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IMPACT OF COVID-19 ON INDIAN EQUITY MARKET VOLATILITY

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Abstract:

This research paper aims to understand how COVID-19 affected the volatility of the Indian Equity Market. BSE Sensex and NSE Nifty 50 data has been used for analysis. These two indices are among the most well-known and widely followed stock market indices in India. They represent a large part of the Indian equity market and include some of the biggest and most influential companies. BSE Sensex tracks 30 major stocks, while NSE Nifty 50 tracks 50, covering various sectors and providing a good overall picture of the market's health and performance.

The paper involves testing and analyzing market volatility after pandemic using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Model.

Keywords: *COVID-19, Economic Analysis, Stock Market Performance, Volatility, Stock Market Indices*

Introduction:

The COVID-19 pandemic has caused unprecedented disruptions across global economies, profoundly impacting financial markets. The Indian equity market, represented by major indices such as BSE Sensex and NSE Nifty 50, experienced significant volatility during this period. Understanding how these fluctuations occurred and their underlying factors is crucial for investors, policymakers, and scholars.

BSE Sensex and NSE Nifty 50 are the two most prominent stock market indices in India. The BSE Sensex, comprising 30 of the largest and most actively traded stocks, and the NSE Nifty 50, including 50 such stocks, are considered barometers of the Indian economy. These indices encompass companies from diverse sectors, offering a comprehensive view of market trends and overall economic health.

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The volatility observed in these indices during the COVID-19 pandemic reflects the broader impact of the crisis on the Indian economy. Sudden market movements, driven by factors such as lockdown measures, changes in consumer behavior, supply chain disruptions, and government policies, necessitate a detailed examination to grasp their implications fully. The paper seeks to contribute to the existing literature on financial market volatility, offering insights into the specific impacts of the COVID-19 pandemic on the Indian equity market. The findings are expected to provide valuable information for stakeholders to navigate future economic uncertainties and enhance market resilience.

Objectives:

The paper is based on following objectives:

1. To analyze how the COVID-19 pandemic influenced the volatility of the Indian equity market, specifically focusing on BSE Sensex and NSE Nifty 50 indices.
2. To conduct an empirical analysis of market volatility during the pandemic period using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model.
3. To identify patterns and trends in the volatility of BSE Sensex and NSE Nifty 50 indices during the COVID-19 pandemic.

Data Collection:

Data on daily closing prices of indices Nifty 50 and Sensex have been collected from the official site of BSE and NSE. Data are collected from 30th August 2019 to 30th June 2020 including both the period before and during COVID-19. GJR GARCH model has been used to analyze the effect of COVID-19 on the stock market volatility.

Data during selected Period:

Below are the plots of the stock price for BSE and NSE over the selectedtime period.

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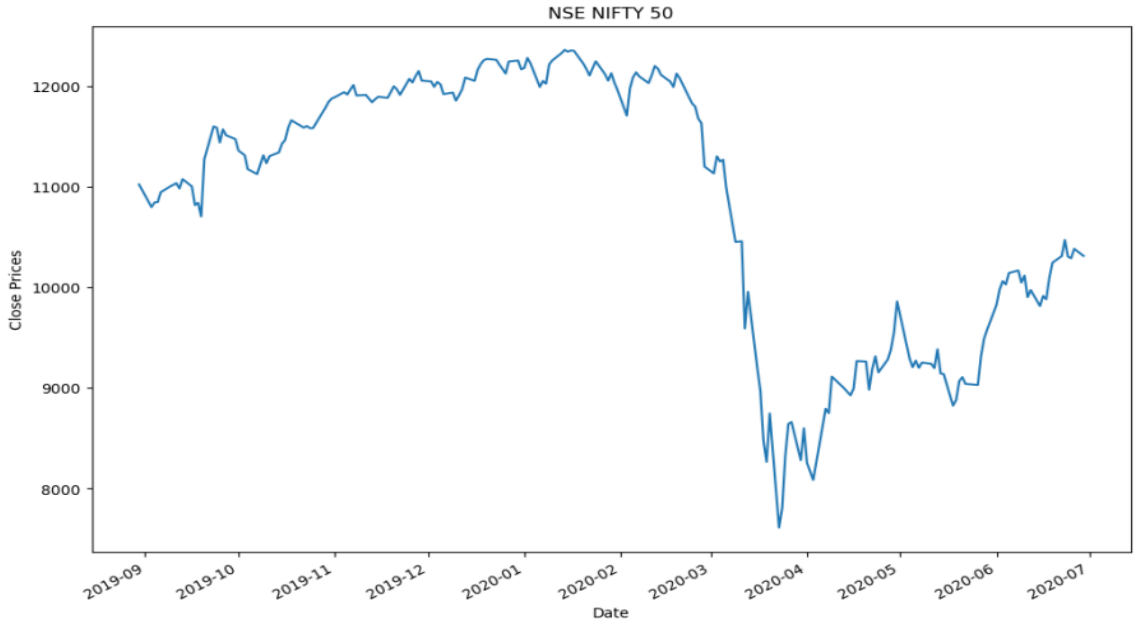
Chart No. 1

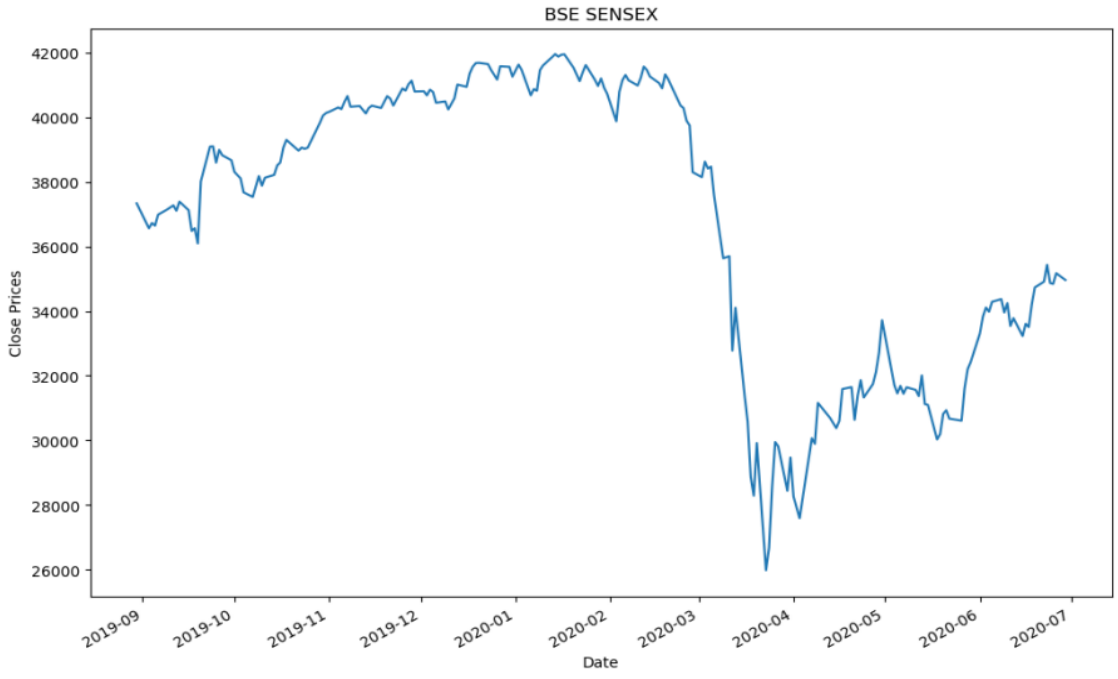
Graphical Representation of Stock Closing Price Index of NSE Nifty 50



Source: Researcher's own work

Chart No. 2

Graphical Representation of Stock Closing Price Index of BSE Sensex



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Source: Researcher's own work

Chart1 and 2 depict the time-related representation of BSE and NSE stock prices, respectively, throughout the analyzed timeframe. Prior to February 2020 (pre-COVID-19 period), both indices exhibit positive trends, forming nearly smooth lines in the figures. However, following the confirmation of the first COVID-19 case in India and the subsequent announcement of the initial lockdown, the prices sharply decline, reaching a nadir at the conclusion of March 2020. Starting from April 2020, a positive trajectory is once again observed. This shift is attributed to the relaxation of lockdown measures implemented by the government in April.

Statistical Summary:

These statistics collectively provide insights into the central tendency, variability, and shape of the distribution for each stock exchange's parameter. It's important to consider these measures together for a comprehensive understanding of the data characteristics.

Table below gives the statistical summary of all both the stock exchanges selected for the purpose of study.

Table No.1

Statistical Summary of Selected Stock Exchange

Parameter	BSE Sensex	NSE NIFTY 50
Mean	36951.17	10890.49
Median	38470.60	11350.52
Standard Deviation	4326.72	1295.85
Kurtosis	-1.0114	-0.9754
Skewness	-0.60401	-0.6462
Minimum	25981.24	7610.25
Maximum	41952.62	12362.29

Source: Researcher's Calculation

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The above table provided descriptive statistics for BSE Sensex and NSE NIFTY 50 offer insights into the characteristics of these stock market indices.

BSE Sensex has a higher mean (36951.17) compared to NSE NIFTY 50 (10890.49), suggesting that, on average, the stock prices in BSE Sensex are higher. It is observed that BSE Sensex has a higher standard deviation (4326.72) compared to NSE NIFTY 50 (1295.85), suggesting that the stock prices in BSE Sensex exhibit greater variability around the mean.

Both indices show negative skewness, indicating a slight leftward skew in the distribution. This implies that there are some lower-than-average values that are pulling the distribution in that direction.The negative kurtosis values for both indices suggest that their distributions have lighter tails than a normal distribution. This implies a lesser likelihood of extreme values.

Overall, these statistics give a snapshot of the central tendency, variability, and shape of the distribution of stock prices for BSE Sensex and NSE NIFTY 50. The higher mean, median, and standard deviation for BSE Sensex suggests a potentially greater level of volatility and variability in stock prices compared to NSE NIFTY 50.

Augmented Dickey-Fuller Test:

In order to make the data predictable at some later point in time and to make sure that the data will show same behavior, any correlation and collinearity within the past data is removed. Augmented Dicky- Fuller (ADF) Test from the Statsmodel package is used to determine whether the data is stationary or non-stationary. The following results were obtained:

Table No. 2

Results of Augmented Dicky-Fuller Test

	BSE Sensex	NSE NIFTY 50
Test Statistics	-1.4338	-1.4318
P-value	0.5659	0.5668
No. of Lags Used	7	7

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Number of Observations Used	192	193
Critical value (1%)	3.4648	3.4646
Critical value (5%)	-2.8767	-2.8766
Critical value (10%)	-2.5748	-2.5748

Source: Researcher's Calculation

The table presents the test statistics and related values for analyzing the volatility of BSE Sensex and NSE Nifty 50 indices. The test statistics for both indices are -1.4338 for BSE Sensex and -1.4318 for NSE Nifty 50. The corresponding p-values are 0.5659 and 0.5668, respectively, indicating that the null hypothesis cannot be rejected at conventional significance levels. Both tests used 7 lags, with 192 observations for BSE Sensex and 193 for NSE Nifty 50. The critical values at the 1%, 5%, and 10% significance levels are 3.4648, -2.8767, and -2.5748 for BSE Sensex, and 3.4646, -2.8766, and -2.5748 for NSE Nifty 50. Given that the test statistics are less extreme than the critical values, there is insufficient evidence to conclude significant volatility changes in the indices during the analyzed period.

Application of Differencing Method:

It was expected that data would be non-stationary as it is quite natural that stock prices have changed over time. If we use this data without transformation, we will get biased results. Hence, it is necessary to make the data stationary. Differencing method is used to make the data stationary. Following figure shows the stationary data of selected stock exchanges that is obtained after removing trends and seasons form non-stationary data.

Chart No.3

Graphical Representation after Applying Differencing Method (NSE NIFTY &BSE Sensex)

NSE NIFTY 50	BSE Sensex

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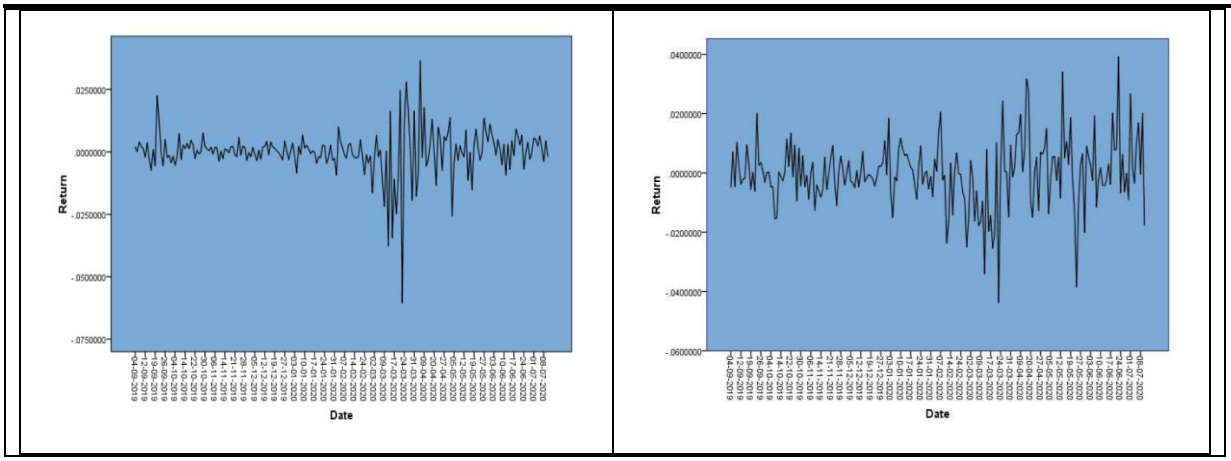

Source: Researcher's Own Work

The analysis indicates that the NSE has exhibited less volatility during COVID-19 compared to the BSE, likely due to effective regulatory measures, a diversified mix of listed companies, and strong investor confidence fostered by transparent communication from the exchange's management. In contrast, the BSE has shown higher volatility, potentially due to a different composition of listed companies, market dynamics, and trading patterns. The concentration of companies in specific industries on the BSE and variations in trading behavior and investor sentiment may have led to more pronounced price fluctuations. Thus, while the NSE's stability can be attributed to its diverse portfolio and robust regulatory framework, the BSE's increased volatility may stem from sector-specific impacts and differing market activities.

Results of GARCH Model:

In the examination of financial market dynamics, the results of the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model provide valuable insights into the volatility patterns. This statistical model is designed to capture and analyze time-varying volatility, offering a nuanced understanding of how fluctuations in financial markets evolve over time. The application of the GARCH model enables a comprehensive assessment of volatility dynamics, aiding in risk management and investment decision-making.

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Chart No. 4

GARCH Model Results (NSE NIFTY 50)

Constant Mean - GARCH Model Results

Dep. Variable:	Returns	R-squared:	0.000
Mean Model:	Constant Mean	Adj. R-squared:	0.000
Vol Model:	GARCH	Log-Likelihood:	-353.857
Distribution:	Normal	AIC:	715.715
Method:	Maximum Likelihood	BIC:	728.908
		No. Observations:	200
Date:	Mon, Nov 27 2023	Df Residuals:	199
Time:	19:25:03	Df Model:	1

Mean Model

	coef	std err	t	P>|t|	95.0% Conf. Int.
mu	0.1254	7.874e-02	1.592	0.111	[-2.897e-02, 0.280]

Volatility Model

	coef	std err	t	P>|t|	95.0% Conf. Int.
omega	0.0845	6.891e-02	1.226	0.220	[-5.059e-02, 0.220]
alpha[1]	0.2991	0.151	1.983	4.732e-02	[3.534e-03, 0.595]
beta[1]	0.7009	0.125	5.602	2.125e-08	[0.456, 0.946]

Source: Researcher's Calculation

1. The estimated mean is 0.1254, with a standard error of 7.874e-02. The t-statistic is 1.592, and the p-value is 0.111, which means the mean is not significantly different from zero at a conventional significance level of 0.05.

2. The table reveals that the coefficient for lagged squared returns and the coefficient for lagged conditional variance are significant and positive, which entailed that volatility is present in NSE Nifty. However, the average (mean) return is positive but insignificant; indicating that past news does not impact current volatility.

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Chart No. 5

GARCH Model Results (BSE Sensex)

Constant Mean - GARCH Model Results

Dep. Variable:	Returns	R-squared:	0.000
Mean Model:	Constant Mean	Adj. R-squared:	0.000
Vol Model:	GARCH	Log-Likelihood:	-355.271
Distribution:	Normal	AIC:	718.542
Method:	Maximum Likelihood	BIC:	731.716
		No. Observations:	199
Date:	Mon, Nov 27 2023	Df Residuals:	198
Time:	19:15:53	Df Model:	1

Mean Model

	coef	std err	t	P>|t|	95.0% Conf. Int.
mu	0.1279	7.683e-02	1.665	9.600e-02	[-2.270e-02, 0.278]

Volatility Model

	coef	std err	t	P>|t|	95.0% Conf. Int.
omega	0.0877	7.860e-02	1.116	0.264	[-6.633e-02, 0.242]
alpha[1]	0.2946	0.163	1.812	7.001e-02	[-2.408e-02, 0.613]
beta[1]	0.7054	0.139	5.090	3.576e-07	[0.434, 0.977]

Source: Researcher's Calculation

1. The estimated average (mean) return in the Indian equity market is 0.1279. The standard error is 0.07683, and the t-statistic is 1.665. The p-value (P>|t|) is 0.096, which is greater than the conventional significance level of 0.05. Therefore, the mean return is not statistically different from zero at the 0.05 significance level.

2. The result shows that the stock market especially the BSE Sensex become volatile during the pandemic period.In summary, the GARCH model results suggest that the BSE Sensex exhibited increased volatility during the pandemic period. The highly significant coefficient for lagged conditional variance implies that past volatility, likely associated with the pandemic's impact, had a persistent effect on the market's current volatility. This aligns with the common understanding that the pandemic led to heightened uncertainty and fluctuations in financial markets globally.

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Conclusion:

The impact of the COVID-19 pandemic on the equity market of India has been profound and multifaceted. The initial onset of the pandemic triggered a sharp and unprecedented decline in stock markets globally, including India. The BSE Sensex and NSE Nifty experienced substantial volatility, with a significant sell-off in March 2020 reflecting heightened investor uncertainty and fear.

In this study, the impact of COVID-19 on the performance of both the BSE and NSE, the two prominent stock markets in India have been explored. The GARCH model served as our tool to assess volatility in the stock market, distinguishing between two distinct time periods—before and after the first confirmed COVID-19 cases emerged in India. The daily closing prices of the BSE and NSE indices were treated as independent variables, while the two time periods were considered dependent variables. Findings indicated heightened volatility in the stock market, particularly evident in the BSE Sensex, during the pandemic. Conversely, the NSE Nifty exhibited no significant impact on volatility during the COVID-19 period. Mean returns are computed separately for pre-COVID-19 and the pandemic period, revealing negative mean returns during the pandemic, signifying losses, and positive returns in the pre-COVID-19 phase. Comparison of standard deviations highlighted larger deviations during the COVID-19 era than the pre-COVID-19 period, illustrating increased market uncertainty. Additionally, stock indices' prices underwent significant changes, with a declining trend observed up to the first lockdown in March. Subsequently, a gradual upward movement occurred, attributed to government policy relaxations. This unprecedented pandemic has brought challenges to all sectors, impacting the stock prices and elevating volatility in the Indian stock markets, affecting the broader financial system. This paper provides a straightforward yet original statistical analysis of the COVID-19 pandemic's effects on the Indian stock market.

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