Risk and Return Behaviour of the Pharmaceutical Sector in India: A PhaseWise Analysis

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Abstract:

This study investigates the performance pharmaceutical sector by comparing with broader market indices. It assesses risk and return behavior of sector in three different periods. Time frequency of data used is weekly in nature. The time period of data used is from 2016 to 2025. The study period divide into three phases, Before Pandemic from 2016 to 2019, Pandemic period from 2020 to 2021 and after pandemic from 2022 to 2025. To measure performance of sector logarithmic returns used. Standard deviation and Descriptive statistics methods are used to measure and compare volatility. For the investigation of deviation in mean returns t tests were used. The result shows that pharmaceutical sector shown high average returns during second phase with high volatility. Compared to other broader market indices higher volatility was observed in pharma sector. The study enhances understanding of pharmaceutical sector performance before, during, and after the crisis.

1. Introduction:

Pandemic changed the world in every aspect, it affected the investment pattern and perception towards risk management. Ashraf and Baker et al. (2020) observed that financial sector shown volatility during crisis. They also noted that pharmaceutical sector captured more attention of investors during pandemic. Existing literature suggests that during periods of global health emergencies and economic instability, investors tend to shift towards defensive sectors perceived as resilient and essential, such as pharmaceuticals and healthcare services (Haroon & Rizvi, 2020). In many economies, pharmaceutical companies experienced increased demand, improved revenue expectations, and heightened investor attention due to their central role in vaccine development, drug production, and public health responses (Mazur, Dang, & Vega, 2021). In emerging markets like India, the pandemic further reinforced the pharmaceutical industry's structural relevance, both economically and strategically. India's position as a global supplier of generic medicines and vaccines strengthened during the pandemic, which likely influenced investor confidence and the stock market performance of pharmaceutical firms. Narayan, Phan, & Liu, 2021 concluded that crisis lead, volatility patterns, and investment behaviour even after the immediate shock subsides .

Moreover, stock market reactions during such periods often reflect not only firm-level fundamentals but also expectations regarding future growth, policy support, and global demand dynamics (Topcu & Gulal, 2020).

2. Literature Review

The COVID-19 pandemic spurred a growing body of research examining its impact on global financial markets, sectoral performance, and investor behaviour. Scholars have widely

documented that pandemic-related uncertainty influenced stock market volatility, returns, and risk perception across countries and industries, with heterogeneous effects across sectors. Early evidence suggests that crisis-driven shocks do not affect all industries uniformly; instead, sectors linked to healthcare, pharmaceuticals, and essential services tend to display resilience and, in some cases, superior performance during such periods. Several studies investigated the immediate reaction of financial markets to the COVID-19 outbreak. Ashraf (2020) found that stock markets across countries responded negatively to rising COVID-19 cases, reflecting uncertainty and economic disruptions. Similarly, Baker et al. (2020) noted that the pandemic generated fear shock that has turn into market volatility, policy uncertainty, and disruptions to economic activity. The pandemic has remained key factor to affect the investor's behaviour across the world. Sector-specific analyses reveal that the healthcare and pharmaceutical industries performed differently from other sectors.

Mazur, Dang, and Vega (2021) revealed that unprecedented demand of pharmaceutical and healthcare affected its stocks prices in extraordinary way. The study highlighted a shift in investor decision to gain stable and growth-oriented return. Haroon and Rizvi (2020) found that sectors directly involved in crisis management and essential goods experienced relatively positive market responses, while tourism, aviation, and hospitality sectors experienced severe declines.

Research on emerging markets also confirms sectoral heterogeneity. Topcu and Gulal (2020) found that emerging stock markets remain more volatile during the pandemic-related developments, but sectoral performance varied with economic structure and industry exposure. Narayan, Phan, and Liu (2021) further emphasized that the uncertainty as an outcome of crisis affected returns and risk across sectors, with healthcare-related industries showing relatively stable performance comparatively. The outcome of discussion emphasis on sectoral changes rather than the structural shifts in financial markets. Considering this context, considerable studies have examined the broader stock market response to COVID-19. Banerjee et al. (2021) studied Indian equity market volatility during pandemic and observed significant volatility. The investor took larger interest in the pharmaceutical sector due to India's role as a global supplier of generic medicines and vaccines. It was found Indian pharmaceutical firms experienced increased market capitalization and correction in investor sentiment during and after the pandemic, reflecting expectations of long-term growth and strategic importance (Bora & Basistha, 2021).

During financial crises, investors often reallocate capital toward sectors perceived as defensive and essential, such as healthcare and consumer staples (Chen & Siems, 2004).

Similar patterns emerged during the COVID-19 pandemic, with pharmaceutical firms benefiting from increased demand, policy support, and global health priorities. These structural shifts may persist into the post-crisis period, affecting long-term investment behaviour and sectoral performance.

3. Research Problem

The major question investigated in this study is behaviour of pharmaceutical indices in 3 different economic phases . The healthcare sector was expected to outperform during the pandemic due to increased demand, empirical validation is required to determine whether this outperformance was statistically significant and whether it entailed higher risk. Thus, the core issue is not simply a performance comparison but an evaluation of the risk–return trade-off across economic regimes.

4. Research objective

1. To compare the average weekly returns of the pharma sector and the Nifty-50.
2. To examine phase-wise changes in returns during Pre-COVID, COVID, and PostCOVID periods.
3. To analyse differences in volatility between the pharma sector and Nifty-50.
4. To test the statistical significance of differences in mean returns.

5. Research Question

1. Does the pharma sector generate significantly different returns compared to the Nifty50 in India?
2. Did the COVID-19 period significantly change the relative performance of the healthcare sector?
3. Is the volatility of the healthcare sector significantly different from that of the market index Nifty-50?
4. Does the pharma sector display resilience during crisis periods?

6. Research Methodology

This study uses quantitative exploratory methodology. Comparative anslysis used to assess tge performance of major indices. The motive of studyis to observe performance of indices in different tine period. It also cover health crisis petiod to observe its effect Th data used in study is secondary in nature. The period of study is from 2016 to 2025. The frequency of data used is Weekly. This data frequency provides clear picture ignoring daily fluctuations and noise.The study uses Log returns. They are widely used in financial time series study.

To assess regime-dependent behaviour, the sample period is divided into three phases: PreCOVID (2016–2019), COVID (2020–2021), and post-COVID (2022–2025). This phase-

wise classification enables the examination of structural changes in performance during crisis and recovery periods. In this paper, first, descriptive statistics are used to summarise the characteristics of returns and volatility across phases. Second, independent-sample t-tests assess whether the mean returns of the healthcare sector differ significantly from those of the broader market. Statistical analyses and visualisations are conducted using R software.

7. Result and discussion

This study uses descriptive statistics. As shown in Table 1, during the pre-COVID period (20162019), the healthcare sector posted a negative return (-0.00167), while the Nifty 50 posted a positive return (0.00229). This indicates underperformance relative to the pre-pandemic period. In contrast, during the COVID period, both indices posted positive returns, with the healthcare sector (0.00540) outperforming the Nifty 50 (0.00337). In the post-COVID period, healthcare indices delivered slightly higher returns than broader market indices. The healthcare sector continued to exhibit a higher risk than the Nifty 50 index.

Table 1: Phase-Wise Risk–Return Comparison

Phase	Pharma Mean	Nifty 50 Mean	Pharma SD	Nifty 50 SD
Pre-COVID	-0.00167	0.00229	0.0276	0.0174
COVID	0.00540	0.00337	0.0361	0.0330
Post-COVID	0.00226	0.00199	0.0214	0.0177

Note: Returns are weekly logarithmic returns

Figure 1: Phase-wise Mean Returns and Volatility

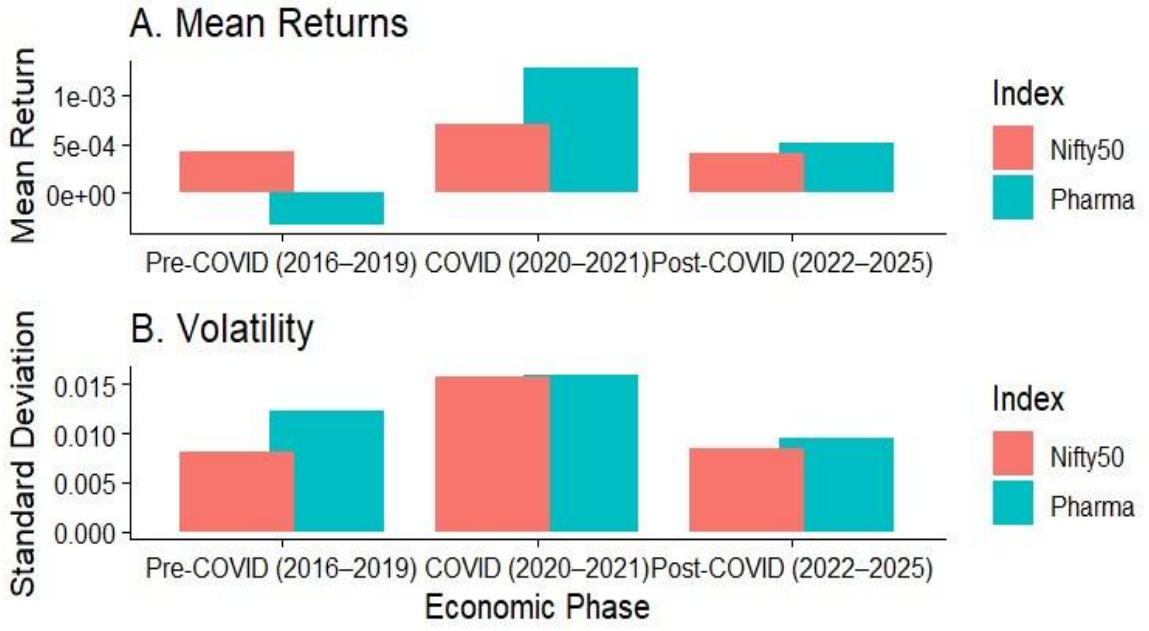


Figure 1 discusses the relationship between mean return and volatility. During COVID, both indices exhibited high volatility, reflecting systematic risk, but the Pharma sector still faces high risk despite the recovery.

Figures 2 and 3 show volatility regime shifts during the COVID period, characterised by extreme ups and downs, sharp rebounds, evident volatility, and negative shocks. The healthcare sector shows occasional crisis-driven upside momentum. The post-crisis period has seen normalisation, reducing volatility, yet the healthcare sector remains relatively more dispersed, indicating sector-specific risk.

Figure 2: Weekly return with the COVID period highlighted

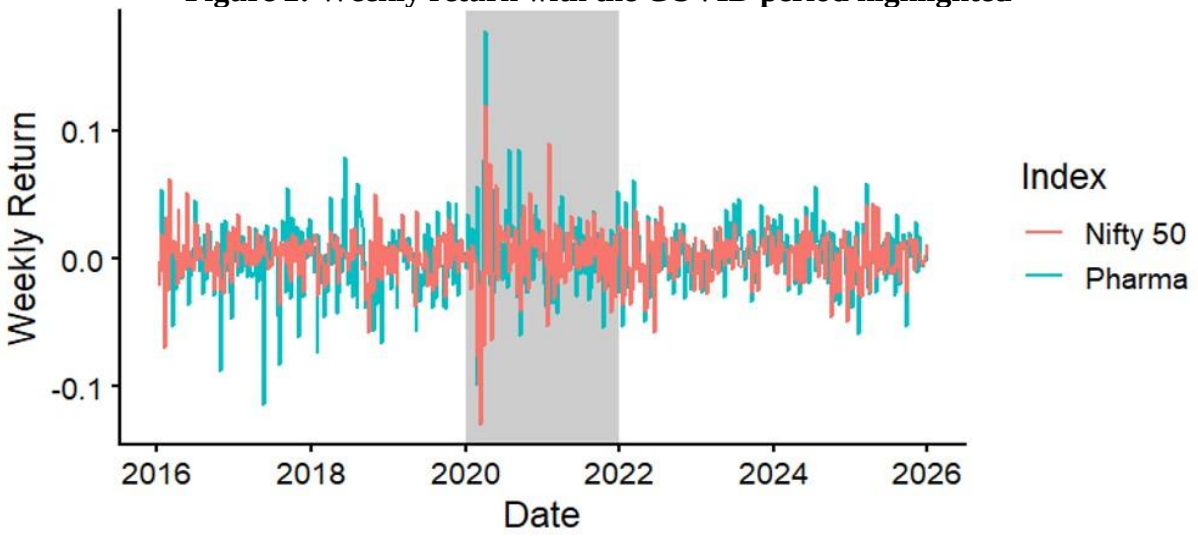


Figure 3. Boxplot graph for phase-wise return distribution

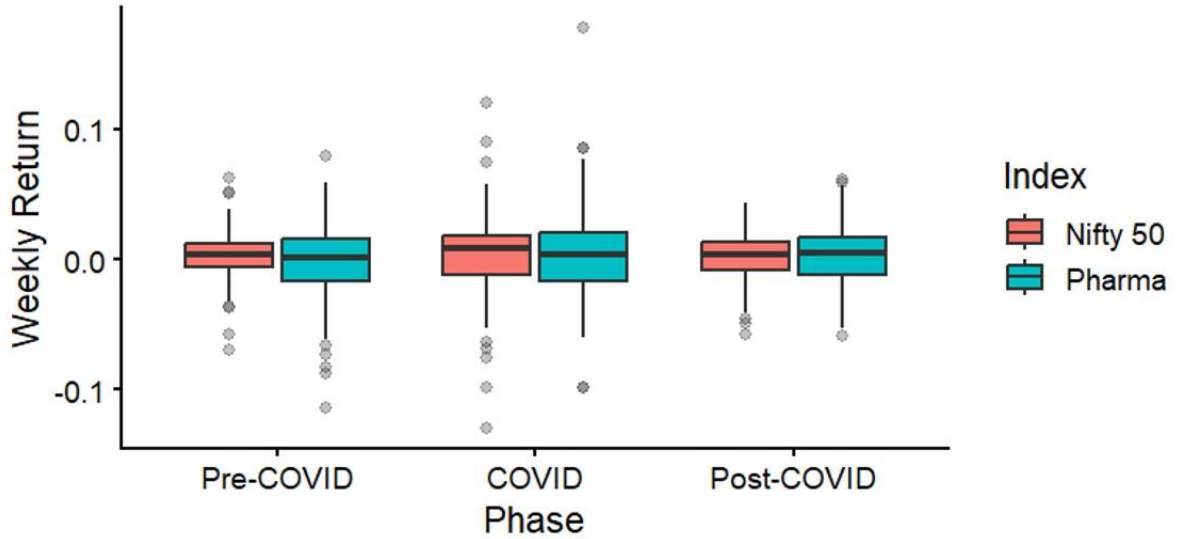


Table 2: Phase-Wise Independent Sample t-Test

Phase	Pharma Mean	Nifty-50 Mean	t-Statistic	p-Value	95% Confidence Interval	Result
Pre-COVID	-0.00167	0.00229	-1.751	0.081	[-0.00840, 0.00049]	Not Significant
COVID	0.00540	0.00337	0.424	0.672	[-0.00743, 0.01149]	Not Significant
Post-COVID	0.00226	0.00199	0.136	0.892	[-0.00352, 0.00404]	Not Significant

Note: Welch Two Sample t-test is used due to unequal variances.

Table 2 presents the results of Welch's t-test, which was appropriately used here due to unequal variances between the groups, providing robust results without assuming equal spreads. Across the three economic phases, the mean return difference between the Pharma sector and the Nifty50 is not statistically significant. Across the Pre-COVID, COVID, and Post-COVID periods, the results indicate that there is no statistically significant difference in average weekly returns between the healthcare sector and the broader market ($p > 0.05$ in all phases). Thus, the results do not provide sufficient support for the research question that the Pharma sector outperformed the Nifty-50 in terms of mean returns across different economic phases.

Figure 4: phase-wise return distribution

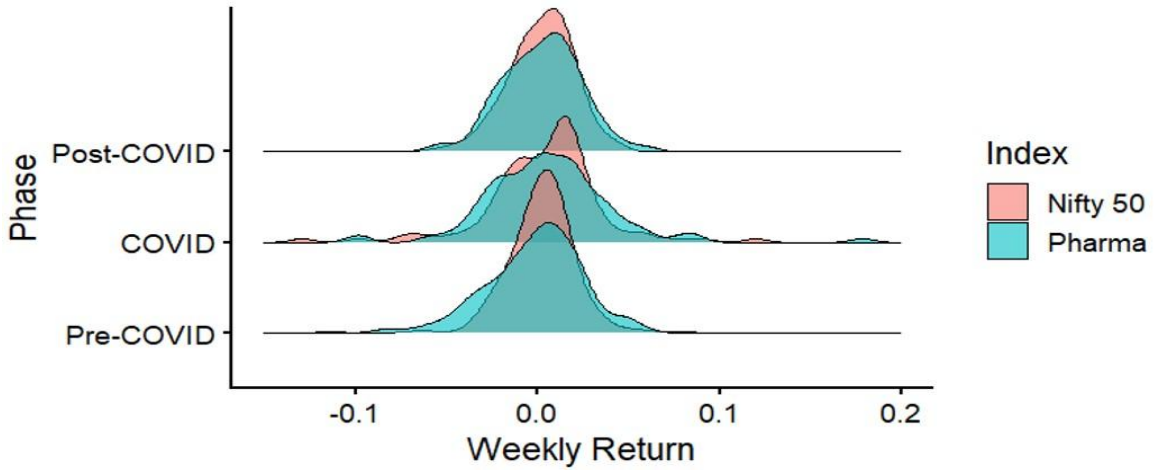


Figure 4 shows that the pharma sector does not deliver statistically significant mean returns relative to the Nifty 50 and exhibits high dispersion. During the COVID-19 pandemic, volatility became market-wide, reducing relative sectoral differences. The findings indicate that the

pharma sector in India behaves more like a higher-risk, cyclical sector than a defensive asset class for market participants.

8. Conclusion

As the study has analyzed the risk and return volatility and consumer's reaction with reference to India's healthcare sector relative to the broader market across the Pre-COVID, COVID, and Post-COVID phases, using weekly data. The average return has remained significantly unchanged across the healthcare sector and Nifty 50 were not statistically different across the three phases, whereas the volatility significantly changed. It reveals that the fear factor has dominantly affected investor's decisions. The COVID period marked a clear structural break, characterised by heightened return dispersion and volatility clustering. The results suggest that crisis periods strengthen systemic risk, thereby reducing sectoral differences in volatility behaviour.

9. Limitations and Future Scope

The analysis is primarily descriptive and comparative, without incorporating advanced volatility models or any robust study. Additionally, the model was restricted but it ignored the macroeconomic variables to explain return dynamics. Future research can build on this study by employing daily high-frequency data and volatility modelling techniques. Incorporating macro-financial factors and international comparisons would further strengthen insights into the evolving risk structure of the healthcare sector in emerging markets.

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