

Exploring the Asymmetric Price Behavior of Health Care and Pharma Sector Stocks of NSE in the Pandemic Period

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Abstract

Purpose : Our research aimed to gain insights into the impact of COVID-19 on the price behavior of healthcare and pharmaceutical sector stocks in the Indian equity market.

Methodology : The necessary price behavior data were gathered from the National Stock Exchange's official website. The price behavior data of the stocks that belong to the chosen sectors was gathered for the first phase of India's strict lockdown period, which ran from March 23 to May 31, 2020. The data were analyzed using descriptive statistical tools and econometric models such as the EGARCH (1,1) model, GARCH (1,1), ADF test, and ARCH-LM test.

Findings : The pharmaceutical and healthcare sectors yielded abnormal earnings and favorable returns during the study period. The companies chosen for this analysis have performed asymmetrically during the pandemic, with the healthcare sector's stocks yielding higher returns than the pharmaceutical sector's stocks.

Practical Implications : Exploring the price behavior of the stocks during the pandemic would help budding retail investors gain clarity to trade the stocks during the negative shocks in the market.

Originality : In contrast to previous research, we have limited our investigation to examining the price behavior of equities in the pharmaceutical and healthcare sectors, which exhibit the opposite behavior from the overall market sentiment throughout the pandemic period.

Keywords : pandemic period, volatility, leverage effect

JEL Classification Code : G10, G11, G14, G19

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Any nation, rich, developing, or undeveloped, has seen its economy severely damaged by the Novel Coronavirus, a name that has terrified people worldwide. COVID-19, a deadly infectious disease, was first found in December 2019 in Wuhan, China, and spread to the rest of the world. The speed and severity with which it spread made the World Health Organization declare this pandemic disease, calling for an international emergency in March 2020. Lockdowns were imposed in almost every nation to slow the virus's

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spread. In addition to healthcare problems, this pandemic presented financial difficulties for humanity. Even the world's largest economies were rocked by this unprecedented lockdown, and people found it difficult to meet their basic needs and go about their daily lives. The governments of every nation in the world began to implement measures to stop the pandemic's rapid spread, including restricting domestic travel, closing schools, closing businesses except those that dealt with necessities, requiring people to wear masks, maintaining social distancing, and more. The government's unavoidable actions caused many inconveniences to people daily.

With 1.3 billion citizens, India is the second most populous country in the world. Proactive steps were taken in March 2020 to halt the rapid spread of COVID-19. India's Prime Minister, Shri Narendra Das Modi, announced a 21-day nationwide lockdown on March 23, 2020, to stop the virus from spreading. This restricted people's freedom of movement. Several laws were put into effect to shield the citizens of this country from COVID-19. This rigorous lockdown was extended to May 3, 2020, with few exceptions. It was extended by the National Disaster Management Authority of India till May 17, 2020, and then again till May 31, 2020. Lockdowns were repeatedly enforced with additional limitations. Several states gradually experimentally loosened their regulations, enabling individuals to resume their regular lives.

The severity of the spread of this disease during the first three consecutive lockdowns brought some severe hiccups in the performance of the day-to-day business activities of all the sectors of the Indian economy. It delivered tremors in the performance of the Indian equity market, too. Some patients even procured more than they needed for their regular medical requirements due to fear of a shortage of supplies. Hence, it was anticipated by a group of investors that companies engaging in these sectors would fetch abnormal profits during the pandemic, which would certainly show a positive impact on the price behavior of the stocks belonging to these sectors.

Nonetheless, some investors held the opposite opinion, believing that since these sectors' companies have spent a substantial amount of money on R&D, any failure could negatively affect their financial standing and possibly even their ability to conduct business. This bipolar opinion created curiosity among the common person and first-generation retail investors to know the ground reality, brewing many questions about whether the companies engaging their business in the pharmaceutical and healthcare sectors have enjoyed the windfall profit during this period. Furthermore, will the price behavior of the pharma and healthcare stocks traded on the Indian equity market be considerably impacted by this extraordinary state of the economy and equity market? To find answers to these questions, we have undertaken this study using the price behavior of stocks belonging to the selected sectors. A close observation of the price behavior of the selected sectoral stocks in the Indian equity market during the selected pandemic would help budding retail investors clarify how to behave in the market during rare situations and succeed in the market swings more safely and wisely.

Literature Review

Since this pandemic was a rare event and did not have a previous occurrence recently, only very few studies have been conducted in this field from 2020 to 2023. Therefore, from the available literature, we have reviewed the studies that have focused on the impact of COVID-19 on the equity market.

The post-COVID studies have recorded that the pandemic has negatively influenced the financial market worldwide (Khan et al., 2020; Zhang et al., 2020). The series of lockdowns and restrictions on international travel severely affected the general economic conditions of the world (Ozili & Arun, 2023). An estimated 347 billion US dollars, or 0.4% of the global GDP, was lost since the pandemic's early stages (Abiad et al., 2020). The pandemic was projected to have caused a 13% decline in global merchandise commerce and a 3% decline in the global gross domestic product. Developing nations saw a significant 4% average decline in GDP (Mou, 2020). This unexpected pandemic created greater uncertainty, and the associated economic losses caused the equity markets

to become more volatile and unpredictable. A significant negative impact was found in the US financial market, and the volatility in the price behavior of the indices substantially increased during the pandemic period (Zhang et al., 2020). The extent of influence on the financial market was worse in the case of developing markets than the developed markets (Harjoto et al., 2021). This was confirmed by a study conducted in Turkey that the emerging financial markets in Asia have been more severely destroyed than the financial markets in Europe (Topcu & Gulal, 2020). A study on the impact of a COVID-19 outbreak on countries from Asia, America, and Europe revealed that Asian countries have experienced abnormal negative returns compared to those from American and European regions (Liu et al., 2020). A study conducted in India found that the first wave of coronavirus severely hit the economy and equity market. A significant negative impact was found in the equity and commodity prices (Syed et al., 2021).

The epidemic has caused increased volatility in the Indian equities market and adverse returns (Bora & Basistha, 2021). Nearly every area of the Indian economy was impacted by the economic crisis. The crisis had a detrimental effect on the Indian GDP and resulted in the loss of 15 million jobs (Ramakumar & Kanitkar, 2021). On a sectoral basis, it was found that the hotel industry was badly and significantly hit during the COVID period, and the healthcare sector took the opposite direction (He et al., 2020). The IT and healthcare sectors experienced a significant positive impact post the pandemic period (Huo & Qiu, 2020; Thorbecke, 2020). The food sector and natural gas sector stocks also earned positive returns during the pandemic period (Mazur et al., 2021). A study conducted to know the impact of COVID on the Indian banking sector has exposed the fact that the banking sector was one of the worst-hit sectors due to the pandemic effect (Mohania & Mainrai, 2020), and the similar result was found by an Indian study conducted to explore the impact on the aviation industry (Narender & Kumar, 2021).

An additional Indian study following the COVID-19 pandemic demonstrated that the Indian equity markets underwent a blood bath due to increased volatility during the epidemic (Bora & Basistha, 2021). Except for the pharmaceutical industry, every sectoral index during the lockdown's initial phase showed negative returns. The study was out in India following the COVID-19 pandemic confirmed this. The sectoral indices have shown asymmetric volatility due to the tremors caused by negative shocks during the pandemic (Naik et al., 2022). Investors across the globe started to hedge their portfolios, and portfolios containing gold and major financial assets were gaining much importance during the pandemic (Akhtaruzzaman et al., 2021). The financial contagion occurred between the crude oil, gold prices, and the equity market during the pandemic (Pandey, 2023). The coronavirus outbreak has led to decreased equity market returns across the countries, and the gold price dynamic had a non-linear impact with the pandemic (Cepoi, 2020). The stock market performance of G20 countries during the early period of post-pandemic showed negative average returns, and a slow recovery was found in the later period (Singh et al., 2020). The countries' fiscal positions in the developing economies were also found to be worse during the pandemic period (Kaur & Kaur, 2023). It was feared that the fiscal policy on spending and accommodative monetary policies to mitigate the crisis by almost all the central banks might exacerbate the inflationary pressure, worsening the macroeconomic situation (Ozili & Arun, 2023).

The studies reviewed have revealed that none of the studies conducted in India have considered the pharma and healthcare sectors to know the impact of the pandemic on the performance of stocks in these sectors. The rationale for choosing these industries for the study is that, throughout the pandemic, only these two industries have shown a robust response. In contrast, all other industries ceased operations daily out of fear and government regulations. Hence, we strongly felt that delving into the price behavior of the stocks belonging to these sectors and exploring the impact of COVID-19 on the price behavior of the selected sectoral stocks will fill the gap we found while reviewing the available literature.

Methodology

Data and Period of the Study

This study aims to determine how COVID-19 has affected the price behavior of stocks related to the pharmaceutical and healthcare industries in the Indian equity market. The daily closing prices of the National Stock Exchange's pharma and healthcare stock segments were considered to accomplish this goal. The daily closing prices for the selected stocks were collected from the official website of NSE, which helped to eradicate the error in collecting the incorrect data that would normally happen during the data collection. The stocks that belong to the pharma and healthcare sector selected for the study are Abbott India Ltd., Alkem Labs, Apollo Hospitals, Auro Pharma, Biocon, Cadila Health Care, Cipla, Divi's Lab, Dr. Lal PathLabs, Dr. Reddy's, Fortis Healthcare, Glenmark Pharma, IPCA Labs, Laurus Labs, Lupin Ltd., NATCO Pharma, Pfizer, Sanofi India, Sun Pharma, and Torrent Pharma. The opted study period of this research work is from March 23, 2020 to May 31, 2020. The stringent lockdown was implemented from March 23, 2020 until May 31, 2020. Therefore, we have selected this time frame for the study, and we think that this will fulfill the study's objectives.

Analytical Framework of the Study

To achieve the study's objective, we have applied statistical tools and econometric models like descriptive statistics, the Augmented Dickey-Fuller test, the ARCH-LM test, symmetric GARCH models, and asymmetric GARCH models. The selected econometric models were applied using the E-views software to arrive at the study's findings. Before applying the descriptive statistical tools and econometric models, the collected daily closing price of the data of the selected stocks was converted into the log of first difference using the formulae $R_t = (\text{Log } P_t - \text{Log } P_0) * 100$, where P_t is the closing price of the selected stocks at time T , P_0 is the closing price of the time $T-1$, and R_t is the log of the first difference or daily return of the stock for period T . The conversion of this first difference has also been used to understand the daily returns of the selected stocks. The descriptive statistical tools like mean, standard deviation, skewness, kurtosis, and Jarque–Bera test were employed to understand the distributional properties of the selected time series and are depicted in Table 1. The results of the Augmented Dickey-Fuller test, conducted on the daily return series of the chosen stocks, are displayed in Table 2 and provide insights into whether the selected time series is stationary, a fundamental prerequisite for additional analysis.

It is necessary to determine whether the chosen series exhibits any indication of the heteroscedasticity effect before evaluating the volatility of the chosen time series. To conclude the process and ascertain whether the heteroskedasticity influence is there, we employed the residual diagnostic test, a lag range multiplier test for the autoregressive conditional heteroskedasticity in the residuals. The results are shown in Table 3. Understanding the price behavior of the chosen stocks in the pharmaceutical and healthcare industries throughout the pandemic is the main goal of this study. Therefore, to fulfill this objective, we have selected the GARCH (1,1) model, as previous research by Amudha and Muthukamu (2018), John et al. (2019), and Muthukamu and Amudha (2020) demonstrated that it was the best-fitted model to characterize the symmetric volatility. The magnitude of fluctuations in the price behavior of the stocks, termed in the financial literature as “volatility,” can be understood by applying the symmetric GARCH family model – GARCH (1,1). The calculation of volatility persistence may be used to understand the period taken by the series to revert its long-run average level, and this can be obtained by employing the formulae $L_{half} = ((\ln (1/2)) / (\ln (\alpha + \beta)))$, where α and β are the calculated ARCH and GARCH coefficients. Table 4 presents the outcomes obtained using the GARCH (1,1) model. To test whether the selected symmetric GARCH family model is fit enough to reveal the symmetric volatility of the selected time series data, we have used the ARCH-LM test. The results obtained from the ARCH-LM test are shown in Table 5. The

outcome of the result should reveal that the residuals obtained post-application of the GARCH (1,1) model should be free from the ARCH effect. It is known that in the financial market, any bad news delivers a more pronounced effect on volatility than good news of the same magnitude, termed as the “leverage effect” in financial literacy. This asymmetric nature of volatility can be measured using the asymmetric GARCH family models. To check whether the selected stocks have experienced any asymmetric volatility during the pandemic, we have employed EGARCH (1,1) and the results are shown in Table 6.

Hypotheses of the Study

The following are the null hypotheses and alternative hypotheses of the study:

- ↗ **H01** : There is no stationarity in the series of the stocks selected for the study.
- ↗ **Ha1** : There is stationarity in the series of the stocks selected for the study.
- ↗ **H02** : The selected time series data are not free from the ARCH effect.
- ↗ **Ha2** : The selected time series data are free from the ARCH effect.
- ↗ **H03** : The selected stocks are not free from the leverage effect.
- ↗ **Ha3** : The selected stocks are free from the leverage effect.

Analysis and Results

Table 1 exhibits the distributional properties of the selected stocks from the pharma and healthcare sectors. The mean return of all the 20 selected stocks is positive, confirming that the selected sectoral stocks have enjoyed

Table 1. Descriptive Statistics of Selected Pharmaceutical and Health Care Stocks

S. No.	Name of the Selected Stocks	Arithmetic Mean	Standard Deviation	Skewness	Kurtosis	Jarque–Bera Value	Probability Value
1	Abbott India Ltd.	0.537739	0.938821	0.318829	5.992972	926.8273	0.0001
2	Alkem Labs	0.069271	1.399202	0.911828	9.711223	543.4412	0.0000
3	Apollo Hospitals	0.367405	0.322318	0.922183	6.922872	446.3903	0.0000
4	Auro Pharma	0.443982	0.833239	1.445602	3.999821	449.9002	0.0002
5	Biocon	0.293817	1.339238	1.938831	8.628253	559.4948	0.0009
6	Cadila Health Care	0.372831	2.933939	2.993571	4.992725	1002.390	0.0000
7	Cipla	0.521972	2.992381	1.929311	9.772602	833.0288	0.0000
8	Divi's Lab	0.497201	1.992832	2.772132	7.882901	299.3829	0.0092
9	Dr. Lal PathLabs	0.399831	1.993822	3.233012	6.938632	777.9562	0.0020
10	Dr. Reddy's	0.492241	0.922834	2.933247	11.83734	984.0054	0.0000
11	Fortis Healthcare	0.477329	2.993331	0.991728	9.337903	804.7769	0.0000
12	Glenmark Pharma	0.382219	0.855239	3.882192	12.94774	339.0081	0.0000
13	IPCA Labs	0.399272	1.832898	3.001921	5.949841	559.0423	0.0002
14	Laurus Labs	0.223491	1.282922	0.911287	6.005823	701.9288	0.0032

15	Lupin Ltd.	0.699539	2.332931	2.992521	6.009422	990.8119	0.0000
16	NATCO Pharma	0.448763	0.922823	1.900811	6.911161	582.9992	0.0000
17	Pfizer	0.633281	1.992662	2.812882	9.002872	733.0287	0.0000
18	Sanofi India	0.391127	1.333891	2.772807	7.399932	944.9202	0.0000
19	Sun Pharma	0.501572	2.001943	2.188722	14.93873	488.0221	0.0000
20	Torrent Pharma	0.466292	1.949245	3.001822	6.922371	699.0261	0.0082

positive returns during this selected pandemic period. Lupin Ltd. (0.699539) followed by Pfizer (0.633281), Abbott India Ltd. (0.537739), Cipla (0.521972), and Sun Pharma (0.501572) have delivered the highest returns during the study period. In contrast, Laurus Labs (0.223491) and Biocon (0.293817) have delivered the lowest returns during the same period. The calculated values of standard deviations for Fortis Healthcare (2.993331) are high, followed by Cipla (2.992381), Cadila Health Care (2.933939), Lupin (2.332931), and Sun Pharma (2.001943), indicating that price behavior of these stocks has shown wild swings during the study period. The same is low in the case of Auro Pharma (0.833239), Glenmark Pharma (0.855239), and NATCO Pharma (0.922823). The skewness values of all the selected stocks show that they are positively skewed during the study period. The skewness value of Glenmark Pharma (3.882192), Dr. Lal PathLabs (3.233012), Torrent Pharma (3.001822), and Cadila Health Care (2.993571) has explained that the returns of these stocks have increased more often than they decreased. The calculated kurtosis values for all the selected stocks are greater than 3. Their values indicate leptokurtic, so they are fat-tailed in their distributional shape. This has confirmed their deviation from the usual distribution. The estimated Jarque–Bera values with probability for every stock selected indicate that the return series is not normally distributed. The estimated probability values for each selected stock are less than 0.05 to confirm that the series is not normally distributed.

Table 2 shows the calculated test statistic values (AT LEVEL) for all three test equations, intercept, trend and intercept, and none, using the Augmented Dickey-Fuller Test to understand the unit root problem in the selected stocks. The null hypothesis (H01) is that there is no stationarity in the series of the stocks selected for the study. The calculated absolute test statistic values must be higher than the absolute test critical values to reject the same. The absolute test critical values at the 5% level probability values are compared to the calculated absolute test statistic values for each of the chosen stocks. Specifically, the test critical value at the 5% level is -2.882921 for intercept, the critical value at the 5% level is -3.422492 for trend and intercept, and the critical value at the 5% level is -1.938326 for none. All of the computed absolute test statistical values are greater than the absolute test critical values at 5% probability, in accordance with the decision criterion to reject the null hypotheses. Therefore, it is determined that all of the chosen stocks in the healthcare and pharmaceutical industries are stationary, rejecting the null hypothesis (H01) and accepting the alternative hypothesis (Ha1). The chosen series is judged suitable enough to be submitted for the heteroskedasticity test.

Table 2. Unit Root Test for the Selected Pharmaceutical and Health Care Stocks

S. No.	Name of the Selected Stocks	ADF Test		
		Intercept	Trend & Intercept	None
1	Abbott India Ltd.	-39.991383	-39.702131	-39.770283
2	Alkem Labs	-48.003317	-47.992348	-47.900312
3	Apollo Hospitals	-93.233953	-93.994233	-93.992312
4	Auro Pharma	-66.033932	-66.109932	-66.099232
5	Biocon	-88.822291	-88.800212	-88.782281

6	Cadila Health Care	-101.99238	-101.90882	-101.90002
7	Cipla	-99.822272	-99.802029	-99.900238
8	Divi's Lab	-45.922033	-45.922011	-45.922099
9	Dr. Lal PathLabs	-88.022394	-88.022991	-88.022281
10	Dr. Reddy's	-109.02239	-109.22291	-109.20029
11	Fortis Healthcare	-79.099191	-79.099126	-79.098225
12	Glenmark Pharma	-90.988801	-90.988807	-90.988799
13	IPCA Labs	-81.822022	-81.822011	-81.822001
14	Laurus Labs	-202.97731	-202.97701	-202.97691
15	Lupin Ltd.	-55.833932	-55.833022	-55.833021
16	NATCO Pharma	-66.928826	-66.928801	-66.928799
17	Pfizer	-90.077291	-90.077118	-90.077271
18	Sanofi India	-176.92372	-176.92301	-176.92311
19	Sun Pharma	-192.92201	-192.92911	-192.92422
20	Torrent Pharma	-202.88263	-202.88109	-202.88202

Note. The test critical value at the 5% level is -2.882921 for the calculation of intercept, -3.422492 for the calculation of trend and intercept, and -1.938326 for the calculation of none.

The results of the residual diagnostic test used to determine the heteroskedasticity impact (ARCH effect) of the chosen stocks are shown in Table 3. The Lagrange multiplier test has been used for each of the chosen stocks, and the resulting *F*-statistic values are contrasted with the matching observed *R*-square values. The series of the chosen stocks does not exhibit the heteroskedasticity effect (ARCH effect), according to the null hypothesis (H02). To reject this null hypothesis, the computed probability values must be less than 0.05, and the estimated *F*-statistic values must be greater than the corresponding observed *R*-squared values. The calculated values shown in Table 3 clearly show that the calculated *F*-statistic values for all the selected stocks are higher than their corresponding observed *R*-squared values. The calculated probability values are less than 0.05, as needed. Hence, it is confirmed that the stocks selected belonging to the pharma sector and healthcare sector are not free from the heteroskedasticity effect and have enough evidence to declare that the null hypothesis (H02) is rejected. The alternative hypothesis (Ha2) is accepted. It is concluded that the heteroskedasticity effect found in the series of all the selected stocks during the study period and the series are fit enough for applying the GARCH family models to estimate the volatility.

Table 3. Heteroskedasticity Test for the Pharmaceutical and Health Care Sector Stocks

S. No.	Name of the Selected Stocks	<i>F</i> -statistic Value	Probability <i>F</i> - Value	Observed <i>R</i> -squared Value	Probability -Chi-square Value
1	Abbott India Ltd.	74.93383	0.0000	74.92022	0.0000
2	Alkem Labs	98.38831	0.0000	98.36222	0.0000
3	Apollo Hospitals	102.9922	0.0000	102.9829	0.0000
4	Auro Pharma	82.92262	0.0000	82.91022	0.0000
5	Biocon	221.9237	0.0000	221.9029	0.0000
6	Cadila Health Care	177.9218	0.0000	177.9201	0.0000
7	Cipla	122.9522	0.0000	122.9499	0.0000

8	Divi's Lab	312.4432	0.0000	312.4399	0.0000
9	Dr. Lal PathLabs	201.3926	0.0000	201.3791	0.0000
10	Dr. Reddy's	155.2213	0.0000	155.2199	0.0000
11	Fortis Healthcare	292.6281	0.0000	292.6259	0.0000
12	Glenmark Pharma	191.2019	0.0000	191.1998	0.0000
13	IPCA Labs	301.2883	0.0000	301.2669	0.0000
14	Laurus Labs	166.1639	0.0000	166.1591	0.0000
15	Lupin Ltd.	94.02272	0.0000	94.02199	0.0000
16	NATCO Pharma	84.99922	0.0000	84.99893	0.0000
17	Pfizer	169.5981	0.0000	169.5901	0.0000
18	Sanofi India	79.72592	0.0000	79.72109	0.0000
19	Sun Pharma	331.9188	0.0000	331.7934	0.0000
20	Torrent Pharma	267.9271	0.0000	267.9199	0.0000

Table 4 shows the outcome of the GARCH (1,1) model applied to the return series of the selected stocks belonging to the pharma and healthcare sectors. The calculated values of the parameters α and β are positive for all the return series of the selected stocks. This is a basic condition to specify that the model is well-defined to specify the volatility. The calculated coefficients of lagged squared values (α) are positive and significant at a 5% level, indicating that any information flow about the previous volatility has an explanatory power on the present volatility. All the calculated coefficient values of lagged conditional variance (β) are greater than zero and

Table 4. Estimating the Volatility for the Pharmaceutical and Health Care Stocks Using the GARCH (1, 1) Model

Name of the Selected Stocks	Alpha Value	Beta Value	The Sum of Alpha and Beta Value	Akaike Information Criterion	Schwarz Information Criterion	Value of Log Likelihood	Volatility Persistence Value
Abbott India Ltd.	0.162282	0.802882	0.965164	22.81661	22.80991	6846.8487	19.54882
Alkem Labs	0.159227	0.807817	0.967044	11.92232	11.92011	7326.3283	20.68399
Apollo Hospitals	0.138243	0.822283	0.960526	9.127292	9.126012	5373.8773	17.21069
Auro Pharma	0.118237	0.802622	0.920859	20.88391	20.87991	9873.7324	8.407047
Biocon	0.072622	0.892229	0.964851	32.10038	32.09912	6349.5487	19.37161
Cadila Health Care	0.109291	0.812721	0.922012	45.36272	45.36001	7435.4319	8.536606
Cipla	0.081723	0.898271	0.979994	21.36491	21.36318	5691.9410	34.29922
Divi's Lab	0.078937	0.900383	0.979320	39.81344	39.80329	7293.8322	33.16997
Dr. Lal PathLabs	0.088369	0.872921	0.961290	88.12802	88.12792	7933.9233	17.55730
Dr. Reddy's	0.102569	0.852021	0.954590	73.87324	73.87189	6934.0387	14.91494
Fortis Healthcare	0.096381	0.891252	0.967633	23.63259	23.63139	5993.9323	21.06677
Glenmark Pharma	0.081663	0.899961	0.981624	79.76512	79.75992	7436.9432	37.37260
IPCA Labs	0.100921	0.846011	0.946932	47.78239	47.77932	5484.9438	12.71177
Laurus Labs	0.082991	0.818892	0.901883	29.67492	29.67401	7499.0373	6.711959
Lupin Ltd.	0.091722	0.839171	0.930893	91.68921	91.68889	7440.6433	9.679348

NATCO Pharma	0.089227	0.869102	0.958329	81.16614	81.16589	8339.3831	16.28477
Pfizer	0.081832	0.891005	0.972837	99.29262	99.28991	5882.9332	25.16990
Sanofi India	0.103296	0.819261	0.922557	64.93228	64.92001	4929.8391	8.599188
Sun Pharma	0.098921	0.879291	0.978212	82.12679	82.12447	7944.8437	31.46541
Torrent Pharma	0.089221	0.873981	0.963202	51.95367	51.95299	6991.6403	18.48781

Note. All the calculated values are significant at the 5% level.

Table 5. GARCH (1, 1) Model Adequacy Checking by Using the ARCH-LM Test for the Selected Pharmaceutical and Health Care Stocks

S. No.	Name of the Selected Stocks	F-statistic Value	Probability F - Value	Observed R-squared Value	Probability –Chi-square Value
1	Abbott India Ltd.	2.839643	0.3934	2.848138	0.3932
2	Alkem Labs	1.873170	0.7432	1.875621	0.7430
3	Apollo Hospitals	3.781671	0.4355	3.783004	0.4351
4	Auro Pharma	2.338203	0.1843	2.339826	0.1843
5	Biocon	2.767173	0.4369	2.768027	0.4366
6	Cadila Health Care	3.743206	0.5644	3.744013	0.5643
7	Cipla	2.673087	0.5845	2.673192	0.5845
8	Divi's Lab	0.915378	0.3464	0.915399	0.3463
9	Dr. Lal PathLabs	1.588391	0.5798	1.589305	0.5796
10	Dr. Reddy's	1.497322	0.4723	1.498021	0.4723
11	Fortis Healthcare	2.622182	0.3763	2.622298	0.3762
12	Glenmark Pharma	4.023781	0.2875	4.023992	0.2871
13	IPCA Labs	1.719332	0.4527	1.719722	0.4527
14	Laurus Labs	3.001272	0.7179	3.001339	0.7178
15	Lupin Ltd.	1.793775	0.2167	1.793788	0.2166
16	NATCO Pharma	2.189366	0.1826	2.189401	0.1826
17	Pfizer	3.580987	0.4272	3.581092	0.4271
18	Sanofi India	2.661402	0.2697	2.661593	0.2697
19	Sun Pharma	3.069241	0.3822	3.069337	0.3821
20	Torrent Pharma	1.992083	0.2637	1.992099	0.2637

significant at the 5% level, which specifies that the previous volatility of the returns significantly influences the current volatility. The selected stocks have all had notable volatility during the research period, as indicated by the fact that the summation of their α and β values, or the $(\alpha + \beta)$ value, which measures conditional volatility, is closer to unity (1). Comparing Auro Pharma (0.920859), Cadila Health Care (0.922012), and IPCA Labs (0.946932) to the other stocks in the chosen list, the computed $(\alpha + \beta)$ values show that they had minimal volatility during the study period. The volatility persistence is high in the case of Glenmark Pharma (37.37260), followed by Cipla (34.29922), Divi's Lab (33.16997), and Sun Pharma (31.46541), indicating that these stocks have experienced high-level volatility during the study period and have taken a longer time to settle down to their long term price average.

Table 5 shows the results obtained after employing the ARCH-LM test using the residuals of GARCH (1, 1) for

the stocks selected for the study. The ARCH-LM test was used to assess the suitability of the applied model or the GARCH (1,1) model, and it was discovered that the computed results meet the specifications. To accept that the residuals are free from the ARCH effect and reject the null hypothesis, the estimated probability values must be more than 0.05, and the computed F -statistic values must be less than the observed R -squared values. It is found that the calculated F -statistic values for all the selected stocks are lower than their corresponding observed R -squared values, and the calculated probability values are greater than 0.05. Hence, it is confirmed that the applied tool GARCH (1,1) is the best-fit model to understand the level of volatility of the stocks selected for the study.

Table 6 shows the calculated values to understand the leverage effect in the price behavior of the selected pharma and healthcare sector stocks. To declare that the stocks are not immune to the leverage effect, the calculated γ value must be less than zero, meaning it must be negative. Additionally, the probability value must be less than 0.05, as all of the selected stocks' calculated γ values must be negative and significant at the 5% level. As a result, we may accept the alternative hypothesis (Ha3) and comfortably reject the null hypothesis (H03). It shows that, as anticipated, the chosen equities had asymmetric volatility during the research period.

Table 6. Estimating the Asymmetric Price Behavior of the Selected Pharmaceutical and Health Care Stocks Using the GARCH (1,1) Model

Name of the Stock	Mean Equation		Variance Equation			AIC	SIC	Log-likelihood
	μ	ω	α	β	γ			
Abbott India Ltd.	0.007568	-0.68293	0.178591	0.805571	-0.008299	7.092822	7.092120	4747.9292
Alkem Labs	0.009341	-0.57955	0.086672	0.890136	-0.090223	6.902843	6.902349	5340.9663
Apollo Hospitals	0.005951	-0.66839	0.081127	0.860451	-0.086092	6.088313	6.087955	4886.2135
Auro Pharma	0.007589	-0.72892	0.083511	0.881382	-0.074887	7.099704	7.099400	4502.5456
Biocon	0.008651	-0.89361	0.119252	0.828623	-0.298869	5.999032	5.998951	7534.9852
Cadila Health Care	0.006591	-0.93381	0.102282	0.841992	-0.084639	6.902055	6.901992	4056.9126
Cipla	0.004951	-0.67334	0.106493	0.838934	-0.069552	7.099281	7.099001	7986.9872
Divi's Lab	0.003829	-0.99713	0.092284	0.849239	-0.074593	5.992782	5.991089	6997.2506
Dr. Lal PathLabs	0.002491	-0.91655	0.086382	0.852915	-0.084681	4.920771	4.920197	7452.9272
Dr. Reddy's	0.003942	-0.92358	0.107882	0.839982	-0.079452	8.462597	8.462198	4452.9272
Fortis Healthcare	0.006469	-1.08856	0.103382	0.852721	-0.057383	5.982119	5.981003	7892.6052
Glenmark Pharma	0.003592	-0.92671	0.092752	0.849273	-0.078293	4.948812	4.948108	3426.8926
IPCA Labs	0.004144	-0.97261	0.089725	0.839224	-0.097273	5.183792	5.183192	7729.9086
Laurus Labs	0.003761	-0.85561	0.082273	0.829223	-0.193882	4.992766	4.992009	6728.9277
Lupin Ltd.	0.002669	-0.93472	0.092353	0.856203	-0.099261	5.709423	5.706372	7825.2102
NATCO Pharma	0.009603	-0.91584	0.079927	0.907212	-0.083622	4.647292	4.647103	5727.0828
Pfizer	0.003762	-0.93379	0.084582	0.859771	-0.068394	7.955492	7.954993	7262.0028
Sanofi India	0.003662	-0.97715	0.074393	0.884623	-0.082249	4.953692	4.952997	3992.2889
Sun Pharma	0.005499	-0.95562	0.083659	0.863994	-0.091728	8.183844	8.182701	5904.9438
Torrent Pharma	0.002663	-0.83471	0.075696	0.869924	-0.086291	6.392725	6.392504	6408.8843

Note. All the γ values are significant at the 5% level.

Summary of the Findings

This part of the study describes the research work's overall findings and the conclusions from the same. It is observed that all the selected stocks enjoyed positive returns during the study period. More specifically, the pharma sector stocks like Lupin Ltd. (0.699539), Pfizer (0.633281), Abbott India Ltd. (0.537739), Cipla (0.521972), and Sun Pharma (0.501572) enjoyed an abnormal profit during the study period when compared with the healthcare sector stocks. It is also noted from the calculated skewness values that the price behavior of almost all the stocks has shown more positive returns than negative returns during the study period. The calculated standard deviation values describe that Fortis Healthcare (2.993331), Cipla (2.992381), Cadila Health Care (2.933939), Lupin Ltd. (2.332931), and Sun Pharma (2.001943) have experienced wild swings when compared with the remaining stocks during the study period. It is found that the calculated skewness values of all the return series of the selected stocks are greater than 3. Hence, it is confirmed that the return series of these selected stocks are not normally distributed and are fat-tailed. The calculated Jarque–Bera values with their corresponding probability values have confirmed that the series is not normally distributed. The pharma and healthcare sector's stocks are found to be stationary based on the findings of the Augmented Dickey–Fuller Test, which is used to determine whether the chosen time series data are stationary. As required, all estimated absolute test statistic values at a level for each of the three equations exceed the absolute test crucial values at 5%. Thus, the chosen time series data from the pharmaceutical and healthcare sector stocks are verified to be stationary and suitable for using the necessary econometric tools to comprehend the volatility.

The heteroskedasticity effect in the selected return series has been tested using the lag range multiplier test. It is found that the calculated F -statistic values for all the selected stocks are higher than their corresponding observed R -squared values and the calculated probability values are less than 0.05 as it is needed. Hence, it is concluded that the stocks belonging to the selected sectors have suffered from the heteroskedasticity effect. Since the return series of the selected stocks are not insulated from the heteroskedasticity effect, to understand the level of volatility associated with the price behavior of the stocks during the study period, the GARCH (1,1) model has been employed. When compared to the other stocks on the list, the results show that Auro Pharma (0.920859), Cadila Health Care (0.922012), and IPCA Labs (0.946932) have shown minimal volatility over the study period. It should be mentioned that Glenmark Pharma (37.37260), Cipla (34.29922), Divi's Lab (33.16997), and Sun Pharma (31.46541) all have significant volatility persistence. These stocks' high volatility over the research period has caused them to take longer to attain their long-term price average.

To check the adequacy of the GARCH (1,1) model applied to specify the nature and level of volatility, the ARCH-LM test is employed, and it found from the results obtained that the residuals retrieved post-application of GARCH (1,1) are free from the ARCH effect. The calculated F -statistic values for all the selected stocks are lower than their corresponding observed R -squared values, and the calculated probability values are greater than 0.05. Therefore, it can be concluded that the GARCH (1,1) model, an established econometric tool, accurately predicts the symmetric volatility linked to the price behavior of the chosen stocks. To determine whether the leverage effect, or other form of asymmetric volatility, is present in the price behavior of the chosen stocks, the GARCH (1,1) model is used. The leverage impact has been observed in the price behavior of the chosen equities, according to the EGARCH (1,1) model results. As required, it is discovered that all of the chosen stocks' computed γ values are negative and significant at the 5% level. Therefore, it is determined that the chosen stocks in the healthcare and pharmaceutical industries are not immune to the leverage impact. During the study period, asymmetric volatility was experienced by all of them.

Conclusion

The COVID-19 pandemic, discovered in the latter part of 2019, caused significant disruptions to people's daily routines. It caused tremors in every business's operations across the globe. However, companies in the pharmaceutical and healthcare industries had to carry out their daily operations to protect people's lives. It is viewed that this critical situation has given a good business opportunity for the companies belonging to these sectors. From the results obtained from our study, we conclude that the selected sectoral stocks performed well during the pandemic period. Investors were confident in the success of the equities in particular sectors. All of the selected stocks generated profits throughout the study period. When comparing stocks from earlier in the pandemic, the healthcare sector performed better than the pharmaceutical sector. At the same time, it is also noted that they experienced a good amount of volatility in their price behavior. Irrespective of the sector, the stocks witnessed volatility in their price behavior. Our study's time range corresponded with a bad market in the Indian equity market; thus, we are compelled to look into whether the selected stocks also experienced the leverage effect. We find that they were not insulated from the asymmetric volatility. We have concluded that the equities in the healthcare and pharmaceutical sectors are not immune to the leverage impact based on the outcomes of our study's application of the EGARCH (1,1) model. During the specific bear phase of the Indian equities market, they encountered asymmetric volatility.

Managerial and Theoretical Implications

We firmly believe that the research study's findings will benefit first-generation and retail investors with limited financial literacy who have entered the equity market. Specifically, the findings will help them understand the concept of volatility, the leverage effect on equity price behavior, and how to guard against financial losses resulting from more swings in equity prices during any unanticipated market turbulence. Furthermore, this study will give some more insights to the academicians about the nature of issues and to the policymakers to arrive at the possible solutions and proactive measures to be taken to protect the investing community.

Limitations of the Study and Scope for Further Research

We strongly recommend that fellow researchers undertake similar research work with more time frames for their study since COVID-19 has lasted for more than two years. Even now, some countries are imposing some minimum restrictions. In this study, we have considered only the short study period, i.e., roughly three months from March 2020 to May 2020. Though the selected period has revealed the severity of the pandemic effect, the sustained impact of the pandemic cannot be pictured using this short study period. This limitation may be avoided by considering more time to explore the pandemic's impact. Studies with lengthy time frames may deliver the long-term impact of COVID on the behavior of the equity markets. Furthermore, we have confined ourselves to limited sectors like pharma and healthcare. A similar study by selecting more sectors would clarify the impact of COVID-19 on the overall performance of the equity market.

Authors' Contribution

Dr. M. Muthukamu created the study's main idea and qualitative and quantitative designs. Dr. S. Amutha compiled the pertinent research and used keywords to filter studies for the Review of Literature. Dr. R. Amudha verified the analytical procedures and gathered the data required for the study. With the help of the co-authors, Dr. M. Muthukamu wrote the text after performing the analytical work by using the statistical program E-views.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

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