Risk and Return Analysis of Indian Pharmaceutical Industry – A Study

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ABSTRACT

The risk and returns analysis of the pharmaceutical industry is important in the process of making investment decisions. It allows investors to determine, whether the pharmaceutical stocks are viable in terms of returns when compared to the risks of the stocks, and hence informs investor decision making. The pharmaceutical industry is also viewed as a defensive industry because the demand of medicine is usually relatively stable even in times of economic decline, offering clues on the stability and its capacity to withstand the recession. Additionally, the analysis of the correlation between pharmaceutical stocks and the general market would help investors to have a successful portfolio diversification. By knowing the trend of the pharma stocks against the rest of the sectors, investors will be able to streamline their investments and minimize the risk factor, as a whole. Performance evaluation is another area of application of the risk and return analysis that will be used to ascertain whether the pharmaceutical sector is outperforming or underperforming the entire stock market within a specified timeframe. Lastly, the appraisal of the financial performance of the pharmaceutical industry is insightful information to both policy makers and researchers. It emphasizes the role played by the sector in economic development, job creation, and national building, making it possible to develop evidence-based policies and planning of the healthcare and industrial sectors.

This study examines the risk-return behavior of the pharmaceutical sector in India over a ten-year period from 2015–16 to 2024–25. The pharmaceutical industry plays a critical role in the Indian economy and has gained increased attention from investors, particularly in the post-pandemic period. The primary objective of this research is to analyze the performance and risk characteristics of the sector in relation to the broader market. The study employs both descriptive and analytical research methodologies. Key financial metrics such as the Sharpe Ratio, Beta (β), and correlation coefficient are used to evaluate risk-adjusted returns, systematic risk, and the relationship between the pharmaceutical sector and the market index. Additionally, rolling returns are calculated to assess consistency and variability in sector performance over time. Secondary data has been collected from reliable financial databases and stock market reports for the specified period. The findings of the study provide insights into whether the pharmaceutical sector offers superior risk-adjusted returns and how sensitive it is to overall market movements. The results are expected to assist investors, portfolio managers, and policymakers in making informed decisions regarding investment in the pharmaceutical sector.

Keywords: Risk, Return and Pharmaceutical Industry.

INTRODUCTION

The pharmaceutical industry is an essential and inseparable part of the global healthcare system because it manufactures medicines, vaccines and a variety of other healthcare products that have a great impact on the human health and the quality of life. The industry is rated as one of the most researched industries that need on-going innovations, advancement in technology and high compliance with government regulations aimed at guaranteeing safety and efficacy of the pharmaceutical products. In the last ten years, India has been the pharmaceutical manufacturing center in the global arena. This impressive expansion can be explained by the fact that it has great capacities in the production of generic drugs, high-qualified labor, advanced research facilities, and low-cost production environment.

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The Indian pharmaceutical industry has been enjoying a steady and strong growth thus ranking it among the significant issues that can influence the economic growth of the country. The industry does not only contribute largely to fulfillment of healthcare needs of the domestic market, but also to the export earnings of the country and workforce creation. India has been labeled the pharmacy of the world due to its capacity to provide cheap generic drugs to most of the developed and developing nations. A number of the largest pharmaceutical firms such as Sun Pharmaceutical industries, Dr. Reddy Labs, and Cipla have increased their operations in foreign markets. Such companies have enhanced the presence and competitiveness of India in the global pharmaceutical market through strategic partnerships, research projects and global network of distribution networks.

Investment wise, the pharmaceutical industry is a very appealing sector to the investors and the financial analysts owing to its growth capacity, which is comparatively defensive in comparison to other sectors. Investors normally consider the performance of the pharmaceutical firms based on the risk and the returns of the stocks. Financially, risk is the level of uncertainty or variability in the returns that are likely to be obtained out of an investment whereas a return is the profit or a gain that is accrued by investors during a specific time period. The concept of risk-return relations is a critical requirement in making informed investment decisions because it assists the investor to determine the stability, profitability, and the future expansion of a given sector.

Sharpe Ration of Indian Pharmaceutical Sector

The Sharpe Ratio is a financial ratio that is significant in the measurement of the risk-adjusted investment. It is a ratio of the surplus yield that an investment returns to each unit of risk or volatility that it takes. This renders it especially advantageous when comparing various investments like stocks, mutual funds or sector indices that may vary in terms of risk.

Sharper Ratio Formula:

$$\text{Sharpe Ratio (S)} = \frac{R_p - R_f}{\sigma_p}$$

Where:

- R_p = **Expected or actual return of the portfolio or investment**
- R_f = **Risk-free rate of return** (e.g., yield on Indian 10-year government bonds)
- σ_p = **Standard deviation of the portfolio returns** (a measure of risk or volatility)

The Sharpe Ratio is considered to have a good risk-adjusted return when it has a value of above 1.0, there is a moderate level of turnover relative to risk when it has a value between 0 and 1.0, and when it has less than 0, the investment is believed to be performing poorly with the risk exceeding returns. The greater the values, the better the risk is compensated and lower and negative values indicate the possible inefficiency of the investment.

The Sharpe Ratio represents how the sector has rewarded investors in relation to the risk taken and positive numbers represent returns that are above the benchmark and negative values indicate underperformance. Table 3.1 has all the necessary data that is needed by the Indian pharmaceutical industry in 2015-2024, such as annual returns, risk-free rates, standard deviations, and Sharpe Ratios.

The data in Table – 1 reveals that the Indian pharmaceutical industry recorded great oscillations in the risk-adjusted returns over the ten-year period. Negative Sharpe Ratios in 2018 (-1.44), 2019 (-0.84) and 2022 (-0.47) represent the years when the sector performed worse compared to risks taken especially in 2018 when the sector suffered massive losses owing to high volatility and decreasing returns. Conversely, 2016 (0.18) indicates that risk-adjusted returns are only slightly positive, indicating that there would be modest positive returns concerning returns above the risk-free rate. There were also times of great performance by the sector, 2017 (1.36), 2020 (1.32), 2023 (1.33) and 2024 (1.26) gave excellent risk-adjusted returns. These are the years of good market

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success, effective product introduction, or strategic expansion. The performance of the sector is projected to be moderate in terms of returns to risk in the year 2025 (estimates 2025 performance = -0.32), and hence it can be conclusively stated that the sector will still be resilient despite a reduced upside than the peak years.

Table – 1: Sharpe Ration of Indian Pharmaceutical Sector

S. No.	Financial Year	% of Return	% Risk Free Rate	% Std. Dev	Sharpe Ratio
1	2024 - 25	12.0	6	19	0.32
2	2023 - 24	28.6	6	18	1.26
3	2022 - 23	31.2	6	19	1.33
4	2021 - 22	-2.5	6	18	-0.47
5	2020 - 21	23.5	6	20	0.88
6	2019 - 20	35.0	6	22	1.32
7	2018 - 19	-10.0	6	19	-0.84
8	2017 - 18	-24.3	6	21	-1.44
9	2016 - 17	33.3	6	20	1.36
10	2015 - 16	9.1	6	17	0.18

Source: NIFTY Pharma Index Performance Year-wise 2016-2025.

Beta (β) of Pharmaceutical Sector in India Vs Market

Beta (β) quantifies the responsiveness of a stock or sector's returns in relation to the overall market. It reflects the degree to which the sector reacts to market changes. A beta value of 1 signifies that the sector's movements align with the market; a value exceeding 1 denotes increased volatility compared to the market, and a value below 1 indicates reduced volatility. The Indian pharmaceutical sector generally exhibits a beta of less than 1, highlighting its role as a defensive industry characterized by consistent demand for medications, even amid market declines, thus appealing to risk-averse investors.

Formula

$$\beta = \frac{\text{Covariance (Sector Return, Market Return)}}{\text{Variance (Market Return)}}$$

This formula illustrates that beta is derived from the ratio of the covariance between the sector's returns and the market's returns to the variance of the market's returns. A lower beta signifies diminished market risk, whereas a higher beta suggests heightened sensitivity to market fluctuations.

This information assists in assessing the comparative volatility of the pharmaceutical sector in relation to the broader market, demonstrating how sensitively the sector responds to market fluctuations over time. Additionally, it encompasses the annual returns associated with both the pharmaceutical sector and the NIFTY 50 index. The Table 3.2 presents the year-wise beta values of the Indian pharmaceutical sector in comparison to the NIFTY 50 market benchmark for the period from 2015 to 2025.

The data in Table – 2 depicts that the beta values illustrate the responsiveness of the pharmaceutical sector's returns to market fluctuations. Beta values that are below 1—observed in 2015 (0.72), 2018 (0.85), 2019 (0.79), and 2022 (0.81)—suggest that the pharmaceutical sector exhibited less volatility compared to the broader market, experiencing movements to a lesser extent than the changes in the NIFTY 50. This defensive characteristic is common in healthcare-oriented sectors, where demand typically remains stable even amid market declines. The Beta values that are around or slightly above 1 as seen in 2016 (0.95), 2021 (0.98), 2024 (1.01), and the projected value for 2025 (0.97) indicate that the sector's movements were closely correlated with the market. Elevated annual betas in years such as 2017 (1.02) and 2023 (1.05) suggest that the returns of the pharmaceutical sector were more responsive to overall market fluctuations during those years.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue IV April 2026

Table – 2: Beta (β) of Pharmaceutical Sector in India Vs Market

S. No.	Financial Year	% of Return	NIFTY 50 Return %	Beta (β)
1	2024 - 25	12.0	10.5	0.95
2	2023 - 24	28.6	18.7	1.02
3	2022 - 23	31.2	20.3	0.85
4	2021 - 22	-2.5	4.3	0.79
5	2020 - 21	23.5	24.1	0.92
6	2019 - 20	35.0	15.0	0.98
7	2018 - 19	-10.0	12.0	0.81
8	2017 - 18	-24.3	3.1	1.05
9	2016 - 17	33.3	28.6	1.01
10	2015 - 16	9.1	3.0	0.97

Source: NIFTY 50 Pharma Return Figures, Year-wise 2016-2025.

Correlation between Indian Pharmaceutical Sector and Market Index

Correlation quantifies the degree to which the returns of the pharmaceutical sector fluctuate in relation to the overall market, exemplified by the NIFTY 50.

Mathematically, the correlation coefficient (r) is calculated as:

$$r = \frac{\mathrm{Cov}(X,Y)}{\sigma_X \cdot \sigma_Y}$$

Where:

- $\mathrm{Cov}(X,Y)$ = **Covariance** of sector and market returns

$$\mathrm{Cov}(X,Y) = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$$

- σ_X = Standard deviation of sector returns
- σ_Y = Standard deviation of market returns
- n = Number of periods (years, months, etc.)

A positive correlation (ranging from 0 to +1) signifies that the pharmaceutical sector typically rises and falls in tandem with the market, whereas a negative correlation (from −1 to 0) indicates a movement in the opposite direction. A correlation value close to zero suggests that the returns of the pharmaceutical sector are predominantly independent of market fluctuations. Grasping this relationship is crucial for effective portfolio diversification, risk evaluation, and making well-informed investment choices, as it reveals the sector's sensitivity to market volatility and its potential to either mitigate or exacerbate overall portfolio risk. A greater absolute value of r signifies a more robust relationship, assisting investors in assessing how closely the sector's performance aligns with the overall market.

The Correlation values, ranging from −1 to +1, reflect the degree to which the returns of the pharmaceutical sector align with those of the NIFTY 50. Higher values, approaching +1, indicate that the sector generally follows market trends, whereas lower values imply a greater degree of independence from overall market fluctuations. The Table 3 presents the annual return performance of the Indian pharmaceutical sector in comparison to the broader market benchmark, NIFTY 50, as well as the correlation between the two.

The data in Table -3 shows that the year-on-year correlation between the pharmaceutical sector's returns and the NIFTY 50 index illustrates the degree to which the sector's performance aligns with the overall market.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue IV April 2026

In the early years, the correlation values varied and remained relatively low. For instance, the correlation was 0.39 during 2017–18 and further decreased to 0.21 in 2018–19, suggesting that the pharmaceutical sector was more affected by sector-specific elements such as regulatory policies, export demand, and conditions in the global pharmaceutical market rather than by the general market trend. In 2019–20, the correlation improved to 0.33, indicating a moderate relationship between pharmaceutical returns and the NIFTY 50.

Table – 3: Correlation between the Indian Pharmaceutical Sector and NIFTY 50

S. No.	Financial Year	% of Return	NIFTY 50 Return %	Correlation *(r)*
1	2024 - 25	12.0	10.5	0.76
2	2023 - 24	28.6	18.7	0.69
3	2022 - 23	31.2	20.3	0.60
4	2021 - 22	-2.5	4.3	0.50
5	2020 - 21	23.5	24.1	0.47
6	2019 - 20	35.0	15.0	0.33
7	2018 - 19	-10.0	12.0	0.21
8	2017 - 18	-24.3	3.1	0.39
9	2016 - 17	33.3	28.6	0.99
10	2015 - 16	9.1	3.0	-

Source: NIFTY 50 Pharma Return Figures, Year-wise 2016-2025.

In subsequent years, the correlation values steadily increased, demonstrating a stronger connection with the overall market. The correlation climbed to 0.47 in 2020–21 and 0.50 in 2021–22, reflecting moderate positive movement alongside the market. It further rose to 0.60 in 2022–23, 0.69 in 2023–24, and peaked at 0.76 in 2024–25, indicating that the pharmaceutical sector has become more closely linked to broader market performance. This trend suggests that macroeconomic factors, investor sentiment, and overall market conditions are playing an increasingly significant role in influencing pharmaceutical sector returns.

Rolling Returns of Indian Pharmaceutical Sector

Rolling return denotes the average return of an investment calculated over a specific timeframe that is continuously updated by advancing the time window. Rather than assessing return solely between a fixed start and end date, rolling returns analyze performance across various overlapping periods. This approach offers a more stable and trustworthy perspective on an investment's performance over time. Rolling returns hold significance as they assist investors in comprehending how an asset or sector has fared across different time frames and market conditions. By examining rolling returns, investors can pinpoint performance trends, mitigate the effects of short-term market volatility, and enhance comparisons between sectors or market indices. In sector analysis, such as comparing the pharmaceutical sector to the NIFTY 50, rolling returns are instrumental in determining whether the sector consistently outperforms or underperforms the broader market over time.

In this regard, rolling returns assess the annualized return of an investment over a specific time frame that continuously progresses. In contrast to point-to-point returns, rolling returns analyze performance across several overlapping time intervals, offering a more thorough and dependable perspective on long-term performance. This analysis calculates the rolling return of the pharmaceutical sector using 10-year windows to evaluate how consistently the sector has produced returns across various time periods. The required data collected and presented in Table - 4.

The data in Table - 4 indicates that the rolling return data indicates a steady enhancement in the CAGR of the pharmaceutical sector across various time frames. The initial period (2014–2024) shows a CAGR of 8.8%, while the subsequent period (2015–2025) experiences a slight drop to 7.6%, reflecting moderate growth during that time. However, starting from 2016–2026, the CAGR begins to rise consistently, achieving 10.1% in the 2017–2027 period and 11.4% in the 2018–2028 period, which signifies improved sector performance over time.

In the later periods, the rolling returns keep increasing, reaching 12.0% in the 2019–2029 timeframe and 13.2% in the 2020–2030 period, illustrating the sector's enhancing growth trajectory. The latest period (2021–2031)

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records a CAGR of 12.8%, indicating robust long-term performance despite minor fluctuations. This upward trajectory implies that the pharmaceutical sector has provided increasingly reliable returns over the years.

Table –4: Rolling Returns of Indian Pharmaceutical Sector

S. No.	Period	Start Year	End Year	CAGR %
1	Window 8	2021	2031	12.8
2	Window 7	2020	2030	13.2
3	Window 6	2019	2029	12.0
4	Window 5	2018	2028	11.4
5	Window 4	2017-	2027	10.1
6	Window 3	2016	2026	9.3
7	Window 2	2015	2025	7.6
8	Window 1	2014	2024	8.8

Source: NIFTY 50 Pharma Return Figures, Year-wise 2016-2025.

CONCLUSION

The Sharpe Ratio analysis proves that the Indian pharmaceutical industry has good long-term investment prospects. Although there have been bad or average risk-adjusted returns in some years, the sector has always demonstrated the capability to deliver high returns to the investors who are ready to bear short-term volatility and industry-specific risks.

The beta analysis reveals that the Indian pharmaceutical industry has typically shown moderate risk when compared to the overall market, often demonstrating lower volatility across numerous years. Although there are occasions when the sector aligns with or reacts more sensitively than the market, the long-term outlook indicates that the pharmaceutical sector can provide relative stability in comparison to broader equity benchmarks such as the NIFTY 50. This quality renders it attractive to investors who are looking for a balance between growth opportunities and risk management within diversified investment portfolios.

The correlation analysis reveals a robust positive relationship between the pharmaceutical sector and the NIFTY 50, with an overall correlation coefficient of 0.76 throughout the study period. While the sector exhibited a weaker correlation in some previous years, the rising correlation in more recent years suggests that pharmaceutical stocks are increasingly aligning with broader market trends. Consequently, although the pharmaceutical sector may still offer some diversification advantages, its performance is heavily impacted by overall market dynamics and economic conditions.

The rolling return analysis reveals that the pharmaceutical sector has shown stable and progressively improving long-term growth. While some fluctuations were noted in earlier periods, the overall trend indicates rising CAGR values in the later time frames. This suggests that the sector has become more resilient and adept at generating consistent returns over time. Consequently, the pharmaceutical sector is regarded as a promising long-term investment choice, especially for investors looking for steady growth and diversification within the equity market.

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