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AN EMPIRICAL ANALYSIS ON INDIAN STOCK MARKET VOLATILITY DURING THE PANDEMIC

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ABSTRACT

The covid pandemic has affected the performance of an economy in various areas and the Indian stock market is not an exception. This study empirically analyses volatility of the Indian during covid 19 pandemic with special reference to BSE and NSE. To determine the market volatility by historical data NSE and BSE closing prices on the daily basis from December 2019 to December 2021. Trend analyze is used to find out the trend pattern of the stock returns on the daily basis and to test the statistical properties of the time series descriptive statistics and Grach (1,1) Model is used analyze the volatility nature of the stocks. The findings strongly confirm the presence of volatility in the Indian stock market during December 2019 to December 2021.

KEY WORDS: GARCH (1,1), NSE, BSE, COVID PANDEMIC, STOCK MARKET

I. INTRODUCTION

In Finance Sector Stock Market plays major role in the development of a country. In India Stock Market has classified into Bombay Stock Exchange and National Stock Exchange. Bombay Stock Exchange is the oldest stock exchange in India located at the Dalal Street in Mumbai. In Bombay Stock Exchange their bench mark known as Sensex is used to measure the index. In Bombay Stock Exchange Top 30 Companies are listed in the Stock Exchange. Companies has classified into 10 or more sectors which contributes towards Indian Economy. Examples: Reliance Industries, ICCI Bank. National Stock Exchange is another type of market in India, It is the largest financial market in India and fourth largest trading volume in the world. National Stock Exchange introduced fully automated, electronic, and screen-based trading in India. And its bench mark knowns as Nifty 50 is used to measure the index. National Stock Exchange Top 50 companies most highly liquid and constant trading Indian companies which are listed on National Stock Exchange. Examples: Reliance Industries, TCS, Hindustan Unilever.

II. REVIEW OF LITERATURE

- According to Bakeretal. Stock market has been affected by the Covid 19pandemic globally. Pandemic creates spikes and volatility in the Us Stock Market.
- According to Daube and Dev and Sengupta financial markets are toxics. Introduction of COVID- 19 in the world ever stock market has been crashed with that pandemic effect and implementation of lockdown.
- According to chen at al and He at al the studied about the effect of covid 19 in the stock market and also about the returns of the stock market around the world.
- According to Ali et al, Liu et al., conduct the research that Asian countries faced worse effects of the pandemic than the advanced economics or country.
- According to Ozili and Arun conducted the research to tested the effects of COVID-19 on the economic and in the financial Sector of US, UK, Japan and South Africa. Results shows that stock price has comes down due to implementation of lockdown and changes in monetary policy.

- According to Gormsen and Koijen studied the impact of COVID-19 on economy of the country and stock prices in the share markets. Study found that the stock market responded quickly to theCOVID-19 outbreak, increasing number of COVID-19 cases through out the country and world.
- According to Ashraf , Mishra et al, Yilmazkudey, Barro et al. conduct the study and found that stock market and returns are declined because of the increase in death rates throughout theworld.
- According to Liu et al, Prabheesh et al done the research that shows there is positive relationship between covid 19 and stock market returns.

III. OBJECTIVES AND METHODOLOGY

Objectives:

- To analyze the volatility of BSE Sensex and Nifty 50 stocks during the pandemic.
- To analyze predictability of the stock returns based on its past values.
- To find out the weather stock market is impacted by the COVID 19 pandemic.

Research 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 and yahoo finance.com. Data are collected from December 2019 to December 2020. Daily closing index value are taken and 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.

Rt = Inpt -Inpt.....-1

Here, Rt, Pt, and Pt-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 Perron (PP) test has been used. The Augmented Dickey-Fuller (ADF) test is based on the estimate of thefollowing regression:

$\Delta Yt = a0 + \gamma 1 yt{-}1 + \sum \beta ipi{=}1\ \Delta yt{-}i + \in t$----------2

IV. CORRELOGRAM

A Correlogram is also called Auto Correlation is visual way to show serial correlation in data that changes over time that is time series. Serial Correlation is also called auto correlation is where an errorat one point in time travels to be subsequent point in time correlograms can give you good whether or not pairs of data show auto correlation.

Correlogram residual squares:

This view displays the autocorrelations and partial autocorrelations of the squared residuals up to any specified number of lags and computes the Ljung-Box. Q-statistics for the corresponding lags. The correlograms of the squared residuals can be used to check autoregressive conditional heteroskedasticity(ARCH)

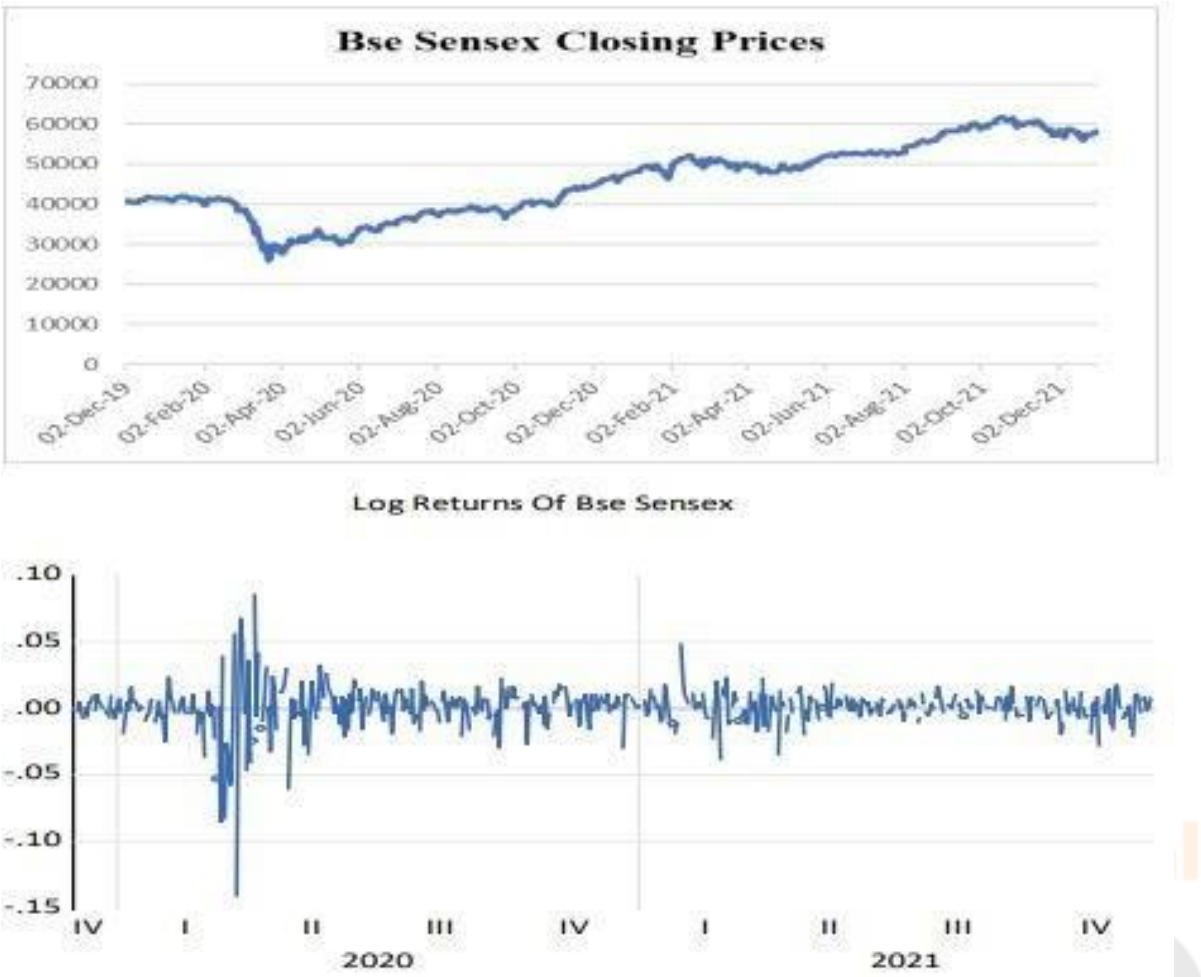
Garch Model (1,1):

The most common Garch model is Garch (1,1) model. Garch (1,1) model indicates the situation wherep □ q □1 is clearly shown. The Garch (p,q) process is weak stationary, if and only if, it satisfies the following condition:

□ □□ □ □ □ q j p j □ j □ j

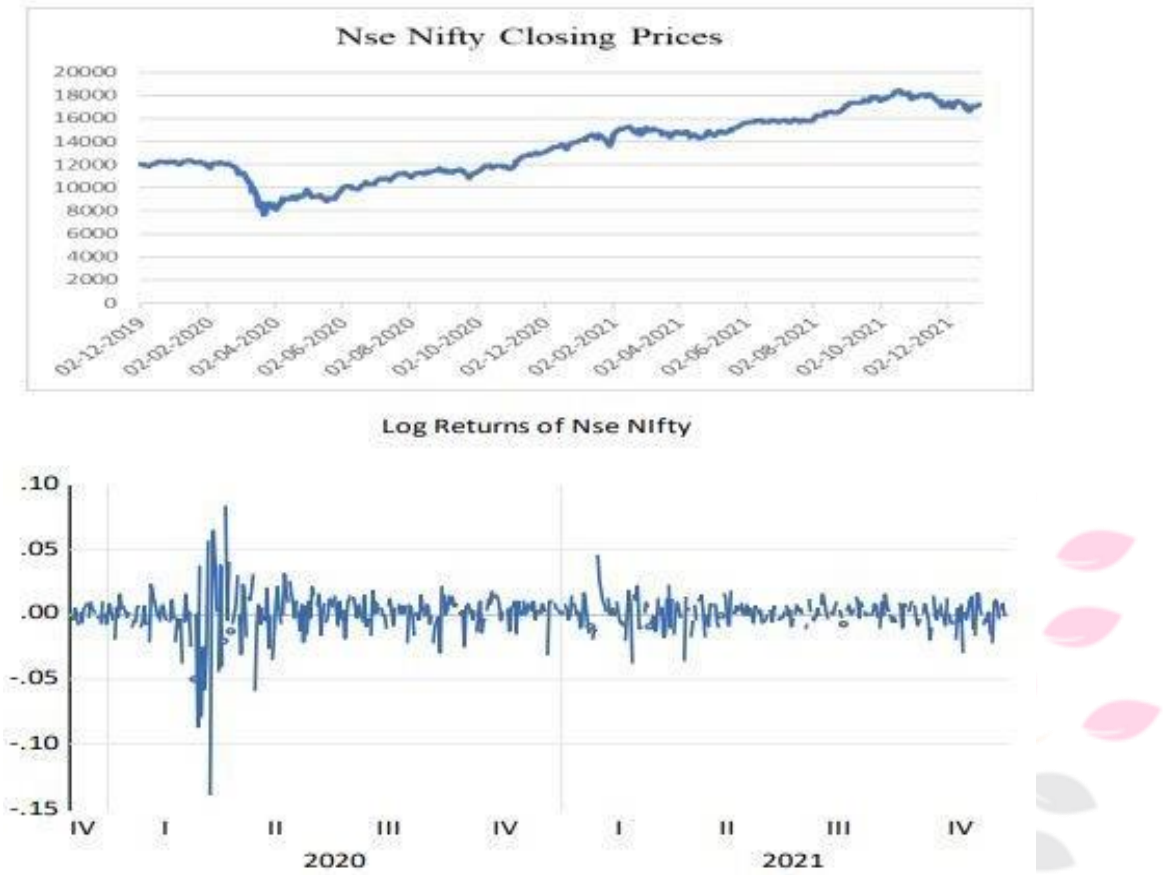
V. TREND ANALYSIS OF NATIONAL STOCK EXCHANGE AND BOMBAY STOCK EXCHANGE RETURNS

Figure 1: Trend Prices Of Closing Prices and Log Returns of BSE Sensex



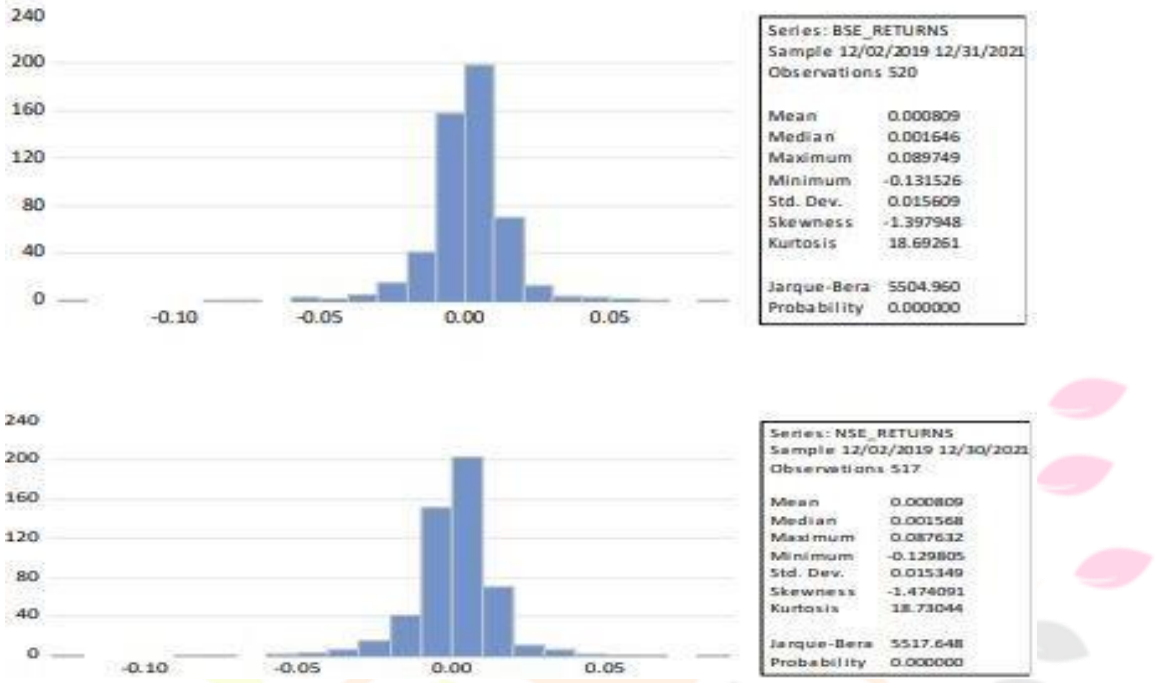
The trend of the closing prices of bse and nse are given in figure 1 and 2.The Trend pattern of the time series of NSE index, Nifty 50 and BSE Sensex and Log returns of the index on a daily basis of from Dec 19- Dec 2021 shows a series of peaks and a trough which shows the vulnerability and wide fluctuations ofthe stock prices during the pandemic especially during the month of march 2020 when there the government had announced a complete lockdown. There is a wide range of data clustering in both the indices which explains the volatility nature of the stock returns. A series values followed by higher volatility and lower volatility. This indicates that a conditional heteroscedastic model should be used. Hence, the data that will be analyzed throughout this paper is the simple log returns. Volatility and the vulnerability of the stock return during the pandemic are further justified in the descriptive statistics and histogram given in Table 1

Figure 2: Trend Prices Of Closing Prices And Log Returns Of National Stock Exchange Nifty:



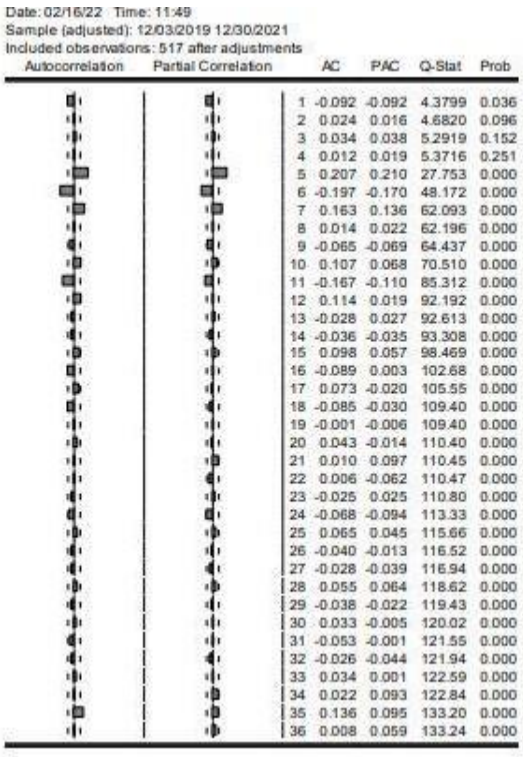
It is stated that a distribution with a kurtosis greater than 3, for both nse and bse and tends to contain moreextreme values, thus, the density function is likely to have heavy tails, as well as a high thin peak around its mean. In Table 1 it can be seen that the log returns of bse returns has a skewness of -1.397 , and -1.474and r_t has a quite high kurtosis, 18.692 and 18.750, indicating that the distribution is leptokurtic. The leptokurtic and the Jarque-Bera statistic strongly rejects the hypothesis of normal distribution of for both bse and nse which is given in Table1.

Table 1: Descriptive Statistics of National Stock Exchange And Bombay Stock Exchange Returns



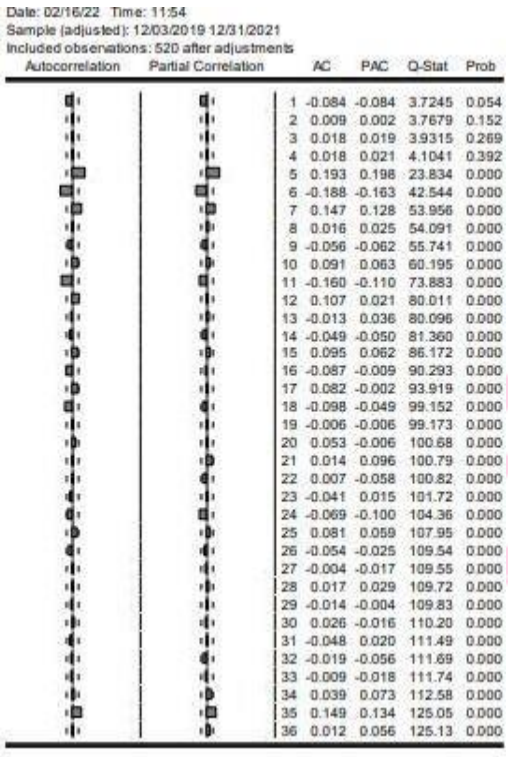
The volatility in bse and nse not directly observable. The volatility is often high for certain periods and low for other periods, known as volatility clustering. Conditional heteroscedastic models, are often used to try and model this kind of behavior. The next step in our path to identify a model, is to check if the series {rt} is dependent, but serially uncorrelated, or at least has minor lower order serial correlations. This is often visually done with autocorrelation plots, of different functions of the series {rt}. The ACF plot of the log returns, shows if there exists any serial correlation of different lag length, between rt and its previous values. The acf of bse and nse are given in table 2.the null hypothesis is rejected since the p values is lesser than 0.05% significance level in case of both bse and nse. The acf and the pacf in Correlogram of the squared returns given in table 2 shows significant spikes in the first 15 lags which isa clear indication of volatility clustering . The null hypothesis rejected for both nse and bse since the P value is lesser than 0.05% for all the lags.

TABLE 2 Correlogram log returns National Stock Exchange and Bombay Stock Exchange



Date: 02/16/22 Time: 11:49
Sample (adjusted): 12/03/2019 12/30/2021
Included observations: 517 after adjustments

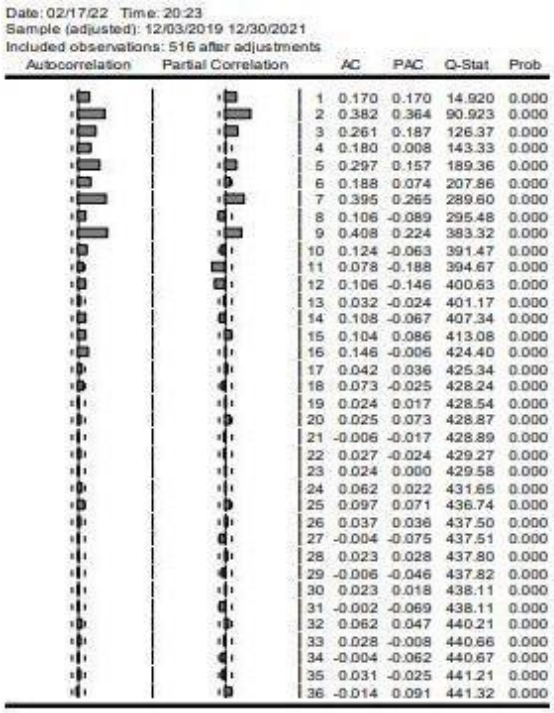
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.092	-0.092	4.3799	0.036
		2	0.024	0.016	4.6820	0.096
		3	0.034	0.038	5.2919	0.152
		4	0.012	0.019	5.3716	0.251
		5	0.207	0.210	27.753	0.000
		6	-0.197	-0.170	48.172	0.000
		7	0.163	0.136	62.093	0.000
		8	0.014	0.022	62.196	0.000
		9	-0.065	-0.069	64.437	0.000
		10	0.107	0.068	70.510	0.000
		11	-0.167	-0.110	85.312	0.000
		12	0.114	0.019	92.192	0.000
		13	-0.028	0.027	92.613	0.000
		14	-0.036	-0.035	93.308	0.000
		15	0.098	0.057	98.469	0.000
		16	-0.089	0.003	102.68	0.000
		17	0.073	-0.020	105.55	0.000
		18	-0.085	-0.030	109.40	0.000
		19	-0.001	-0.006	109.40	0.000
		20	0.043	-0.014	110.40	0.000
		21	0.010	0.097	110.45	0.000
		22	0.006	-0.062	110.47	0.000
		23	-0.025	0.025	110.80	0.000
		24	-0.068	-0.094	113.33	0.000
		25	0.065	0.045	115.66	0.000
		26	-0.040	-0.013	116.52	0.000
		27	-0.028	-0.039	116.94	0.000
		28	0.055	0.064	118.62	0.000
		29	-0.038	-0.022	119.43	0.000
		30	0.033	-0.005	120.02	0.000
		31	-0.053	-0.001	121.55	0.000
		32	-0.026	-0.044	121.94	0.000
		33	0.034	0.001	122.59	0.000
		34	0.022	0.093	122.84	0.000
		35	0.136	0.095	133.20	0.000
		36	0.008	0.059	133.24	0.000



Date: 02/16/22 Time: 11:54
Sample (adjusted): 12/03/2019 12/31/2021
Included observations: 520 after adjustments

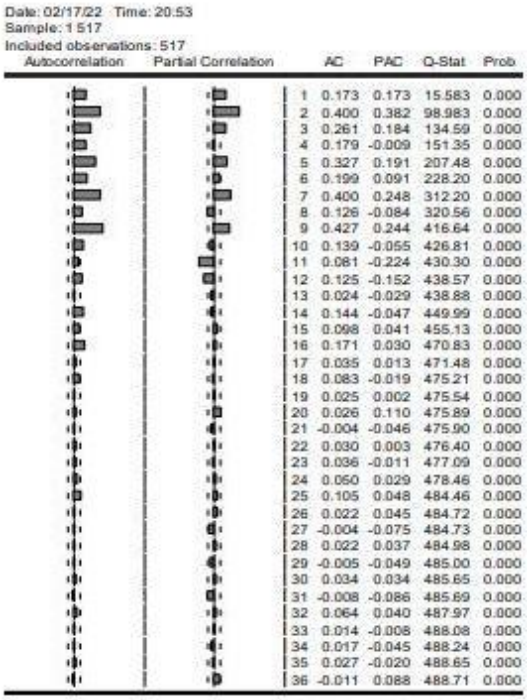
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.084	-0.084	3.7245	0.054
		2	0.009	0.002	3.7679	0.152
		3	0.018	0.019	3.9315	0.269
		4	0.018	0.021	4.1041	0.392
		5	0.193	0.198	23.834	0.000
		6	-0.188	-0.163	42.544	0.000
		7	0.147	0.128	53.956	0.000
		8	0.016	0.025	54.091	0.000
		9	-0.056	-0.062	55.741	0.000
		10	0.091	0.063	60.195	0.000
		11	-0.160	-0.110	73.883	0.000
		12	0.107	0.021	80.011	0.000
		13	-0.013	0.036	80.096	0.000
		14	-0.049	-0.050	81.360	0.000
		15	0.095	0.062	86.172	0.000
		16	-0.087	-0.009	90.293	0.000
		17	0.082	-0.002	93.919	0.000
		18	-0.098	-0.049	99.152	0.000
		19	-0.006	-0.006	99.173	0.000
		20	0.053	-0.006	100.68	0.000
		21	0.014	0.096	100.79	0.000
		22	0.007	-0.058	100.82	0.000
		23	-0.041	0.015	101.72	0.000
		24	-0.069	-0.100	104.36	0.000
		25	0.081	0.059	107.95	0.000
		26	-0.054	-0.025	109.54	0.000
		27	-0.004	-0.017	109.55	0.000
		28	0.017	0.029	109.72	0.000
		29	-0.014	-0.004	109.83	0.000
		30	0.026	-0.016	110.20	0.000
		31	-0.048	0.020	111.49	0.000
		32	-0.019	-0.056	111.69	0.000
		33	-0.009	-0.018	111.74	0.000
		34	0.039	0.073	112.58	0.000
		35	0.149	0.134	125.05	0.000
		36	0.012	0.056	125.13	0.000

Table 3 - Correlogram of squared log return of National Stock Exchange And Bombay StockExchange



Date: 02/17/22 Time: 20:23
Sample (adjusted): 12/03/2019 12/30/2021
Included observations: 516 after adjustments

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.170	0.170	14.920	0.000
		2	0.382	0.364	90.923	0.000
		3	0.261	0.187	126.37	0.000
		4	0.180	0.008	143.33	0.000
		5	0.297	0.157	189.36	0.000
		6	0.188	0.074	207.86	0.000
		7	0.395	0.265	289.60	0.000
		8	0.106	-0.089	295.48	0.000
		9	0.408	0.224	383.32	0.000
		10	0.124	-0.063	391.47	0.000
		11	0.078	-0.188	394.67	0.000
		12	0.106	-0.146	400.63	0.000
		13	0.032	-0.024	401.17	0.000
		14	0.108	-0.067	407.34	0.000
		15	0.104	0.086	413.08	0.000
		16	0.146	-0.006	424.40	0.000
		17	0.042	0.036	425.34	0.000
		18	0.073	-0.025	428.24	0.000
		19	0.024	0.017	428.54	0.000
		20	0.025	0.073	428.87	0.000
		21	-0.006	-0.017	428.89	0.000
		22	0.027	-0.024	429.27	0.000
		23	0.024	0.000	429.58	0.000
		24	0.062	0.022	431.65	0.000
		25	0.097	0.071	436.74	0.000
		26	0.037	0.036	437.50	0.000
		27	-0.004	-0.075	437.51	0.000
		28	0.023	0.028	437.80	0.000
		29	-0.006	-0.046	437.82	0.000
		30	0.023	0.018	438.11	0.000
		31	-0.002	-0.069	438.11	0.000
		32	0.062	0.047	440.21	0.000
		33	0.028	-0.008	440.66	0.000
		34	-0.004	-0.062	440.67	0.000
		35	0.031	-0.025	441.21	0.000
		36	-0.014	0.091	441.32	0.000



Date: 02/17/22 Time: 20:53
Sample: 1 517
Included observations: 517

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.173	0.173	15.583	0.000
		2	0.400	0.382	98.983	0.000
		3	0.261	0.184	134.59	0.000
		4	0.179	-0.009	151.35	0.000
		5	0.327	0.191	207.48	0.000
		6	0.199	0.091	228.20	0.000
		7	0.400	0.248	312.20	0.000
		8	0.126	-0.084	320.56	0.000
		9	0.427	0.244	416.64	0.000
		10	0.139	-0.055	426.81	0.000
		11	0.081	-0.224	430.30	0.000
		12	0.125	-0.152	438.57	0.000
		13	0.024	-0.029	438.88	0.000
		14	0.144	-0.047	449.99	0.000
		15	0.098	0.041	455.13	0.000
		16	0.171	0.030	470.83	0.000
		17	0.035	0.013	471.48	0.000
		18	0.083	-0.019	475.21	0.000
		19	0.025	0.002	475.54	0.000
		20	0.026	0.110	475.89	0.000
		21	-0.004	-0.046	475.90	0.000
		22	0.030	0.003	476.40	0.000
		23	0.036	-0.011	477.09	0.000
		24	0.050	0.029	478.46	0.000
		25	0.105	0.048	484.46	0.000
		26	0.022	0.045	484.72	0.000
		27	-0.004	-0.075	484.73	0.000
		28	0.022	0.037	484.98	0.000
		29	-0.005	-0.049	485.00	0.000
		30	0.034	0.034	485.65	0.000
		31	-0.008	-0.086	485.69	0.000
		32	0.064	0.040	487.97	0.000
		33	0.014	-0.008	488.08	0.000
		34	0.017	-0.045	488.24	0.000
		35	0.027	-0.020	488.65	0.000
		36	-0.011	0.088	488.71	0.000

Garch (1,1) Model For Bombay Stock Exchange and National Stock Exchange:

Coefficients for the average stock return for BSE AND NSE given in table 3 ARE 0.00115 AND 0.001081 and its positive but the past values of both bse and nse are not significant since the significant p- values are greater than 0.05% significance level and hence the return cannot strongly predict the current series. hence the past returns value does not have a strong predictability of the current returns. the arch term is0.130for bse and 0.125 in nse and the garch term is 0.850 and 0.853 and both these terms are statistically significant at 1percent level. this gives the result of the GARCH model .the time varying volatility includes constant of 0.000000423 in case of bse and 0.000000416 for nse plus its past of 0.850and 0.8530and a component which depends on past errors of 0.0280 and 0.0153 .
These findings clearly establish the presence of time varying conditional volatility of returns of BSE AND NSE. The results also ensure a presence of volatility shocks especially during the pandemic period

Table 3: Garch(1,1) For of National Stock Exchange And Bombay Stock Exchange

Dependent Variable: BSE_RETURNS
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 02/16/22 Time: 14:45
Sample (adjusted): 12/04/2019 12/31/2021
Included observations: 519 after adjustments
Convergence achieved after 18 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.001152	0.000452	2.547944	0.0108
BSE_RETURNS(-1)	0.028021	0.048848	0.573642	0.5662
Variance Equation				
C	4.23E-06	1.51E-06	2.806450	0.0050
RESID(-1)^2	0.130034	0.020822	6.245082	0.0000
GARCH(-1)	0.850011	0.025953	32.75132	0.0000

R-squared	-0.006041	Mean dependent var	0.000816
Adjusted R-squared	-0.007987	S.D. dependent var	0.015623
S.E. of regression	0.015685	Akaike info criterion	-6.109831
Sum squared resid	0.127191	Schwarz criterion	-6.068869
Log likelihood	1590.501	Hannan-Quinn criter.	-6.093783
Durbin-Watson stat	2.222339		

Dependent Variable: NSE_RETURNS
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 02/16/22 Time: 14:30
Sample (adjusted): 12/04/2019 12/30/2021
Included observations: 516 after adjustments
Convergence achieved after 20 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.001081	0.000466	2.317766	0.0205
NSE_RETURNS(-1)	0.015399	0.048679	0.316344	0.7517
Variance Equation				
C	4.16E-06	1.52E-06	2.735533	0.0062
RESID(-1)^2	0.125917	0.020347	6.188498	0.0000
GARCH(-1)	0.853212	0.026131	32.65159	0.0000

R-squared	-0.003384	Mean dependent var	0.000819
Adjusted R-squared	-0.005336	S.D. dependent var	0.015362
S.E. of regression	0.015403	Akaike info criterion	-6.126111
Sum squared resid	0.121953	Schwarz criterion	-6.084966
Log likelihood	1585.537	Hannan-Quinn criter.	-6.109988
Durbin-Watson stat	2.213424		

VI. FINDINGS

Due to the Covid-19 pandemic and implementation of lockdown in India .Stock Market has crashes and become highly volatility is proven with the historical data of National Stock Exchange And Bombay StockExchange on the daily basis. With the help of EViews Software log returns, correlogram, correlogram residual squares and Grach (1,1) Model.

VII. CONCLUSION

Due to covid 19 pandemic situation and lockdown enforce by the government of the India, and increases in price of the commodity of the goods and many people lost their jobs , investors are looking to invest in markets are reasons for the stock market volatility. We find out that covid 19 has impact the stock marketvolatility with help of EViews software.

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