

Original Article

# Optimal Portfolio Construction Using Modern Portfolio Theory and Sharpe's Single Index Model: Evidence from NSE Listed Companies

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**ABSTRACT:** *This study focuses on the construction of an optimal portfolio using Modern Portfolio Theory (MPT) with reference to the top 20 market capitalization companies listed on the National Stock Exchange (NSE). The analysis is based on secondary data collected from the Bloomberg database for the period January 2021 to December 2025. Key financial metrics such as mean return, standard deviation, and beta were computed to evaluate the risk-return profile of selected stocks. The findings reveal that Bajaj Finance (20.3%) and SBI (19.2%) offer higher returns but are associated with higher risk, whereas Nestle and HUL demonstrate lower volatility with stable returns. The Excess Return to Beta Ratio indicates that Reliance (10.00), HDFC Bank (9.39), and Bajaj Finance (9.23) provide superior risk-adjusted performance. A cutoff rate ( $C_i$ ) of approximately 0.0110 was determined using Sharpe's Single Index Model, and only stocks exceeding this threshold were included in the optimal portfolio. The final portfolio comprises diversified stocks such as Reliance, HDFC Bank, TCS, Infosys, and Bajaj Finance. The study concludes that a systematic and quantitative approach enhances portfolio efficiency by optimizing the trade-off between risk and return.*

**KEYWORDS:** *Modern Portfolio Theory, NSE, Risk-Return Analysis, Beta, Sharpe Ratio, Optimal Portfolio, Diversification.*

## 1. INTRODUCTION

The concept of portfolio construction has evolved significantly over time, driven by the increasing complexity of financial markets and the need for scientific investment strategies. In modern finance, investors are no longer guided solely by intuition or speculation; instead, they rely on structured models that quantify risk and return. Among these, Modern Portfolio Theory (MPT) stands out as a foundational framework that enables investors to construct portfolios that optimize returns for a given level of risk. The theory emphasizes diversification, suggesting that a well-balanced portfolio of assets can reduce overall risk without compromising expected returns. In the Indian context, particularly within the National Stock Exchange (NSE), portfolio construction has gained prominence due to increased participation from institutional and retail investors, technological advancements, and greater access to financial data (Sharma, 2016; Gupta, 2018). The NSE represents one of the most dynamic and liquid stock exchanges in the world, offering a wide array of investment opportunities across sectors. With the rapid expansion of the Indian economy and integration with global financial systems, the behavior of stock prices has become increasingly complex and volatile. This volatility underscores the importance of adopting systematic approaches like MPT to manage investment risk effectively. The theory's core principle of mean-variance optimization allows investors to evaluate the expected return of a portfolio relative to its risk, measured by standard deviation. Studies by Reddy (2019) and Kumar and Singh (2020) highlight that the application of MPT in emerging markets like India can significantly enhance portfolio performance by identifying efficient combinations of assets.

In recent years, the availability of high-frequency financial data and advanced analytical tools has transformed the way portfolios are constructed and managed. Databases such as Bloomberg provide comprehensive and reliable financial information, enabling researchers and practitioners to perform detailed quantitative analyses. The integration of such data sources with MPT models allows for more accurate estimation of returns, variances, and covariances among securities. Researchers like Patel (2021) and Mehta (2022) emphasize that the use of real-time data improves the robustness of portfolio optimization techniques, making them more applicable in volatile and uncertain market conditions. This development has made portfolio construction more data-driven and less reliant on subjective judgment.

The COVID-19 pandemic and subsequent economic disruptions have further highlighted the importance of resilient investment strategies. Market conditions during and after the pandemic have been characterized by heightened uncertainty, sectoral shifts, and rapid changes in investor sentiment. As noted by Rao (2022) and Verma (2023), traditional portfolio strategies often struggled to adapt to these unprecedented changes, necessitating a re-evaluation of existing models. MPT, with its emphasis on diversification and risk management, provides a useful framework for navigating such turbulent periods. However, its

assumptions, such as normally distributed returns and stable correlations, may not always hold true in real-world scenarios, particularly during crises.

Another critical aspect of portfolio construction is the selection of assets based on market capitalization. Large-cap stocks, which dominate indices like the NSE, are generally considered more stable and less risky compared to mid-cap and small-cap stocks. By focusing on the top 20 companies based on market capitalization, this study aims to analyze portfolios that reflect the core structure of the Indian equity market. According to Iyer (2024) and Nair (2025), large-cap portfolios tend to exhibit lower volatility and more consistent returns, making them suitable for applying MPT principles. Moreover, these companies often have better liquidity, transparency, and investor confidence, which further enhances the reliability of portfolio analysis.

Despite the widespread application of MPT, there remains a need to revisit its relevance in the current financial landscape. The increasing integration of global markets, advancements in financial technology, and the availability of sophisticated analytical tools have created new opportunities and challenges for investors. This study seeks to construct an optimal portfolio using MPT for NSE-listed stocks, utilizing recent data from 2021 to 2025 obtained from the Bloomberg database. By doing so, it aims to provide practical insights into risk-return optimization in a contemporary setting. The findings of this study are expected to contribute to both academic literature and practical investment decision-making by demonstrating the applicability of MPT in modern financial markets.

## 2. REVIEW OF LITERATURE

Sharma (2016) examined the application of Modern Portfolio Theory in the Indian stock market and found that diversification plays a crucial role in minimizing unsystematic risk. The study highlighted that investors who diversified their portfolios across multiple sectors experienced more stable returns compared to those with concentrated investments. Gupta (2018) extended this analysis by focusing on the correlation structure among NSE-listed stocks, concluding that low or negatively correlated assets significantly improve portfolio efficiency. Both studies emphasize the importance of asset selection and diversification in achieving optimal portfolio performance. Reddy (2019) conducted an empirical analysis of NSE stocks using mean-variance optimization and demonstrated that portfolios constructed using MPT outperform randomly selected portfolios in terms of risk-adjusted returns. Similarly, Kumar and Singh (2020) explored the impact of macroeconomic variables such as inflation, interest rates, and GDP growth on portfolio returns. Their findings suggest that external economic factors play a significant role in shaping portfolio performance, indicating that investors must consider both market-specific and macroeconomic variables while constructing portfolios.

Patel (2021) utilized historical stock price data to construct efficient frontiers and identified portfolios that offer the highest return for a given level of risk. The study concluded that investors can benefit from systematically selecting portfolios along the efficient frontier rather than relying on speculative strategies. Mehta (2022) further enhanced this approach by incorporating real-time data analytics, demonstrating that dynamic portfolio rebalancing leads to improved performance in volatile market conditions. These studies highlight the evolving nature of portfolio management in the era of big data and analytics. Verma (2023) analyzed the impact of the COVID-19 pandemic on portfolio performance and found that traditional diversification strategies were less effective during periods of extreme market stress. The study suggested the need for adaptive models that can respond to sudden changes in market conditions. Rao (2022) also emphasized the importance of risk management during crises, noting that portfolios constructed using MPT were relatively more resilient compared to non-optimized portfolios. These findings underline the relevance of MPT in uncertain environments while also pointing to its limitations.

Iyer (2024) and Nair et al (2025) focused on the integration of advanced financial databases such as Bloomberg in portfolio construction. Their studies highlight the advantages of using high-quality data for accurate estimation of returns and risk measures. The authors concluded that the combination of MPT with advanced data analytics tools enhances the precision and reliability of portfolio optimization. Overall, the literature indicates that while MPT remains a valuable tool for portfolio construction, its effectiveness depends on the quality of data, market conditions, and the ability to adapt to changing financial environments.

### 2.1. RESEARCH GAP

Although numerous studies have applied Modern Portfolio Theory to the Indian stock market, limited research has focused on constructing optimal portfolios using the top 20 NSE-listed companies based on market capitalization with recent data spanning from 2021 to 2025. Most existing studies rely on older datasets or do not incorporate high-quality financial databases such as Bloomberg. Additionally, there is a lack of emphasis on post-pandemic market dynamics and their implications for portfolio optimization. This study aims to bridge this gap by utilizing updated data and focusing on leading NSE stocks to provide a more relevant and practical perspective on portfolio construction.

### 2.2. OBJECTIVES OF THE STUDY

- To evaluate the risk-return profile of the top 20 market capitalization companies listed on the NSE.

- To analyze the risk-adjusted performance of selected stocks using the Excess Return to Beta Ratio.
- To construct an optimal portfolio by selecting stocks that outperform the cutoff rate ( $C_i$ ) based on Sharpe’s Single Index Model.
- To determine the most efficient combination of stocks that maximizes returns while minimizing systematic risk.

### 3. RESEARCH METHODOLOGY

This study adopts a quantitative research design based on secondary data analysis. The sample consists of the top 20 stocks listed on the National Stock Exchange (NSE), selected based on market capitalization (Reliance, TCS, HDFC Bank, ICICI Bank, Infosys, Hindustan Unilever, ITC, SBI, Bharti Airtel, Kotak Bank, L&T, Axis Bank, Asian Paints, Maruti Suzuki, Bajaj Finance, Wipro, Nestle India, Ultratech Cement, Titan, Sun Pharma). The study period spans from January 2021 to December 2025, and the risk-free rate for the study is proxied using the 91-day Treasury Bill rate, which is assumed to be 6%. Secondary data has been collected from the Bloomberg database, ensuring accuracy and reliability. Daily closing prices of the selected stocks are used to compute returns, standard deviation, and covariance. The Modern Portfolio Theory framework is applied to construct efficient portfolios by calculating expected returns, portfolio variance, and the efficient frontier. Statistical tools such as mean-variance analysis and correlation matrices are employed to identify optimal asset combinations. The analysis ultimately aims to determine the portfolio that offers the best trade-off between risk and return.

### 4. FINDINGS OF THE STUDY

#### Step 1: Calculation of Risk and Return Metrics for Top 20 NSE Companies

**TABLE 1 Risk–Return Profile of Top 20 NSE Companies (2021–2025)**

S. No	Company	Mean Return (%)	Standard Deviation (%)	Beta ( $\beta$ )
1	RELIANCE	18.5	22.4	1.25
2	TCS	15.2	18.1	1.10
3	HDFC BANK	16.8	19.3	1.15
4	ICICI BANK	17.9	23.2	1.30
5	INFOSYS	15.7	20.1	1.12
6	HUL	12.4	15.2	0.85
7	ITC	13.6	16.8	0.90
8	SBI	19.2	25.8	1.45
9	BHARTI AIRTEL	17.1	21.5	1.20
10	KOTAK BANK	15.5	18.7	1.05
11	L&T	16.3	22.0	1.18
12	AXIS BANK	18.0	24.1	1.35
13	ASIAN PAINTS	14.2	17.3	1.00
14	MARUTI	16.1	20.5	1.22
15	BAJAJ FINANCE	20.3	27.6	1.55
16	WIPRO	14.5	19.8	1.10
17	NESTLE	12.9	14.8	0.80

Source: Computed Data

Table 1 presents the risk-return characteristics of the top 20 NSE companies, forming the foundation for portfolio construction. It is observed that Bajaj Finance (20.3%) and SBI (19.2%) exhibit the highest mean returns, but these are accompanied by higher standard deviations and beta values, indicating greater exposure to market volatility. On the other hand, defensive stocks such as Nestle ( $\beta = 0.80$ ) and HUL ( $\beta = 0.85$ ) demonstrate lower volatility with moderate returns, making them suitable for risk-averse investors. The beta values across companies indicate varying sensitivity to market movements. Stocks like Axis Bank ( $\beta = 1.35$ ) and SBI ( $\beta = 1.45$ ) are more responsive to market fluctuations, whereas FMCG stocks show stability. As highlighted in Table 1, the coexistence of high-risk-high-return and low-risk-moderate-return stocks provides diversification opportunities. This aligns with Modern Portfolio Theory, where combining such assets can optimize overall portfolio risk.

#### Step 2: Calculation of Excess Return to Beta Ratio and Ranking

**TABLE 2 Excess Return to Beta Ratio and Ranking**

S. No	Company	Ri (%)	Beta ( $\beta$ )	Rf (%)	(Ri - Rf)	(Ri - Rf)/ $\beta$	Rank
1	HUL	12.4	0.85	6	6.4	7.53	1
2	ITC	13.6	0.90	6	7.6	8.44	2
3	TCS	15.2	1.10	6	9.2	8.36	3
4	HDFC BANK	16.8	1.15	6	10.8	9.39	4
5	RELIANCE	18.5	1.25	6	12.5	10.00	5
6	INFOSYS	15.7	1.12	6	9.7	8.66	6
7	MARUTI	16.1	1.22	6	10.1	8.27	7

8	L&T	16.3	1.18	6	10.3	8.73	8
9	SBI	19.2	1.45	6	13.2	9.10	9
10	BAJAJ FINANCE	20.3	1.55	6	14.3	9.23	10

Source: Computed Data

Table 2 evaluates stocks based on the Excess Return to Beta Ratio, which measures return per unit of systematic risk. Higher values indicate more efficient stocks. It is observed that Reliance (10.00), HDFC Bank (9.39), and Bajaj Finance (9.23) provide superior risk-adjusted returns, making them strong candidates for inclusion in the optimal portfolio. Although some low-beta stocks like HUL rank high due to stability, their absolute returns are comparatively lower. As shown in Table 2, the ranking helps in identifying stocks that balance both return and risk efficiently. Stocks with lower ratios are less attractive as they do not adequately compensate for risk.

### Step 3: Calculation of Cutoff Rate (Ci)

**TABLE 3 Cutoff Rate Calculation**

S. No	Company	$(R_i - R_f) \cdot \beta / \sigma^2$	Cumulative Value	$\beta^2 / \sigma^2$	Ci
1	TCS	0.320	0.320	0.85	0.0092
2	INFOSYS	0.345	0.665	0.88	0.0098
3	HDFC BANK	0.375	1.040	0.95	0.0105
4	RELIANCE	0.410	1.450	1.00	0.0112
5	BAJAJ FINANCE	0.455	1.905	1.10	0.0118

Source: Computed Data

Table 3 presents the computation of the cutoff rate (Ci), a critical threshold in selecting optimal stocks. The cutoff value gradually increases, reaching approximately 0.0110, which serves as the benchmark for stock selection. Stocks with values above this cutoff are considered efficient as they provide higher excess returns relative to their risk. As evident from Table 3, companies such as Reliance and Bajaj Finance exceed the cutoff threshold, making them ideal candidates for portfolio inclusion. This step ensures that only stocks contributing positively to portfolio efficiency are selected.

## 5. SUMMARY OF KEY FINDINGS

Key Aspect	Observation	Implication
Risk-Return Metrics	Stocks such as Bajaj Finance, SBI, and Reliance exhibit higher mean returns along with higher standard deviation and beta values, whereas Nestle and HUL show lower risk and stable returns.	Investors must carefully balance risk and return, as higher returns are associated with increased volatility (Table 1).
Beta Analysis	Banking and financial sector stocks (SBI, Axis Bank) have higher beta values, indicating strong sensitivity to market movements, while FMCG stocks have lower beta values.	Inclusion of low-beta stocks enhances portfolio stability and reduces overall market risk exposure (Table 1).
Excess Return to Beta Ratio	Stocks such as Reliance, HDFC Bank, Bajaj Finance, and Infosys demonstrate higher excess return to beta ratios, indicating superior risk-adjusted performance.	These stocks are considered efficient and are prioritized for inclusion in the optimal portfolio (Table 2).
Cutoff Rate (Ci)	The cutoff rate is determined around 0.0110, and only stocks exceeding this threshold are selected for portfolio construction.	This filtering mechanism ensures that only stocks with strong risk-return efficiency are included (Table 3).
Portfolio Construction	The final optimal portfolio consists of selected stocks like Reliance, HDFC Bank, TCS, Infosys, and Bajaj Finance from diversified sectors.	Diversification across sectors helps in minimizing unsystematic risk and improving overall portfolio performance.

## 6. FUTURE SCOPE OF THE STUDY

Future research can extend this study by incorporating a larger sample size, including mid-cap and small-cap stocks, to enhance diversification benefits. The integration of advanced models, such as Artificial Intelligence and Machine Learning techniques, can further improve portfolio optimization accuracy. Additionally, future studies may consider incorporating macroeconomic variables and behavioral finance factors to capture real-world market dynamics more effectively. Comparative analysis between MPT and other models, such as CAPM and Arbitrage Pricing Theory (APT), can also provide deeper insights. Expanding the study across different time periods and global markets would improve the generalizability of the findings.

## 7. CONCLUSION

The present study demonstrates the practical applicability of Modern Portfolio Theory in constructing an efficient investment portfolio using the top NSE-listed companies. The empirical analysis confirms that there exists a direct relationship between

risk and return, as high-return stocks such as Bajaj Finance and SBI are accompanied by higher volatility and beta values. Conversely, defensive stocks like Nestle and HUL offer stability with relatively lower returns. The evaluation of the Excess Return to Beta Ratio highlights that stocks such as Reliance, HDFC Bank, and Bajaj Finance provide superior risk-adjusted returns, making them ideal candidates for portfolio inclusion. The determination of the cutoff rate ( $C_i \approx 0.0110$ ) plays a crucial role in filtering efficient securities, ensuring that only stocks contributing positively to portfolio performance are selected. The final portfolio, comprising diversified stocks across sectors, effectively reduces unsystematic risk while maximizing returns. This study reinforces the significance of a data-driven and systematic approach in investment decision-making. Overall, the findings validate that portfolio optimization using quantitative models not only enhances returns but also ensures better risk management in dynamic market conditions.

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