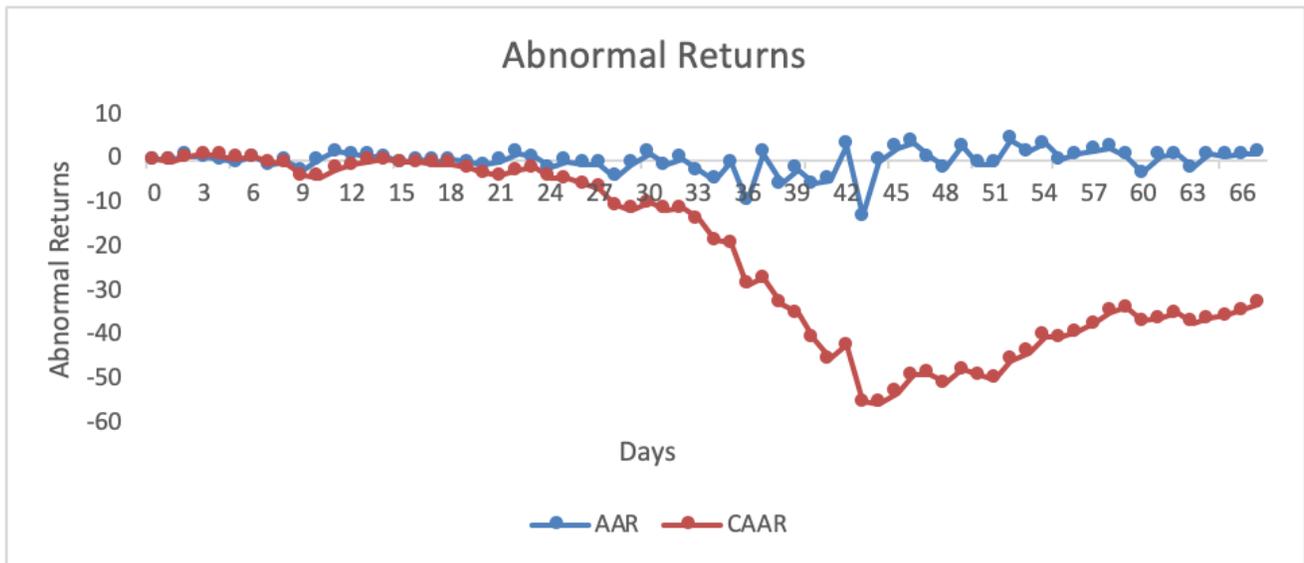
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# Figures



**Figure 1**

Monthly Returns on the BSE 500 Index. X-axis: Time Y-axis: Monthly Buy and Hold Return



**Figure 2**

Average Abnormal Returns and Cumulative Average Abnormal Returns. X-axis: Time Y-axis: Abnormal Return (AAR and CAAR)



**Figure 3**

Industry-wise AAR and CAAR. X-axis: Time Y-axis: Abnormal Return (AAR and CAAR)