

OPTIMAL PORTFOLIO CONSTRUCTION USING SHARPE'S SINGLE INDEX MODEL

Abstract: Security analyzing and selection of portfolios and managing them in the right manner helps in improving the investor's awareness about the trends and changes that exist in the market and helps the investors as a very attractive avenue for investment. Security analysis and portfolio management expertise are necessary for making informed investing decisions. A logical investor seeks to maximize return while minimizing risk. The scope of the current study is related to equity portfolio construction with chosen equities from the Nifty 50 because there are several investment routes with varied levels of risk. Both individual and institutional investors find it difficult to put together an ideal portfolio. The purpose of this study is to educate investors about the value of Sharpe's Single Index Model for constructing portfolios. As more company's trade on the stock exchanges, Indian investors may also benefit from Sharpe's Single Index Model (SIM) steadily rising with time. The Nifty 50 index's fifteen companies were chosen for the investigation. Only four of the fifteen example companies were chosen using SIM to create an optimal portfolio. The findings of this study and similar micro level investigations are more useful to fund managers.

Key words: Systematic Risk, Unsystematic Risk, Cut-off rate, Beta, Excess Return to Beta Ratio

1.INTRODUCTION

Investments are made on assets with the intention of generating income or capital growth. Every investment has risk and a potential return. Investment risk is the potential for the actual return to differ from the predicted return. It is necessary to have understanding about security analysis and portfolio management in order to make informed investing selections. Securities are combined to form a portfolio. Any portfolio created, whether by a fund manager or an individual investor, is anticipated to achieve the objectives of the investor. A logical investor seeks to maximize return while minimizing risk. Therefore, it's crucial to build a portfolio using one of the two common methods, classic or modern.

In the conventional method, the investor's needs for income and capital growth are assessed, and suitable assets are chosen to match those needs. The Markowitz model is utilized in the contemporary method to choose stocks based on a risk and return analysis. The framework for assessing risk was laid by Markowitz, whose contribution is sometimes referred to as "Modern Portfolio Theory." He has offered analytical methods for portfolio analysis and selection. For this contribution to portfolio management, he was awarded the Nobel Prize in 1990. However, William Sharpe expanded on Markowitz's work. He examined the portfolio while taking the market index into account. He reduced the volume and variety of input data needed for the analysis of portfolios. He performed the various, intricate calculations. With more businesses being traded on stock exchanges every year, investors can also benefit from Sharpe's Single Index Model. One of India's top stock exchanges, National Stock Exchange of India Limited (NSE), is headquartered in Mumbai. Several financial entities, including banks and insurance companies, are the proprietors of the NSE. It is the biggest derivatives exchange in the world. by number of contracts traded[a] and the third largest in cash equities in terms of trade volume for

2022[b]. According to market capitalization, it is one of the biggest stock exchanges in the world. Investors in India and throughout the world frequently use the NSE's flagship index, the NIFTY 50, a 50-stock index, as a gauge of the Indian capital market. NSE introduced the NIFTY 50 index in 1996. The National Stock Exchange (NSE) is a prestigious organization with national and global clout. The current study was conducted with these factors in mind in order to aid investors in making wise decisions.

1.1 REVIEW OF LITERATURE

Chauhan (2014) constructed a portfolio using top ten stocks of NIFTY. In the study, it was found to be an easy and simple method to calculate optimal portfolio. In this method, fewer number of variables are used as compared to Markowitz Model. It is named Single Index Model as it uses only a single index for portfolio construction. Nalini (2014) in her study considered 15 stocks of various sectors from S&P index, taking BSE Sensex as market index. It was found that risk can be reduced by diversifying the portfolio. Only four stocks were selected in the optimal portfolio. The capital market is still in a developing stage in India, so this model can be of great use. FIIs are investing vastly through stock exchanges. Gopalakrishnan (2014) in his study of 13 actively traded scrips of NSE IT Index, concluded that there exists a significant relationship between IT index and S&P and Nifty. It was found that most of the IT stocks were undervalued compared to the current market levels and investors could consider these stocks for inclusion in their portfolios. Vardarajan, (n.d.) in his study of 20 stocks from Steel, Banking and Media and Entertainment sector concluded that SIM acts as a tool for portfolio selection and helps investors in taking informed decisions. The stock market is volatile and investors need to regularly monitor and update their portfolio. Taneja and Bansal (2011) found that SIM successfully diversifies almost all unsystematic risk. According to Jensen (1969) portfolio performance can be measured by finding the difference between actual and expected returns of a portfolio at a given point of time, taking into account expected returns, risk less rate of return, systematic risk and return on market portfolio. Investors are generally risk averse and they prefer certain rather than uncertain incomes. If they are holding a stock for a longer period or taking additional risks, they want to be compensated through extra return over and above the risk-free rate of return, which is the risk premium. A natural relationship exists between measures of portfolio performance and efficiency. Alexander and Resnick (1985) stated that the construction of optimal portfolio is based on the composition and location of efficient frontier. To determine these, investors need to find estimates of variance, co variance and expected returns, co variances and variances must be found by the investor. They further conclude that in the presence of a risk-free asset, the efficient portfolio will consist of a combination of both, risk free asset and tangency portfolio. Edwin, Martin and Manfred (1978) believe that under alternative sets of assumptions about variance and co variance, common stock returns the optimal portfolio can be easily devised by simple ranking. The advantages of using simple ranking are that portfolio managers can easily understand the unique characteristics of stock, which are to be included in the portfolio and the optimal portfolio can be very easily devised without much efforts. Naveen (1997) constructed an optimal portfolio using stocks of 30 blue-chip companies listed in BSE. It was found in his study that unsystematic risk or residual variance plays a significant role in determining the proportion of investment in optimal portfolio. He further emphasized that portfolio must be evaluated periodically owing to the volatile nature of stock markets.

2.NEED FOR THE STUDY

When choosing assets for his portfolio, every investor experience confusion. Additionally, he struggles with selecting how much money to invest in each asset. An ideal portfolio can be created using the Sharpe's Single Index concept to assist investors in navigating such tumultuous times. Finding a portfolio that best meets his needs is made easier with this information. The goal of the current study is to demonstrate that using this model, a person may build a portfolio that offers the highest return for a particular degree of risk.

3.PROBLEM STATEMENT

When thinking about investing in securities, a potential investor must decide which securities to purchase from a big selection and how to distribute their money among several securities. The difficulty is that the investor finds it difficult to choose which securities to hold and how much money to put into each of them. Although an investor can also create an ideal portfolio using the Markowitz Model, the Single Index Model is more useful for bypassing the challenge of data input and time cost consideration. The current study is titled "**Optimal Portfolio Construction Using Sharpe's Single Index Model- A Study of Selected Stocks from NSE**" as a result.

SCOPE OF THE STUDY

A risk component is always considered while making investment decisions by rational investors. To spread out the risk, they prefer to invest in a portfolio, which is a collection of securities. Investors have a wide range of investment options at their disposal. While some investing options include a significant amount of risk, others may be either less risky or risk-free. Therefore, it is crucial to inform the investor about their options for investing and the associated risk and return. The focus of the current study is linked to equities portfolio development with chosen stocks from the NSE because there are numerous investment routes with varied levels of risk. RESEARCH METHODOLOGY

The study is empirical in nature. The study is based on secondary source and the data required for this study was obtained from the website www.moneycontrol.com. Fifteen companies from the Nifty 50 index were selected for the study. The steps followed are

i). Estimate the return on stock. The equation to be used

$$R_i = \frac{(P_t - P_o)}{P_o} \times 100$$

Where,

P_t = current year price

P_o = previous year price

- Beta, to evaluate the risk.

$$\beta = \frac{\sum (R_m - \bar{R}_m) (R_i - \bar{R}_i)}{(\sum (R_m - \bar{R}_m)^2)}$$

Where

β = beta

R_m = return of market index

\bar{R}_m = mean of market index

R_i = return of individual stock

\bar{R}_i = mean of individual stock

- The excess return to Beta is computed using following formula:

$$\frac{R_i - R_f}{\beta}$$

The securities are ranked according to this ratio.

The variance of the index movement is computed as under:

$$\sigma^2 = \frac{\sum (R_m - \bar{R}_m)^2}{N-1}$$

The variance of the Stock price movement is computed as under:

$$\sigma^2 = \frac{\sum (R_i - \bar{R}_i)^2}{N-1}$$

The systematic and unsystematic risks are computed as under:

$$\text{Systematic risk} = \beta^2 \sigma_m^2$$

$$\text{Unsystematic risk} = \sigma_{ei}^2 - \text{Systematic risk}$$

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

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

σ_{ei}^2 = unsystematic risk

β = beta value of individual security

σ_m = market index risk

$R_i - R_f$ = excess return

- X_i and Z_i are to be determined to know how much funds needs to be invested in each security using the following formula:

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

Where,

X_i = proportion of investment

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

σ_{ei}^2 = unsystematic risk

β = beta value of individual security

$R_i - R_f$ = excess return

C^* = cut off point

MERITS OF SHARPE'S SINGLE INDEX MODEL

The following are the merits of SIM:

- The model is simple to understand and easy to apply.
- If one has 'n' securities at his disposal, it requires only (3n+2) estimates but Markowitz's model requires $n(n-1)/2$ estimates.
- It provides an estimate of security's return as well as of the index value.

d) It greatly helps in obtaining the following inputs required for applying the Markowitz's model:

- i) The expected return on each security
 - ii) The variance of return on each security
 - iii) The covariance of return between each pair of securities
- e) This provides reason for either the 'inclusion' or the 'exclusion' of a security while constructing an optimal portfolio.

LIMITATIONS OF SIM

- a. The Single Index Model put forth by William Sharpe optimizes for a single point in time rather than taking market uncertainty into account as time goes on.
- b. This model makes the assumption that security price movements are solely linked by a shared movement with the market. But there are additional elements, such as industry-specific considerations, that affect the movement of securities together in addition to the general business and market conditions.

DATA ANALYSIS AND INTERPRETATION

The data analysis and interpretation for the current investigation are presented in this section of the paper. The information needed for this investigation was gathered from secondary sources. For the study, 15 Nifty 50-listed businesses have been chosen. The chosen businesses come from several corresponding fields. They are displayed below:

Table 1.1: Sample Companies

| <i>Sl No</i> | <i>Company name</i> |
|--------------|-----------------------------------|
| 1 | Adani Enterprises Ltd |
| 2 | Apollo Hospitals Enterprise Ltd |
| 3 | Asian Paints Ltd |
| 4 | Bajaj Finance Ltd |
| 5 | Bharti Airtel Ltd |
| 6 | Cipla Ltd |
| 7 | Coal India Ltd |
| 8 | HDFC Bank Ltd |
| 9 | Infosys Ltd |
| 10 | ITC Ltd |
| 11 | JSW Steel Ltd |
| 12 | Maruti Suzuki India Ltd |
| 14 | NTPC Ltd |
| 13 | Oil & Natural Gas Corporation Ltd |
| 15 | Ultratech Cement Ltd |

Table 1.1 represents the list of sample companies selected for the purpose of this study. The historical stock prices pertaining to the above companies for six years (2017-2022) were collected from www.moneycontrol.com. The returns of the individual securities and market index are calculated using the following formulae:

$$\text{Security Return} = \frac{\text{Current Year Security Price} - \text{Previous Year Security Price}}{\text{Previous Year Security Price}} \times 100$$

$$\text{Index Return} = \frac{\text{Current Year Index} - \text{Previous Year Index}}{\text{Previous Year Index}} \times 100$$

Mean Returns of the securities and index are calculated using the following formulae:

- $\bar{R}_i = \sum R_i / N$
- $\bar{R}_m = \sum R_m / N$

Where,

\bar{R}_i = mean of individual security returns

R_i = individual security returns

\bar{R}_m = mean of market index returns

R_m = market index returns

N = number of returns

Nifty 50 is the index selected as benchmark index for the present study. A sample of fifteen companies listed under this index was selected for constructing an optimal portfolio using Sharpe's Single Index Model. As a first step, the mean returns of these companies' stocks were computed and tabulated as under:

Table 1.2: Mean Returns of Sample Companies' Stocks

| <i>Sl. No</i> | <i>Scrip Name</i> | <i>Mean Return (in %)</i> |
|---------------|-----------------------------------|---------------------------|
| 1 | Adani Enterprises Ltd | 109.31 |
| 2 | Apollo Hospitals Enterprise Ltd | 30.93 |
| 3 | Asian Paints Ltd | 24.51 |
| 4 | Bajaj Finance Ltd | 45.05 |
| 5 | Bharti Airtel Ltd | 26.25 |
| 6 | Cipla Ltd | 14.16 |
| 7 | Coal India Ltd | -1.17 |
| 8 | HDFC Bank Ltd | 19.07 |
| 9 | Infosys Ltd | 23.75 |
| 10 | ITC Ltd | 7.44 |
| 11 | JSW Steel Ltd | 32.90 |
| 12 | Maruti Suzuki India Ltd | 12.04 |
| 13 | NTPC Ltd | 4.99 |
| 14 | Oil & Natural Gas Corporation Ltd | -1.16 |
| 15 | Ultratech Cement Ltd | 13.74 |

Source: Computed and compiled by the author

Table 1.2 shows the mean returns of the fifteen companies selected for the construction of an optimal portfolio using Sharpe's Single Index Model. This table reveals that Adani Enterprises Ltd has the highest return of 109.31% and NTPC company has the lowest mean return of 4.99%. (Coal India Ltd and ONGC Ltd has offered negative returns, hence they were not taken into consideration)

In order to know the market risk face by each security, the beta values of sample companies' stock returns were computed and tabulated below.

Table 1.3: Beta values of the Sample Companies' Stocks

| <i>Sl. No</i> | <i>Scrip Name</i> | <i>Beta Values</i> |
|---------------|-----------------------------------|--------------------|
| 1 | Adani Enterprises Ltd | 5.36 |
| 2 | Apollo Hospitals Enterprise Ltd | 2.09 |
| 3 | Asian Paints Ltd | 0.86 |
| 4 | Bajaj Finance Ltd | 2.22 |
| 5 | Bharti Airtel Ltd | 2.88 |
| 6 | Cipla Ltd | 0.59 |
| 7 | Coal India Ltd | -1.01 |
| 8 | HDFC Bank Ltd | 0.96 |
| 9 | Infosys Ltd | 0.81 |
| 10 | ITC Ltd | -0.77 |
| 11 | JSW Steel Ltd | 2.47 |
| 12 | Maruti Suzuki India Ltd | 2.41 |
| 13 | NTPC Ltd | 0.35 |
| 14 | Oil & Natural Gas Corporation Ltd | 1.50 |
| 15 | Ultratech Cement Ltd | 1.73 |

Source: Computed and compiled by the author

Table 1.3 shows the beta values of the fifteen companies' stock returns. A beta below 1 indicates either an investment in stocks with lower volatility than the market, or a volatile investment whose price movements are not highly correlated with the market. Adani Enterprises Ltd has the highest beta value of 5.36 which means it is highly volatile. Apollo Hospitals (2.09), Bajaj Finance (2.22), Bharti Airtel (2.88) and Maruti Suzuki (2.41) have the beta values greater than 1 which means they are volatile. Coal India (-1.01) and ITC Ltd (-0.77) have negative beta, which represents lower volatility

Table 1.4: Ranking of the Stocks based on Excess Return to Beta Ratio

| <i>Sl no</i> | <i>Company Name</i> | <i>R_i</i> | <i>R_i-R_f</i> | <i>β</i> | <i>(R_i-R_f)/β</i> | <i>Rank</i> |
|--------------|-----------------------------------|----------------------|------------------------------------|----------|--|-------------|
| 1 | Adani Enterprises Ltd | 109.31 | 102.31 | 5.36 | 19.09 | 3 |
| 2 | Apollo Hospitals Enterprise Ltd | 30.93 | 23.93 | 2.09 | 11.45 | 7 |
| 3 | Asian Paints Ltd | 24.51 | 17.51 | 0.86 | 20.37 | 2 |
| 4 | Bajaj Finance Ltd | 45.05 | 38.05 | 2.22 | 17.14 | 4 |
| 5 | Bharti Airtel Ltd | 26.25 | 19.25 | 2.88 | 6.69 | 10 |
| 6 | Cipla Ltd | 14.16 | 7.16 | 0.59 | 12.14 | 6 |
| 7 | Coal India Ltd | -1.17 | -8.17 | -1.01 | 8.09 | 9 |
| 8 | HDFC Bank Ltd | 19.07 | 12.07 | 0.96 | 12.57 | 5 |
| 9 | Infosys Ltd | 23.75 | 16.75 | 0.81 | 20.68 | 1 |
| 10 | ITC Ltd | 7.44 | 0.44 | -0.77 | -0.57 | 13 |
| 11 | JSW Steel Ltd | 32.90 | 25.90 | 2.47 | 10.48 | 8 |
| 12 | Maruti Suzuki India Ltd | 12.04 | 5.04 | 2.41 | 2.09 | 12 |
| 13 | NTPC Ltd | 4.99 | -2.01 | 0.35 | -5.73 | 15 |
| 14 | Oil & Natural Gas Corporation Ltd | -1.16 | -8.16 | 1.50 | -5.44 | 14 |
| 15 | Ultratech Cement Ltd | 13.74 | 6.74 | 1.73 | 3.89 | 11 |

Source: Computed and compiled by the author

The excess return and excess return to beta ratio are shown in Table 1.4. The difference between the anticipated return on the stock and the risk-free rate of interest is known as excess return. In this study, it is assumed that the risk-free rate of interest is 7%. The additional return on a security for every unit of systematic risk is measured by the excess return to beta ratio. In accordance with Table 1.4, Infosys stock has the largest excess return to beta ratio (20.68), while NTPC stock has the lowest excess return to beta ratio (-5.73). This ratio shows how a company's stock's prospective risk and reward relate to one another. According to a rating of equities based on the excess return to beta ratio, Infosys is ranked top and NTPC is ranked second.

The unsystematic risk of individual securities, as determined by e_{i2} , is likewise estimated and listed in Table 1.5 along with the systematic risk of those stocks. Due to specific characteristics that only influence the company issuing such securities, it is the one-of-a-kind risk affecting the firm. It is a risk that can be avoided or managed. According to their rankings, the companies are mentioned in this table. The ' C_i ' values are calculated by multiplying the beta by the excess return, multiplied by the unsystematic risk e_{i2} , and dividing the result by the excess return. The following formula is used to determine the Unsystematic risk:

$$\sigma^2_{ei} = \sigma^2 - \beta^2 \sigma^2_m$$

where,

σ^2_{ei} = unsystematic risk

σ^2 = individual security risk

β = beta value of individual security

σ^2_m = expected variance of market index

Table 1.5: Unsystematic Risk (σ^2_{ei}) of Sample Companies

| <i>Sl No</i> | <i>Company name</i> | σ^2 | β | β^2 | σ^2_{ei} |
|--------------|-----------------------------------|------------|---------|-----------|-----------------|
| 1 | Adani Enterprises Ltd | 6911.65 | 5.36 | 28.73 | 4368.22 |
| 2 | Apollo Hospitals Enterprise Ltd | 1793.65 | 2.09 | 4.37 | 1406.94 |
| 3 | Asian Paints Ltd | 351.05 | 0.86 | 0.74 | 285.57 |
| 4 | Bajaj Finance Ltd | 1242.05 | 2.22 | 4.93 | 805.73 |
| 5 | Bharti Airtel Ltd | 1364.10 | 2.88 | 8.29 | 629.80 |
| 6 | Cipla Ltd | 775.67 | 0.59 | 0.35 | 744.85 |
| 7 | Coal India Ltd | 773.59 | -1.01 | 1.02 | 683.28 |
| 8 | HDFC Bank Ltd | 286.49 | 0.96 | 0.92 | 204.90 |
| 9 | Infosys Ltd | 921.84 | 0.81 | 0.66 | 863.76 |
| 10 | ITC Ltd | 485.70 | -0.77 | 0.59 | 433.21 |
| 11 | JSW Steel Ltd | 859.19 | 2.47 | 6.10 | 319.07 |
| 12 | Maruti Suzuki India Ltd | 1123.08 | 2.41 | 5.81 | 608.89 |
| 13 | NTPC Ltd | 370.74 | 0.35 | 0.12 | 359.89 |
| 14 | Oil & Natural Gas Corporation Ltd | 720.88 | 1.5 | 2.25 | 521.69 |
| 15 | Ultratech Cement Ltd | 392.23 | 1.73 | 2.99 | 127.27 |

(For Calculations, we have used σ^2_m (Expected Market Index Variance) = 88.53)

Table 1.6: Sample Companies based on their Ranks and Unsystematic Risk

| <i>Rank</i> | <i>Company Name</i> | <i>Ri</i> | β | σ^2_{ei} |
|-------------|-----------------------------------|-----------|---------|-----------------|
| 1 | Adani Enterprises Ltd | 102.31 | 5.36 | 4368.22 |
| 2 | Coal India Ltd | -8.17 | -1.01 | 683.28 |
| 3 | Bajaj Finance Ltd | 38.05 | 2.22 | 805.73 |
| 4 | Asian Paints Ltd | 17.51 | 0.86 | 285.57 |
| 5 | Infosys Ltd | 16.75 | 0.81 | 863.76 |
| 6 | ITC Ltd | 0.44 | -0.77 | 433.21 |
| 7 | Apollo Hospitals Enterprise Ltd | 23.93 | 2.09 | 1406.94 |
| 8 | JSW Steel Ltd | 25.90 | 2.47 | 319.07 |
| 9 | HDFC Bank Ltd | 12.07 | 0.96 | 204.90 |
| 10 | Bharti Airtel Ltd | 19.25 | 2.88 | 629.80 |
| 11 | Cipla Ltd | 7.16 | 0.59 | 744.85 |
| 12 | Ultratech Cement Ltd | 6.74 | 1.73 | 127.27 |
| 13 | Maruti Suzuki India Ltd | 5.04 | 2.41 | 608.89 |
| 14 | Oil & Natural Gas Corporation Ltd | -8.16 | 1.5 | 521.69 |
| 15 | NTPC Ltd | -2.01 | 0.35 | 359.89 |

Source: Computed and compiled by the author

Table 1.6 reveals that out of fifteen companies, Adani Enterprises Ltd has the highest value of 4368.21 and Ultratech Cement Ltd has the least risk of 127.27. As a next step the ‘Ci’ was computed and tabulated below:

Table 1.7: Ci of Sample Companies' Stocks

| Rank | Company Name | R_i | β | σ_{ei}^2 | $(R_i - R_f)\beta$ | $(R_i - R_f)\beta/62ei$ | $\Sigma(R_i - R_f)\beta/62ei$ | $62m*\Sigma(R_i - R_f)\beta/62ei$ | $\beta^2/62ei$ | $\Sigma\beta^2/62ei$ | $1+62m*\Sigma\beta^2/62ei$ | Ci |
|------|-----------------------------------|--------|---------|-----------------|--------------------|-------------------------|-------------------------------|-----------------------------------|----------------|----------------------|----------------------------|------|
| 1 | Adani Enterprises Ltd | 102.31 | 5.36 | 4368.2183 | 17.781252 | 0.116947 | 0.116947 | 10.291300 | 0.006577 | 0.006577 | 1.578773 | 6.52 |
| 2 | Coal India Ltd | -8.17 | -1.01 | 683.2775 | 15.016447 | 0.022419 | 0.139365 | 12.264157 | 0.001493 | 0.008070 | 1.710152 | 7.17 |
| 3 | Bajaj Finance Ltd | 38.05 | 2.22 | 805.7340 | 13.986460 | 0.085550 | 0.224916 | 19.792592 | 0.006117 | 0.014187 | 2.248418 | 8.80 |
| 4 | Asian Paints Ltd | 17.51 | 0.86 | 285.5697 | 12.225888 | 0.031664 | 0.256580 | 22.579020 | 0.002590 | 0.016776 | 2.476330 | 9.12 |
| 5 | Infosys Ltd | 16.75 | 0.81 | 863.7571 | 12.039887 | 0.009145 | 0.265725 | 23.383812 | 0.000760 | 0.017536 | 2.543174 | 9.19 |
| 6 | ITC Ltd | 0.44 | -0.77 | 433.2141 | 8.521210 | 0.011662 | 0.277387 | 24.410085 | 0.001369 | 0.018905 | 2.663612 | 9.16 |
| 7 | Apollo Hospitals Enterprise Ltd | 23.93 | 2.09 | 1406.9399 | 8.099623 | 0.025147 | 0.302534 | 26.622999 | 0.003105 | 0.022009 | 2.936824 | 9.07 |
| 8 | JSW Steel Ltd | 25.90 | 2.47 | 319.0729 | 7.650882 | 0.146290 | 0.448824 | 39.496544 | 0.019121 | 0.041130 | 4.619446 | 8.55 |
| 9 | HDFC Bank Ltd | 12.07 | 0.96 | 204.9016 | 5.281658 | 0.023756 | 0.472580 | 41.587044 | 0.004498 | 0.045628 | 5.015250 | 8.29 |
| 10 | Bharti Airtel Ltd | 19.25 | 2.88 | 629.8006 | 4.255115 | 0.056039 | 0.528619 | 46.518507 | 0.013170 | 0.058798 | 6.174199 | 7.53 |
| 11 | Cipla Ltd | 7.16 | 0.59 | 744.8523 | 0.275787 | 0.000129 | 0.528748 | 46.529849 | 0.000467 | 0.059265 | 6.215325 | 7.49 |
| 12 | Ultratech Cement Ltd | 6.74 | 1.73 | 127.2732 | -0.153176 | -0.003602 | 0.525146 | 46.212872 | 0.023516 | 0.082781 | 8.284695 | 5.58 |
| 13 | Maruti Suzuki India Ltd | 5.04 | 2.41 | 608.8852 | -0.811425 | -0.007740 | 0.517406 | 45.531742 | 0.009539 | 0.092320 | 9.124119 | 4.99 |
| 14 | Oil & Natural Gas Corporation Ltd | -8.16 | 1.5 | 521.6882 | -10.104048 | -0.043578 | 0.473828 | 41.696881 | 0.004313 | 0.096632 | 9.503656 | 4.39 |
| 15 | NTPC Ltd | -2.01 | 0.35 | 359.8931 | -25.732762 | -0.008759 | 0.465069 | 40.926099 | 0.000340 | 0.096973 | 9.533609 | 4.29 |

Source: Computed and compiled by the author

Table 1.7: represents the Ci of sample companies. The β^2/σ_{ei}^2 and its cumulative are necessary for the calculation of Ci. The maximum Ci value is 0.50. Therefore, the value of 0.50 is considered as the 'cut-off point'. The securities which come after the cut-off point will not be considered for the optimal portfolio construction. The Ci is calculated and tabulated as under:

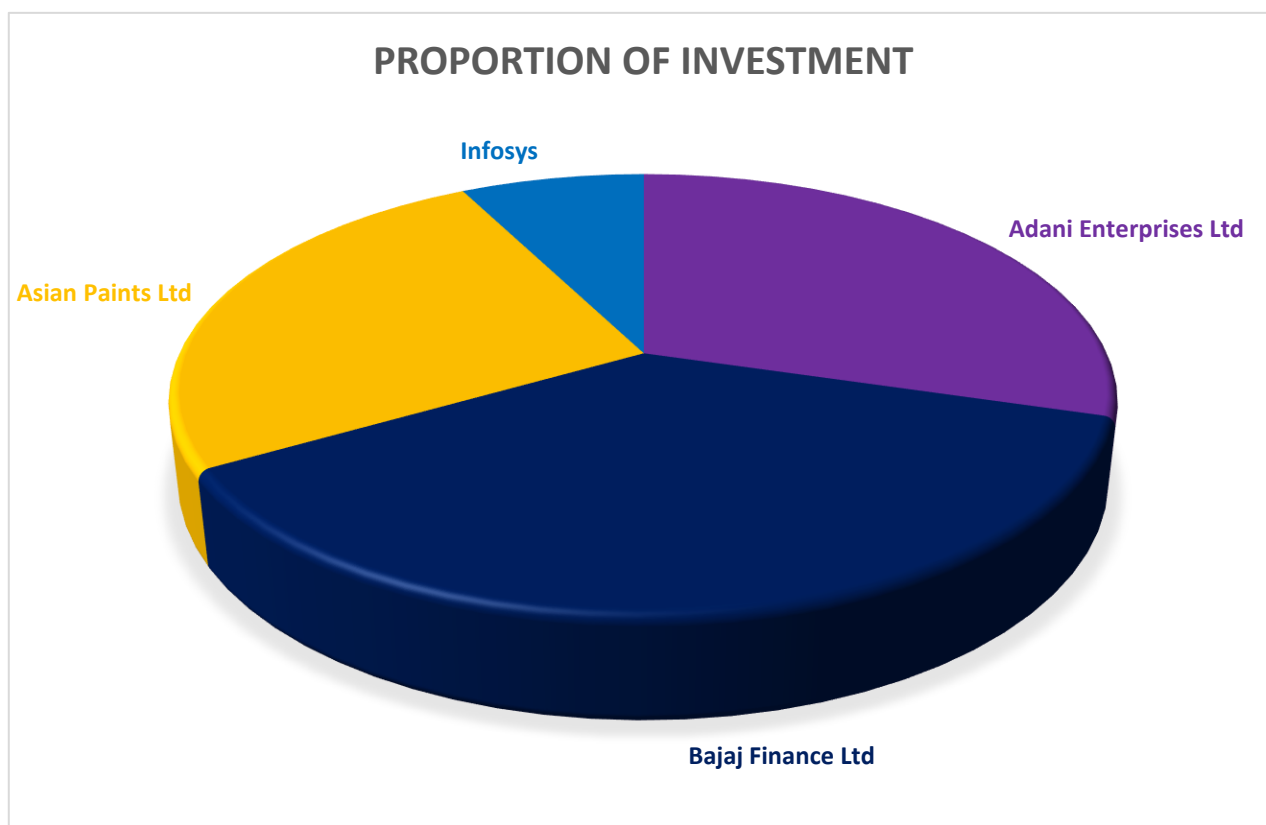
Table 1.8: Proportion of Investment Proposed

| Sl No | Company Name | Ci | Zi | Xi |
|--------------|-----------------------|------|-------|---------|
| 1 | Adani Enterprises Ltd | 6.52 | 0.011 | 29.55% |
| 2 | Bajaj Finance Ltd | 8.8 | 0.013 | 37.14% |
| 3 | Asian Paints Ltd | 9.12 | 0.009 | 25.77% |
| 4 | Infosys | 9.19 | 0.003 | 7.54% |
| Total | | | 0.036 | 100.00% |

Source: Computed and compiled by the author

Table 1.8: represents the proportion of investment to be made in each security. The four securities mentioned in the table are selected for the optimal portfolio. The percentage of funds to be invested in each security is presented in **Figure 1.1**:

Figure 1.1: Proportion of Investment Proposed



Four businesses were chosen from a sample of fifteen for the best portfolio construction using SIM. Knowing the percentage of investment to be made in each company's security is crucial once the companies on which investments are to be made have been identified. The amount of investment needed by the investor to get maximum returns is shown in Figure 4.1. The chart indicates that 62.95% of the investment may be made in Ultratech Cement stock (i.e., the majority of the money will be put into this company's stock), with 25.85% going to Infosys Ltd, 8.60% to Maruti Suzuki India Ltd, and 2.61% to ITC Ltd stock. An examination of the individual security returns from these stocks, together with their respective returns on portfolio is also presented below:

Table 1.9: Return on Portfolio

| Company Name | Xi | Returns In % | Return on Portfolio % |
|----------------------------------|-------------|--------------|-----------------------|
| Infosys Ltd | 0.26 | 23.75 | 6.14 |
| Ultratech Cement Ltd | 0.63 | 13.74 | 8.65 |
| Maruti Suzuki India Ltd | 0.09 | 12.04 | 1.04 |
| ITC Ltd | 0.03 | 7.44 | 0.19 |
| Total Return on Portfolio | 1.00 | | 16.02 |

Source: Computed and Compiled by the Author

Table 1.9 represents the proportion of investment, individual security return and the returns on portfolio. The returns on portfolio are calculated based on the proportion of investment in each security. The highest return on portfolio is from the Ultratech Cement Ltd i.e., 8.65% and the lowest is ITC Ltd i.e., 0.19%. Total return from the optimal portfolio is 16.02%. When one looks at the individual returns from the stocks in the above portfolio, it may be observed that Infosys Ltd company's security returns are higher than the portfolio return. On the other hand, Ultratech Cement Ltd, Maruti Suzuki Ltd.'s scrips and ITC Ltd.'s scrips' returns are less than the portfolio return. Thus, the inclusion of stocks in a portfolio is beneficial to companies despite the fact that expected returns from individual stocks is less. that expected returns from individual stocks is less.

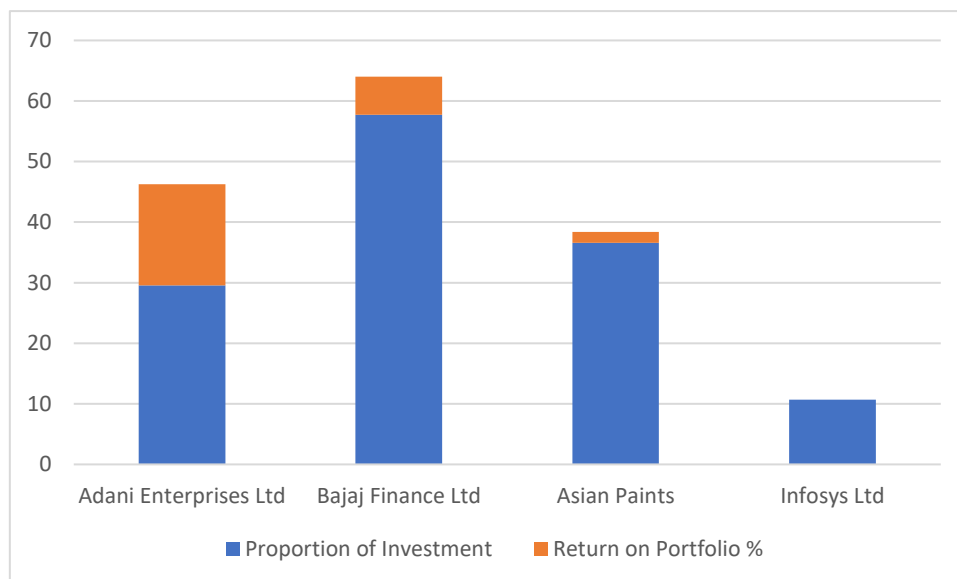


Figure 1.2: Proportion of Investment and Return on portfolio

Figure 1.2 depicts the proportion of investment to be made in individual security and the portfolio returns. Ultratech Cement has the highest portfolio return and ITC Ltd has the lowest portfolio return. If the investor invests on the above constructed portfolio, his total expected portfolio return is 16.02%. Thus, the Sharpe's Single Index Model is useful to investors and helps the fund managers in deciding about the securities to be included in his portfolio to derive the best benefits of diversification.

FINDINGS

The following is a presentation of the study's findings:

1. The NTPC Limited has the lowest return (4.9%) and Adani Enterprises Limited has the best return (109.31%). Investments in assets with high return potential might be undertaken if the investor wishes to maximize profit without taking risk into account. Even though the return on the stock is high, the risk associated with it should be taken into account when making investing decisions.
2. If the portfolio is diversified, the risk might be decreased. The goal of diversification is to minimize risk while achieving a certain level of projected return.
3. Adani Enterprises Ltd.'s return has the highest beta value of any security at 5.36, indicating that it is extremely volatile. The stock returns of the businesses Bharti Airtel Ltd (2.88), Apollo

Hospitals Enterprise Ltd (2.09), JSW Steel Ltd (2.47), Maruti Suzuki India Ltd (2.41), and Ultratech Cement Ltd (1.73), all of which have beta values more than 1, are also erratic. However, they are less erratic when compared to the return on the Adani Enterprises Limited security.

4. The excess return to beta ratio calculates the additional return on an investment for each unit of systematic risk. The excess return to beta ratio for the stock of Infosys Limited is 20.68, while that of NTPC Limited is the lowest at -5.73. The link between possible risk and reward associated with a security's return is shown by this ratio.
5. The unsystematic risk e_i^2 for the stock return of Adani Enterprises Limited is 4368.22, while the risk e_i^2 for Ultratech Cement Ltd. is 127.27. Due to specific characteristics that only influence the company issuing such securities, it is the one-of-a-kind risk affecting the firm. This risk can be avoided.
6. The proportion of investment to be made as well as the four securities ranked from 1 to 4 based on the C_i values were determined. The shares of Bajaj Finance Limited would receive 57.72% of the investment, followed by those of Asian Paints (36.58%), Adani Enterprises Ltd. (29.55%), and Infosys Limited (10.70%). This suggests that the shares of the Bajaj Finance company may be where the majority of the money is invested.

CONCLUSION

Both individual and institutional investors find it difficult to put together an ideal portfolio. This research tried to use the Sharpe's Single Index Model to create an ideal portfolio. Only four of the fifteen example companies were chosen for the ideal portfolio. The final investment choice should only be taken after taking into account all the variables affecting the securities. These may be general economic factors or any other macroeconomic variables that control how these securities move and behave in the market. This type of micro study needs to be undertaken frequently, taking into account various sample types.

The fund managers of emerging economies like India, where the capital markets are still in their development stages and many foreign institutional investors are also interested in investing in the top stocks traded through these countries' stock exchanges, will find greater value in the results of the current study and similar micro level studies.

REFERENCES

1. Nalini, R. "Optimal portfolio construction using Sharpe's single index model-a study of selected stocks from BSE." *International Journal of Advanced Research in Management and Social Sciences* 3.12 (2014): 72-93.
<https://dokumen.pub/facing-global-digital-revolution-proceedings-of-the-1st-international-conference-on-economics-management-and-accounting-bes-2019-9780367339128-9780429322808.html>

2. Varadharajan, P. "Construction of equity portfolio of large caps companies of selected sectors in India with reference to the Sharpe Index Model." *International Journal of Physical and Social Sciences* 2.8 (2012): 37-50.
<https://d1wqtxts1xzle7.cloudfront.net/32564413/IJMRA-PSS1409-libre.pdf?1391214767>
3. Basha, S. Mahabub, and M. S. Ramaratnam. "Construction of an Optimal Portfolio Using Sharpe's Single Index Model: A Study on Nifty Midcap 150 Scripts." *Indian Journal of Research in Capital Markets* 4.4 (2017): 25-41
<https://indianjournalofmarketing.com/index.php/ijrcm/article/view/120919>
4. indianjournalofmarketing.com/index.php/ijrcm/article/view/120919 Murthy, Jogonalapuram. "The construction of optimal portfolio using sharpe's single index model-an empirical study on nifty metal index." *Sumedha Journal of Management* 7.1 (2018): 126-134
<https://www.proquest.com/openview/4778873d64daa24dc58056c73a7e085d/1?pq-origsite=gscholar&cbl=1936345>
5. Portfolio construction using the Sharpe index model with reference to banking and information technology sectors Varadharajan, P. "Portfolio construction using the Sharpe index model with reference to banking and information technology sectors." *Prime Journal of Business Administration and Management* 1.12 (2011): 392-398.
<https://scholar.google.com/scholar?cluster=16870044609506285132&hl=en&oi=scholarrr>
6. Construction Of an Optimal Portfolio Using The Single Index Model: An Empirical Study Of Pre And Post Covid 19 Reddy, Karthik, et al. "Construction Of An Optimal Portfolio Using The Single Index Model: An Empirical Study Of Pre And Post Covid 19." *Journal of Pharmaceutical Negative Results* (2023): 406-417.
[file:///C:/Users/swaro/Downloads/JPNR+-+03+,+2023+-+51%20\(2\).pdf](file:///C:/Users/swaro/Downloads/JPNR+-+03+,+2023+-+51%20(2).pdf)
7. Construction of Optimal Portfolio on Selected Stocks of BSE Using Sharpe's Single Index Model Rout, Biswajit, and J. Panda. "Construction of optimal portfolio on selected stocks of BSE using sharpe's single index model." *Srusti Management Review* 12.1 (2020): 27-41
<https://scholar.google.com/scholar?cluster=16870044609506285132&hl=en&oi=scholarrr>
8. Security analysis and Portfolio management by Donald E Fischer and Ronald J Jordan (6th Edition), Pearson Publications. Fischer, Donald E., and Ronald J. Jordan. "Security analysis and portfolio management." (*No Title*) (1987).
9. Aouni, Belaïd (2009), Multi attribute Portfolio selection – New Perspective, INFOR; Feb 2009; 47, 1; ABI/INFORM Aouni, Belaïd. "Multi-attribute portfolio selection: New perspectives." *INFOR: Information Systems and Operational Research* 47.1 (2009): 1-4.
10. Construction of portfolio using Sharpe index model with special reference of banking industry Varadharajan, P., and P. Vickerman. "Construction of portfolio using Sharpe index model with special reference of banking industry." *Management Journal of Siva Sivani Institute of Management* 3.2 (2011): 5-13
<https://scholar.google.com/scholar?cluster=16870044609506285132&hl=en&oi=scholarrr>
11. <https://www.nseindia.com/>

12. <http://www.info.shine.com/>

13. <https://financialservicesltd.net/>

14.

15.

2 moneycontrol.com

<https://www.moneycontrol.com/>

3 nseindia

www.nseindia.com