

# The Outbreak of COVID-19 Pandemic and Its Impact on Stock Market Volatility: Evidence from a Worst-affected Economy

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## Research

**Keywords:** COVID-19, Stock market, Volatility, BSE, NSE, GJR GARCH

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# **The outbreak of COVID-19 pandemic and Its Impact on Stock Market**

## **Volatility: Evidence from a worst-affected economy**

### **Abstract**

The outbreak of COVID-19 has affected the entire global financial market in an unprecedented way. Due to the disruptions that emerged in the global market; the financial market of India also reacted to the pandemic and witnessed sharp volatility. Given the COVID-19 situation, this paper empirically investigates the impact of COVID-19 on the Indian stock market. Using daily closing prices of indices such as Nifty and Sensex, this study examines the volatility of these indices over the period 3<sup>rd</sup> September 2019 to 10<sup>th</sup> July 2020. Further, the study has attempted to make a comparative analysis of the return of the stock market in pre-COVID-19 and during the COVID-19 situation. GARCH model is used to capture the volatility of the indices. Findings reveal that the stock market in India has experienced volatility during the pandemic period. While comparing the results with that of the pre-COVID-19 period, we find that return on the indices is higher in the pre-COVID-19 period than during COVID-19. The return of both the stock market reached the bottom line during the first lockdown period, which is from 24<sup>th</sup> March to 6<sup>th</sup> April.

**Keywords: COVID-19, Stock market, Volatility, BSE, NSE, GJR GARCH**

### **I. Introduction:**

The rapid spread of the unprecedented COVID-19 pandemic has put the world in jeopardy and changed the global outlook unexpectedly. Initially, the SARS-CoV-2 virus, which caused the COVID-19 outbreak triggered in Wuhan city, Hubei province of China in December 2019, and with time it spread all over the globe. This pandemic is not only a global health emergency but is

a significant global economic downturn too. As many countries adopt strict quarantine policies to fight with the unseen pandemic, their economic activities are suddenly shut down. Transports being limited and even restricted among countries have slowed down global economic activities. Most importantly, consumers and firms have prevented their usual consumption patterns due to the creation of panic among them and created market abnormality. Uncertainty and risk created due to this pandemic, causing significant economic impact all over the globe affecting both advanced and emerging economies such as the US, Spain, Italy, Brazil, and India. In this context, the financial market has responded with dramatic movement and adversely affected. The global financial market risk has increased substantially in response to the pandemic (Zhang et al., 2020). Investors are suffering sufficient losses due to fear and uncertainty. For example, due to the impact of this pandemic, the global stock market has struck out about US\$6 trillion in one week from 24<sup>th</sup> to 28<sup>th</sup> February (Ozili and Arun, 2020). The market value of Standard & Poor (S&P) 500 indexes declined to 30% since the Covid-19 outbreak. According to Azimili (2020) increased uncertainty affects the required rate of return and thus current market value of stocks.

Although there is limited current literature related to the impact of COVID-19 on the financial market, the existing empirical studies have provided an exciting result. Baret et al., (2020), in their research on financial markets and banks, have found that there is a fall in the share of oil, equity, bonds throughout the world as a result of the COVID-19 pandemic. Jim, (2020), argued that due to social distancing measure productivity of the companies get adversely affected, and it leads to a decrease in revenue, higher operating cost, and cash flow challenges to the companies. In Europe, the Financial Times Stock Exchange 100 index witnessed a sharp one-day fall since 1987 (BBC News, 2020). Igwe (2020) is of the view that the shock from this pandemic can increase the volatility that can negatively affect the economic and financial system of every

country. Most of the developed and developing countries' financial markets are adversely affected by this unexpected pandemic. The leading economy, the US stock market hit the circuit breaker mechanism four times in ten days in March 2020 (Zhang et al., 2020). The stock market of Europe and Asia has also jumped. UK's leading index FTSE has fallen more than 10% on 12<sup>th</sup> March 2020 (Zhang, 2020). Vishnoi and Mookerjee (2020) observed that the stock market in Japan had dropped more than 20% in December 2019. The stock market of Spain, Hong Kong, and China also declined to 25.1%, 14.75, and 12.1% in their price from 8<sup>th</sup> March to 18<sup>th</sup> March 2020 (Shehzad, 2020). Shehzad (2020), in his study, also found a harm full impact on stock returns of the S&P 500 and an inconsequential impact on the Nasdaq Composite index. Georgieva (2020) pointed out that the COVID-19 pandemic brought the entire globe near to financial crises more hazardous than Global Crises 2007-08.

Gradually the worst effect of the pandemic spread to the emerging economy too. If we consider the financial market of the emerging economy a gloomy picture caught our eyes as this economy is worst- hit by the collapse of oil prices. The outbreak of the COVID-19 pandemic makes this picture more critical. The top leading emerging economies such as Brazil, Russia, Mexico gradually moved towards hard mobility restrictions that will bring down the emerging economies to a recession of -1 percent in 2020 (Herfero, 2020). In South Korea the Coronavirus disease caused KOSPI to drop below 1600 in their history after ten years (So, 2020). In China higher uncertainty due to COVID-19 results in greater volatility of stock return (Liu, 2020). The government of India announced Janata Curfew on 22<sup>nd</sup> March 2020 and lockdown policy to maintain social distancing practice to slow down the outbreaks from 24<sup>th</sup> March 2020. As the government announced such a lockdown policy, various economic activities have been stopped suddenly. The financial market of India is witnessed sharp volatility as a result of the disruption

of the global market. As a result of fall out in the global financial market, the Indian stock market also witnesses sharp volatility. It has also borne the brunt of the COVID-19 pandemic.

There are two major stock indices in India- Bombay Stock Exchange (BSE), Sensex, and National Stock Exchange (NSE), Nifty. If we look at the Bombay Stock Exchange there is a drop in the Sensex index to 13.2% on 23<sup>rd</sup> March 2020. It was the highest single they fall after the news of the Harshad Mehta Scam, 28<sup>th</sup> April 1991 (Mandal, 2020). Similarly Nifty has also declined to almost 29% during this period. Some economists have considered the impact of COVID-19 on the Indian stock market as a 'Black-Swan Event' i.e. the occurrence of a highly unanticipated event with an extremely bad impact. Due to the lockdown policy adopted by the government, the factories have reduced the size of their labour force as well as production level which disrupted the supply chain. Again because of the uncertainty prevailing among mankind, people also reduce their consumption habits leading to demand-side shock. Studies have also found that the entire previous pandemic had affected only the demand chain. But this COVID-19 pandemic has affected both the demand chain and supply chain.

Despite the severe impact of COVID-19 on the stock market of the entire economy, there is limited study on it especially in the case of an emerging economy. To shed light on this aspect, this paper attempts to investigate the impact of COVID-19 on the two important stock market of India. GJR GARCH model is used to make the study more significant in terms of volatility in stock index prices due to the outbreak of the pandemic and lockdown policy adopted by the Indian government. Major findings of the study reveal the volatile nature of BSE Sensex and NSE Nifty, the two prominent stock market of India.

The paper is organized as follows. Section I starts with an introduction, section II represents a literature review, section III describes the sources of the data and methodology, section IV shows results and discussion and section V ends with the conclusion.

## **II. Literature Review:**

The impact of COVID-19 on the financial market as well as the stock market has been subject to many empirical studies both in advanced and emerging economies. Existing literature found diverse results in these regards. Ozili and Arun (2020) have conducted an empirical study on the effect of social distancing policy that was adopted to prevent the spread of the Corona Virus, based on four continents: North America, Africa, Asia, and Europe. The study found that 30 days of social distancing policy or lockdown hurts the economy through its negative impact on stock prices. Azimili (2020) also researched on understanding the impact of coronavirus on the degree and structure of risk-return dependence in the US by using quantile regression. The results indicate that following the COVID-19 outbreak the degree of dependence between returns and market portfolio has raised in the higher quantiles that lowering the benefits of diversification. The author also studied the GSIC and stock return relationship and found that the GSIC return relationship revealed an asymmetric pattern, lower tails influenced negatively almost twice as compared to the upper tails. Shezad et al. (2020) conducted a study to analyze the non-linear behavior of the financial market of the US, Italy, Japan, and China market return by applying the Asymmetric Power GARCH model. The study confirmed that COVID-19 harm the stock returns of the S&P 500. However, it revealed an inconsequential impact on the Nasdaq Composite index. An empirical study conducted by Cepoi (2020) on the relationship between COVID-19 related news and stock market returns across the topmost affected countries. By employing a panel quantile regression this study found that the stock market presents asymmetry

dependence on COVID-19 related information. Osagie et al. (2020) by applying Quadratic GARCH and Exponential GARCH models with dummy variables found that the COVID-19 hurts the stock returns in Nigeria and recommended that a stable political environment, incentive to indigenous companies, diversification of economy, flexible exchange rate regime be implemented to improve the financial market. Becker (2020), in his study, found that there is a dramatic fall in oil prices by 70-80 percent. It is severe than the financial crisis of 2008/09. This is a serious issue for the economy as the country is highly dependent on oil revenue. There is a huge gap between the depreciated exchange rate i.e. 20 percent and the fall in oil prices i.e. 70-80 percent. According to Herfero (2020), the third wave of the COVID-19 pandemic has hit the emerging economy worst resulting decrease in the business activities. This unprecedented shock increases the risk-averse nature which increases the financial cost. Latin America is affected worst because of her much dependency on external financing. Due to the restriction on transport export have declined. Restriction in the international movement has hampered the tourism sector leading to a fall in revenue. Hyun-Jung (2020) has made a study on the stock market of South Korea, another leading country of the emerging economies. In his analysis, it was found that the economy has shown a roller-coaster ride. The monthly export shows a downtrend in January, improved in February, then again dipped down in March and June. The country's export volume has come down to an 11.2 percent point in comparison to the previous year. Raja Ram (2020) in his study has found that COVID-19 crashes the entire global share. Indian stock market also experienced sharp volatility due to the collapse of the global financial market. Again fall in FPIs also reduces the return of the Indian stock market. By analyzing the history of all unexpected events the author has considered COVID-19 also a "black swan" event. He has further analyses the history of the crash and recovery of the Indian stock market and concluded that the economist

can't predict the recovery of the economy until a stable public-health system. Ravi (2020) has compared the pre-COVID-19 and during COVID-19 situation of the Indian stock market. His findings revealed that before COVID-19 i.e. at the beginning of January, trade of NSE and BSE were at their highest levels hitting peaks of 12,362 and 42,273 respectively showing favorable stock market conditions. After the outbreak of the COVID-19 stock market came under fear as BSE Sensex and NSE Nifty fell by 38 percent. It leads to a 27.31 percent loss of the total stock market from the beginning of this year. The Stock of some other sectors such as hospitality, tourism, and entertainment has been dropped by more than 40% due to transport restrictions. Mondal (2020) has rigorously analyzed the agony of the deadly pandemic on the Indian stock market. Findings reveal that BSE Sensex has witnessed the biggest single-day fall of 13.2 percent that has surpassed the infamous fall of 28<sup>th</sup> April 1992. Nifty also has a steep dive of 29%, overtaking the disaster of 1992. As people have compressed their consumption only to necessary products only the FMCG Company has shown a positive return whereas other companies face a sharp decline (Rakshit and Basistha, 2020).

There is various literature available on the impact of COVID-19 on different sectors such as health, agriculture, industry, trade, and commerce but a limited specific study has been conducted on its impact on the stock market of the emerging economy. The Stock market plays an important role in the economy. As India is one of the important parts of the emerging economy, this paper through light to study the impact of COVID-19 on the Indian stock market. GJH GARCH is an efficient model to test the volatility of BSE and NSE, the two major stock market of India. Again a few studies have focused on comparing the outcome of the two stock markets before COVID-19 and during the COVID-19 situation. Our study has also made attempted to compare the returns of both the stock market in those two mentioned time frames.

### III. Data and methodology:

The study is based on secondary sources of data. Data on daily closing prices of indices Nifty and Sensex have been collected from the official site of BSE and NSE. Data are collected from 3<sup>rd</sup> September 2019 to 10<sup>th</sup> July 2020 including both the period before and during COVID-19. The 1<sup>st</sup> positive case of India was found on 30<sup>th</sup> January 2020. Data on COVID-19 positive cases are collected from the report of the Ministry of Health and Family Welfare, Government of India. Hence, for this study, the period before this date is considered as the pre-COVID-19 era and the period after this date is considered as during the COVID-19 era.

In the estimations, we take the natural logarithm of each price data to reduce the observed skewness in the stock price data distribution. To calculate the return, the following formula has been used:

$$R_t = \ln P_t - \ln P_{t-1} \dots\dots\dots (1)$$

Here,  $R_t$ ,  $P_t$ , and  $P_{t-1}$  represent the day-wise return, the closing price of the stock at time  $t$ , and the previous day's closing price at time  $t-1$ , while  $\ln$  symbolizes the natural log.

To check whether a time series was stationary or non-stationary, Dickey Fuller (1979) and Philips and Parron (PP) test has been used. The Augmented Dickey-Fuller (ADF) test is based on the estimate of the following regression:

$$\Delta Y_t = \alpha_0 + \gamma_1 y_{t-1} + \sum_{i=1}^p \beta_i \Delta y_{t-i} + \epsilon_t \dots\dots\dots (2)$$

Here,  $\Delta$  represents 1<sup>st</sup> difference operator,  $p$  symbolized lag,  $\alpha_0$  represents constant,  $\gamma_1$  and  $y_{ij}$  are parameters and  $\epsilon_t$  denotes a stochastic error term. If  $\gamma = 0$ , then the series is said that it is a unit root and non-stationary.

To analyze the effect of COVID-19 on the stock market volatility GJR GARCH model was used. One of the limitations of the GARCH model is that this model imposes symmetric volatility response to positive and negative shocks (Sakthivel et al, 2020). This is due to the reason that conditional variance in equation (3) is the magnitude of the lagged residuals and therefore does not account for their sign.

This asymmetric response of conditional volatility to information can be captured by including, along with the standard GARCH variables, squared values of  $\varepsilon_{t-1}$  when  $\varepsilon_{t-1}$  negative (Gltosan, Jagannathan, and Runkle, 1993). The GJR GARCH model was estimated as follows:

$$h_t = \alpha_0 + \sum_{j=1}^q \alpha_j \varepsilon_{t-1}^2 + \sum_{i=1}^p \beta_i h_{t-1} + \sum_{k=1}^r \gamma_k I_{t-1} \varepsilon_{t-1}^2 \dots \dots \dots (3)$$

Where,  $I_{t-1} = 1$  if  $\varepsilon_{t-1} < 0$ ;  $= 0$  other wise.

For a leverage effect  $\gamma > 0$ . The condition for non-negativity would now be  $\alpha_0 \geq 0$ ,  $\alpha_1 \geq 0$ ,  $\beta_1 \geq 0$ , and  $\alpha_1 + \gamma_1 \geq 0$ . In the model, the good news ( $\varepsilon_{t-1} > 0$ ) and bad news ( $\varepsilon_{t-1} < 0$ ), have contrasting impacts on the conditional variance, good news has an effect of  $\beta_1$ , while bad news has an effect of  $\alpha_1 + \gamma_1$ . If  $\gamma_1 > 0$ , negative shocks tend to have more volatility and is known as the leverage effect of the  $i$ th order. If  $\gamma_1 \neq 0$ , the news effect is symmetric.

A dummy variable was introduced in the conditional mean and variance equation to investigate the impact of the COVID-19 outbreak on the volatility of NSE and BSE. The model modified as per the GJR GARCH approach was specified as,

$$R_t = \alpha_0 + \beta_1 R_{t-1} + \gamma_1 D_1 + \varepsilon_1 \dots \dots \dots (4)$$

$$h_t = \alpha_0 + \sum_{j=1}^q \alpha_j \epsilon_{t-1}^2 + \sum_{i=1}^p \beta_i h_{t-1} + \sum_{k=1}^r \gamma_k I_{t-1} \epsilon_{t-1}^2 + \lambda_1 D_1 \dots \dots \dots (5)$$

The dummy variable D1 assumes the value 0 for the pre-COVID-19 era and 1 for the during COVID-19 era. A negative and statistically significant coefficient for the dummy variable implies that the COVID-19 pandemic caused a reduction in the volatility of the Indian stock market. A positive and statistically significant coefficient for the dummy variable implies that the COVID-19 crises caused an increase in the volatility of the Indian stock market.

**IV. Discussion and Analysis:**

This paper uses the daily price and return of two stock indices of India, BSE, and NSE. First and foremost, we calculate the descriptive statistics of the price and return of BSE and NSE series. In table: 1 the mean return which is a major indicator of profit shows a negative value, indicating a loss in stock. Negatively skewed return with high kurtosis value indicates chances of high losses in both the stock markets. Likewise, the return of pre-COVID-19 and during COVID-19 is presented in Table: 2. As India reports the 1<sup>st</sup> case of COVID-19 on 30<sup>th</sup> January 2020, before this period is considered to be as the pre-COVID-19 era and the period after 30<sup>th</sup> January is considered as the COVID-19 period for the study. In Table: 2, it is observed that the mean return of both the indices is positive in the pre-COVID-19 era but daily mean returns are negative during the COVID-19 era, implying an adverse impact on stock returns. The standard deviation of the indices has increased during the COVID-19 era which implies that the volatility of the indices has increased during the COVID-19 time frame.

Table: 1 Descriptive statistics of the entire sample

	BSE Sensex		NSE Nifty	
	Price	Return	Price	Return
<b>Observation</b>	209	208	209	208
<b>Mean</b>	466.9311	-0.000113	10879.09	-5.78E-06
<b>Median</b>	496.5000	-0.000139	11303.30	0.0004
<b>Maximum</b>	573.6500	0.039111	12362.30	0.0364
<b>Minimum</b>	283.3000	-0.043645	7610.250	-0.0603
<b>Std. Dev</b>	77.23121	0.011278	1269.041	0.00929
<b>Skewness</b>	-0.708423	-0.95679	-0.63336	-1.53543
<b>Kurtosis</b>	2.349923	5.285872	2.083647	14.15163
<b>JB</b>	21.16169	45.60252	21.28587	1159.505

*Source: Author's Calculation*

Table: 2 Descriptive statistics of stock return of pre-COVID-19 and during COVID-19 period

	BSE Sensex		NSE Nifty	
	Pre-COVID-19 era	During COVID-19 era	Pre-COVID-19 era	During COVID-19 era
<b>Mean</b>	8.84E-05	-0.000239	0.000471	-0.000448
<b>Median</b>	-0.000306	0.000217	0.000455	2.95E-05
<b>Maximum</b>	0.020004	0.039111	0.022507	0.036482
<b>Minimum</b>	-0.015436	-0.043645	-0.008378	-0.060383
<b>Std. Dev</b>	0.006570	0.014427	0.003938	0.012348
<b>Skewness</b>	0.307638	-0.097568	1.844912	-1.229302
<b>Kurtosis</b>	3.643217	3.72661	12.00168	8.530320
<b>JB</b>	3.268177	2.491638	394.3503	168.8313

*Source: Author's Calculation*

Fig: 1 and Fig: 2 represents the time plot of BSE and NSE stock prices respectively over the examined period. Before February 2020 (Pre COVID-19 period) the prices of both the indices are positive and show almost a smooth line in the figure. But after reporting the 1<sup>st</sup> case in India as well as the declaration of the first lockdown, it moves down to the bottom of the steep at the end of March 2020. From April 2020, it again shows a positive trend. This is because relaxation has been adopted in the case of a lockdown policy from April by the government.

Fig: 1 Time plot of BSE stock price



Fig: 2 Time plot of NSE stock price

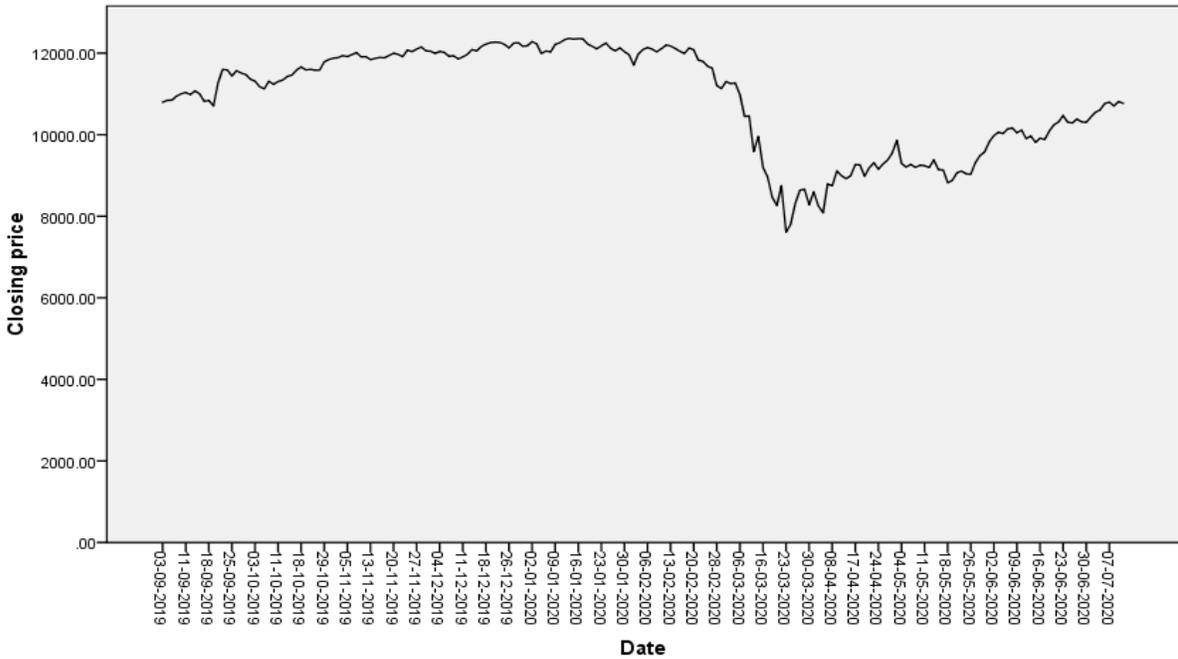


Fig: 3 and Fig: 4 present the log return of BSE and NSE from the period 3/09/2019 to 10/07/2020

and evidence of volatility is shown with the help of these two diagrams. The result depicts that BSE is more volatile than NSE.

Fig: 3 Log return of BSE

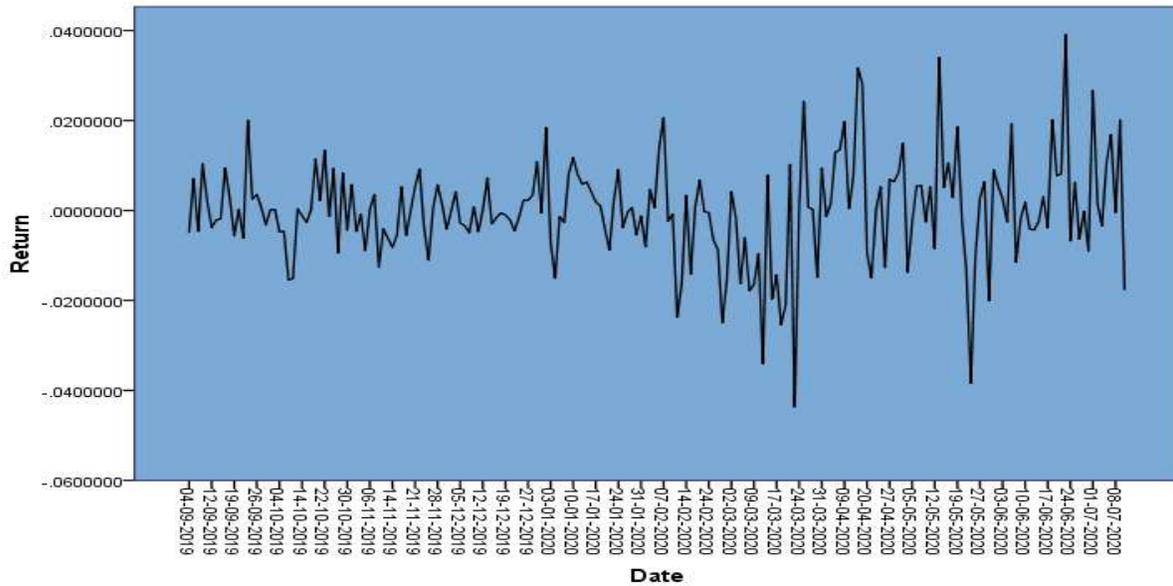
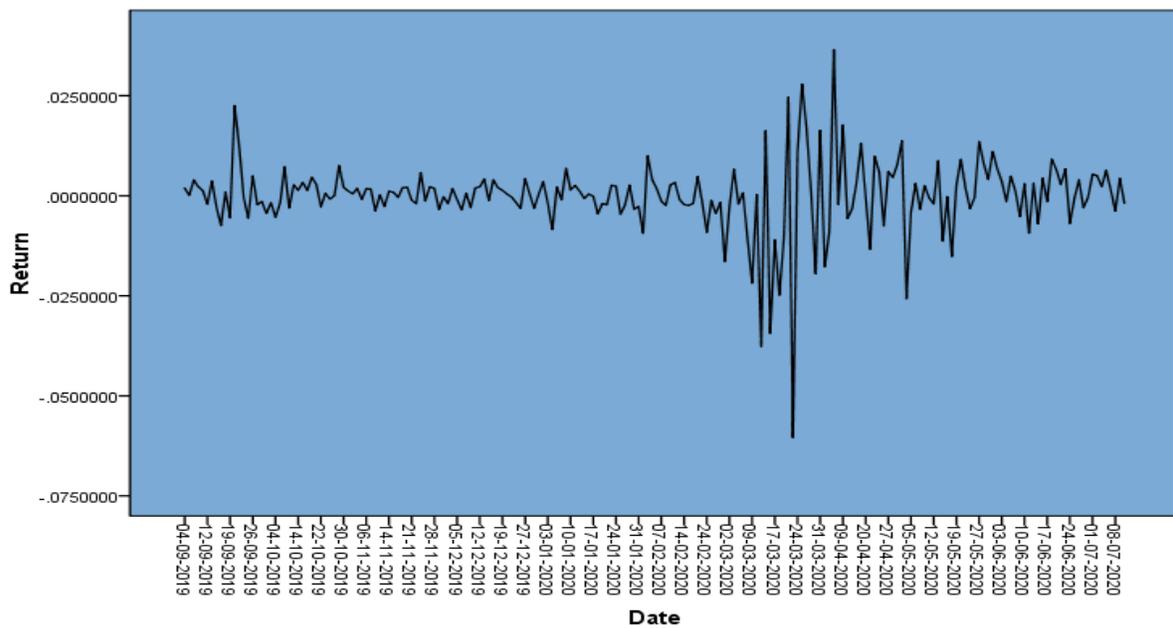


Fig: 4 Log return of NSE



To check the stationarity of two indices, BSE and NSE, we perform ADF and PP stationarity tests. The result presented in Table: 3 revealed that most of the log indices are non-stationary in level form, hence the null hypothesis is accepted. Although, log indices have been found stationary in the 1<sup>st</sup> difference in both ADF and PP tests. Consequently, the indices are found stationary in 1<sup>st</sup> deference. Therefore, the unit root tests justify the existence of stationarity at the first difference.

Table: 3 Result of unit root statistics

Name of Index	ADF in Level	ADF in 1 <sup>st</sup> difference	PP in Level	PP in 1 <sup>st</sup> difference
<b>BSE Sensex</b>	-1.269416 (0.6438)	-12.24932* (0.0000)	-1.456996 (0.5535)	-12.64598* (0.0000)
<b>NSE Nifty</b>	-1.619650 (0.4707)	-16.60469* (0.0000)	-1.220566 (0.6657)	-16.43414* (0.0000)

\*&\* indicates 1% and 5% significance level. *Source: Author's Calculation*

Table 4 presents the estimated results on the GJR-GARCH model with BSE Sensex and from this table, it has been observed that the coefficient of asymmetric ( $\lambda_1$ ) and GARCH ( $\beta_1$ ) are significant. The coefficient of ARCH ( $\alpha_1$ ) is found negative but significant; this particular finding indicates the existence of the ARCH effect in the BSE Sensex series. Further, the coefficient of GARCH was appeared positive and significant, which implies that volatility clustering was present in the BSE index. The Positive and significant asymmetric effect also indicates the presence of asymmetric effect and this implies that negative shocks news tends to increase volatility more than positive shocks. To capture volatility, a dummy variable (D1) has been added in both mean and variance equation; D1 takes the value of 0 and 1 for the pre and during the COVID-19 era respectively. The result exhibits that the coefficient of the dummy

variable for BSE Sensex in the mean equation is negative but not significant. Conversely, in the variance equation, it is positive and significant. This inferred that the spot market volatility in the BSE stock market has increased during the COVID-19 period.

Table: 4 Result of GJR GARCH model with BSE Sensex

Mean Equation	Coefficients	Z-statistics	P-value
<b>Parameters</b>			
$\beta_0$	-0.001621	-1.677327	0.0935
$\gamma_1$	-0.000705	-0.235801	0.8136
<b>Variance Equation</b>			
$\alpha_0$	1.23E-05	10.86474*	0.0000
$\beta_1$	1.024974	329.0440*	0.0000
$\lambda_1$	0.040947	1.893853**	0.0542
$\alpha_1$	-0.089238	10.86474*	0.0000
$\delta_2$	4.16E-05	4.248481*	0.0000

\*&\*\* indicates 1% and 5% significance level. *Source: Author's Calculation*

Table: 5 presents the result of GJR GARCH with NSE Nifty. The table reveals that the coefficient of asymmetric ( $\lambda_1$ ) and GARCH ( $\beta_1$ ) are significant and positive, which entailed that volatility is present in NSE Nifty. However, the coefficient of ARCH is positive but insignificant; indicating that past news does not impact current volatility. On the other hand, it can be noticed that the coefficient of dummy variable (D1) in the mean equation is negative but in variance, it is positive and insignificant. In both equations the coefficient of the dummy is

insignificant, implying no significant impact of the COVID-19 period on the volatility of NSE stock price.

Table: 5 Result of GJR GARCH model with NSE Nifty

Mean Equation	Coefficients	Z-statistics	P-value
<b>Parameters</b>			
$\beta_0$	0.000659	0.983215	0.3255
$\gamma_1$	-0.000945	-0.526764	0.5984
<b>Variance Equation</b>			
$\alpha_0$	2.82E-06	1.687363	0.0915
$\beta_1$	0.822061	30.55926*	0.0000
$\lambda_1$	0.357850	4.805764*	0.0000
$\alpha_1$	0.000418	1.687363	0.9887
$\delta_2$	7.83E-06	1.070103	0.2846

\* & \* indicates 1% and 5% significance level. *Source: Author's Calculation*

### Diagnostic Measure:

Ljung-Box Q and ARCH LM test is used to check the serial correlation and Heteroskedasticity in the square of standardized residuals of the model. The result indicates that there is an absence of serial correlation and Heteroskedasticity which is shown in (Table: 6). All the models performed correctly in this study.

Table: 6 Diagnostic Parameters

Variable	Serial Correlation		Heteroskedasticity	
	Q statistics	P-value	F statistics	P-value
BSE Sensex	30.760	0.716	0.278137	0.8919
NSE Nifty	23.924	0.938	0.161734	0.9575

*Source: Author's Calculation*

## V. Conclusion:

In this study, we investigated the effect of COVID-19 on the performance of BSE and NSE; the two stock markets of India-. GJH GARCH model is used to test the volatility in the stock market by taking the two time periods, before and after 1<sup>st</sup> positive COVID-19 cases in India. These two periods are taken as the dependent variable and per day closing price of BSE and NSE indices are considered as the independent variable. The result shows that the stock market especially the BSE Sensex become volatile during the pandemic period. In the case of another stock index, NSE Nifty, it was found that there is no such significant impact of the COVID-19 period on the volatility of NSE stock prices. The mean return in pre-COVID-19 and during the COVID-19 period is calculated separately. The result revealed that with negative mean returns, the stock market faces losses during the pandemic, whereas return is shown positive in the pre-COVID-19 phase. By comparing the standard deviation, it was noticed that the deviation is large during the COVID-19 era than the pre-COVID-19 time. Similarly, the price of the stock indices also shows a significant change. In the pre-COVID-19 period, the price was high but during the COVID-19 period it shows a declining trend up to the 1<sup>st</sup> lockdown period i.e. to the end of March but after this, it again takes an upward movement gradually. It is on account of the relaxation added to the lockdown policy by the Indian government. The unprecedented pandemic has already brought

challenges to almost all countries. Not a single sector is left unaffected because of COVID-19. In brief, the results conclude that the Coronavirus outbreak has affected the stock price and increased the volatility in the Indian stock markets, and affect the financial system. Accordingly, this paper tries to provide a very simple but original statistical analysis of the COVID-19 pandemic by taking the case of the Indian stock market.

### **Declarations:**

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### **Authors' contribution**

Both author agreed on the content of the study. DB<sup>1</sup> and DB<sup>2</sup> collected the data, undertook literature review and developed the theoretical framework. Both author agreed on the methodology. DB<sup>1</sup> analyzed the data. Both authors read the manuscript and approved it.

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Not applicable

## **Availability of data and materials**

The study covered the time period between 3/09/2019 to 10/07/2020 and it used secondary data. Data on daily closing prices of indices Nifty and Sensex have been collected from the official site of BSE and NSE accessible at <https://in.finance.yahoo.com/> while data on COVID-19 positive cases are collected from the report of the Ministry of Health and Family Welfare, Government of India accessible at <https://www.mohfw.gov.in/>.

## **Competing interests**

The authors declare that they have no competing interest in this publication.

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# Figures



Figure 1

Time plot of BSE stock price

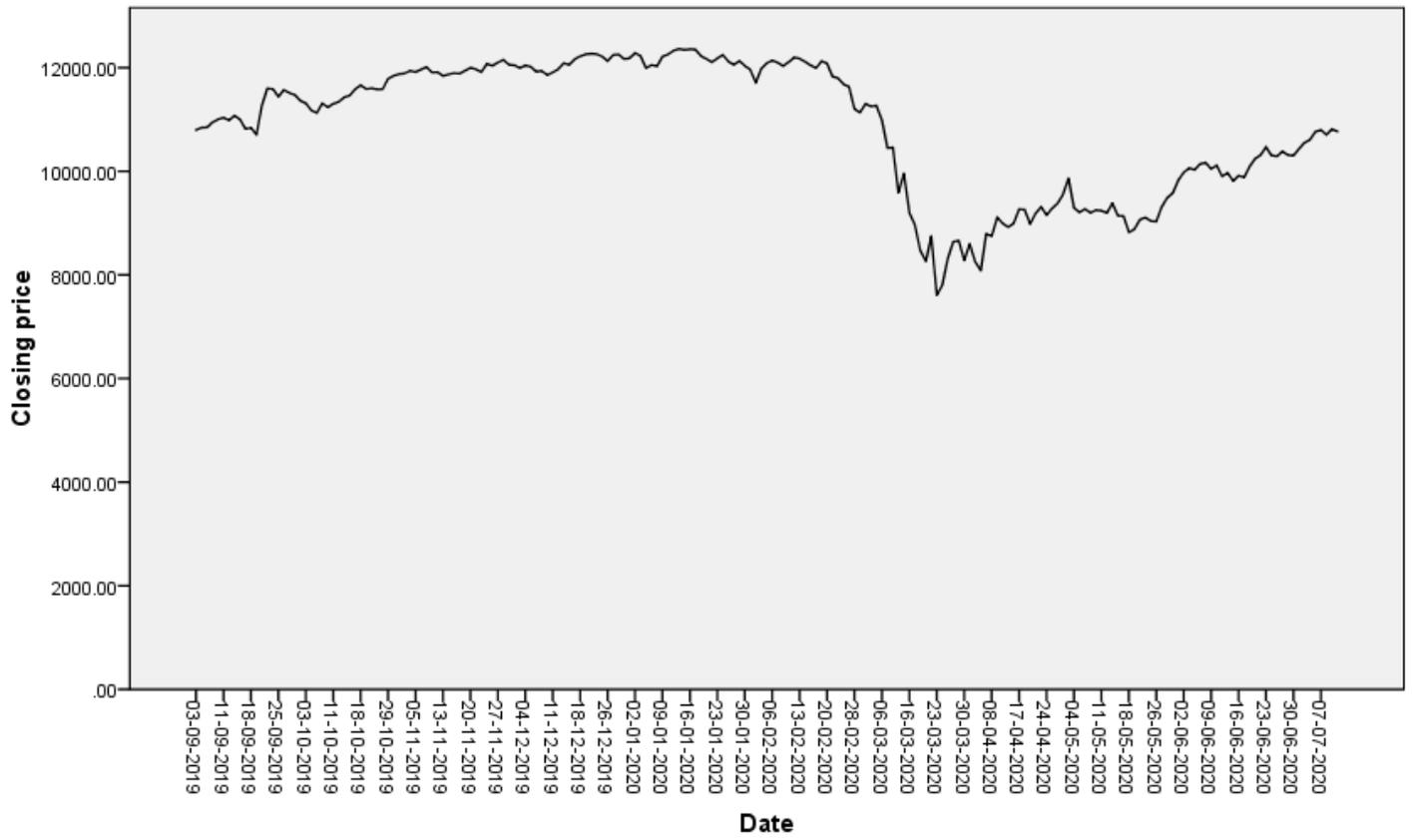
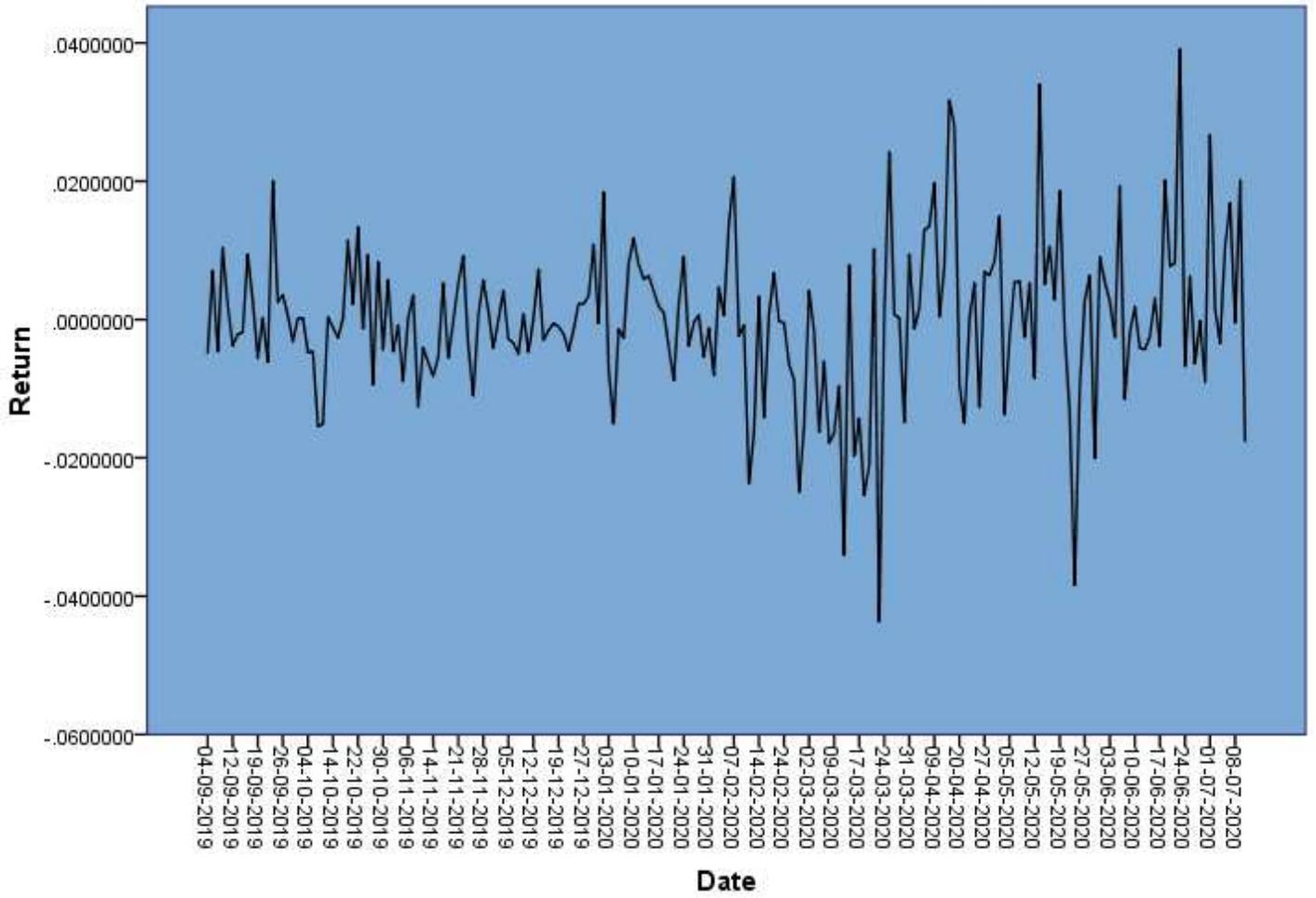


Figure 2

Time plot of NSE stock price



**Figure 3**

Log return of BSE

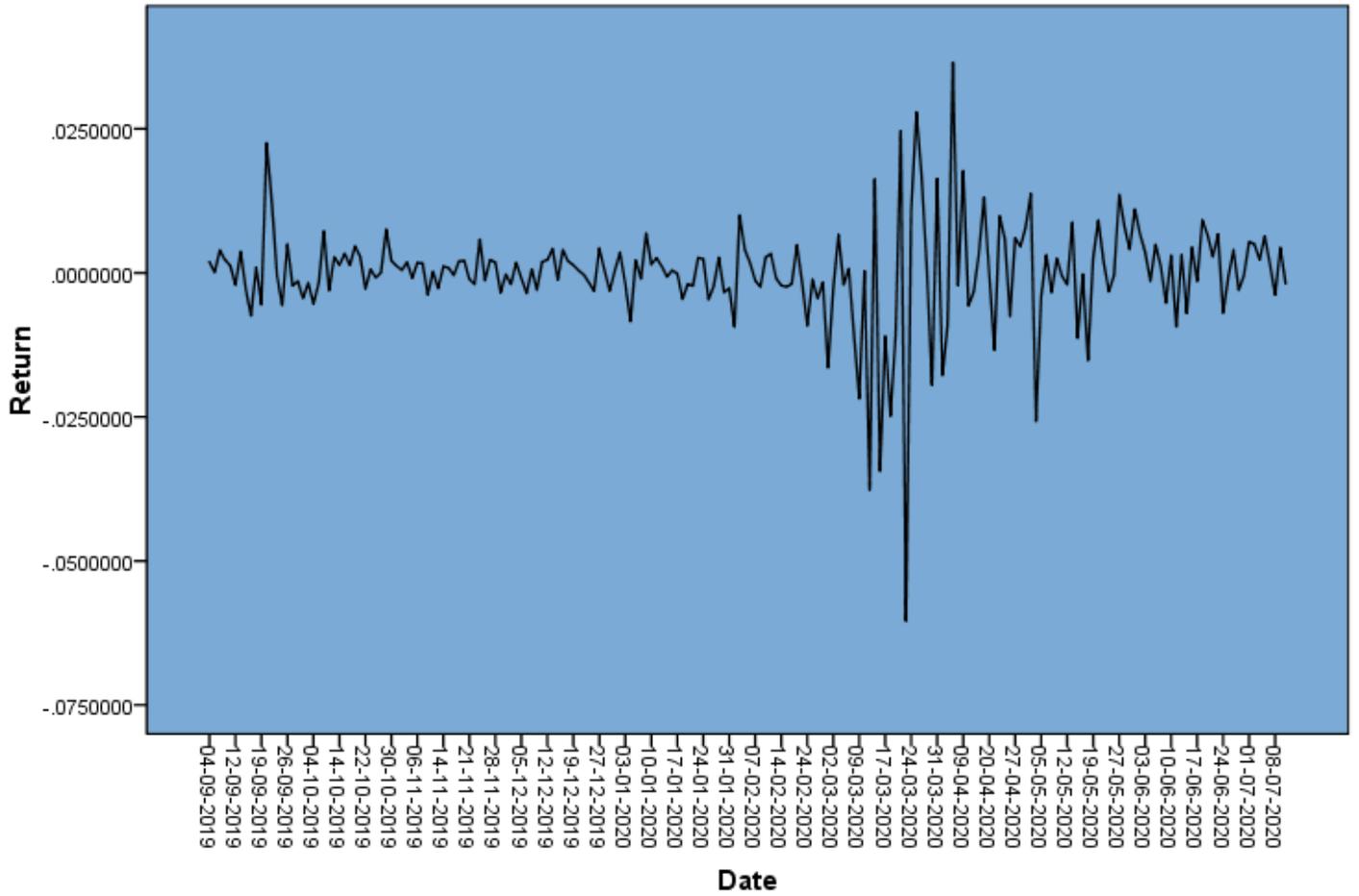


Figure 4

Log return of NSE