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# Impact of Covid-19 on the Volatility of Stock Markets: An Empirical Investigation of the Indian Stock Markets

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**Abstract**
Covid-19 has left its mark in almost all the sectors throughout the world. Pre, During and Post periods of Covid-19 have drastic movements in terms of demand, supply, investment, income, consumption, savings and the likewise factors. Even Researchers in the Medical and Pharmaceutical fields have been debating whether to call current period as post Covid-19 period or not. The reason is nothing but the emerging variants of Covid-19 either still have their presence or expected in the recent times. Even though almost the entire world is now vaccinated, the risk and volatility of the investment decisions and patterns remain the same. COVID-19 pandemic has profound impact on global stock market with comparatively for a short term but lasting wise, much more for the long term. With the immediate effect, the pandemic outbreak, the stock market witnessed the extreme volatility with some sharp fall in the early 2020 followed with some rapid recoveries fuelled by government stimulus measures and vaccine developments. The short-term effect is highlighted the vulnerabilities on the fiscal market with some external shocks. However, the long-term impact of COVID-19 on the stock market volatility got extended with the primary shocks while enhancing the trend of digitalization, hybrid and remote working including e-commerce trade. This favoured the tech-related and sectoral gaps thereby making the stocks of these sectors also becoming more vulnerable. Furthermore, the surrounding of the pandemic founded the new variants and policy responses to continue with the market volatility. The stock market investors and policymakers remain pretty much alert in exploring and formalizing the trends especially in the period which is most often called as the post COVID-19 period.
This Research has attempted to examine the effect of Covid-19 on the volatility of Indian Stock Market. Researchers have used Generalized Autoregressive Conditional Heteroscedasticity Model. Nifty and Sensex Stock Market Index closing prices were used for the Research Study. Period covering September 03, 2019 to July 10, 2020 was selected for the Study. Evidence suggest that the Indian Stock Market was unstable during the outbreak. Return on the indices was higher before Covid-19 as measured by our comparison of pre and post Covid-19 performances.

**Key Words:** Stock Market, Nifty 50, Covid-19, Event Studies, Risk, Investment

## 1. Introduction

Remarkable speed with which the Covid-19 epidemic has spread has instantly altered global perspectives. Pandemic was sparked by the discovery of the SARS-CoV2 Virus in Wuhan-China in December 2019. It eventually reached many other parts of the world. The pandemic remains to be the worldwide economic disaster as well as health crisis. Many nations halted all economic activities while strict quarantine measures were adapted by all the nations to stop the spread of the disease. The global economy has been hampered by regulations and bans imposed on international transportation. Most notably, widespread panic has discouraged normal purchasing patterns among consumers and

businesses. Amongst world's big economies, U.S., Spanish, Italian, Brazilian and Indian economies have felt the effects of the epidemic's uncertainty and risk to the maximum possible extent. The financial market has made a dramatic shift, with disastrous results. The stock market, the bond market and the financial industry as a whole have all been significantly impacted by the economic volatility caused by COVID-19.

Gold's price has skyrocketed while oil has plummeted as a result of the pandemic. Firzli (2020) calls this pandemic "the worst financial calamity in history". In most of the cases observed, Corporate Debts have recorded at the peak of the volume of the times while corporations are highly leveraged making weak businesses more likely to fail. As a result of the pandemic, the risk and volatility of the international financial markets have increased considerably. (Zhang et.al.,2020).

From 24$^{th}$ to 28$^{th}$ March, the world's stock markets dropped by about $6 Trillion as a result of this infection. (Ozili & Arun, 2020). Losing of 30% of its value by the S&P 500 since the start of Covid-19 is another impact. Azimili (2020) mentioned that the expected and required rate of return has been influencing current value of stock market.

In an effort to prevent the pandemic, the Indian government imposed Janata Curfew on March 22, 2020. Also, a Lockdown Plan was presented on March 24, 2020. Following this, many businesses closed. Global market upheaval has made the Indian Financial Market unstable (Raja Ram, 2020).

The Indian Stock Market has been thrown into the chaos by the global financial sector's decline. Major stock indices in India include the Sensex on Bombay Stock Exchange (BSE) and the Nifty on the National Stock Exchange (NSE). As of 23.03.2020, the BSE Sensex had fallen by 13.2%. Prior to 28.04.1991 when Harshad Mehta scam was unearthed, this was the most affected hit (Mandal, 2020).

There has been an approximately 29% drop in the Nifty throughout this time. In response to the government's "lockdown" plan, several businesses reduced their staff and productivity. The supply chain experienced disruptions as a result of this. According to some Analysts, the impact of Covid-19 on the Indian Stock Markets is "Black Swan Event". This is nothing but a devastating event that no one saw coming. Since there is so much unpredictability in the world, people are once again cutting back on their spending. This in turn causes a jolt to consumer demand. The information also showed that the Shipping Process was not affected by the preceding Pandemic. In general, Covid-19 has affected both demand as well as supply side of the industry. The pandemic revealed the weaknesses of the financial market in spite of an exceptional involvements of the union banks and governments. The immediate arrangements included financial support including disaster financial packages pumped into the economy and interest rates cut down.


**Figure 1: https://m.economictimes.com/thumb/msid-74623659,width-640,height-480,resizemode-7/10-year-sensex-cagr.jpg**

The research problem is to investigate the impact of Covid-19 on the volatility of the stock market. Sentiments of Investors and the movements of the thought processes with the advancement in the combating of the Covid-19 in the form of financial reforms, vaccine development and so on need to be mapped with the movement of the stock market indices. Collapsing of the indexes of the stock markets has been and would remain to be the product of wave of uncertainty and unpredictability of the funds and profitability expectations.

However, the real reason toward the volatility of the Stock Market still remains to be unearthed, at least partially. Although much has been written on how COVID-19 might affect the market as a whole, especially in the developed nations, it is not nearly. The reason being, much study has been devoted to emerging countries. This Research attempts to quantify the effect of Covid-19 on the two major Indian Indices of the Stock Markets. To add, impact of Covid-19 on some specific sectors and industries played a crucial role in driving the stock market volatility. A few sectors like E-Commerce, Online Communication got a boom during the Pandemic period whereas Hospitality, Tourism, Airline Industries, Automobile Industries were the major sectors to get affected due to setback. Getting a glimpse of the real impact of Covid-19 on stock prices remains necessary for not only the Investors but also for Policymakers.

The Research Objectives remain to be:

a) To assess the effect of Covid-19 on Indian Stock Markets

b) To assess Stock Market position in Indian Stock Markets pre and post Covid-19

c) To draw definitive and defendable conclusions and suggestions from the findings of the Research.

To add, impact of Covid-19 on some specific sectors and industries played a crucial role in driving the stock market volatility. A few sectors like E-Commerce, Online Communication got a boom during the Pandemic period whereas Hospitality, Tourism, Airline Industries, Automobile Industries were the major sectors to get affected due to setback. Getting a glimpse of the real impact of Covid-19 on stock prices remains necessary for not only the Investors but also for Policymakers.

## 2. Literature Review

Both developed and developing countries have looked into how CO VID-19 will affect the stock 4 financial markets. In the relevant literature, there were many different kinds of findings, Ozili and Arun (2020) looked at the effects of social distance limits to stop the spread of corona virus. North America, Africa, Asia and Europe are all being looked at. Research shows that stock prices go down when people are locked in their homes for 30 days or otherwise cut off from society. Azimili (2020) used quantile regression to study how the Covid-19 changed the pattern of risk-reward reliance in the U.S. Post occurrence of Covid-19, the top quantiles have come to depend more on their returns and market portfolios. Diversification has become less useful because of this. The author also identified an asymmetry between GSIC (Google Search Index for Corona Virus) and stock returns with the negative impact of tails on stock returns being nearly twice as great as that of tails on the higher end of the distribution.

Results indicated that S&P 500 stock prices were impacted negatively due to Covid-19. However, the overall impact was negligible for the Nasdaq composite. Cepoi (2020) conducted an empirical investigation to determine whether the financial markets in the nations where the outbreak badly hit, reported negatively or not. The results of the investigation were as expected, the markets responded negatively. Various ways in which the market responded to the Covid-19 were investigated using panel quantile regression with dummy variables in quadratic and exponential GARCH Models. According to Osagie et.al. (2020), Covid-19 outbreak badly impacted Nigerian stock returns. Studies revealed that the financial sector might be helped by a more stable political climate, incentive for local businesses, a more diverse economy and a more forgiving exchange rate regime. Baker (2020) analysed that oil prices have dropped by as much as 80% in very short period of time as compared to the financial crisis of 2008-2009.

Because oil money is crucial for the economy, this

is a big worry. Compared to the 70% / 80% drop in the oil prices, the 20% drop in the currency rate does not seem to like that of a big deal.

Herrero (2020) says that the third wave of the Covid-19 has had the most impacting factor on the rising economies leading to a drop in economic activity. This makes people less willing to take risks, which makes prices go up. Latin America feels the effects of this crisis more than other places because it gets so much help from other countries. Because there are fewer ways to move things, there are fewer shipments. International travel restrictions have hurt the tourism business because they have led to less money coming in. Hyun-Jung (2020) looked into South Korea's stock market, which is another major developing country. His research shows that the economy has been in a bad place. In January, exports go down, in February, they go up, and then in March and June, they go down again. Based on what they found, the pandemic has hurt Asia's emerging markets the most, while it has hurt Europe's emerging markets less. The developing market economies are currently being hurt by a credit crunch. This is sometimes called as the effect of "capital flow" limitation. (Ahmed et al., 2020). Goldberg and Reed (2020) said that businesses in developing countries will lose money because of COViD-19 in 2020 and thereafter for some time a well. This meant that governments in developing economies had to pay higher interest rates when borrowing money. Frankel (2020) and Mohnot (2011) examined how the epidemic might affect the economy. Exports, tourist spending and remittances from migratory workers are all harmed by the spread of COVID-19. Based on his findings, Raja Ram (2020) concludes that Covid-19 wipes out all human life on the earth. Overall impact of the global Covid-19 effect was also observed in Indian Stock Market making more volatile. It also had an effect of falling of foreign portfolio investments quantum. The author figured out that the spread of COVID-19 was a "black swan" by looking at all of the strange things that have happened in the past. Even if the economist spends a lot of time studying how the Indian stock market goes up and down, he won't be able to make accurate predictions about the economy until the safety of public health is ensured and observed. Ravi (2020) analysed the condition of the Indian Stock Market before and after Covid-19 outbreak. Both the Sensex observed a drop of around 38% merely after hearing about the Covid-19. Drop of 27.31% in the market was also observed. More than 40% of the jobs in Hotels, Tourism and Entertainment Industries were lost.

Mandal (2020) has done a lot of research on how the deadly epidemic might affect Indian Stock Markets. Bombay Stock Exchange Sensex maximum in one day since April 28, 1992 when it fell by 13.2%. The Nifty has also dropped by 29%, which is more than the drop in 1992. Since people only buy things they need, only the FMCG company has made money. Other businesses, on the other hand, have seen a big drop in sales (Rakshit & Basistha, 2020).

Due to travel restrictions imposed in all the Countries during Co vid-19, the earnings of those sections of the public got affected to a large extent which represented considerable numbers amongst investors. In a way, their earnings impacted directly on the economy of their respective countries as well as investment in Stock Markets by them. This also remained to be one of the crucial factors behind the highlighted volatility of the stock markets during that period. (Adda, 2016). Liu et. al. (2020) presented through research that the leading 21 countries in which the outbreak of the pandemic was at its peak had the most worsened negative effect on the investments in stock markets and corresponding index movements. It was also noticed that in Asian region, the major volatility in the stock market indexes was observed. Harjoto et.al.(2021) research outputs have validated the results by Liu et.al. (2021). In this research, the event analysis was used in order to study the relationship between Covid-19 outbreak and its negative impact on the global markets while making Capital Markets as focussed parameter. Only different observation of the study was in the form of positive abnormal returns recorded by the US Stock Markets including especially the large firms. Al-Awadhi et.al.(2020) focussed his research around Capital Markets in China and has observed different degrees and intensities of the Covi-19 impact on various sectors in Chinese Capital Markets. He used Panel Regression to analyse the data collected. Study

showed that the high market capitalization stocks were adversely affected due to Covid-19 and showed extreme volatility during the Covid-19 period and thereafter as well. The research also recorded observation that volatility intensity was comparatively less in IT and Pharmaceutical Sectors. One of the important findings validated by Topcu and Gulal (2020) noted that European emerging economies were comparatively in a better position in absorbing the shocks of Covid-i9 as compared to the Asian emerging economies. The immediate natural outcome of the same was in the form of increased debts of emerging markets. Siu and Wong (2004), Lee and McKibbin (2004) have also validated in their respective research studies that the Covid-19 effect on the volatility of the stock markets globally have not observed direct relationship as a necessary feature. In the sense, in various cases, there was no direct impact of Covid-19 on the volatility of the Capital Markets. It affected the economy, sectors, earnings, spending, interest rates, consumption patterns, price levels and all these factors collectively impacted the investment decisions by the investors in the capital markets.

Many studies have looked at how COVID-19 has affected health, agriculture, industry, trade and commerce in developing countries but not as many have looked at how it has affected stock markets in these countries.

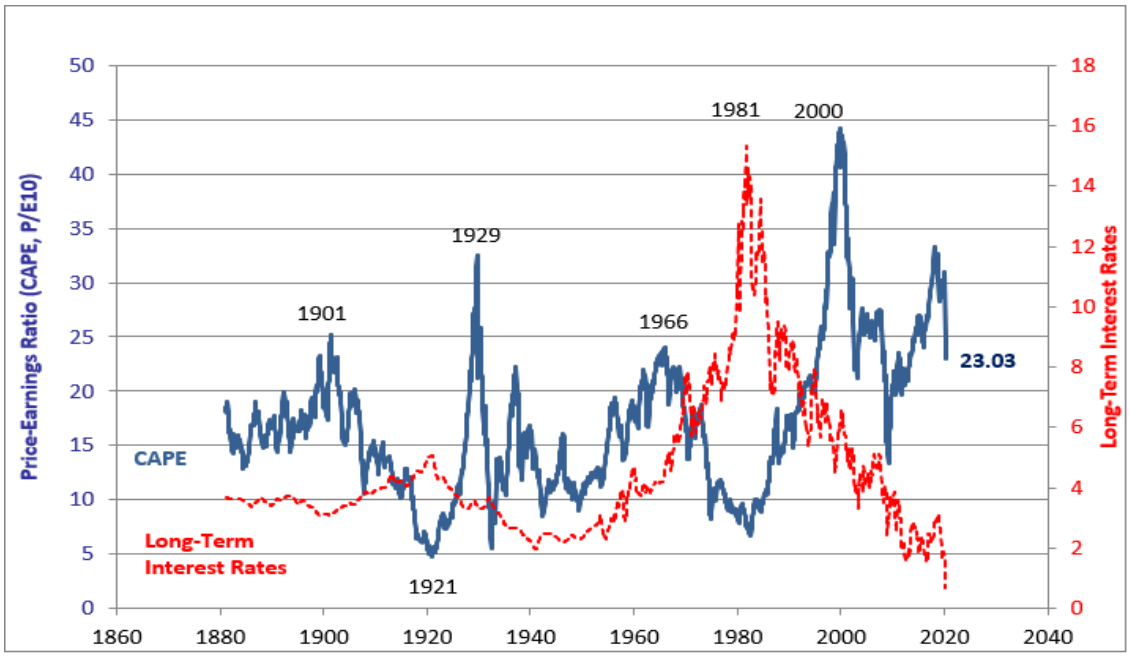


**Figure 2: https://assets.weforum.org/editor/hLW4k5Wqjoo3HvCIJqalt6gfCIMVoEwBNF43MXn71ro.PNG**

In a nutshell, a healthy stock market is crucial for the effective and efficient functioning of the economy. In this Study, Researchers aim to figure out how Covid-19 pandemic have affected and will affect the stock markets in India. As India is one of the important emerging markets, this remains to be the crucial aspect of the current Study. The GJR GARCH Model remains to be a good way to figure out how volatile BSE and NSE Markets in India are. One of the observations through literature review and references emerged that comparatively less attention has been paid on how the stock market moved pre and post Covid-19 outbreak. Hence, the Researchers also looked at how the Stock Markets performed during the two periods of Research. In addition to the immediate market instability, researchers have researched the potential long-term economic effects of the pandemic. Both the facets of impact in terms of current and long term are attempted to be addressed by the Researchers through this Study.

## 3. Research Methodology

The study relies on accurate and reliable data collected from authentic sources. Last prices for NIFTY and BSE Sensex were taken every day from BSE as well as NSE websites between 3rd September 2019 to 10th July 2020, both before and

after Covid-19. In the research, the first five months happen before COVID-19 and the next five months happen during it. India got confirmation on 30th January that it had its first positive case. A report from the Ministry of Health and Family Welfare lists cases of Cytomegalovirus Type 19 (COVID-19) infection (Vaccination updates, 2022).

The stock market's volatility was studied by looking at the BSE and NSE closing prices. Researcher estimate by taking the natural logarithm of each price point. This makes the distribution of stock prices more even.

By comparing returns from the BSE and the NSE before and after COVID, changes in stock price returns have been looked at. Osagie et al., 2020 did a study that showed this: The following formula was used to figure out how much money was made:

$$R_t = l_n P_t - l_n P_{t-1}$$

Wherein $R_t$ = daily return

Pt = the stock's closing price at that time

t-1 = stock's closing price at time from the previous day

ln = natural log

Time series have been tested for stationarity using the augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) unit root tests. Correct outcome is estimated using the PP unit root test as it adjusts the ADF test statistics for heteroscedasticity and autocorrelation consistency. Typically, the PP test is used to detect errors in heteroscedasticity. The following was utilised for the estimated regression using the ADF test:

$$\Delta Y_t = \alpha_0 + \gamma_1 y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \varepsilon_t$$

In this instance, Δ stands for the first difference operator, p for the lag, 0 for a constant, 1 and I for parameters, and t for a random error term. If = 0, then the series has a unit root and is not stationary.

The ADF test incorporates a "lagged difference term" into the regression in order to account for the potential that the error term is related to itself in a particular way. PP does not employ a difference term with a lag to address serial correlation in the error term. Instead, a nonparametric serial correlation approach is employed. This denotes that the PP test is superior to the ADF test.

The PP test is based on the following regression estimate:

$$\Delta Y_t = \alpha + \rho y_{t-1} + \varepsilon_t$$

α = constant

ρ = parameter

$\mathcal{E}_t$ = residual

Impact of Covid-19 on the volatility of the stock market is analysed while applying GJR GARCH Model. Glosten et al. (1993) and Zakoian (1994) developed a model to quantify dissimilar shocks on financial decisions. It is a weakness of the GARCH model that it responds in the same way to positive and negative shocks (Sakthivel et al. 2014). This is due to the fact that the signs of the lagged residuals are ignored by Equation (4)'s conditional variance".

$$h_t = \propto_0 + \sum_{j=1}^{q} \propto_1 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_1 h_{t-1} + \sum_{k=1}^{r} \gamma_i I_{t-1} \varepsilon_{t-1}^2$$

$I_{t-1}$ = 1

if $\mathcal{E}_{t-1} < 0$; = 0 otherwise.

In the model, the good news (e t 1 > 0) and bad news (e t 1 < 0) have contrasting impacts on the conditional variance, good news has an effect of P 1, while bad news has an effect of a 1 + y l. If y l>0, negative shocks lead to increased volatility which will bring the leverage effect of the ith order. If y 1 = 0, the news effect is symmetric".

The conditional mean and variance equation include a dummy variable for examining how the COVID-19 pandemic has altered the volatility of NSE and BSE. The GJR GARCH technique describes the altered model as follows:

$$P_t = \alpha 0 + \beta_1 P_{t-1} + \gamma 1 D_1 + \varepsilon_1,$$

$$h_t = \propto_0 + \sum_{j=1}^{q} \propto_1 \varepsilon_{t-1}^2 + \sum_{i=1}^{p} \beta_1 h_{t-1} + \sum_{k=1}^{r} \gamma_i I_{t-1} \varepsilon_{t-1}^2 + \lambda_1 D_1$$

It is anticipated that the value of the dummy variable D1 will be 0 before COVID-19 and 1 after COVID-19. If the dummy variable's coefficient is negative and significant, then it is hypothesized that the COVID-19 pandemic reduced volatility in

the Indian stock market. Indicating that the COVID-19 crisis did increase Indian stock market volatility, the dummy variable's coefficients are positive and statistically significant.

## 4. Empirical Analysis

First, descriptive statistics are used to describe the prices and returns on BSE and NSE series. If the Stock's main measure of profitability, i.e. the mean return is negative, as shown below, it is quite clear that the money was lost. Both the Stock Markets are likely to lose the money because they have a high kurtosis and a negatively skewed returns. Both before and after Covid-19, this rate of return is same. The period before discovery of the first case of Covid-19 in India is referred to as pre Covid-19 period whereas and time after the discovery of the first case is post Covid-19 period. Before the outbreak, each index had a positive daily mean return. However, this changed then the Pandemic started. Based on these numbers, it looks like Covid-19 hurt stock returns to a considerable extent. Standard Deviations show that the indices have become more unstable since Covid-19.

**Table 1 - Descriptive statistical presentation of the sample**

| | **BSE Sensex** | **NSE Nifty** | | |
|---|---|---|---|---|
| | **Price** | **Return** | **Price** | **Return** |
| Observation | 209 | 208 | 209 | 208 |
| Mean | 466.94 | -0.000114 | 10,879.09 | -5.7966 |
| Median | 496.5 | -0.000140 | 11,303.31 | 0.0005 |
| Maximum | 573.65 | 0.03912 | 12,362.31 | 0.0365 |
| Minimum | 283.3 | -0.043657 | 7,610.251 | -0.0604 |
| SD | 77.24 | 0.011280 | 1,269.041 | 0.00930 |
| Skewness | -0.71 | -0.96 | -0.64 | -1.53545 |
| Kurtosis | 2.35 | 5.29 | 2.083648 | 14.15164 |
| JB | 21.17 | 45.61 | 21.28588 | 1,159.506 |

**Table 2 - Descriptive data of stock returns of pre and during the pandemic**

| | **BSE Sensex** | **NSE Nifty** | | |
|---|---|---|---|---|
| | **Pre-Covid-19 Era** | **During Covid-19 Era** | **Pre-Covid-19 Era** | **During Covid-19 Era** |
| Mean | 8.85-05 | -0.000240 | 0.000472 | -0.000449 |
| Median | -0.000307 | 0.000218 | 0.000456 | 2.965435 |
| Maximum | 0.020005 | 0.039112 | 0.022507 | 0.036483 |
| Minimum | 0.015437 | 0.043646 | -0.008379 | -0.060384 |
| SD | 0.006571 | 0.014428 | 0.003939 | 0.012349 |
| Skewness | 0.307639 | -0.097569 | 1.844913 | -1.229303 |
| Kurtosis | 3.653218 | 3.72662 | 12.00169 | 8.530321 |
| JB | 3.268178 | 2.491639 | 394.3504 | 168.8314 |

The BSE and NSE stock prices for the time period under review are shown in Figures 1 and 2, respectively. Upward trends in the values of both indices may be seen before February 2020, and they both follow a straight line (pre-COVID-19 timeframe). By the end of March 2020, however, once the first case has been detected in India and the first lockdown has been enforced, the disease could be observed at the base of the hill. As of April 2020, the upward trend has resumed. This is because, beginning in April, the government altered its policy regarding lockdown procedures.

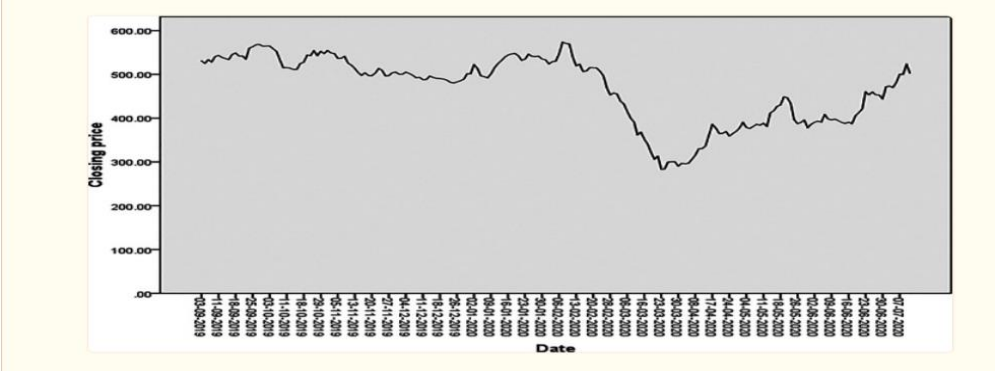


**Figure 2: BSE Stock Prices**

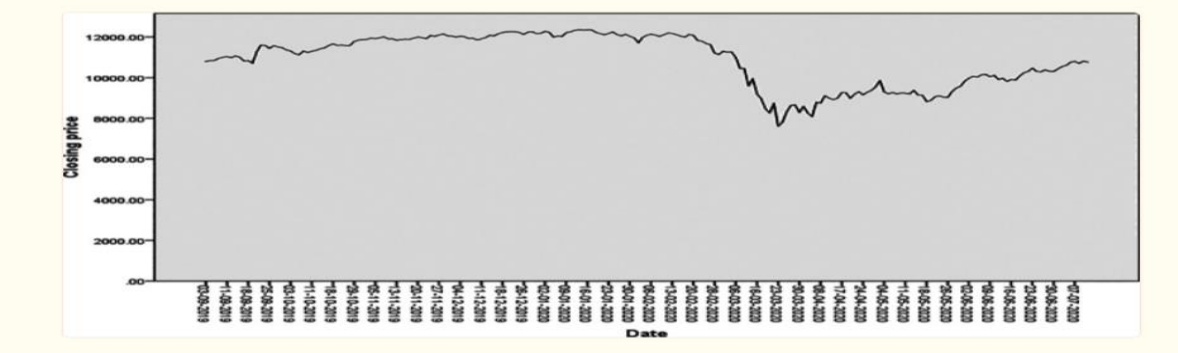


***Figure 3: NSE Stock Prices***

The BSE and NSE log returns from 3 Sep, 2019 through 10 July, 2020 are shown in figures below respectively. Both of these charts show how volatile the market can be. The outcomes show that the BSE is less steady than the NSE. Since the BSE, India's principal stock exchange is well-known, a substantial number of international investors participate. Therefore, BSE is likely to be more volatile than NSE.

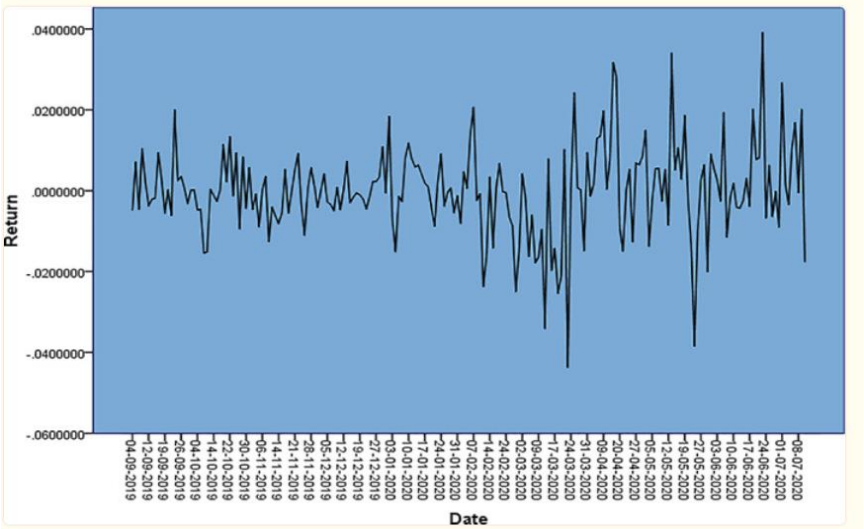


**Figure 4: BSE Log Returns**

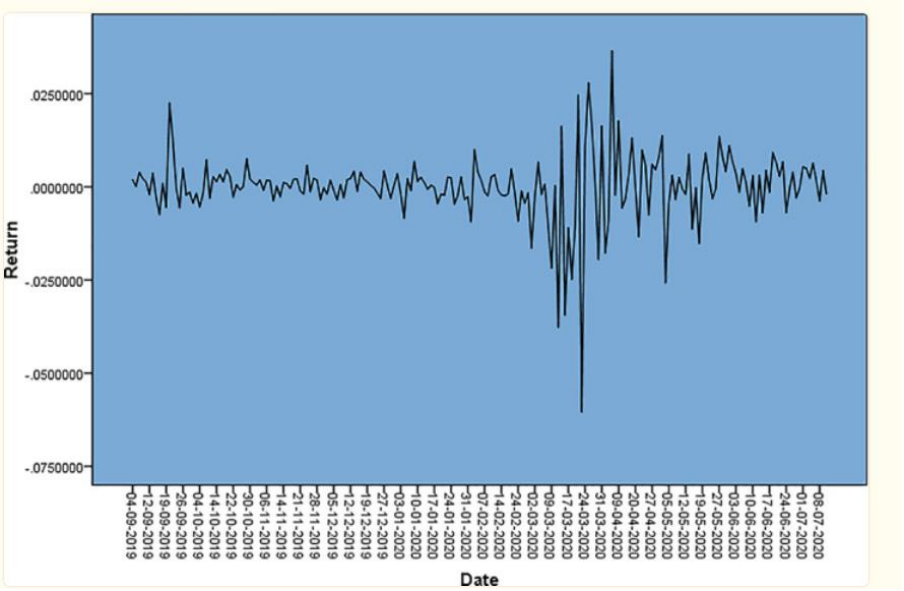


**Figure 5: NSE Log Returns**

BSE and NSE steadiness are evaluated using the ADF and PP stationarity tests. This is supported by the data in Table 3 indicating that the vast majority of log indices are not level. However, both the ADF and PP tests demonstrated that the log indices for the first difference were stable. This indicates at a first glance that the indexes are stable. The unit root tests therefore support the notion that the initial difference is stationary.

**Table 3 – Unit Root Analysis**

| Index | ADF level | ADF first difference | PP level | PP first difference |
|---|---|---|---|---|
| BSE Sensex | -1.269416(0.6438) | -12.24932*(0.0000) | -1.456996(0.5535) | -12.64598*(0.0000) |
| NSE Nifty | -1.619650(0.4707) | -16.60469*(0.0000) | -1.220566(0.6657) | -16.43414*(0.0000) |

**Table 4 - BSE Sensex and GJR GARCH model results**

| Mean equation parameters | Coefficients | Z-statistics | p-value |
|---|---|---|---|
| $\beta_0$ | -0.001621 | -1.677327 | 0.0935 |
| $\gamma_1$ | -0.000705 | -0.235801 | 0.8136 |
| Variance equation | | | |
| | 1.24-05 | 10.86474* | 0.0000 |
| $\alpha_0$ | 1.024974 | 329.0440* | 0.0000 |
| $\beta_1$ | 0.040947 | 1.893853** | 0.0542 |
| $\gamma_1$ | -0.089238 | 10.86474* | 0.0000 |
| $\alpha_1$ | 4.17-05 | 4.248481* | 0.0000 |
| $\delta_2$ | | | |

Table 4 shows the estimated results. The asymmetry (1) and GARCH (1) coefficients in this table are both quite high. As a result, we conclude that the ARCH effect does exist in the BSE Sensex series and that the ARCH (1) coefficient is negative but still statistically significant. Having a statistically positive and significant GARCH coefficient is further proof of volatility clustering in the BSE index. The mean and variance calculations include a dummy variable (D 1) to account for the fact that prices might fluctuate rapidly. Before the COVID-19 period, the value of D 1 is 0 and after it, it is 1. According to the data, the coefficient in the mean equation for the BSE Sensex dummy variable is negative but statistically insignificant. On the other hand, it is significant and positive in the variance equation.

**Table 5 - NSE Nifty and GJR GARCH model results**

| **Mean equation parameters** | **Coefficients** | **Z-statistics** | **p-value** |
|---|---|---|---|
| $\beta_0$ | 0.00058 | 0.82312 | 0.315 |
| $\gamma_1$ | -0.00088 | -0.42187 | 0.625 |
| Variance equation | | | |
| | 1.645-0 | 1.59346 | 0.082 |
| $\alpha_0$ | 0.735627 | 28.8634* | 0.000 |
| $\beta_1$ | 0.287453 | 3.78645* | 0.000 |
| $\gamma_1$ | 0.00028 | 1.4387453 | 0.816 |
| $\alpha_1$ | 6.15-0 | 1.459745 | 0.184 |
| $\delta_2$ | | | |

Table 5 demonstrates the GJR GARCH's relationship with the NSE Nifty. Both the GARCH and asymmetry coefficients in the table are significant and positive, indicating that NSE Nifty is volatile. If the asymmetric term has a large positive value, it means that larger effect on NSE sock market volatility is by negative shocks than the positive shocks. However, while the ARCH coefficient is positive, it is not statistically significant. This suggests that recent events have little bearing on the current level of volatility. The dummy variable's coefficient is near to zero in all equations, suggesting that the COVID-19 period had a negligible effect on the price volatility of NSE stocks.

The Ljung-Box Q and ARCH LM tests are used to examine the model's standardised residuals for serial correlation and heteroscedasticity respectively. Table 6 demonstrates that neither serial correlation nor heteroscedasticity are present.

**Table 6 - Diagnostic parameters**

| Variable | Serial correlation | | Heteroscedasticity | |
|---|---|---|---|---|
| | 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 |

## 5. Findings And Conclusions

Main focus of this Research was on the BSE and NSE Stock Markets. Volatility of the Stock Markets is analysed using GJH GARCH Model. This is done while covering the pre and post Covid-19 phases in India. Closing prices of the BSE and NSE closing prices are considered as independent variable. The two timespans under Research consideration remain to be dependent variable. Research has demonstrated how irrationally the BSE Sensex and Stock Market reacted during the outbreak of Covid-19. However, Covid-19 had a negligible impact on the price volatility of NSE Stocks as depicted by NSE Nifty Index. Separate calculation is done to determine the average return before and after Covid-19.

The data showed that the average return on the stock market is negative during Covid-19 period whereas it was positive before that. In the same way, the prices of stock indices have changed a lot. Before Covid-19, the price was high while it started to go down slowly and kept going down until the end of March 2020 when the first Lockdown period started. However, after this point, price started to go up again as the Indian Government softened the policy of Lockdown. All over the World, almost all the countries had problems due to the Covid-19 outbreak as such kind of thing had never been experienced before. Covid-19 affected almost all the sectors of Industries barring a few with more or less intensity. The results of the Research demonstrate that the Coronavirus outbreak has altered the value of stocks and contributed to the increased trend of market volatility in India. This analysis employs a novel and fundamental statistical method to examine Covid-19 via the lens of Indian Stock Market.

## 6. Recommendations

Financial Market has collapsed on a fundamental level because of Covid-19. The Government needs to implement the right policy measures to bring back the Stock Market to normalcy in terms of usually observed trends and patterns. The crisis would have reached its height if not for the assistance of the unconventional policies. As a result, putting the money into the market is crucial and essential as well. As an immediate measure, Reserve Bank of India (RBI) has lowered its benchmark policy rate by 115 basis points. Announcement of investment of INR 8 Lakh Crore in the financial market remains to be one such measure resorted to by the Reserve Bank of India. Even though the investors had an impression that the phase due to the Covid-19 remains to be temporary for some time, the intensity of the impact and the degree of uncertainty created by the Pandemic remain to be little vague and open ended till date. Prioritization of the portfolios to spread the risk across all the sectors and classes is highly recommended now. Diversification in the portfolios should also be followed by the Investors as it will flow in the direction of the impact of volatility and create the reserve against any unexpected market downturn in the coming future. Investors with a long term horizon should view this as an opportunity to explore. RBI should also reduce the interest rates in the debt markets. In a way, during and post Covid-19 outbreak, Pharmaceutical sector has been in comparatively stable and increasing swing. To spread the sustainable growth patterns across the Stock Market and in the Economy as a whole, both Central Government and Reserve Bank of India should think of short term and small impact measures just to be refined and modified from time to time. Finding out one common and the most effective remedy of all problems is a distant and perhaps non-achievable objective. Instead, many short term and small revival oriented measures would help the Stock Markets to recover fully.

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