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Nisarg A. Joshi*
Nirma University

IMPACT OF COVID-19 ON PERFORMANCE ON INDIAN STOCK INDICES: A STUDY FOR NSE COMPOSITE AND SECTORAL INDICES

Keywords: COVID-19, volatility, index returns, NSE, sectoral indices, post-COVID-19

J E L Classification: C32, C41, F21, G01, G11.

Abstract: Purpose/Objective: The objective of the paper was to scrutinize the impact of COVID-19 on the performance of composite and sectoral indices of National Stock Exchange (NSE) of India.

Methodology and Approach: The study included sample daily closing prices from July 2019 to December 2020 for two composite indices and nine sectoral indices of NSE. The sample was divided into three sub-samples to check the impact before, during and after (after the lockdown was lifted) the pandemic on the volatility of returns. The volatility measures were regressed using a dummy variable for COVID-19.

Findings: The results showed that there was an increase in the volatility of returns of the indices during COVID-19 as compared to post-lockdown period. It was also found that the skewness of returns of the indices have become more negative in the post-COVID-19 (post-lockdown) period.

Practical Implications/Conclusion: The findings of the study have significant implications and impacts regarding the decision making for equity analysts, portfolio management firms, investors and traders for assessing their investment in a better way and

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* Contact information: nisarg@nisargjoshi.com, Institute of Management, Nirma University Ahmedabad – 382481, Gujarat, India, phone: 9723500052; ORCID ID: https://orcid.org/0000-0002-2417-4158.

deciding their investments. The author believed that these results would magnify the volatility relations.

Introduction

The stock prices have plunged significantly due to COVID-19, which has led to unexpected downward pressure on global indices like never before. In this context, there are recent and relevant studies which had studied the effect of COVID-19 on performance of stock indices, volatility, stability of stock indices etc., which were supported by other empirical studies. Such signal of panic trading and augmented volatility in various markets across the globe was recognized by certain studies such as Al-Awadhi, Al-Saifi, Al-Awadhi and Alhamadi, 2020; Baker, Bloom, Davis, Kost, Sammon and Viratyosin, 2020; Kartal, Depren and Kılıç Depren, 2020; Phan and Narayan, 2020; Harif, Aloui, and Yarovaya, 2020. Baker et al. (2020) estimated that the way the market was showing the volatility during the month of March; 2020 would be much greater than the historical crisis such as Black Monday triggered by DJIA decline of 22% in one day in 1987 or the monetary crisis at the global level which was prompted by subprime crisis of 2008 or the Great Depression of 1930. This was experienced by the Indian stock indices as the NSE and BSE paused the trading amid triggering the lower circuit threshold of 10% twice in two weeks during March 2020.

The Indian stock market started having major shocks in the first quarter of the year 2020 prejudiced by the global meltdown and COVID-19 which was centered in China initially. The first crash in Indian market was seen on February 1, 2020 when Nifty crashed by 3% and Sensex crashed by 2% in one day. This was just the beginning as the stock market crash risk became significant amid WHO's announcement of COVID-19 as a potential epidemic. In the last week of February 2020, both Sensex and Nifty plunged for entire week resulted in the worst weekly fall in more than a decade. The stock market crash became severe in the month of March when in the first week of March markets went down by 1,000 points. On March 9, 2020, Sensex went down by 1,941.67 points and Nifty went down by 538 points amid the havoc created by COVID-19 outbreak. On 12th March, WHO acknowledged COVID-19 as universal epidemic and Sensex closed at 33 months low and crashed by 8.18% and Nifty crashed by 8.30%. During the next week, Sensex plunged continuously for 4 trading days where the highest single day crash was 8%. The biggest crash in one day in the Indian markets was seen next week when COVID-19 led to lockdown in India along

with other countries and the markets crashed in the fear of recession where Sensex crashed by 13.15% and Nifty reduced by 12.98%. Mazur, Dang and Vega (2020) studied the crash of stock market amid COVID-19 and found a significant volatility.

This paper emphasizes the impact of COVID-19 on performance of stock indices in India. This study quantifies the performance of Indian stock indices by measuring the volatility of index returns. The purpose of the study is to augment the argument of response of the stock market to unforeseen events for assessing the risk and making the decisions. This study tries to focus on checking the variables used for predicting the performance of the stock indices such as standard deviation, skewness and kurtosis.

For last couple of years, many researchers have worked on checking the effects of coronavirus on different factors like economic performance, liberal policies announced by the government, health sector, tourism and hospitality, migration and contrary, stock indices etc. Most of the studies done on the stock markets have used composite indices of the markets and majorly from the economically advanced economies. There are also a few studies available which have worked on the similar line for the developing economies using the composite indices but there is very little work done on all the sectoral indices present in a particular market. There was one study done in the context of Indian market, which has used pre-COVID-19 and during-COVID-19 period for their event study (Chaudhary, Bakhshi & Gupta, 2020). This study focuses on studying the impact of COVID-19 on Indian market using the composite index along with the sectoral indices.

Literature Review

Stock market returns are affected by major events happening in a country as well as in the world and these returns are the true mirror of the economic situation of any country. Previous studies show the impact of news on the stock returns (Li, 2018). Pendell and Cho (2013) studied the impact of foot-and-mouth disease outbreaks on the performance of stock returns. Al-Awadhi et al. (2020) found that the number of cases and deaths due to COVID-19 resulted in negative returns in the stock listed in China.

Loh (2006) studied the impact of another pandemic of SARS on the aviation sector stocks of various countries and found that aviation sector was more sen-

sitive to the information of pandemic as compared to other industries. These results were reinforced by another study by (Chen, Jang & Kim, 2007; Brown & Smith, 2008) who concluded that along with aviation sector, other industries like hotels, tourism, FMCG, etc. also had a significant negative impact caused by SARS. Wang and Kutan (2013) concluded that there was a significant positive return of the stock of biotechnology and pharmaceutical companies of Taiwan amid pandemic. In this line, another study was conducted by Del Giudice and Paltrinieri (2017) with respect to another pandemic in the African region named Ebola and its impact on stock returns.

Nageri (2019) studied the volatility persistence of stock returns for Nigerian stock index during pre- and post-sub-prime crisis using GARCH model with three error distribution and found that the volatility in the Nigerian market was low before the sub-prime crisis and was very high after sub-prime crisis. He also concluded that the traders who short their positions to make abnormal profits by spreading rumors should be monitored, regulated and restricted to avoid high volatility persistence.

Fernandes (2020) stated that the COVID-19 pandemic could not be compared with previous epidemic as it made a more severe impact on economies of the globe and were not restricted to specific region or economies of the world. COVID-19 had a massive impact on the stock indices across the world like never before because along with the downfall in the economic activities, other factors like investor sentimentality, fear, uncertainty, etc. also affected the markets negatively. The global stock markets were affected by COVID-19 in the most dangerous manner as compared to other pandemics in the history of mankind (Goodell, 2020; Okorie & Lin, 2021; David, Inácio & Tenreiro Machado, 2021).

Asian markets were affected more by COVID-19 as compared to developing indices in the European region (Topcu & Gulal, 2020). The impact of COVID-19 in India was far more severe as compared to other economic events such as demonetization of the year 2016 or the implementation of Goods and Services Tax in the later year (Mishra & Mishra, 2020). There were numerous studies conducted in the recent past to how the stock markets have responded to COVID-19 based on various samples like regions, developing economies, most affected economies, etc. (Zaremba, Kizys, Aharon & Demir, 2020; Siddiqui, Ahmed & Naushad, 2020; Okorie & Lin, 2020; Ali, Alam & Rizvi, 2020; Izzeldin, Muradoğlu, Pappas & Sivaprasad, 2021; Aslam, Ferreira, Mughal & Bashir, 2021).

Liu, Manzoor, Wang, Zhang and Manzoor (2020) used event study to check the effect of COVID-19 on the stock returns of the economies which were affect-

ed the most by the pandemic and found that the stock indices reacted negatively to the outbreak of the pandemic which resulted in a fall in the returns. In the same line, Mishra and Mishra (2020) studied effect of COVID-19 on the Asian economies neighboring China using the same method and found the results which were consistent with Liu et al. (2020). Singh, Dhall, Narang and Rawat (2020) used an event study with panel regression to check the stock market responses amid COVID-19.

International financial markets became unpredictable and the risk has also elevated due to unprecedented pandemic situations (Zhang, Hu & Ji, 2020). According to Albulescu (2020), the volatility index of China and other countries nearby and estimated that the volatility in the market will increase with increase in the spread of COVID-19. Ahmar and Val (2020) studied the short-run impact of coronavirus on Spain's stock market index and found that SutteARIMA was a better method to estimate the effect of COVID-19 on the index.

Methods

Data Sampling

The market returns were obtained from the official website of National Stock Exchange by taking the daily closing prices of two composite indices of the Exchange, namely Nifty 50 and Nifty 500 and nine sectoral indices, i.e., Bank Nifty, Nifty Auto, Nifty Realty, Nifty Financial Services, Nifty FMCG, Nifty IT, Nifty Media, Nifty Metal and Nifty Pharma. The closing prices were taken for the period from January 1, 2019 to December 31, 2020 and from July 2019 to December 2020. Table 1 shows the descriptive statistics for the entire sample separated into three sub-samples for the pre-COVID-19 period (July 2019 to December 2019), during COVID-19 lockdown period (January 2020 to June 2020) and post-COVID-19 lockdown period (July 2020 to December 2020).

Methodology

Daily returns of the composite indices and the sectoral indices were calculated using the natural logarithm of the daily price changes. The daily returns were calculated using the following equation where R_t is the return on index, P_t is the price on index, and P_{t-1} is the price on index at the end of the previous day.

$$R_t = ln\left(\frac{P_{it}}{P_{i,t-1}}\right)$$

A regression framework was developed to examine the impact of COVID-19 on volatility of the index returns. The regression framework was constructed to measure the impact using different measures of variability such as standard deviation (SD), skewness (SKEW) and kurtosis (KUR). For this purpose, COVID-19 was added as a dummy variable in the equation as a binary variable with '0' for the pre-COVID-19 period and '1' for the during COVID-19 (lockdown period) and post-COVID-19 (post-lockdown) period. For the purpose of the study, post-lockdown period was considered as post-COVID-19 period. Though the pandemic did not end in India in June 2020, once the lockdown was lifted and the phase of wise unlock was implemented by the government, the economic activities restarted and the impact of the removal of restrictions on the volatility was investigated as post-COVID-19 period. The analysis was done in two parts to check the impact of COVID-19 on the performance of the Indian indices. The first regression analysis was done for the period before COVID-19 (July 2019 to December 2019) and during COVID-19 lockdown (January 2020 to June 2020). The second regression analysis was done for the period before COVID-19 (July 2019 to December 2019) and for the period after COVID-19 lockdown was lifted (July 2020 to December 2020).

The impact of COVID-19 on volatility of returns is captured by a variety of factors such as increase in number of COVID-19 positive cases, increase in number of deaths due to COVID-19, the impact of the interaction between number of cases and deaths, increase in number of cases and deaths globally, etc. These factors will lead to change in the investors' mentality regarding investment during the pandemic. The investors will be hesitant to invest in the capital markets which will lead to increase in fear of index/volatility index. Such fear will in turn lead to increased volatility in the market and will result in the market crash due to such pandemic. The objective of the paper is to measure such impact of COVID-19 on variability of returns by taking a binary dummy variable as mentioned above. In the first part of the regression analysis, the impact of COVID-19 on volatility of the index returns was measured as the combined effect of $\beta_0 + \beta_1$ as the impact of COVID-19 was captured by the dummy variable shown as β_1. Similarly, the impact of removal of lockdown (post-COVID period) on volatility of index returns was captured by

$\beta_0 + \beta_1$ as the impact of post-COVID-19 period was captured by the dummy variable shown as β_1.

This study was conducted using the regression framework under the assumptions of Generalized Least Squares (GLS) method rather than OLS regression considering heteroscedasticity and autocorrelation of the data. For the purpose of this analysis, all the dependent variables were calculated using the rolling data for one month.

These models had taken SD, SKEW and KUR as the dependent variables for each composite and sectoral index in the sample and the impact of COVID-19 was checked using a binary dummy variable. The value of dummy variable was considered as '0' for the period prior to the pandemic (July 2019 to December 2019) and was considered '1' for the period during the pandemic (January 2020 to June 2020) and after the lockdown was lifted (July 2020 to December 2020).

$$SD_t = \beta_0 + \beta_1 COVID_t + \varepsilon_t$$

Where SD_t was the standard deviation for the index at time t, and COVID-19 was a dummy variable equal '0' for the period before COVID-19 and 1 for the period during and after COVID-19 lockdown (i.e., from January 2020 to June 2020, and from July 2020 to December 2020) and ε_t is the error term at time t.

$$SD_t = \beta_0 + \beta_1 COVID_t + \varepsilon_t$$

Where $SKEW_t$ was the skewness for the index at time t, and COVID-19 was a dummy variable equal '0' for the period before COVID-19 and 1 for the period during and after COVID-19 lockdown (i.e., from January 2020 to June 2020, and from July 2020 to December 2020) and ε_t is the error term at time t.

$$KUR_t = \beta_0 + \beta_1 COVID_t + \varepsilon_t$$

Where KUR_t was the kurtosis for the index at time t, and COVID-19 was a dummy variable equal '0' for the period before COVID-19 and 1 for the period during and after COVID-19 lockdown (i.e., from January 2020 to June 2020, and from July 2020 to December 2020) and ε_t is the error term at time t.

Results and Discussion

The results of the descriptive statistics are shown in next three tables. The descriptive statistics have been shown for three periods, before the pandemic (July 2019 – December 2019) and during the pandemic lockdown (January 2020 – June 2020) and after the pandemic lockdown (July 2020 – December 2020) after keeping in mind a comparable time-frame for the sub-samples. The mean returns of the pre-COVID-19 period and post-COVID-19 period (post-lockdown) were found to be positive for all indices whereas the mean returns were negative for the COVID-19 period except the returns of the pharma sector index which were found to be positive during the COVID-19 period. The mean returns of indices in the pre-COVID-19 period were found to be positive except four sectoral indices like information technology sector, media, metal and pharmaceutical sector. Three out of these four sectors' returns plunged further during the COVID-19 period majorly after the lockdown was imposed by the government and all other indices' returns were also turned into negative except pharma which performed well due to pandemic. Once the lockdown was lifted and the economy had started gaining its momentum, all the indices have shown positive returns in the period of July to December 2020.

The market was found to be more volatile during the COVID-19 period. The standard deviation of returns was very high during the COVID-19 period due to investor sentimentality towards fear due to pandemic and the supply pressure in the market. The highest volatility was found in sectoral indices like banks, financial services, metal sector and realty sector as compared to composite indices. The volatility in the post-COVID-19 period was similar to the volatility experienced by the indices in the time period before COVID-19.

Table 1. Descriptive Statistics for Pre-COVID Period (July 2019 – December 2019)

	Nifty 50	Nifty 500	Bank Nifty	Nifty Auto	Nifty Realty	Nifty Fin. Ser.	Nifty FMCG	Nifty IT	Nifty Media	Nifty Metal	Nifty Pharma
Mean	0.0003	0.0002	0.0002	0.0003	0.0004	0.0006	0.0002	-0.0002	-0.0010	-0.0005	-2.5E-05
Median	0.0008	0.0012	0.0008	-0.0012	0.0019	0.0011	-0.0001	0.0006	-0.0010	-0.0011	-3.7E-05
Max	0.0518	0.0515	0.0798	0.0944	0.0405	0.0690	0.0431	0.0281	0.0744	0.0552	0.0321
Min	-0.0216	-0.0219	-0.0280	-0.0402	-0.0636	-0.0302	-0.0197	-0.0479	-0.0463	-0.0382	-0.0340
Std. Dev.	0.0094	0.0094	0.0146	0.0176	0.0163	0.0133	0.0088	0.0106	0.0199	0.0185	0.0115
Skewness	1.2944	1.2127	1.4782	1.0348	-0.5572	1.3446	1.5602	-0.7979	0.2665	0.1646	-0.0114
Kurtosis	9.6065	9.4884	10.131	8.7863	4.5294	9.8853	10.288	5.7346	4.0100	2.6831	3.0407
JB Statistic	258.03	245.91	305.45	193.54	18.35	280.03	322.17	51.37	6.6851	1.0704	0.0111
Prob.	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0353	0.5855	0.9944
Sum	0.0317	0.0219	0.0334	0.0396	0.0471	0.0712	0.0192	-0.0179	-0.1230	-0.0619	-0.0031
Sum Sq. Dev.	0.0108	0.0107	0.0262	0.0378	0.0325	0.0215	0.0094	0.0139	0.0484	0.0419	0.0161
Obs.	123	123	123	123	123	123	123	123	123	123	123

S o u r c e : author's calculation.

Table 2. Descriptive Statistics for during COVID Period (January 2020 to June 2020)

	Nifty 50	Nifty 500	Bank Nifty	Nifty Auto	Nifty Realty	Nifty Fin. Ser.	Nifty FMCG	Nifty IT	Nifty Media	Nifty Metal	Nifty Pharma
Mean	-0.0013	-0.0012	-0.0033	-0.0016	-0.0031	-0.0026	-1.6E-05	-0.0005	-0.0024	-0.0027	0.0017
Median	-0.0005	0.0011	-0.0008	0.0012	-0.0005	0.0013	0.0010	0.0012	0.0003	0.0003	0.0008
Max	0.0840	0.0740	0.0999	0.0989	0.0619	0.0891	0.0799	0.0864	0.0644	0.0759	0.0986
Min	-0.1390	-0.1370	-0.1831	-0.1490	-0.1205	-0.1736	-0.1119	-0.1006	-0.1089	-0.1233	-0.0935
Std. Dev.	0.0267	0.0251	0.0351	0.0298	0.0299	0.0343	0.0219	0.0257	0.0288	0.0318	0.0224
Skewness	-1.268	-1.5744	-1.1526	-0.7965	-1.0939	-1.1815	-0.5851	-0.6976	-0.9362	-0.7369	-0.1357
Kurtosis	9.5213	10.5482	8.5450	8.6649	5.5769	7.86//62	10.888	7.1765	4.8596	5.2348	8.2399
JB Statistic	250.95	342.79	184.81	177.47	58.56	149.98	325.95	99.375	35.695	36.729	141.09
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	-0.1664	-0.1526	-0.4087	-0.2050	-0.3857	-0.3208	-0.0019	-0.0590	-0.2946	-0.3411	0.2166
Sum Sq. Dev.	0.0871	0.0772	0.1504	0.1089	0.1096	0.1438	0.0588	0.0810	0.1015	0.1238	0.0616
Obs.	123	123	123	123	123	123	123	123	123	123	123

S o u r c e : author's calculation.

Table 3. Descriptive Statistics for Post-COVID Period (July 2020 to December 2020)

	Nifty 50	Nifty 500	Bank Nifty	Nifty Auto	Nifty Realty	Nifty Fin. Ser.	Nifty FMCG	Nifty IT	Nifty Media	Nifty Metal	Nifty Pharma
Mean	0.0023	0.0023	0.0029	0.0024	0.0033	0.0028	0.0009	0.0038	0.0015	0.0038	0.0019
Median	0.0033	0.0036	0.0044	0.0031	0.0051	0.0038	0.0013	0.0031	0.0024	0.0044	0.0026
Max	0.0223	0.0233	0.0406	0.0332	0.0620	0.0402	0.0276	0.0510	0.0522	0.0430	0.0522
Min	-0.0319	-0.0350	-0.0418	-0.0473	-0.0581	-0.0332	-0.0306	-0.0429	-0.0640	-0.0570	-0.0478
Std. Dev.	0.0097	0.0094	0.0172	0.0137	0.0192	0.0150	0.0087	0.0139	0.0187	0.0171	0.0159
Skewness	-1.0795	-1.3544	-0.2894	-0.7416	-0.1069	-0.1845	-0.4300	0.2058	-0.3412	-0.7334	-0.1522
Kurtosis	4.5436	5.7656	2.8362	4.8833	3.9127	2.7101	4.6969	4.9453	4.3969	4.6942	4.6249
JB Statistic	37.86	80.55	1.94	30.89	4.7240	1.1841	19.45	21.25	12.992	26.994	14.691
Prob.	0.0000	0.0000	0.3781	0.0000	0.0942	0.5531	0.0000	0.0000	0.0015	0.0000	0.0006
Sum	0.3054	0.3068	0.3804	0.3135	0.4374	0.3645	0.1282	0.4969	0.2049	0.4912	0.2573
Sum Sq. Dev.	0.0121	0.0114	0.0382	0.0242	0.0475	0.0289	0.0098	0.0249	0.0451	0.0376	0.0324
Obs.	129	129	129	129	129	129	129	129	129	129	129

Source: author's calculation.

The skewness values of all the indices were found to be negative during the COVID-19 period and post-COVID-19 period as compared to positively skewed values before COVID-19 except realty and IT sector. These two sectors had negative skewness values for all the three sub-sample time frames. The returns were following leptokurtic distribution based on the high kurtosis values for all the indices for entire time frame. The results of JB statistic showed that majority of the indices did not follow normal distribution during the entire time period except metal and pharma sectors which were found to have normal distribution in pre-COVID-19 period whereas bank sector and financial services sector were having normal distribution in the post-COVID-19 period.

The correlation results show that the correlation among indices have increased during the pandemic. For the post-COVID-19 period, the correlation had decreased among the indices. These findings are in consistent with Akter and Nobi (2018) who found that the returns of the indices were less dispersed during the pandemic.

The results of the regression analysis are shown in table 4, 5 and 6. This first analysis shows the impact of COVID-19 on indices volatility before COVID-19 and during COVID-19, including the lockdown period. The results show that there is a significant positive relationship between the pandemic and the volatility of all the indices in the sample. These findings are in line with Yousef (2020) who also concluded that the volatility of Indian market had increased amid COVID-19.

Table 4. Regression Results for Model 1 for Pre-COVID and during COVID-19 (July 2019 to June 2020)

Index	Constant (β_0)	P value	(β_1)	P value	Adjusted R^2
Nifty 50	0.0090 (9.4204)	0.0000***	0.0129 (9.5818)	0.0000***	0.2704
Nifty 500	0.00896 (10.0271)	0.0000***	0.0116 (9.1902)	0.0000***	0.2541
Nifty Bank	0.013595 (11.3632)	0.0000***	0.015528 (9.1772)	0.0000***	0.2536
Nifty Auto	0.016768 (16.7816)	0.0000***	0.008558 (6.0559)	0.0000***	0.1271
Nifty Reality	0.016174 (21.78458)	0.0000***	0.009688 (9.2270)	0.0000***	0.2556
Nifty Financial Services	0.012364 (10.54431)	0.0000***	0.016253 (9.8011)	0.0000***	0.2795

Table 4. Regression…

Index	Constant (β_0)	P value	(β_1)	P value	Adjusted R^2
Nifty FMCG	0.008376 (10.39899)	0.0000***	0.009675 (8.4938)	0.0000***	0.2250
Nifty IT	0.010451 (11.8971)	0.0000***	0.010877 (8.7553)	0.0000***	0.2359
Nifty Media	0.019580 (29.86678)	0.0000***	0.006062 (6.5389)	0.0000***	0.1456
Nifty Metal	0.018221 (22.2939)	0.0000***	0.010303 (8.9137)	0.0000***	0.2426
Nifty Pharma	0.011979 (16.8907)	0.0000***	0.007053 (7.0319)	0.0000***	0.1651

S o u r c e : author's calculation, ***Significant at 1% level, **Significant at 5% level.

The results in table 4 show that Nifty 50 had the highest value of co-efficient among composite indices which can be inferred as the blue-chip companies (Large Cap.) are more volatile than small and mid-cap companies. It can also be seen in the results as the co-efficient of Nifty 50 was higher than Nifty 500 index. Among the sectoral indices, finance sector was found to have highest volatility (0.016253) followed by the bank sector (0.015528). These sectors had experienced higher volatility than all the composite indices. These results indicate that investor sentimentality was against the financial sector during the pandemic time considering the increase in NPAs amid extended lockdown and financial relaxations. The health care sector was found to have the least volatility during COVID-19 and shown upward trend.

The results show the impact of COVID-19 on volatility of returns. The results show that the volatility of returns of Nifty 50 index in the pre-COVID-19 period was 0.9% which had increased to 2.19% during the pandemic. The highest volatility of returns was found in the bank sector which had increased from 1.36% in the pre-COVID-19 period to 2.91% during the lockdown period followed by the financial services sector (2.86%). Pharma sector and FMCG sector had shown the resistance during the COVID-19 period as they had shown the least volatility of returns.

The regression results regarding the impact of COVID-19 on indices volatility before COVID-19 and after COVID-19 lockdown are also shown in table 5. These results show that, once the lockdown was lifted by the government and the economic

activities resumed, there was a mixed relationship between COVID-19 and volatility of the indices. The co-efficient value of all indices from the sample have shown negative value. These results indicate that post-COVID-19, once the lockdown had lifted, there was a negative relationship between COVID-19 and volatility. Nifty pharma had shown the insignificant relationship between COVID-19 and volatility.

Table 5. Regression Results for Model 1 for Pre-COVID-19 and Post-COVID-19 (July 2019 to December 2020 & July 2020 to December 2020)

Index	Constant (β_0)	P value	(β_1)	P value	Adjusted R^2
Nifty 50	0.356603 (5.6631)	0.0000***	-0.958746 (-10.7661)	0.0000***	0.3193
Nifty 500	0.303785 (4.7878)	0.0000***	-1.082286 (-12.0613)	0.0000***	0.3710
Nifty Bank	0.077353 (1.0739	0.2839	-0.645293 (-6.3346)	0.0000***	0.1377
Nifty Auto	0.605246 (8.8857)	0.0000***	-1.126552 (-11.69489)	0.0000***	0.3566
Nifty Reality	-0.332747 (-5.9633)	0.0000***	-0.639902 (-8.1090)	0.0000***	0.2091
Nifty Financial Services	0.096032 (1.3515)	0.1778	-0.835188 (-8.3115)	0.0000***	0.2175
Nifty FMCG	0.227140 (2.9502)	0.0035***	-0.424732 (-3.9009)	0.0001***	0.0549
Nifty IT	-0.543955 (-7.5705)	0.0000***	0.225583 (2.2199)	0.0273**	0.0158
Nifty Media	0.189601 (6.0433)	0.0000***	-0.8295 (-18.6962)	0.0000***	0.5872
Nifty Metal	0.167234 (6.9002)	0.0000***	-0.558835 (-16.3044)	0.0000***	0.5195
Nifty Pharma	0.168255 (2.7964)	0.0056***	-0.036558 (-0.4296)	0.6678	-0.0033

S o u r c e : author's calculation, *** Significant at 1% level, ** Significant at 5% level.

The results showing the impact of COVID-19 on skewness are shown in table 6 and table 7. The results of the first analysis depict that there is a mixed relation between COVID-19 and skewness of all the indices in the sample. Among composite indices, Nifty 500 (0.697574) has the highest positive co-efficient which

can be inferred as the small and mid-cap stock have higher skewness as compared to stock which are included in Nifty 50. Nifty 50 index showed an insignificant positive relationship between COVID-19 and skewness.

The sectoral indices which were found to have the highest negative co-efficient is Nifty IT (-1.170203), and highest positive co-efficient is Nifty Realty (2.089636). Nifty bank, Nifty auto, Nifty financial services and Nifty media have insignificant relationship between COVID-19 and skewness. The results of the analysis for the pre-COVID-19 and post-COVID-19 period also show mixed relation between COVID-19 and skewness of the indices. Nifty 500 index and Nifty FMCG index showed insignificant positive relationship between COVID-19 and skewness.

Table 6. Regression Results for Model 2 for Pre-COVID-19 and during COVID-19 (July 2019 to June 2020)

Index	Constant (β_0)	P value	(β_1)	P value	Adjusted R^2
Nifty 50	1.270817 (8.3014)	0.0000***	0.309386 (1.4289)	0.1543	0.0042
Nifty 500	1.147216 (7.0876)	0.0000***	0.697574 (3.0474)	0.0026***	0.0327
Nifty Bank	1.504908 (11.3424)	0.0000***	0.008447 (0.0450)	0.9641	-0.005
Nifty Auto	1.818009 (9.6656)	0.0000***	-0.409359 (-1.5389)	0.1251	0.0056
Nifty Realty	0.464673 (1.9774)	0.0491**	2.089636 (6.2880)	0.0000***	0.1359
Nifty Financial Services	1.792925 (13.5131)	0.0000***	-0.02242 (-0.1195)	0.9050	-0.004
Nifty FMCG	1.572924 (9.2106)	0.0000***	-0.355282 (-1.4711)	0.1426	0.0047
Nifty IT	2.288402 (10.7758)	0.0000***	-1.170203 (-3.8964)	0.0001***	0.0547
Nifty Media	0.637226 (7.1181)	0.0000***	-0.000420 (-0.0033)	0.9974	-0.0041
Nifty Metal	-0.433009 (-6.0955)	0.0000***	0.911095 (9.0690)	0.0000***	0.2490
Nifty Pharma	0.259024 (2.3996)	0.0172**	1.077574 (7.0587)	0.0000***	0.1661

S o u r c e : author's calculation, *** Significant at 1% level, ** Significant at 5% level.

Table 7. Regression Results for Model 2 for Pre-COVID-19 and Post-COVID-19 (July 2019 to December 2020 & July 2020 to December 2020)

Index	Constant (β_0)	P value	(β_1)	P value	Adjusted R^2
Nifty 50	0.008977 (40.7533)	0.0000	0.001018 (3.3080)	0.0011	0.0381
Nifty 500	0.008962 (39.7758)	0.0000	0.000474 (1.5043)	0.1338	0.0050
Nifty Bank	0.013595 (34.5211)	0.0000	0.004555 (8.2760)	0.0000	0.2119
Nifty Auto	0.016768 (44.8521)	0.0000	-0.003162 (-6.0509)	0.0000	0.1243
Nifty Reality	0.016174 (45.6823)	0.0000	0.003266 (6.5993)	0.0000	0.1450
Nifty Financial Services	0.012364 (33.8803)	0.0000	0.003466 (6.7948)	0.0000	0.1525
Nifty FMCG	0.008376 (43.7738)	0.0000	6.90E-05 (0.2580)	0.7966	-0.0037
Nifty IT	0.010451 (56.5388)	00000	0.003620 (14.0138)	0.0000	0.4377
Nifty Media	0.019580 (60.1984)	0.0000	-0.001317 (-2.8963)	0.0041	0.0286
Nifty Metal	0.018221 (73.0026)	0.0000	-0.001500 (-4.2990)	0.0000	0.0651
Nifty Pharma	0.011979 (61.9221)	0.0000	0.003771 (13.9458)	0.0000	0.4353

S o u r c e : author's calculation, *** Significant at 1% level, ** Significant at 5% level.

The relationship between COVID-19 and kurtosis shows a negative relationship between COVID-19 and kurtosis. In the analysis of pre-COVID-19 and during COVID-19 period, Nifty 500 index was found to have highest negative relationship, which can be inferred as the small and mid-cap stocks have higher skewness as compared to stocks which are included in Nifty 50. The second analysis shows mixed relationship in the post-COVID-19 period where five indices out of the sample show positive relationship out of which only two indices' results were significant.

Table 8. Regression Results for Model 3 for Pre-COVID-19 and during COVID-19 (July 2019 to June 2020)

Index	Constant (β_0)	P value	(β_1)	P value	Adjusted R^2
Nifty 50	0.356603 (5.7856)	0.0000***	-1.174631 (-13.6350)	0.0000***	0.4242
Nifty 500	0.303785 (4.5401)	0.0000***	-1.280558 (-13.6929)	0.0000***	0.4263
Nifty Bank	0.077353 (1.1362)	0.2570	-0.402242 (-4.2273)	0.0000***	0.0630
Nifty Auto	0.605246 (9.1783)	0.0000***	-1.034794 (-11.2274)	0.0000***	0.3325
Nifty Reality	-0.332747 (-8.2767)	0.0000***	0.471542 (8.3918)	0.0000***	0.2167
Nifty Financial Services	0.096032 (1.3958)	0.1640	-0.317783 (-3.3047)	0.0011***	0.0380
Nifty FMCG	0.227140 (3.3005)	0.0011***	-0.417605 (-4.3416)	0.0000***	0.0664
Nifty IT	-0.543955 (-7.3702)	0.0000***	0.7906 (7.6643)	0.0000***	0.1870
Nifty Media	0.189601 (4.0336)	0.0001***	-0.176333 (-2.6840)	0.0078***	0.0241
Nifty Metal	0.167234 (4.4952)	0.0000***	-0.4836 (-9.3009)	0.0000***	0.2541
Nifty Pharma	0.168255 (3.1101)	0.0021***	-0.261170 (-3.4540)	0.0006***	0.0417

S o u r c e : author's calculation, *** Significant at 1% level, ** Significant at 5% level.

Table 9. Regression Results for Model 3 for Pre-COVID-19 and Post-COVID-19 (July 2019 to December 2020 & July 2020 to December 2020)

Index	Constant (β_0)	P value	(β_1)	P value	Adjusted R^2
Nifty 50	1.270817 (7.3182)	0.0000***	-0.394219 (-1.6242)	0.1000*	0.0065
Nifty 500	1.147216 (5.4005)	0.0000***	0.353545 (1.1908)	0.2349	0.0017
Nifty Bank	1.504908 (13.3041)	0.0000***	-1.677408 (-10.6098)	0.0000***	0.3077
Nifty Auto	1.818009 (9.4877)	0.0000***	-0.491157 (-1.8339)	0.0679*	0.0093
Nifty Reality	0.464673 (3.7878)	0.0002***	0.215547 (1.2571)	0.2099	0.0023
Nifty Financial Services	1.792925 (17.4404)	0.0000***	-2.227391 (-15.5019)	0.0000***	0.4881
Nifty FMCG	1.572924 (11.1982)	0.0000***	-0.858837 (-4.3747)	0.0000***	0.0674
Nifty IT	2.288402 (11.9478)	0.0000***	-0.543323 (-2.0296)	0.0435**	0.0123
Nifty Media	0.637226 (5.6164)	0.0000***	0.202065 (1.2742)	0.2038	0.0025
Nifty Metal	-0.433009 (-4.5018)	0.0000***	1.310607 (9.7489)	0.0000***	0.2726
Nifty Pharma	0.259024 (2.8173)	0.0052***	1.066053 (8.2959)	0.0000***	0.2128

S o u r c e : author's calculation, *** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.

Conclusion

The purpose of the study is to check the impact of COVID-19 on the variability of returns of composite and sectoral indices of the Indian market. This study focuses on change in the returns of the sample during the pandemic and after the pandemic by measuring the forecasting variables of the indices' performance. The findings show that the Indian indices have shown more volatility during COVID-19 as compared to pre-COVID-19 and post-COVID-19 period.

The study prompts that investor sentimentality can be prevented against pessimistic behavior if the panic is being controlled. The findings of the study

have shown that variability of returns in terms of standard deviation turned negative in the post-COVID-19 period. For the benchmark index of Nifty 50, the standard deviation of returns was found to be 2.19% during the COVID-19 period which had decreased to -0.60% in the post-COVID-19 period.

This study has analyzed the relationship between COVID-19 and volatility of stock returns for two composite indices and nine sectoral indices using three measures, namely skewness, standard deviation and kurtosis. The study used the daily closing prices of all the indices for the period from July 2019 to December 2020, where the sample was divided into three sub-samples, i.e., pre-COVID-19 period, during COVID-19 period and post-COVID-19 period. The major findings of the study indicate that the average returns of the indices to be negative during COVID-19 period. It is also evident that the indices in the sample replicate a very high volatility during the pandemic period as compared to before COVID-19 and post-COVID-19 period.

The results of generalized least squares regression show that there is a significant positive correlation between COVID-19 and standard deviation of the indices during COVID-19 period. The post-COVID-19 relationship shows that the volatility in the indices reduced during the period from July 2020 to December 2020. The results of the impact of COVID-19 on skewness of index returns show that there is a mixed relationship between COVID-19 and skewness of returns of indices. The relationship between COVID-19 and kurtosis show negative results during the pandemic as well as the post-pandemic period.

The findings of the study have significant implications and impacts regarding the decision making for equity analysts, portfolio management firms, investors and traders for assessing their investment in a better way and deciding their investments. Increase in volatility will resort to anxiety in the investors and traders which will motivate the participants to take lesser risk for the time-being. The results of this study have appropriate impact in relation to FDIs and FIIs in India and across the world.

One of the major implications of this study is for the policymakers to study the changing aspects of the investor's sentiments and the pandemic. This can help the policymakers to regulate and control the impact and intensity of the anxiety in the investors so that markets can be reinforced in a better way and volatility can be avoided to the maximum possible extent. The policymakers should be more careful regarding the crash risk of stock indices during COVID-19 because of upsurge in COVID-19 cases and deaths.

The results of the study suggest that a rational investor should not invest in the stocks during the pandemic. It can be recommended to speculators that they can build a position at a low price when the market plunges and make a considerable profit in a short time period resulting from the recovery of the market. The investors who are interested in the investment over a long horizon should invest in the blue-chip stocks or the market indices to get exponential returns over a period of time.

In the future, the researchers can take a cue from this study as this study is constructed using the composite indices and sectoral indices using daily closing prices. It does not include individual stocks which can be further investigated to check the impact of the pandemic on a particular stock's performance. A study can be done using weekly or monthly data which can be used to study the seasonality effect along with COVID-19. The event study approach can be used by calculating the average abnormal returns and cumulative average abnormal returns for the period before COVID-19 and after COVID-19. This study is limited only to composite and sectoral indices of National Stock Exchange. Similar kinds of study can be done using other indices of the various markets of India as well as of other countries. Another methodology can be adopted such as robust regression by giving weights to the data points or panel regression or autoregressive distributed lag regression to get different inferences. Further research can be done to check the structural changes before and after COVID-19.

References

Ahmar, A.S., & del Val, E.B. (2020). SutteARIMA: Short-term forecasting method, a case: COVID-19 and stock market in Spain. *Science of The Total Environment*, 729, 138883. http://dx.doi.org/10.1016/j.scitotenv.2020.138883.

Akter, N., & Nobi, A. (2018). Investigation of the financial stability of S&P 500 using realized volatility and stock returns distribution. *Journal of Risk and Financial Management*, 11(2), 22. http://dx.doi.org/10.3390/jrfm11020022.

Al-Awadhi, A.M., Al-Saifi, K., Al-Awadhi, A., & Alhamadi, S. (2020). Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance*, 27, 100326. http://dx.doi.org/10.1016/j.jbef.2020.100326.

Albulescu, C.T. (2020). Coronavirus and financial volatility: 40 days of fasting and fear. *Working Paper SSRN*. http://dx.doi.org/10.2139/ssrn.3550630

Ali, M., Alam, N., & Rizvi, S.A.R. (2020). Coronavirus (COVID-19) – An epidemic or pandemic for financial markets. *Journal of Behavioral and Experimental Finance*, 27, 100341. http://dx.doi.org/10.1016/j.jbef.2020.100341.

Aslam, F., Ferreira, P., Mughal, K. S., & Bashir, B. (2021). Intraday volatility spillovers among european financial markets during COVID-19. *International Journal of Financial Studies*, 9(1), 1–19. http://dx.doi.org/10.3390/ijfs9010005.

Baker, S., Bloom, N., Davis, S.J., Kost, K., Sammon, M., & Viratyosin, T. (2020). The unprecedented stock market reaction to COVID-19. *Hoover Institution Economics Working Paper*, 20112, 1–22. https://www.hoover.org/sites/default/files/research/docs/20112-davis.pdf.

Brown, M.R., & Smith, R.D. (2008). The economic impact of SARS: How does the reality match the predictions?. *Health Policy*, 88(1), 110–120. http://dx.doi.org/10.1016/j.healthpol.2008.03.003.

Chaudhary, R., Bakhshi, P., & Gupta, H. (2020). The performance of the Indian stock market during COVID-19. *Investment Management and Financial Innovations*, 17(3), 133–147. http://dx.doi.org/10.21511/imfi.17(3).2020.11.

Chen, M.-H., Jang, S., & Kim, W.G. (2007). The impact of the SARS outbreak on Taiwanese hotel stock performance: An event-study approach. *International Journal of Hospitality Management*, 26(1), 200–212.

David, S.A., Inácio, C.M.C., & Tenreiro Machado, J.A. (2021). The recovery of global stock markets indices after impacts due to pandemics. *Research in International Business and Finance*, 55, 101335. http://dx.doi.org/10.1016/j.ribaf.2020.101335.

Del Giudice, A., & Paltrinieri, A. (2017). The impact of the Arab spring and the Ebola outbreak on African equity mutual fund investor decisions. *Research in International Business & Finance*, 41, 600–612.

Fernandes, N. (2020). *Economic effects of coronavirus outbreak (COVID-19) on the world economy.* Barcelona: IESE Business School. https://edisciplinas.usp.br/pluginfile.php/5662406/mod_resource/content/1/FERNANDES_Economic%20Effects%20of%20Coronavirus%20Outbreak%20%28COVID19%29%20on%20the%20World%20Economy.pdf.

Goodell, J.W. (2020). COVID-19 and finance: Agendas for future research. *Finance Research Letters*, 35, 101512. http://dx.doi.org/10.1016/j.frl.2020.101512.

Harif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 Pandemic, Oil Prices, Stock Market and Policy Uncertainty Nexus in the US Economy: Fresh Evidence from the Wavelet-Based Approach. *International Review of Financial Analysis*, 70(C). http://dx.doi.org/10.2139/ssrn.3574699.

Izzeldin, M., Muradoğlu, Y.G., Pappas, V., & Sivaprasad, S. (2021). The impact of COVID-19 on G7 stock markets volatility: Evidence from a ST-HAR model. *International Review of Financial Analysis*, 74, 101671. https://dx.doi.org/10.1016/j.irfa.2021.101671.

Kartal, M.T., Depren, Ö., & Kılıç Depren, S. (2020). The Determinants of Main Stock Exchange Index Changes in Emerging Countries: Evidence from Turkey in COVID-19 Pandemic Age. *Quantitative Finance and Economics*, 4(4), 526–541. https://doi.org/10.3934/qfe.2020025.

Li, K. (2018). Reaction to news in the Chinese stock market: A study on Xiong'an new area strategy. *Journal of Behavioral and Experimental Finance*, 19, 36–38. https://dx.doi.org/10.1016/j.jbef.2018.03.004.

Liu, H., Manzoor, A., Wang, C., Zhang, L., & Manzoor, Z. (2020). The COVID-19 Outbreak and Affected Countries Stock Markets Response. International Journal of Environmental Research and Public Health, 17(8), 2800. https://dx.doi.org/10.3390/ijerph17082800.

Loh, E. (2006). The impact of SARS on the performance and risk profile of airline stocks. *International Journal of Transport Economics*, 33(3), 401–422.

Mazur, M., Dang, M., & Vega, M. (2020). COVID-19 and the march 2020 stock market crash. Evidence from S&P1500. *Finance Research Letters*, 38(1), 101690. http://dx.doi.org/10.1016/j.frl.2020.101690.

Mishra, P.K., & Mishra, S.K. (2020). Corona Pandemic and Stock Market Behaviour: Empirical Insights from Selected Asian Countries. *Millennial Asia*, 11(3), 341–365. http://dx.doi.org/10.1177/0976399620952354.

Nageri, K.I. (2019). Evaluating volatility persistence of stock return in the pre and post 2008-2009 financial meltdown. *Copernican Journal of Finance & Accounting*, 8(3), 75–94. http://dx.doi.org/10.12775/CJFA.2019.013.

Okorie, D.I., & Lin, B. (2021). Stock markets and the COVID-19 fractal contagion effects. *Finance Research Letters*, 38, 101640. http:/dx./doi.org/10.1016/j.frl.2020.101640

Pendell, D.L., & Cho, C. (2013). Stock market reactions to contagious animal disease outbreaks: An event study in Korean foot-and-mouth disease outbreak. *Agribusiness*, 29(4), 455–468.

Phan, D., & Narayan, P. (2020). Country Responses and the Reaction of the Stock Market to COVID-19: a Preliminary Exposition. *Emerging Markets Finance and Trade*, 56(10), 2138–2150. http://dx.doi.org/10.1080/1540496X.2020.1784719.

Siddiqui, T.A., Ahmed, H., & Naushad, M. (2020). Diffusion of COVID-19 impact across selected stock markets: a wavelet coherency analysis. *Investment Management and Financial Innovations*, 17(4), 202–214. http://dx.doi.org/10.21511/imfi.17(4).2020.19.

Singh, B., Dhall, R., Narang, S., & Rawat, S. (2020). The Outbreak of COVID-19 and Stock Market Responses: An Event Study and Panel Data Analysis for G-20 Countries. *Global Business Review*. http://dx.doi.org/10.1177/0972150920957274.

Topcu, M., & Gulal, O.S. (2020). The impact of COVID-19 on emerging stock markets. *Finance Research Letters*, 36, 101691. http://dx.doi.org/10.1016/j.frl.2020.101691.

Wang, L., & Kutan, A.M. (2013). The impact of natural disasters on stock markets: Evidence from Japan and the US. *Comparative Economic Studies*, 55(4), 672–686.

Yousef, I. (2020). The Impact of Coronavirus on Stock Market Volatility. *International Journal of Psychosocial Rehabilitation*, 24(6), 18069–18081. http://dx.doi.org/10.37200/IJPR/V24I6/PR261476.

Zaremba, A., Kizys, R., Aharon, D.Y., & Demir, E. (2020). Infected Markets: Novel Coronavirus, Government Interventions, and Stock Return Volatility around the Globe. *Finance Research Letters*, 35, 101597. http://dx.doi.org/10.1016/j.frl.2020.101597.

Zhang, D., Hu, M., & Ji, Q. (2020). Financial markets under the global pandemic of COVID-19. Finance Research Letters, 36, 101528. http://dx.doi.org/10.1016/j.frl.2020.101528.