

## CONSTRUCTION OF DIVERSIFIED PORTFOLIO USING SHARPE SINGLE INDEX MODEL WITH REFERENCE TO SELECTED STOCKS OF NIFTY50

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### ABSTRACT

The purpose of this research is to build a diversified portfolio using the Sharpe Single Index Model (SSIM) and chosen equities from the NIFTY50 index. The SSIM is a well-known portfolio management tool that takes into accounts both individual stock returns and their connection with the market index. This study will use the SSIM to determine appropriate weights for each selected stock, taking into account risk and return characteristics. This approach's diversified portfolio seeks to improve risk-adjusted returns by limiting exposure to unsystematic risk while capturing market-related swings. The study's findings are intended to be useful for investors looking to develop diversified portfolios utilizing the SSIM approach in the context of the NIFTY50 index.

**Keywords:** systematic risk, unsystematic risk, beta, cut-off rate, excess return to beta

### INTRODUCTION

The creation of a diversified portfolio is an important part of investment management that seeks to balance risk and return by distributing investments over several assets. The Sharpe Single Index Model (SSIM) has emerged as a helpful instrument for portfolio diversification in the field of equity investing. The SSIM examines the link between individual stock returns and overall market performance, allowing investors to compare the risk and return characteristics of individual stocks to a market index.

In this research, we concentrate on building a diversified portfolio using the SSIM approach, which is especially applied to equities from the NIFTY50 index. The NIFTY50 is India's leading stock market index, consisting of the top 50 businesses listed on the National Stock Exchange (NSE). We want to capture a representative sample of the Indian equities market by picking stocks from this index.

The SSIM technique provides a systematic framework for determining the best asset allocation within a portfolio. The SSIM permits the identification of stocks that contribute favourably to portfolio performance while limiting risk by taking into accounts both individual stock returns and their connection with the NIFTY50 index. This study intends to give practical consequences for investors wishing to optimise their investment portfolios in the Indian equities market by utilising the SSIM approach with reference to the selected stocks of the NIFTY50.

### STATEMENT OF PROBLEM

An investor contemplating investing in securities has the challenge of selecting from among a large number of securities and allocating funds across a group of assets. The obstacle is that the investor must decide which securities to hold and how much to invest in each of them. While the Markowitz Model allows an investor to create an ideal portfolio, the Single Index Model aids in eliminating the difficulties of data entry and time cost consideration. Therefore, the current study as entitled as, "Construction of Diversified Portfolio using Sharpe Single Index Model with reference to selected Stocks of Nifty50".

### OBJECTIVES

1. To analyze Risk and Return of selected companies of various sectors.
2. To analyze the selected equity stock and to construct an optimum portfolio using sharp's single index model approach.

**REVIEW OF LITERATURE**

**1) Mr. B P Chandan Shri Guru and Dr. Chaya Bagrecha (2022)** “Building an optimal portfolio using Sharpe's single index model: A study of BSE Sensex constituent companies” The study's goal is to calculate the proportion of investment in each security from the generated portfolio. This study reveals the exact technique to portfolio generation and implementation, which is ultimately advantageous to investors in selecting firms for their portfolio and maximising their return while incurring suitable risk.

**2) Dr. N Krishnamoorthy and Mahabub Basha S (2022)** “An empirical study on construction portfolio with reference to BSE” The purpose of this research is to investigate the potential for investors in terms of returns and risk while investing in selected stocks of companies listed on the BSE Sensex 30. According to the report, the pharmaceutical and financial services businesses made reasonable profits while posing the most risk throughout the study period during the pre- and post-Covid-19 eras.

**3) M Sathyapriya (2021)** “Optimum Portfolio Construction Using Sharpe Index Model With Reference to Infrastructure sector and Pharmaceutical Sector” The goal is to investigate the asset value of twenty distinct NSE-listed firms from the Infrastructure and Pharmaceutical industries. They discovered that the performance of the infrastructure sector is worse than that of the pharmaceutical sector since only one business, GMR, was chosen for the portfolio, accounting for only 7% of the investment share.

**4) Biswajit Rout and J.K.Panda (2020)** “Construction of Optimal Portfolio on Selected Stocks of BSE Using Sharpe’s Single Index Model” This research intends to analyze the opportunities accessible to investors in terms of returns and investment risk while investing in equities of enterprises listed on the Bombay stock market. The findings of the study shows that portfolio beta is significantly lower than the market beta and portfolio return is much higher than the portfolio variance.

**5) Dr. Aloysius Edward J. and Prof. Jagadish K K (2020)** “Optimum Portfolio Construction Using Sharpe Index Model with Reference to Banking Sector” The primary goal of this research is to construct an optimal stock portfolio from selected stocks belonging to banking firms in India's public and private sectors, using the Sharpe Single Index methodology. The study's findings indicate that building an ideal portfolio using Sharpe's Single Index approach is more relevant and beneficial for individual and institutional investors.

**6) Nazneenaara Rafik Shaikh, Dr. Vijay Gondaliya (2019)** “To Construct an Optimum Portfolio using Sharpe’s Single Index Model- A Study of Selected Stocks from NSE” The study's main purpose is to create an optimum portfolio for a certain NSE stock using Sharpe's Single Index Model. It may also be used to determine the weighting of each firm in an ideal portfolio and to understand portfolio risk and return behaviour. The study's findings show that the presence of estimation risk reduced the relative contribution of estimated systematic risk on portfolio selection. The results are impressive, with an average return that is significantly higher than the market return.

**7) Madan K. M, Dr. Manoj Kumara N. V (2018)** “Empirical Study of Optimum Portfolio Construction – Selected NSE Stocks” Analysing the risk and return of various investment channels is the goal of this research. The results of this study on investment choices take into consideration a variety of factors, such as general or macroeconomic factors, that affect share price movement. It aids in managing profitability and minimising risk while assisting both individual and institutional investors in making decisions about their investments.

**8) Dr. Ajay Kumar Patel, Subhodeep Chakraborty (2018)** “Construction of Optimal Portfolio Using Sharpe’s Single Index Model and Markowitz Model: An Empirical Study on Nifty50 Stocks” Knowing which Securities are performing well and which are performing poorly in the market is the goal. Out of 50 equities, just six have done well, providing investors with better returns and lower risk, according to the study's findings.

**9) Dr. Simranjeet Kaur Sandhar, Dr. Neetika Jain, Ruchi Kushwah (2018)** “Optimal Portfolio Construction: A Case Study of NSE” The goal of this study is to distribute investment in various equities based on risk-return parameters. The analysis discovered that, with the exception of three firms (Maruti, Tata Steel, and HDFC), all of the sample businesses' stocks are cheap, and hence investors might choose these equities to modify their portfolio.

**10) Sangita Choudhary (2017)** “Equity Investment Decisions: Determinants for Retail Investors” The purpose of this article is to identify features and their interrelationships that impact retail investors' decision to invest in stock or not. It is an attempt to investigate several factors that impact the decision to invest or not invest in shares. According to the study's results, demographic considerations and economic conditions are strategic in nature, setting the tone for other factors that influence the choice to invest in equities.

**RESEARCH METHODOLOGY**

The relevant data has been collected from the secondary sources of information (NSE website). In this, NIFTY50 is taken as a Market index. The research design used in this research is the empirical design as the material gathered is compared to hypothesis. The top 15 companies based on their market capitalization is selected for the study. The historical stock prices pertaining to the selected stocks for six years (2017 to 2023) were collected from NSE website. The tools and techniques used in the study are Sharpe Single Index Model, Correlation and Regression. Initially mean returns, beta, excess return to beta, variance, systematic and unsystematic risks are calculated in this study.

Ci values for all the stocks according to the ranked order is computed using the following formula:

$$C_i = \frac{\sigma_m^2 \sum_{i=1}^N \frac{(R_i - R_f)}{\sigma_{ei}^2} \times \beta_i}{1 + \sigma_m^2 \sum_{i=1}^N \frac{\beta_i^2}{\sigma_{ei}^2}}$$

Where,

$\sigma^2_m$  = variance of the market index

$\sigma^2_{ei}$  = variance of stock movement that is not associated with the movement of market index i.e., stocks' unsystematic risk

The point will be selected as cut off point after which cumulative value of Ci start declining. Those securities which have value of Ci more or equal to cut off point will be selected in optimum portfolio.

The proportion for each selected securities will be found by using the following formula

$$X_i = \frac{Z_i}{\sum_{i=1}^N Z_i}$$

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2} \left[ \left( \frac{R_i - R_f}{\beta_i} \right) - C^* \right]$$

Where the first expression (X<sub>i</sub>) indicates the weights on each security and the second expression shows the relative investment in each security.

**HYPOTHESIS**

**H0:** There is no significant impact of Individual Stocks on Nifty50.

**H1:** There is a significant impact of Individual Stocks on Nifty50.

**LIMITATIONS OF THE STUDY**

The limitations of the present study are:

- 1) Only fifteen companies have been selected for the study
- 2) The results of the study may not be universally applicable
- 3) Only six years data has been collected for this study

**DATA ANALYSIS AND INTERPRETATION**

The top fifteen companies which are selected for this study based on market capitalization value are as follows: HDFC Bank Ltd, Hindustan Unilever Ltd, Infosys Ltd, Housing Development Finance Corporation Ltd, ITC Ltd, Bharti Airtel Ltd, Bajaj Finance Ltd, Larsen & Toubro Ltd, HCL Technologies Ltd, Asian Paints Ltd, Maruti Suzuki India Ltd, Sun Pharmaceutical Industries Ltd, Titan Company Ltd, Ultratech Cement Ltd, Oil & Natural Gas Corporation Ltd.

**Table 5.1 Table showing Sharpe's performance index rating of the chosen firms is displayed, along with a stock ranking.**

Sl. No	Company Name	Ri	Rf	$\beta$	$(R_i - R_f)/\beta$	Rank
1	Titan Company Ltd	0.1363	0.0497	0.9421	0.0919	1
2	Bajaj Finance Ltd	0.1367	0.0497	1.4564	0.0598	2
3	Hindustan Unilever Ltd	0.0803	0.0497	0.6332	0.0483	3
4	Asian Paints Ltd	0.0768	0.0497	0.7448	0.0364	4
5	Bharti Airtel Ltd	0.0746	0.0497	0.8419	0.0296	5
6	Ultratech Cement Ltd	0.0595	0.0497	1.0032	0.0098	6
7	Housing Development Finance Corporation Ltd	0.0543	0.0497	1.2294	0.0038	7
8	Infosys Ltd	0.0515	0.0497	0.8257	0.0022	8
9	HCL Technologies Ltd	0.0438	0.0497	0.7301	-0.0081	9
10	Maruti Suzuki India Ltd	0.0397	0.0497	1.0661	-0.0094	10
11	Sun Pharmaceutical Industries Ltd	0.0430	0.0497	0.6578	-0.0102	11
12	Larsen & Toubro Ltd	0.0377	0.0497	1.0386	-0.0116	12
13	HDFC Bank Ltd	0.0334	0.0497	1.0755	-0.0152	13
14	ITC Ltd	0.0348	0.0497	0.7149	-0.0209	14
15	Oil & Natural Gas Corporation Ltd	0.0130	0.0497	0.9313	-0.0394	15

The above graph represents the ranking of stocks from highest to lowest based on excess return to beta. Titan Company ranked highest among other stocks; 2<sup>nd</sup> is Bajaj Finance; 3<sup>rd</sup> is Hindustan Unilever Ltd; followed by Asian Paints, Bharti Airtel, Ultratech Cement, etc. and ONGC ranked least.

**Table 5.2 Table showing Ci of selected stocks**

Sl.NO	Companies	Ci
1	Titan Company Ltd	0.0257
2	Bajaj Finance Ltd	0.0738
3	Hindustan Unilever Ltd	0.0748
4	Asian Paints Ltd	0.0782

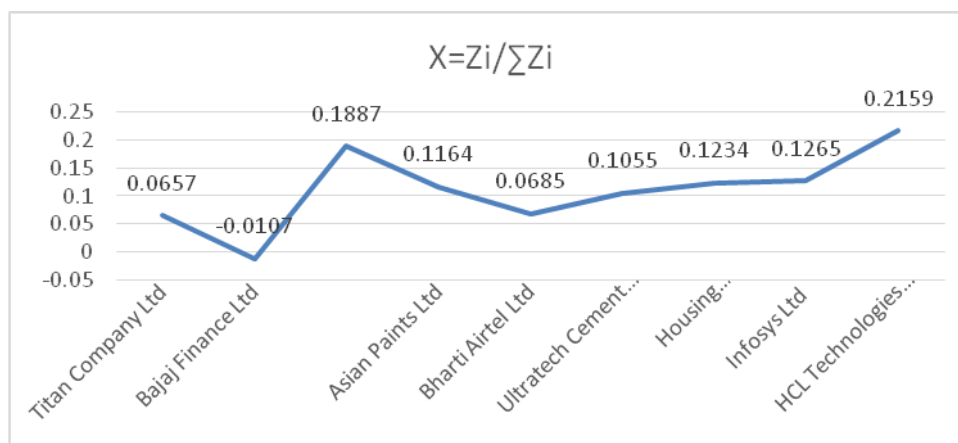
5	Bharti Airtel Ltd	0.0884
6	Ultratech Cement Ltd	0.1058
7	Housing Development Finance Corporation Ltd	0.1379
8	Infosys Ltd	0.1735
9	<b>HCL Technologies Ltd</b>	<b>0.2038 (C*)</b>
10	Maruti Suzuki India Ltd	-1.3542
11	Sun Pharmaceutical Industries Ltd	-0.6478
12	Larsen & Toubro Ltd	-0.2472
13	HDFC Bank Ltd	-0.1602
14	ITC Ltd	-0.1395
15	Oil & Natural Gas Corporation Ltd	-0.1261

In the above table the HCL Technologies Limited has considered to be C\* as its Ci value i.e., 0.2038 is the highest among all the stocks and the companies which are above this company is included in the portfolio construction.

**Table 5.3 Table showing the proportion of investment in optimal portfolio.**

Sl. No	Company Name	$\frac{\beta_i}{\sigma_{ei}^2}$	$\frac{(R_i - R_f)}{\beta}$	C*	$\frac{(R_i - R_f)}{\beta} - C^*$	$X = \frac{Z_i}{\sum Z_i}$
1	Titan Company Ltd	0.3109	0.0919	0.2038	-0.1119	0.0657
2	Bajaj Finance Ltd	-2.4640	0.0598	0.2038	-0.1440	-0.0107
3	Hindustan Unilever Ltd	0.1505	0.0483	0.2038	-0.1554	0.1887
4	Asian Paints Ltd	0.2627	0.0364	0.2038	-0.1674	0.1164
5	Bharti Airtel Ltd	0.4645	0.0296	0.2038	-0.1742	0.0685
6	Ultratech Cement Ltd	0.3358	0.0098	0.2038	-0.1940	0.1055
7	Housing Development Finance Corporation Ltd	0.2962	0.0038	0.2038	-0.2000	0.1234
8	Infosys Ltd	0.2912	0.0022	0.2038	-0.2016	0.1265
9	HCL Technologies Ltd	0.1793	-0.0081	0.2038	-0.2119	0.2159

The above computation implies that investing in every stock is not practical for investors, hence Sharpe's single index model produces the best portfolio. This allows the investor to build the best portfolio possible. Asian paints have the highest proportion i.e., 0.1164.

**Graph: 5.3 Graph showing the proportion of investment in the selected stocks**

According to Sharpe's Single Index Model, we have created an optimum portfolio with top 9 yielding stocks. i.e Titan, HUL, Asian Paints, Bharthi Airtel, Ultratech Cement, HDFC Ltd., Infosys and HCL Technologies. AS per the calculations, it is suggested to invest 21.59% in HCL, 18.87% in HUL, 12.65% in Infosys, 12.34% in HDFC, 11.64% in Asian Paints, 10.55 % in Ultratech, 6.85% in Bharathi Airtel and 6.57 % in Titan Ltd.

### Regression:

The regression analysis is done for the companies which are included in the portfolio. There are nine companies which are selected for the portfolio construction. Since the R square value is 0.8363 i.e., 83.63% we can interpret that the individual stocks are impacting market by 83.63% and remaining 16.37% by other factors. The intercept value is greater than the significant value 0.05 i.e., 0.2625, we accept the null hypothesis (H<sub>0</sub>) where, there is no significant impact of Individual Stocks on Nifty50.

### FINDINGS

- Bajaj Finance Ltd has excess return to Beta 1.456 and Hindustan Unilever Ltd beta 0.633 being the least among all the 15 stocks. It indicates that Hdfc bank, Housing development finance corporation, Bajaj Finance, L&T, Maruti Suzuki and Ultratech Cement is highly volatile, and the remaining HUL, Infosys, ITC, Airtel, HCL, Asian Paints, Sun Pharmaceutical, Titan Company and ONGC are lower volatile comparing to the market.
- The nine securities ranking from 1 to 9 based on the C<sub>i</sub> values were identified along with the proportion of investment to be made. The proportion of the investment to be made is 21.59% in HCL Technologies stock which is the highest proportion and 6.57% in Titan Company stocks which is the lowest proportion.

### CONCLUSION

Finally, building a diversified portfolio utilising the Sharpe Single Index Model with reference to chosen Nifty50 equities might be a wise method for investors. The Sharpe Single Index Model is a powerful tool that takes into accounts both the systematic risk and possible returns of individual companies in a portfolio. Investors can reduce the unsystematic risk associated with individual equities by including a diverse group of stocks from the Nifty50 index into their portfolio. This technique helps investors to diversify their assets across industries and firms, lowering the influence of a single stock's performance on the total portfolio. The Sharpe Single Index Model assists in discovering stocks that contribute favourably to portfolio performance while taking their respective risk levels into account. As a result, investors may obtain optimal risk-adjusted returns and maximise their investing potential in the Nifty50 market.

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