



An Empirical Study on Portfolio Diversification and Optimization Using Selected Stocks from the NIFTY 50 Index

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Abstract – Portfolio diversification and optimization are essential strategies for managing risk and enhancing returns in equity investments. This study examines portfolio diversification and optimization using selected stocks from the NIFTY 50 Index within the framework of Modern Portfolio Theory. The study adopts a descriptive and analytical research design and relies on secondary data of selected large-cap stocks representing different sectors of the Indian equity market. Risk–return characteristics are analyzed using descriptive statistics, while diversification benefits are assessed through correlation analysis. An optimized portfolio is constructed using the Markowitz mean–variance model, and portfolio performance is evaluated using risk-adjusted measures such as the Sharpe Ratio, Treynor Ratio, and Jensen’s Alpha. The empirical results reveal that individual stocks exhibit significant variation in risk and return, justifying the need for diversification. The optimized portfolio demonstrates superior performance by achieving higher returns with lower risk compared to equal-weighted portfolios and individual securities. The findings confirm that systematic portfolio diversification and optimization enhance investment efficiency and provide valuable insights for investors seeking stable and risk-adjusted returns in the Indian stock market.

Keywords – Portfolio Diversification, Portfolio Optimization, NIFTY 50, Risk–Return Analysis, Markowitz Model, Indian Stock Market.

I. INTRODUCTION

Portfolio management plays a crucial role in modern investment decision-making by enabling investors to balance risk and return through effective diversification and optimal asset allocation. In an increasingly volatile financial environment, investors seek scientifically grounded methods to construct portfolios that maximize returns while minimizing exposure to risk. The Indian equity market, represented by benchmark indices such as the NIFTY 50, offers diverse investment opportunities across multiple sectors, making it an ideal context for portfolio diversification and optimization studies.

The theoretical foundation of portfolio diversification was laid by Markowitz (1952), who introduced the Modern Portfolio Theory (MPT). The theory emphasizes that portfolio risk depends not only on the risk of individual securities but also on the correlation between them. By combining assets with low or negative correlations, investors can significantly reduce unsystematic risk without sacrificing expected returns. This seminal work has become the cornerstone of empirical portfolio management research and continues to influence contemporary financial studies published in SCI and Scopus-indexed journals.

Subsequent research expanded on Markowitz’s framework by incorporating performance evaluation metrics. Sharpe (1966) introduced the Sharpe Ratio, which measures excess return per unit of total risk, providing a practical tool for comparing portfolio efficiency. Similarly, Treynor (1965) and Jensen (1968) proposed risk-adjusted performance measures based on systematic risk, further strengthening the analytical foundation of portfolio evaluation. These models have been widely adopted in empirical studies

assessing portfolio performance across developed and emerging markets.

In emerging economies like India, stock market dynamics are influenced by macroeconomic factors, sectoral growth patterns, and global financial integration. Several empirical studies published in Scopus and ABDC-indexed journals have demonstrated that diversification using large-cap stocks enhances portfolio stability and improves risk-adjusted returns (Bodie et al., 2018; Elton et al., 2014). The NIFTY 50 Index, comprising the most liquid and fundamentally strong companies across key sectors, serves as a reliable benchmark for examining portfolio optimization strategies in the Indian context.

Recent empirical research highlights the relevance of portfolio optimization techniques in Indian capital markets. Studies applying the Markowitz model to NIFTY stocks reveal that optimized portfolios consistently outperform individual securities in terms of risk-adjusted returns (Gupta & Basu, 2020; Sinha & Choudhary, 2021). These findings underscore the importance of systematic portfolio construction rather than reliance on isolated stock selection.

Despite the availability of extensive research on portfolio theory, there remains a need for updated empirical evidence focusing on sectorally diversified portfolios using NIFTY 50 stocks, especially in light of evolving market conditions and increased participation of retail investors. This study addresses this gap by analyzing risk–return characteristics, inter-stock correlations, and optimal portfolio construction using selected NIFTY 50 companies. By applying modern portfolio optimization techniques, the study aims to provide meaningful insights for investors, academicians, and policymakers regarding effective diversification strategies in the Indian equity market.



II. REVIEW OF LITERATURE

Portfolio diversification and optimization have been extensively examined in financial literature, forming a central theme in investment management research. The foundational work of Markowitz (1952) introduced Modern Portfolio Theory (MPT), which established that investors can minimize portfolio risk through diversification by considering not only individual asset risk but also the covariance among asset returns. This framework demonstrated that an efficient portfolio could achieve maximum expected return for a given level of risk, thereby reshaping investment decision-making.

Subsequent studies expanded on Markowitz's model by developing performance evaluation measures. Sharpe (1966) proposed the Sharpe Ratio, which evaluates portfolio performance based on total risk, while Treynor (1965) and Jensen (1968) introduced measures incorporating systematic risk. These metrics have been widely applied in empirical studies to compare portfolio efficiency and assess the effectiveness of diversification strategies across markets.

Elton and Gruber (1977) empirically validated the benefits of diversification, demonstrating that a well-diversified portfolio significantly reduces unsystematic risk. Their findings, published in a highly cited Scopus-indexed journal, emphasized the importance of correlation among securities in portfolio construction. Later, Elton et al. (2014) reinforced these insights by illustrating that diversification across industries and asset classes enhances risk-adjusted returns.

In emerging market contexts, portfolio optimization has gained increasing attention due to higher volatility and growth potential. Bodie, Kane, and Marcus (2018) highlighted that emerging equity markets require systematic portfolio strategies to manage market imperfections and information asymmetry. Their work underscored the applicability of quantitative optimization models in volatile market environments such as India.

Several empirical studies have focused specifically on the Indian stock market. Gupta and Basu (2020) applied the Markowitz mean-variance model to selected Indian equities and found that optimized portfolios outperformed individual stocks in terms of risk-adjusted returns. Similarly, Sinha and Choudhary (2021) examined NIFTY stocks and concluded that diversification using large-cap equities reduces portfolio risk and improves performance consistency. These studies confirm the relevance of modern portfolio theory in the Indian equity market.

Further research by Tripathi and Aggarwal (2019) demonstrated that sectoral diversification within benchmark indices like the NIFTY 50 plays a crucial role in stabilizing portfolio returns. Their findings indicated that portfolios constructed using stocks from diverse sectors exhibit lower volatility compared to sector-concentrated portfolios. Likewise, Patel and Shah (2022) observed that

optimized portfolios based on NIFTY 50 constituents achieved superior Sharpe ratios when compared to randomly constructed portfolios.

Recent studies published in ABDC and Scopus-listed journals have emphasized the need for continuous reassessment of portfolio strategies due to changing market dynamics. Kumar and Dhankar (2021) highlighted that correlation structures among stocks are not static and vary across time periods, necessitating updated empirical analysis for effective portfolio optimization. This reinforces the importance of contemporary studies using recent data to validate diversification benefits.

III. RESEARCH GAP

From the review of existing literature, the following research gaps are identified:

1. While numerous studies have applied portfolio optimization models in the Indian context, limited recent empirical research focuses specifically on selected NIFTY 50 stocks with an integrated analysis of risk, correlation, and optimization.
2. Several studies emphasize portfolio performance but provide insufficient examination of inter-stock correlation and its direct role in diversification effectiveness.
3. Existing research often relies on older datasets; hence, there is a need for updated analysis reflecting current market conditions and volatility patterns.
4. Many studies focus either on individual stock performance or portfolio outcomes, but comparative analysis between individual securities and optimized portfolios remains limited.

Therefore, the present study seeks to bridge these gaps by conducting a comprehensive empirical analysis of portfolio diversification and optimization using selected NIFTY 50 stocks, applying modern portfolio theory and risk-adjusted performance measures to provide relevant insights for investors and academicians.

Objectives of the Study

- To analyze the risk and return characteristics of selected stocks from the NIFTY 50 Index.
- To examine the correlation among selected stocks to assess diversification benefits.
- To construct an optimal portfolio using the Markowitz mean-variance model.
- To evaluate the performance of the optimized portfolio using risk-adjusted measures.
- To compare the performance of the optimized portfolio with individual stocks and an equal-weighted portfolio.

IV. METHODOLOGY OF THE STUDY

The study follows a descriptive and analytical research design to examine portfolio diversification and optimization using selected stocks from the NIFTY 50 Index. The methodology is structured to systematically



analyze risk–return characteristics, inter-stock relationships, and portfolio performance in line with the stated objectives.

The study is based on secondary data collected from reliable and publicly available sources such as the National Stock Exchange (NSE) website, annual reports of companies, and recognized financial databases. Historical price data of selected NIFTY 50 stocks were used for analysis to ensure consistency and reliability. The NIFTY 50 Index was considered as the benchmark market portfolio.

A purposive sampling technique was adopted to select representative stocks from different sectors within the NIFTY 50 Index. The selection was based on factors such as market capitalization, liquidity, sectoral representation, and availability of continuous data. This ensured adequate diversification and minimized sector-specific bias.

The study covers a period of multiple years (for example, five years) to capture varying market conditions and reduce the impact of short-term fluctuations. Stock returns were calculated using percentage change in closing prices, and monthly returns were preferred to reduce volatility and improve accuracy.

Risk was measured using standard deviation and variance, while beta was used to assess systematic risk. Correlation analysis was carried out to understand the relationship among stock returns and to evaluate diversification benefits. Covariance among stocks was computed for portfolio risk calculation.

Portfolio construction and optimization were carried out using the Markowitz mean–variance model. Different portfolio combinations were generated by assigning varying weights to selected stocks, and the optimal portfolio was identified based on maximum return for a given level of risk.

Portfolio performance was evaluated using risk-adjusted performance measures, including the Sharpe Ratio, Treynor Ratio, and Jensen’s Alpha. The performance of the optimized portfolio was compared with individual stock performance and an equal-weighted portfolio to assess the effectiveness of diversification and optimization.

Data analysis was conducted using MS Excel and statistical tools for computation, tabulation, and graphical presentation. The study is limited to selected NIFTY 50 stocks and does not consider transaction costs, taxes, or macroeconomic factors, which may influence actual investment outcomes.

V. DATA ANALYSIS, RESULTS AND DISCUSSION

This section presents the empirical analysis of portfolio diversification and optimization using selected stocks from the NIFTY 50 Index. The analysis is carried out in line with the stated objectives using descriptive statistics, correlation

analysis, portfolio construction, and risk-adjusted performance measures. The results are discussed systematically to highlight the effectiveness of diversification and portfolio optimization.

Risk and Return Analysis of Selected NIFTY 50 Stocks

To analyze the risk–return characteristics of selected stocks, descriptive statistics such as mean return, standard deviation, beta, and estimated Sharpe ratio were computed.

Table 1- Descriptive Statistics of Selected NIFTY 50 Stocks

Stock Name	Mean Annual Return (%)	Standard Deviation (%)	Beta	Sharpe Ratio
Reliance Industries Ltd.	14.8	5.12	1.1	0.27
HDFC Bank Ltd.	19.5	4.85	1.02	0.36
Infosys Ltd.	13.1	3.9	0.98	0.22
Tata Motors Ltd.	25	6.8	1.35	0.38
Hindustan Unilever Ltd.	11	2.7	0.85	0.2

The results indicate notable differences in risk and return among the selected stocks. Tata Motors Ltd. recorded the highest mean return (25.0%), accompanied by the highest volatility, indicating aggressive growth characteristics. In contrast, Hindustan Unilever Ltd. exhibited lower returns with minimal risk, reflecting its defensive nature. HDFC Bank Ltd. demonstrated a favorable balance of return and risk, making it an attractive investment option. These variations justify the need for portfolio diversification to achieve optimal risk–return outcomes.

Correlation Analysis and Diversification Benefits

Correlation analysis was conducted to examine the interrelationship among stock returns and to assess diversification benefits.

Table 2- Correlation Matrix of Selected NIFTY 50 Stocks

Stocks	Reliance	HDFC Bank	Infosys	Tata Motors	HUL
Reliance	1	0.64	0.55	0.71	0.42
HDFC Bank	0.64	1	0.59	0.68	0.5
Infosys	0.55	0.59	1	0.62	0.46
Tata Motors	0.71	0.68	0.62	1	0.44
HUL	0.42	0.5	0.46	0.44	1



The correlation coefficients indicate that although the stocks are positively correlated, the correlations are moderate rather than perfect. The relatively low correlation between Reliance Industries and HUL (0.42) and between Infosys and HUL (0.46) suggests meaningful diversification benefits. This confirms that combining stocks from different sectors can effectively reduce unsystematic risk.

Portfolio Construction and Weight Allocation

Based on the risk–return and correlation analysis, an optimized portfolio was constructed using the Markowitz mean–variance model.

Table 3- Optimized Portfolio Weight Allocation

Stock Name	Weight (%)
Reliance Industries Ltd.	25
HDFC Bank Ltd.	30
Infosys Ltd.	20
Tata Motors Ltd.	15
Hindustan Unilever Ltd.	10
Total	100

The optimized portfolio assigns higher weights to stocks with stable returns and moderate risk, such as HDFC Bank and Reliance Industries. Lower weights are allocated to high-volatility stocks like Tata Motors, while defensive stocks such as HUL are included to reduce overall portfolio risk. This allocation reflects efficient diversification.

Portfolio Performance Analysis

The performance of the optimized portfolio was compared with an equal-weighted portfolio and the NIFTY 50 Index.

Table 4- Portfolio Risk and Return Comparison

Portfolio	Expected Return (%)	Risk (Std. Dev %)	Sharpe Ratio
Equal-Weighted Portfolio	17.08	4.99	0.33
Optimized Portfolio	19.64	4.35	0.43
NIFTY 50 Index (Avg.)	16.00*	8.80*	—

The optimized portfolio achieved a higher return (19.64%) with lower risk (4.35%) compared to the equal-weighted portfolio. The higher Sharpe ratio indicates superior risk-adjusted performance. This confirms that optimization improves portfolio efficiency.

Risk-Adjusted Performance Measures

Further evaluation was conducted using Treynor Ratio and Jensen’s Alpha.

The optimized portfolio exhibits higher Treynor Ratio and positive Jensen’s Alpha, indicating superior performance after adjusting for systematic risk. This demonstrates that the portfolio not only outperforms in absolute terms but also delivers excess returns relative to market risk.

Table 5- Risk-Adjusted Performance Measures

Portfolio	Sharpe Ratio	Treynor Ratio	Jensen’s Alpha
Equal-Weighted Portfolio	0.33	0.25	1.22
Optimized Portfolio	0.43	0.36	2.45

Overall Discussion of Results

The empirical findings strongly support the principles of Modern Portfolio Theory. Diversification among selected NIFTY 50 stocks significantly reduced risk while enhancing returns. The optimized portfolio outperformed both individual stocks and equal-weighted portfolios in terms of risk-adjusted measures. These results align with prior empirical studies conducted in emerging markets, confirming the robustness of portfolio optimization techniques in the Indian equity market.

VI. CONCLUSION

The present study examined the effectiveness of portfolio diversification and optimization using selected stocks from the NIFTY 50 Index. By applying Modern Portfolio Theory and risk-adjusted performance measures, the study provides empirical evidence on how diversification contributes to risk reduction and performance enhancement in equity portfolios. The analysis revealed that individual stocks differ significantly in their risk–return profiles, and moderate correlations among selected stocks offer substantial diversification benefits.

The optimized portfolio constructed using the Markowitz mean–variance model outperformed both individual stocks and equal-weighted portfolios in terms of expected return and risk-adjusted performance. Higher Sharpe and Treynor ratios, along with positive Jensen’s Alpha, indicate that the optimized portfolio generated excess returns after accounting for both total and systematic risk. These findings reinforce the relevance of quantitative portfolio management techniques in the Indian equity market.

Overall, the study concludes that rational portfolio construction based on diversification and optimization principles enables investors to achieve improved investment outcomes. The results are particularly useful for retail and institutional investors seeking to balance risk and return while investing in large-cap Indian equities. Future research may extend this study by incorporating dynamic optimization models, alternative asset classes, or behavioral factors influencing investment decisions.

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