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Testing Behaviour of Daily Stock Return in Indian Stock Market during Pandemic Induced Crisis Period

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Abstract
The present study empirically investigates the day-of-the-week effect anomaly in the Indian equity market considering daily data for the equity market index,S&P BSE Sensex for the period from January 1, 2018, to August 30, 2022.The pre-COVID period (Period 1) is assumed to be a period starting from January 1, 2018, until the lockdown announcement in India on March 25, 2020. The 'during COVID (Period 2) period is from March 25, 2020, to August 30, 2022, consisting of the entire period from the date of announcement of the first lockdown in India on March 25, 2020, to August 30, 2020.The Ordinary Least Square technique has been used in analyzing the data. The study found that for the Entire period, Tuesday had the largest statistically significant return, with no positive returns on any other day of the week. All weekly coefficients of return, except Tuesday during the pre-COVID era were negative and not statistically significant. The study's total returns were notably favorable on Tuesday alone. Additionally, the observed results indicate statistically substantial negative returns in the market on Monday. Our research intends to help portfolio managers and ordinary investors comprehend portfolio allocation strategies in the face of COVID-19's varied week-to-week impacts and volatility.
Keywords: Daily Return, COVID-19, day-of-the-week effect, Volatility
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Introduction:
In empirical finance, testing market anomalies in stock returns in the form of the day-of-the-week effect, the month-of-the-year effect, the week-of-the-month effect, the hour-of-the-day effect, etc. has become an active field of research that has been receiving great attention from financial analysts across the world. The day-of-the-week effect is a phenomenon that constitutes a form of anomaly where the average daily return of the market is not the same for all the days of the week as we expect based on an efficient market hypothesis. In efficient markets, when we consider the strong form, current stock prices reflect all kinds of publicly available information as well as insider information. Consequently, in a strong, well-built type of market efficiency, researchers as well as financial analysts assert that it is impracticable to generate surplus profits depending on insider information [Malkiel, Burton G. (2003)]. If an anomaly in the market exists, investors can take advantage of the same and adjust their buying and selling strategies accordingly to increase their returns by timing the market. In recent years, researchers across the world have shown keen interest in modeling the effect of the COVID-19 virus outbreak on stock returns and volatility in developed and emerging economies.

Literature review:
Before the outbreak of the Corona virus in 2020 worldwide, in the majority of developed markets such as United Kingdom, the USA and Canada, some prominent studies like Cross (1973), Gibbons & Hess (1981), Keim&Stambaugh (1984), Theobald & Price (1984), Jaffe &Westerfield (1985), Harris (1986) Simrlock& Starts (1986), Board and Sutcliffe (1988), and Kohers and Kohers (1995), Tang, and Kwok (1997) for 6 indices [Dow Jones Industrial Average]. Index(US), Financial Times Index (UK), Nikkei Average Index (Japan), Hang Seng Index (Hong Kong), FAZ General Index (Germany), and All Ordinary Index (Australia)] and a lot of researchers have observed that Mondays' Average returns are pessimistically negative , and Fridays' are showing positive retuns. Alternatively, the stock exchange market starts sliding and ends increasing. Yet, in some other studies such as Condoyanni, O'Hanlon & Ward (1987), Solnik&Bousqet (1990) in the French stock market; Athanassakos& Robinson (1994) in the Canadian market, Jaffe &Westerfield (1985) in the stock markets of Australia an d Japan, Kim (1988) in the stock markets of Japan and Korea, Aggarwal &Rivoli (1989) in the stock markets of Hong Kong, Singapore, Malaysia, and the Philippines, Ho (1990) in the stock markets of Australia, Hong Kong, Japan, Korea, Malaysia, and New Zealand, the Philippines, Singapore, Taiwan, and Thailand Wong, Hui, and Chan (1992) in the markets of Singapore, Malaysia, Hong Kong, and Thailand, Dubois &Louvet (1996) in the stock markets of Japan, Australia, Agrawal, and Tandon (1994) for eighteen countries

and many others, the negative average returns are observed on Tuesdays. In addition, IN Istanbul stock exchange, there existed negative average returns on Tuesdays [Athanassakos, G. et.al (1994), Balaban (1995) and Özmen (1997)].

With the emergence of the Coronavirus in 2020, there have been several research studies conducted all over the world regarding the influence of COVID on stock market returns and volatility. Adnan et al. (2020) investigated the response of capital markets to COVID-19 by considering the individual stock returns of 311 registered firms. The study exposed that the domestic stock market showed a significant response to the event. Studies subsequently examined the stock market integration on account of the COVID-19 pandemic on global markets and the information spill over among the various economies. Yong and Laing (2020) investigated the reaction of the U.S. stock market to the World Health Organisation's COVID-19 Global Emergency announcement while focusing on firms with global exposure. Salisu and Akanni (2020) compiled an index, namely, the Global Fear Index, during the COVID-19-led pandemic period. Based on panel data, the results suggest that the fear index is a significant predictor of stock returns during the pandemic. The result found that the forecasted future performance of predictive models based on GFI for stock returns is improved by common macro factors and the "asymmetry" effect. Barro (2020) found that stock market returns declined significantly because of flu-related deaths in 48 countries. Liu et al. (2020c) and Prabheesh et al. (2020) exhibit a positive affiliation between stock returns and COVID-19. Zaremba, M. Atif, et al. (2020) investigated the effect of policy measures adopted at the governmental level to deal with the novel coronavirus on stock market volatility in 67 countries and found that government interference in dealing with COVID-19 enhanced stock market volatility. Yan and Qian (2020) have explored event studies to ascertain and prove that the prices of stocks in the consumer industry turned down drastically in a small number of days during the early pandemic phase and recovered later in reaction to government policies. In the financial industry, systematic risk rose significantly during the COVID-19 outbreak. Ravi (2020) has made a comparison between the pre-COVID-19 and post-COVID-19 situation of the stock market in India. His findings revealed that the start of January 2020, immediately before the outburst of the COVID-19-led pandemic, witnessed a peak of 12,362 and 42,273, respectively, in terms of trade on the NSE and BSE, which showed encouraging stock market conditions. After the outbreak of COVID-19, the stock market came under a panic situation as the NSE Nifty and BSE Sensex declined abruptly. Afzal et al. (2022) found, using GARCH (1, 1) and selected BSE indices for SENSEX, Bank, FMCG, Industrial, and Corporate Bonds, that the COVID-19 pandemic has badly affected the performance of the stock market of India temporarily for a shorter period. Mondal (2020) has meticulously examined the distress of the fatal pandemic on the stock market in India. The BSE Sensex showed the largest single-day collapse of 13.2 percent, surpassing the notorious downfall of April 28, 1992. Nifty furthermore has a sheer drop of 29%, going beyond the catastrophe of 1992. Narayan, P.K. (2021) tried to appraise spill over shocks from exchange rate returns of yen, euro, CAD, and GBP and found that exchange rate displays a stronger influence on market return during the COVID-19 period, using an hourly data-based, dynamic VAR model. Weiqing Li et al. (2022) portrayed an empirical connection between fear of COVID-19 and stock market volatility using AR (1) and GARCH (1, 1) to measure stock market volatility associated with the COVID-19 pandemic. The findings suggest that COVID-19 panic is the fundamental basis for stimulating stock market volatility. The results demonstrate that stock market performance and GDP growth decreased significantly, despite average increases during the pandemic.

After probing diverse studies in different Indian and global contexts, it can be affirmed that there may be no concurrence on estimating the impact of COVID-19 on the returns and volatility of returns in India as well as various stock market indices as a result of the Corona virus outbreak. None of the recent earlier research explored the day-of-the-week effect on stock returns considering 'pre-COVID' and 'during COVID' time frameworks in the Indian context so ornately.

Therefore, the study empirically attempts to find out the presence of anomalies in the day-of-the-week effect on the returns of the Indian stock market (BSE) during the outbreak of the pandemic and the lockdown policy adopted by the Indian government.

Methodology:

The daily closing prices were taken from the official websites of BSE for the period from January 1, 2018 to August 30, 2022. The pre-COVID period (Period 1) is assumed to be a period starting from January 1, 2018, until the lockdown announcement in India on March 25, 2020. The 'during COVID (Period 2) period is from March 25, 2020, to August 30, 2022, consisting of the entire period from the date of announcement of the first lockdown in India on March 25, 2020, to August 30, 2020. Within the sample period,BSE closing price data consists of a total of 1155 observations in terms of working days in the stock market except notified holidays,, Saturdays, and Sundays, out of which 549 observations are related to the pre-COVID period and 606 observations are related to the during COVID ' period. Instead of using the term post-COVID' period, we use the term 'during COVID' because WHO has not yet declared the end of the COVID-19-induced pandemic till the end date of our cap period.

In the estimations, we take the natural logarithm of each price data point to reduce the observed skewness in the stock price data distribution. The stock return data used in this research consists of the logarithmic first difference of closing stock prices, which is defined symbolically as follows:

To calculate the return, the following formula has been used:

$R_t = lnP_t - lnP_{t-1}$ ……………………………………………………… (1)

Here, R_t= daily stock return

P_t= closing price of the stock at time t

and P_{t-1} = previous day's closing price at time t-1

whileln symbolizes the natural log

The day-of-the-week effect in the Indian market was examined by many researchers[Chowdhury(1991),Poshakwala(1996),Goswami and Anshuman(2000),Chaudhury(2000), Bhattacharya,Sarkar and Mukhopadhyaya(2003)].All these studies except Chaudhury(2000), Bhattacharya et.al (2003) have been based on the data of the mid1980s and mid1990s and all these studies have used conventional methods by fitting the OLS technique. Following the same pattern, wehavelent support to a variety of models to seek out the affiliation between return and volatility. Following Berument&Kiymaz (2003):

$$R_t = \alpha_0 + \alpha_M D_{Mt} + \alpha_T D_{Tt} + \alpha_W D_{Wt} + \alpha_H D_{Ht} + \alpha_F D_{Ft} + \sum_{i=1}^{n} \alpha_i R_{t-i} + \gamma D_t + \varepsilon_t \quad \text{-------(2)}$$

Where D_{Mt}, D_{Tt}, D_{Wt}, D_{Ht}, D_{Ft} are the dummy variables for Monday, Tuesday,Wednesday, Thursday, and Friday, respectivelyand $R_t$is the return for period t. We use dummy variable value 1 for a specific day, otherwise 0. Moreover, we include the lagged values of the return variable in the equation to reduce the chances of having an auto-correlated error.The above-mentioned equation assumes the existence of constant variance. It may cause ineffective estimates if there is a time-varying variance.

Analysis of results:

The descriptive statistics represented numerically how data series are distributed for the BSE stock market of India over time. Table 1 designates significant changes in the allocation structure of returns between the pre-COVID-19 era and during the COVID-19 era.

Table 1: Descriptive statistics of stock return of pre-COVID-19 and during COVID-19 period

Descriptive statistics	BSE SENSEX			
	Price	Pre-COVID-19 era return	During COVID-19 era return	Entire period return
Mean	43544.16	-0.044506	0.132712	0.048403
Median	39513.39	0.030544	0.152768	0.085625
Maximum	61765.59	5.594630	8.594739	8.594739
Minimum	25981.24	-14.10174	-6.121976	-14.10174
Std. Dev.	9178.866	1.248572	1.290288	1.273146
Skewness	0.536412	-3.645121	0.225915	-1.503355
Kurtosis	1.838563	40.55972	8.814578	23.22031
Jarque-Bera	120.3070	33486.26	857.4230	20094.08
Probability	0.000000	0.000000	0.000000	0.000000
Observations	1154	549	605	1154

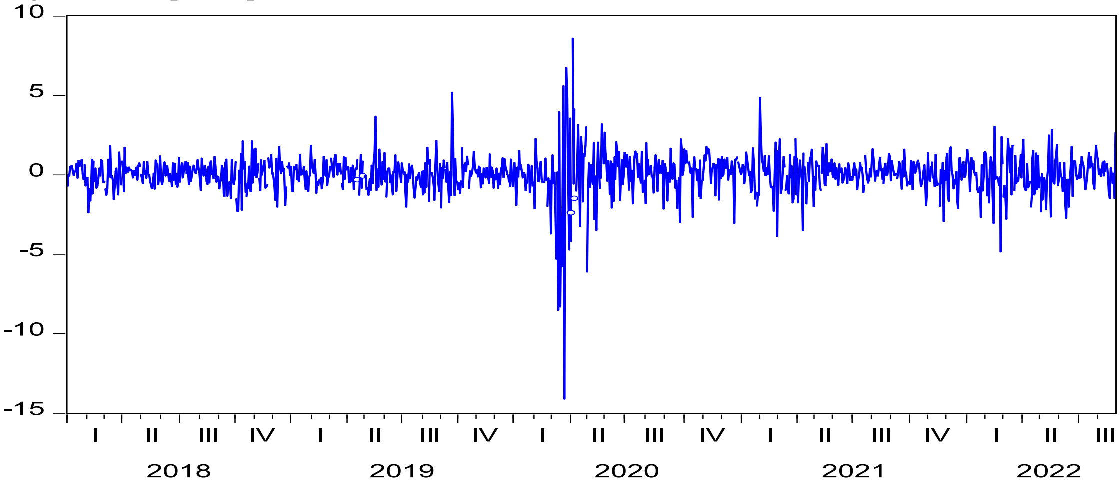
Source: Authors'own estimate

The standard deviation is higher than mean and median for BSE index returns in India. The Sensex has a maximum return of 8.59% and minimum return of -14.10%.In BSE stock markets, 'during COVID' period shows positive returns as compared to the 'pre-COVID' period. However, in the pre-COVID period and also in the entire time frame, the returns displayed were negatively skewed.

A negative skewness is generally not desirable because it highlights the risk of left-tail events, frequently referred to as "black swan events," which are unpredictable events that are beyond what is normally expected of a situation and have potentially severe consequences. The negativity in the skewness of return signifies that an investor may anticipate recurrent little gains and hardly any huge losses. In this situation, an investor or trader should be aware that there is still a probability of large losses. Positively skewed distributions of investment returns are generally preferred by investors over negative skewness since there is some probability of gaining huge profits and a few big gains can cover all the frequent small losses. However, during the COVID-19 era, the return series emerges as more or less symmetric as the skewness value lies between -0.5 and +0.5.

The distribution of return appeared to be highly leptokurtic, which indicates that return series, in both the pre-and post-COVID periods, displayed a thicker tail as well as a higher peak than a normal distribution, signifying the presence of enormous movements of stock prices on either side. However, its kurtosis has declined considerably in the post-COVID period. Given the Indian stock market, these movements were emblematic products of "euphoria to despondency cycles" (Gupta, 1997, Page 3).

Figure: 1: Graphical presentation of return in BSE SENSEX



Source: Computed by authors from tabulated data

Plotting time series data against time and observing its movement in form of graph is an important effort towards analyzing time series data. As a result of the worldwide manifestation of corona virus, stock market returns in India along with all other major stock markets of the world displayed noteworthy volatility towards the end of the first quarter of 2020.India along with major economies in the world with which India has trading partnerships and strong market integration went on for long-run painstaking lockdown, movement restrictions of people of the economies, and closed down the progress of all economic activities. The rapid and unanticipated multiplication effect had a significant adverse impact on financial markets, especially stock markets all over the world. The diagrammatic presentation of return data for the BSE index for the whole study period shown in Figure 1 exhibits strong volatility in stock returns in the Indian stock market since the outbreak of the first quarter of 2020 as compared to the prior period commencing from 2018. The diagrammatic design based on time series data reflects some of the unusual changes that happened at capital markets in India throughout our study period, perhaps owing to the manifestation of the COVID-19 virus. The graph shows the continuous mean reversal, volatility clustering, and also the evidence of volatility.

Table 2: Mean and Standard Deviation of BSE Returns Based on Days of a Week

Day of the Week	Mean Return			Standard Deviation of Returns		
	Pre-COVID-19 era	During COVID-19 era	Entire period	Pre-COVID-19 era	During COVID-19 era	Entire period
All Monday	-0.237886 (-1.33488)	-0.105841 (-0.77325)	-0.169313 (-1.52323)	1.885978	1.505656	1.696690
All Tuesday	0.008964 (0.120725)	0.466461 (4.128562)	0.251637 (3.394834)	0.771643	1.247947	1.073996
All Wednesday	-0.021017 (-0.25312)	0.163787 (1.487481)	0.076961 (1.094311)	0.866874	1.221182	1.071208
All Thursday	-0.095721 (-0.86511)	0.140132 (1.202821)	0.030409 (0.375341)	1.144528	1.292079	1.228682
All Friday	-0.081703 (-0.48866)	0.025005 (0.246476)	-0.027153 (-0.28099)	1.745587	1.083192	1.443067
All Days of All Week	-0.08547	0.128542	0.0325082	1.317521	1.275527	1.385343

Source: Authors 'own estimate

Table 2separately displays the mean and the standard deviations of returns for each working day of the week, segregating the entire period into the pre-COVID period and the during-COVID period. We have separated day-wise returns (for all 5 days in a week) to analyze the behavior of returns of individual days to comprehend if the returns are statistically significant or not and if they endow with additional information that can be used by market participants. The result interestingly expounds that a positive mean return is found significant on Tuesday at the BSE market, corroborated by many researchers. In contrast, Monday, the opening date of the stock market at the beginning of each week, displays the worst return in all cases. Although for the whole period, Table 2 discloses the presence of significant negative returns on Mondays as well as on Fridays, sub-period-oriented result break-ups show a diverse narrative. During the pre-COVID period, the returns were negative for all working days except Tuesday. However, during the COVID period, returns about all days of the week except Monday were positive.

This result also divulges the varying pattern of volatility over the days of the week in the Indian stock market. Volatility, captured with respect to the standard deviation of returns, came out to be declining from the very beginning of the week till the middle of the week (Wednesday). After that, it remains increasing until the closure day of the week (Friday) of the stock market in the aggregate throughout the entire period. It signifies that in the case of BSE, increasing stock market volatility from the middle of the week to the close of the week raises the required rate of return on common stocks, and consequently, stock prices will fall, resulting in a decrease in daily return. Reversals will happen during the first part of the week until Wednesday as declining volatility trends set in, which results in an increase in stock price as well as stock return. However, in the pre-COVID period, the volatilities with respect to Monday, Wednesday, Thursday, and Friday have augmented, and on Tuesday, they have declined considerably. During the COVID period, the volatilities with respect to Monday and Thursday have amplified, and the volatilities on Tuesday, Wednesday, and Friday have decreased comparatively.

Table: 3: Day of the week effect and stock market volatility in pre-covid, during-covid and entire sample period (Ordinary Least Square technique)

BSE Returns				
Variables(Day of the week)	Coefficients	Pre-covid [1/01/2018 24/3/2020]	During- covid [25/3/2020-30/8/2022]	Entire period [1/01/2018 30/8/2022]
Monday	β_M	-0.231243* (-1.9877)	-0.109227 (-0.9369)	-0.275604* (-3.02)
Tuesday	β_T	0.002070 (0.0174)	0.469381* (4.0444)	0.132405* (2.4347)
Wednesday	β_W	-0.018207 (-0.1529)	0.153642 (1.3144)	-0.023593 (-0.2559)
Thursday	β_H	-0.09882 (-0.8262)	0.126809 (1.0906)	-0.083986 (-0.9089)
Friday	β_F	-0.080971 (-0.6833)	0.025726 (0.2145)	-0.137302 (-1.4809)
Return	R_{t-1}	-0.138106 (-3.2505)	0.022779 (0.5572)	-0.052598 (-1.7854)
Dummy	D_t	-	-	0.215715 (2.8991)

Source: Authors 'own estimate

*significant at 5% level; Durbin-Watson value: 1.8874

In table-3, in times of covid outbreak, a regression model with BSE sensex return as dependent variable and individual day of the week dummies being independent variables was estimated separately three times to reflect the volatility of the returns of the day of the week in BSE in pre covid, during covid and entire period of our study.

The result for BSE sensex return analysis for the entire study period indicates the highest return on Tuesday (0.132405), which is statistically significant, and we found no positive return on any day of the week other than Tuesday while studying the entire period data. However, the lowest insignificantly negative return was found on Wednesday (--0.023593). Therefore, Table 9 discloses that, with a t-statistic of 2.4347, returns for the entire study period are having a significantly positive effect on Tuesday only. The findings for the pre-COVID period and during the COVID period nevertheless tell a diverse narrative.

Our empirical results have shown that on Monday, the market had statistically significant negative returns. The most satisfactory explanation that could be cited for negative returns on Monday is that the most unfavorablenews appears during the weekends. These unfavorable news influences the majority of the investors negatively, causing them to sell on the following Monday.

In the pre-COVID period, all coefficients of return for each day of the week except Tuesday are seen to be negative and also not significant. The day level seasonality based on return corresponding to 'during COVID period' has been observed to be reversed: significant Tuesday effect (positive, t values being 4.0444), and the rest of the days of the week have insignificant positive effects. The above result ensures that the returns of the entire study have a significantly positive effect on Tuesday only, the t-statistic being 2.4347.

Conclusions

The empirical study observed the day-of-the-week effect abnormality in the Indian stock market for the period from January 1, 2018, to August 30, 2022, considering 1155 daily days of trading data. By applying the Ordinary Least Square technique, while looking at the entire sample for analysis to find out the day-of-the-week effect in the Indian equity market, we found that the highest return on Tuesday which is statistically significant, and we found no positive return on any day of the week other than Tuesday while studying entire period data. In the pre-COVID period, all coefficients of return for each day of the week except Tuesday are seen to be negative and also not significant. The day level seasonality based on return corresponding to 'during the COVID period' has been observed to be reversed: significant Tuesday effect and the rest of the days of the week have insignificant positive effects. The above result ensures that the returns of the entire study have a significantly positive effect on Tuesday only. Moreover, the observed findings have shown that the market has statistically significant negative returns on Monday. The reason may be because the most hostile news comes into sight during the weekends. These adverse news persuade the majority of the investors negatively, causing them to sell on the following Monday.

The above OLS regression results have been substantiated by the descriptive statistics where the behavior of returns of individual days figures out that a positive mean return is found significant on Tuesday at the BSE market, corroborated by many researchers. In contrast, Monday, the opening date of the stock market at the beginning of each week, displays the worst return in all cases. Sub-period-oriented result break-ups show a varied sequence of events. During the pre-COVID period, the returns were negative for all working days except Tuesday. However, during the COVID period, returns about all days of the week except Monday were positive.

The result also reveals the unstable pattern of volatility over the days of the week in the Indian stock market. Volatility, captured with respect of the standard deviation of returns, came out to be declining from the very beginning of the week till the middle of the week (Wednesday). After that, it remains increasing until the closure day of the week (Friday) of the stock market in the aggregate throughout the entire period. , In the pre-COVID period, the volatilities concerning Monday, Wednesday, Thursday, and Friday have augmented, and on Tuesday, they have declined considerably. During the COVID period, the volatilities concerning Monday and Thursday have amplified, and the volatilities on Tuesday, Wednesday, and Friday have decreased comparatively.

The results of our study will be helpful for retail investors and portfolio managers in understanding the portfolio allocation methods in case of diverse day-of-the-week effect returns and volatility arising due to the catastrophe caused by the COVID-19 eruption.

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