# Plan for the Uncertainty - Empirical Study on Optimal Portfolio and Investments

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*Portfolio selection is a key to financial management and investment decision-making; Numerous classes of portfolio selection issues are amenable to efficient optimization-based solutions. This paper examines the study to devise a method for selecting the best portfolio for investing in Indian equity stocks that correspond to various economic subsectors. The paper's theme is an empirical study using the latest data on the topic. The methodology and calculations can be replicated to build an optimal portfolio of sectors for investing in related stocks. Hence the optimal portfolio balances, low risk with high return while considering all other pertinent factors.*

**Keywords:** Optimal Portfolio, Markowitz Model, Jensen's Measure, Risk Free Rate, Capital Allocation

## 1. Introduction

In computational finance and economics, there is an increasing interest in addressing optimization methodology as a result of the development of optimization algorithms and the proliferation of high-performance computer systems. Therefore, it is not surprising that a significant number of Nobel Prizes in Economics have been granted for mathematical programming. For instance, in 1990, Harry Markowitz, Merton Miller, and William Sharpe were awarded the Nobel Prize for their research of markets for financial assets.

The presence of a securities market is a necessary component of contemporary market economies. The investor has the option of depositing any excess financial assets in either depositary institutions or securities. Investing in the stock market is associated with a higher level of risk (than investing in depositary institutions), but it also offers the potential for higher profits. The profitability of the investor can be measured, by the amount of return it generates in comparison to the amount of risk it exposes itself to. A common definition of risk is "uncertainty in the realization of expected results," often known as "the threat of unintended occurrences." At the stock exchange, the term "risk" refers to the probability that the actual rate of return will differ from the anticipated or planned rate of return.

Investors who put their discretionary funds into the securities market work toward the goal of earning the highest return consistent with the level of risk they are willing to assume. The nature of the financial instrument determines the nature of the relationship that exists between the potential risk and the potential reward. When it comes to investing in securities, the time period of the investment is a very important consideration. It is vital to strike a balance between the amount of risk taken and the length of time the investment is held. This increases the possibility for profit from a higher rate of return while simultaneously lowering the risk that the investment would be lost. In other words, an investment that is held for a short period of time (up to a year) should be one that is made in secure and reliable securities, whereas an investment that is held for a longer period of time could be one that is made in securities with a higher risk level, while at the same time being an investment that has the potential for higher returns. It is common knowledge that the securities market has a history of sustained growth over the long run, despite the fact that, in the near term, it is prone to significant fluctuations.

The process of selecting a portfolio is essential for effective financial management and investment decision-making. Individuals can invest in equities on their own or with the assistance of portfolio managers. There are a variety of types of portfolio selection problems that can be effectively solved using optimization-based approaches. The purpose of this paper is to analyze the study that was conducted to develop a method for selecting the optimal portfolio for investing in Indian equities stocks that correspond to a variety of economic subsectors. The focus of the paper will be an empirical investigation that makes use of the most recent data available on the subject. The approach and calculations can be reproduced to construct the best possible portfolio of industries for investing in equities that are related to those industries. Therefore, the optimal portfolio strikes a compromise between low risk and high return, while also taking into account all of the other relevant characteristics. Following assessment of the pertinent literature, the study's objectives and research methodology have been outlined. To gain an understanding of the relative measurements, a comparison of the various methods for selecting the optimal portfolio has also been conducted.

## 2. Review of Literature

The release of Harry Markowitz's Ph.D.[1][2] dissertation titled "Portfolio Selection" in the early 1950s marked the beginning of the first revolution in the field of portfolio theory. The results of this study demonstrated how to comprehend and quantify the underlying trade-offs between risk and return that are associated with a portfolio. The introduction of mean-variance analysis,

a quantitative method for the examination of portfolios, was a game-changer in the fields of economics and finance. When this analysis is finished, one will be able to create and answer problems involving portfolio optimization. The solution consists of choosing the portfolio that generates the highest (best) mean return while maintaining risk levels that are below an acceptable bound.

[3][4]The economic and financial markets are notoriously difficult to understand. It's true that an economy is made up of things like technology, acts, markets, financial institutions, and industries; all of these things are real and physical. Beliefs, however, are what lie behind them, guiding them and being guided by them on a sub-particle level. Beliefs are the subjective expectations, numerous hypotheses, and half-hoped anticipations that human beings have.

The study on the optimal holding period for Istanbul equities was explored using the Mean Variance (MV) efficient portfolio. The study covered the time period from January 2000 to November 2004. The findings demonstrated that the MV efficient investment portfolio performed significantly better over the long term (Ulucan, 2007)[5]. Nageswari et al. (2013)[6] estimated the future risk and return of assets in order to construct an ideal portfolio that considerably decreases the variance of return values. During the time period of April 2007 through March 2012, the BSE Sensex was analyzed using the daily closing prices. An optimal rate of return, or cut-off rate, was determined, which aids in the process of selecting companies for a portfolio.

A comparison of the traditional portfolio theory and the modern portfolio theory for the purpose of selection a portfolio has been made by Gopalakrishna Muthu (2014)[7]. Secondary data from the NSE Index were taken into consideration for the years 2004-2008. According to the findings of the study, which utilized regression on market and security return, IT Index possesses greater sensitivity than the stock market. The research looked at undervalued stock options, which can be used to improve an existing portfolio. The purpose of the research conducted by Nalini (2014)[8] was to raise awareness among investors about the usefulness of Sharpe's model in the process of constructing a portfolio. 15 companies from the BSE Sensex Index were looked at, along with their annual price changes. A portfolio was constructed by selecting four different stocks based on their respective Ci values.

The study by Saravanan and Natarajan (2012)[9], an optimum portfolio was developed, and it consisted of four equities chosen from the Nifty 50 stocks. For the time period of April 2006 through December 2011, daily stock and index data were taken into consideration. The rate of return that was deemed acceptable served as the basis for determining the proportion of investments allocated to each stock. According to Debasish et al. (2012)[10], an optimal portfolio consists of three stocks out of a total of 14 stocks in the manufacturing sector, which includes automobiles, cement, textiles, paints, oils, and refineries. They came to this conclusion after analyzing the performance of each stock individually. The allocation of investment capital was determined based on a number of criteria, including beta value, return, risk-free rate of return, and unsystematic risk.

Using Sharpe's approach, Niranjan Mandal et al. (2013)[11] created a portfolio that was optimized for performance. It was decided that the BSE Sensex will serve as the market performance gauge. The data were for the period beginning in April 2001 and ending in March 2011. Securities with a rate that was higher than a predetermined threshold were taken into consideration, and the percentages of investments made in various securities were calculated.

According to Anangnostopoulos and Mamanis (2010)[12], the formulation of the problem of portfolio optimization involved optimising the objectives including tradeoffs between risk and return as well as the number of securities that should be included in an ideal portfolio. There are restrictions placed on the proportion of the investments made in assets, and these restrictions are designed to eliminate the possibility of having smaller quantities of holdings or investments in assets that have similar features. Mangram (2013)[13] performed an analysis on the effect that the number of securities held in a portfolio has on its level of diversification. He came to the conclusion that while systematic risk cannot be eliminated, unsystematic risk can be significantly reduced by diversification.

## 3. Data Specification

Our study is based on stock price value. The daily sample spans from July 2021 to April 2022 inclusive for a total of 206 observations for Infosys, BDL, JSW Energy, Tata Power, CIPLA and NIFTY 50. Both price series have been taken from the same market region in order to maintain consistency and ensure that the comparison is logical. Statistical properties of the sample data are given in the table 1 below

**Table 1** *Descriptive Statistics*

| INFOSYS | | BDL | | JSW ENERGY | | TATA POWER | | CIPLA | | NIFTY | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| Mean | 1731.38301 | Mean | 448.9917476 | Mean | 301.3342233 | Mean | 200.8084951 | Mean | 942.1757282 | Mean | 17183.75388 |
| Standard Error | 6.557692618 | Standard Error | 7.154123006 | Standard Error | 3.579252086 | Standard Error | 3.473348846 | Standard Error | 3.016032437 | Standard Error | 49.63894722 |
| Median | 1722.85 | Median | 411.425 | Median | 307.825 | Median | 224.225 | Median | 931.725 | Median | 17295.825 |
| Mode | 1720.85 | Mode | 375.05 | Mode | 167.1 | Mode | 125.9 | Mode | 915.95 | Mode | 17213.6 |
| Standard Deviation | 94.12059546 | Standard Deviation | 102.6809819 | Standard Deviation | 51.37193175 | Standard Deviation | 49.85193431 | Standard Deviation | 43.28820904 | Standard Deviation | 712.4529225 |
| Sample Variance | 8858.68649 | Sample Variance | 10543.38405 | Sample Variance | 2639.075372 | Sample Variance | 2485.215354 | Sample Variance | 1873.869042 | Sample Variance | 507589.1668 |
| Kurtosis | -0.407819904 | Kurtosis | 4.584999476 | Kurtosis | 0.596244723 | Kurtosis | -1.291315805 | Kurtosis | 0.067173944 | Kurtosis | -0.462357649 |
| Skewness | 0.050123923 | Skewness | 2.242713876 | Skewness | -0.772541062 | Skewness | -0.544317461 | Skewness | 0.84328482 | Skewness | -0.572333299 |
| Range | 397.8 | Range | 493.85 | Range | 233.7 | Range | 169.45 | Range | 207.85 | Range | 2844.95 |
| Minimum | 1541.7 | Minimum | 361.45 | Minimum | 165.1 | Minimum | 120.35 | Minimum | 860.2 | Minimum | 15632.1 |
| Maximum | 1939.5 | Maximum | 855.3 | Maximum | 398.8 | Maximum | 289.8 | Maximum | 1068.05 | Maximum | 18477.05 |
| Sum | 356664.9 | Sum | 92492.3 | Sum | 62074.85 | Sum | 41366.55 | Sum | 194088.2 | Sum | 3539853.3 |
| Count | 206 | Count | 206 | Count | 206 | Count | 206 | Count | 206 | Count | 206 |
| Confidence Level(95.0%) | 12.92916971 | Confidence Level(95.0%) | 14.10509395 | Confidence Level(95.0%) | 7.056865937 | Confidence Level(95.0%) | 6.848066739 | Confidence Level(95.0%) | 5.946420107 | Confidence Level(95.0%) | 97.86832204 |

## 4. Methodology

In this empirical work, we use a variety of models (Markowitz Model, Sharpe Ratio, Treynor Ratio, Jensen's Measure) for understanding the best allocation of optimal portfolio based on stock prices of the selected companies.

$$R_p = \sum_{i=1}^{n} w_i r_i$$

**Portfolio Return Formula**

$$w_a^2\sigma_a^2 + w_b^2\sigma_b^2 + 2w_a w_b \sigma_{ab}$$

**Portfolio Variance Formula for two stocks**

$$U = rc - (0.5 * A * sigma\ c * sigma\ c)$$

**Utility Formula for the Stock**

$$Sharpe\ Ratio = (Portfolio\ Return - risk\ free\ rate)/Portfolio\ risk$$

$$Treynor\ Ratio = (Portfolio\ Return - risk\ free\ rate)/Portfolio\ beta$$

$$Jensen's\ Measure = Portfolio\ Return - CAPM$$

- **Sample and Data**

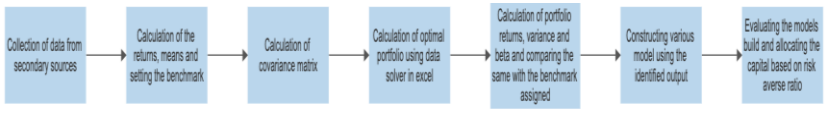
The research is purely based on secondary data and the study exhibits on the historical data of the stock prices of companies from different industries which has been selected for the study. For this study we have selected five Indian companies (Infosys, BDL, JSW Energy, Tata Power, CIPLA) which were performing good during the period of study. The time period of the selected stock prices of companies is based on previous one-year daily data.

- **Variables for the Study**

For this study the variables which are considered:

- Daily stock closing prices of five companies
- Daily Returns of five companies
- Mean returns of five companies for the selected period
- Beta of the stock for five companies
- Market risk of the current period

- Steps for analyzing the data




**Step 1:** Collection of data from secondary sources
**Step 2:** Calculation of the returns, means and setting the benchmark
**Step 3:** Calculation of covariance matrix
**Step 4:** Calculation of optimal portfolio using data solver in excel
**Step 5:** Calculation of portfolio returns, variance and beta and comparing the same with the benchmark assigned
**Step 6:** Constructing various model using the identified output
**Step 7:** Evaluating the models build and allocating the capital based on risk averse ratio

## 5. Data Analysis

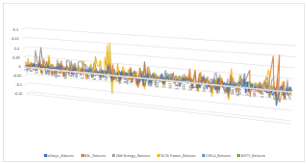


**Figure 1** *Trend Analysis of Returns of five companies with respect to NIFTY 50*

As per the graphical representation (Figure 1), we can see that each companies have significance to generate return especially there are spikes in the trend pattern for Tata Power and BDL Returns and it is correlated with the trend pattern of NIFTY 50

**Table 2** *Mean Returns and Risk of the stock of Five Companies with Respect to NIFTY 50*

| | **Mean Returns** | **RISK** |
|---|---|---|
| Infosys | 0.000138449 | 0.015235657 |
| BDL | 0.003981233 | 0.02972832 |
| JSW Energy | 0.003357748 | 0.029442017 |
| TATA Power | 0.00384406 | 0.030844095 |
| CIPLA | 0.000137301 | 0.015694719 |
| NIFTY | 0.000478076 | 0.010431345 |

The expected value, or mean, of all the potential returns on investments that make up a portfolio is referred to as the mean return in the field of securities analysis. The amount that a stock returns on a monthly basis can be referred to as its mean return, which is equivalent with the term expected return. The process of making projections on the future value of a stock is an essential part of stock analysis. Investors and analysts will make an effort to forecast future revenue and growth as a means of judging whether or not a particular investment is worth the risk that is associated with it. An investor can have a better knowledge of how particular securities can affect the portfolio as a whole by calculating the mean or expected return of a portfolio of investments. This can help the investor make more informed investment decisions.

**Table 3** *Covariance matrix of five companies with Respect to NIFTY 50*

| COVARIANCE MATRIX | | | | | | |
|---|---|---|---|---|---|---|
| | **Infosys** | **BDL** | **JSW Energy** | **TATA Power** | **CIPLA** | **NIFTY** |
| **Infosys** | 0.000232125 | -0.00002892 | 0.000030011 | 0.000147336 | 0.000013498 | 0.000099566 |
| **BDL** | -0.00002892 | 0.000883773 | 0.000151304 | 0.00012332 | 0.000023644 | 0.000064279 |
| **JSW Energy** | 0.000030011 | 0.000151304 | 0.000866832 | 0.000265547 | -0.000012107 | 0.000090518 |
| **TATA Power** | 0.000147336 | 0.00012332 | 0.000265547 | 0.000951358 | 0.0000021331 | 0.000159194 |
| **CIPLA** | 0.000013498 | 0.00002364 | -0.000012107 | 0.0000021331 | 0.00024632 | 0.000012758 |
| **NIFTY** | 0.00009957 | 0.00006428 | 0.000090518 | 0.000159194 | 0.000012758 | 0.000108813 |
| **Beta of the stocks** | 0.00009957 | 0.00006428 | 0.000090518 | 0.000159194 | 0.000012758 | 0.000108813 |

The covariance is a statistical method that is applied to the problem of determining the nature of the connection that exists between the actions of two independent random variables. When two stocks tend to move in the same direction at the same time, this is known as having a positive covariance; when they move in the other direction, this is known as having a negative covariance. When building a portfolio, it is essential to make an effort to lower total risk by including assets that have a negative covariance with each other and with the other holdings in the portfolio. In order to calculate the measure of covariance between the prices of several equities, analysts make use of historical price data. This makes the implicit assumption that the same statistical relationship between asset prices will continue into the future, which is not necessarily the case in all circumstances. The risk of a portfolio can be reduced to a manageable level by including assets that have a negative covariance.

**Table 4** *Optimal Portfolio Allocation*

| | **Construction Of Portfolio's** | | | |
|---|---|---|---|---|
| | Equal weights(A) | Random Weights(B) | Random Weights 2 (C) | Optimal Portfolio |
| **Infosys** | 0.2 | 0.2 | 0.3 | 23% |
| **BDL** | 0.2 | 0.1 | 0.1 | 11% |
| **JSW Energy** | 0.2 | 0.3 | 0.4 | 15% |
| **TATA Power** | 0.2 | 0.3 | 0.1 | 45% |
| **CIPLA** | 0.2 | 0.1 | 0.1 | 7% |
| **Sum** | 1 | 1 | 1 | 100% |

Construction of different portfolios are given in the above table (Table 4) where the first 3 portfolios have been created on the basis of random weights and the optimal portfolio has been created by the data solver in excel which gives more accuracy than the calculations done manually. While comparing with the random weights and the equal weights we can identify clearly that the optimal portfolio gives the best return for the amount of risk an investor takes. While investing 20%, 20% and 30% respectively in Infosys, in case of equal and random weights the data solver is suggesting us to invest only 23% in Infosys to get the best return; for BDL it is 20%, 10% and 10% respectively and the data solver suggests 11% of investment; for JSW Energy it is 20%, 30% and 40% respectively and the data solver suggests 15% of investment; for Tata Power it is 20%, 30% and 10% respectively and the data solver suggests 45% of investment; and for CIPLA it is 20%, 10% and 10% respectively and the data solver suggests 11% of investment.

**Table 5** *Return, Variance and Risk of Equal, Randoms and Optimal Portfolio*

| | **Equal weights(A)** | **Random Weights(B)** | **Random Weights 2 (C)** | **Optimal Portfolio** |
|---|---|---|---|---|
| **Portfolio Return** | 0.002291758 | 0.002600086 | 0.002180893 | 0.002680575 |
| **Portfolio Variance** | 0.000184477 | 0.000269038 | 0.000230878 | 0.000314297 |
| **Portfolio Risk** | 0.013582248 | 0.016402382 | 0.015194661 | 0.01772843 |

Here in the above table, we are finding the portfolio risk, variance, and returns simultaneously, and it clearly shows us that the optimal portfolio has the lowest risk, variance, and return possible.

**Table 6** *Risk Free Rate and Sharpe Ratio of Equal, Randoms and Optimal Portfolio*

| | Equal weights(A) | Random Weights(B) | Random Weights 2 (C) | Optimal Portfolio |
|---|---|---|---|---|
| Risk Free Rate | 1.346% | 1.346% | 1.346% | 1.346% |
| Sharpe Ratio | -0.988667328 | -0.817979025 | -0.883620508 | -0.756520992 |

The return on an investment is compared with the risk of the investment using the Sharpe ratio which is a mathematical expression of the concept that excess returns over a period of time may signify increased volatility and risk, as opposed to investment expertise, and it shows how this insight can be expressed. William F. Sharpe, an American economist, initially referred to the ratio he developed as the reward-to-variability ratio when he first presented it in 1966 as an outgrowth of his work on the capital asset pricing model (CAPM). The numerator of the Sharpe ratio consists of the predicted returns along with a benchmark such as the rate of return on a risk-free investment or the overall performance of a specific type of investment. The standard deviation of returns over the same period of time, which is a measure of volatility and risk, is used as the denominator in this formula. We need to utilize the risk-free rate in order to calculate the Sharpe ratio. We can obtain the risk-free rate on the RBI website, which is also where the rate for T-bills is listed. Because we are interested in the daily returns, we need to determine the risk-free rates on a daily basis, thus we have divided the T-bills rate by 365 in order to do so. The T-bills rate has been regarded to be the risk-free rate on an annual basis and thus we will obtain 1.346%.

When the Sharpe ratio is negative, it indicates that the risk-free rate or the benchmark rate is higher than the portfolio's historical or predicted return, or that the return on the portfolio is likely to be negative. Alternatively, it indicates that the risk-free rate or the benchmark rate is higher than the portfolio's expected return. According to the data presented in the table that came prior to (Table 6), the optimal portfolio has the lowest Sharpe ratio, which comes in at -0.756520992, and the Sharpe ratio for equal weights is the highest and the worst of the three.

**Table 7** *Capital Allocation for Optimal Portfolio*

| Capital Allocation | |
|---|---|
| Risky Portfolio | |
| rp | 0.002680575 |
| Sigma(risk) | 0.01772843 |
| return on capital(rc) | 0.01346 |
| risk on capital(sigma c) | 0 |
| Proportion (P) | 0 |
| | |
| Risk Free Portfolio | |
| rf | 0.01346 |
| Proportion (1-P) | 1 |
| | |
| Utility | 0.01346 |
| U= rc-(0.5*A*sigma c*sigma c) | |
| | |
| A | 3 |

When it comes to constructing and maintaining a well-balanced investment portfolio, asset allocation plays a very essential role. After all, it is one of the most important aspects that determines your overall profits; in fact, it is more important than selecting specific stocks. The process of allocating capital involves distributing, redistributing, and investing monetary resources with the goal of maximizing profits for stakeholders. It is essential to the long-term success of a business that the chief executive officer and the chief financial officer come to a strategic decision regarding the company's finances. Each strategy ought to use an asset mix that is reflective of the goals you want to achieve, taking into account the level of risk you are willing to take and the amount of time you intend to invest. A strategic asset allocation plan requires regular rebalancing as well as the setting of goals for the strategy's performance. Investors who are wary of taking risks and desire active management of their portfolios could find the insured asset allocation strategy appealing. Here as the next step we have calculated the allocation of capital of the optimal portfolio using the utility and risk averse ratio. The risk averse ratio has been assumed as 3 that denotes capital A and the utility has been calculated. Hence it is interpreted that, if we invest 0.0026% in the optimal portfolio with a risk of 0.017, we will get a return of capital of 0.0134%, where the utility will be same as of return on capital.

## 6. Results and Discussions

**Table 8** *Table Showing the Portfolio Evaluation*

| Portfolio Evaluation | | | | | |
|---|---|---|---|---|---|
| | Equal Weights | Random Weights (A) | Random Weight (B) | Optimal Portfolio | Market |
| Ratios | Portfolio A | Portfolio B | Portfolio C | Portfolio D | NIFTY 50 |
| Sharpe Ratio | -0.988667328 | -0.817979025 | -0.883620508 | -0.756520992 | -1.289811164 |
| Treynor Ratio | -157.8558434 | -131.2700928 | -150.0474988 | -117.1287797 | -123.6929914 |
| Jensen Measure | 0.002291718 | 0.002600037 | 0.002180851 | 0.00268052 | NA |
| M Square | -0.008576936 | -0.006906180 | -0.007742886 | -0.006342253 | NA |

**Table 9** *Table Showing Beta of the Portfolio*

| | Equal weights(A) | Random Weights(B) | Random Weights 2 (C) | Optimal Portfolio |
|---|---|---|---|---|
| Beta of Portfolio | 0.000085263 | 0.00010253 | 0.000089700 | 0.000114909 |

The risk-adjusted performance of an investment portfolio can be determined using the Treynor Index, which does this by calculating the portfolio's excess return relative to the amount of risk it takes on. When discussing the Treynor Index, the term "excess return" refers to the amount of money made in addition to the amount of money that might have been made from a risk-free investment. Beta, which is a measure of overall market risk or systematic risk, is utilized as the criterion for determining the level of exposure to market risk for the Treynor Index. A portfolio's beta indicates the extent to which its return is likely to fluctuate in reaction to variations in the return of the broader market. The higher the Treynor Index is, the greater the excess return that the portfolio is generating for each unit of overall market risk. This is because the Treynor Index measures the portfolio's exposure to overall market risk. From the above table (Table 8), it is clear that when comparing to NIFTY 50, the equal weights and random weights portfolio is having more Treynor ratio than optimal portfolio thus it indicates the optimal portfolio is the best allocation of weights to different company stocks.

A return on an investment or portfolio that either exceeds or falls short of the anticipated return on the portfolio or investment can be measured using Jensen's Measure. This measure can be applied to both positive and negative outcomes. The Jensen's Measure is a statistical tool that determines whether the return on an investment portfolio is higher than or lower than the expected return that is specified by the capital asset pricing model. The capital asset pricing model (CAPM) can be used to forecast and determine the appropriate rate of return for an asset. However, there are certain investments within portfolios that have rates of return that are either higher than the average return on the market or lower than the average return. The Jensen's Measure is sometimes referred to as the alpha of Jensen's alpha. In addition, investors examine the extent to which the return on a portfolio compensates for the inherent risk of the portfolio by conducting an accurate analysis of the performance of the portfolio. The Jensen's measure is a useful tool for accomplishing this goal. The majority of the time, investors will choose investment portfolios that have a lower risk and a higher rate of return. The capital asset pricing model, also known as CAPM, is a tool that may be used to determine the level of risk and rate of return that are typically associated with an investment or portfolio. Jensen's Alpha equals $R(i) - R(f) + B \times R(m) - R(f)$. It is however essential to be aware that the aforementioned method is utilized in instances in which the CAPM is presumed to be accurate. The following are the underlying variables that are included in the formula: The actual return on the portfolio or investment is denoted by the letter $R(i)$ The actual return on the predicted market index is denoted by the letter $R(m)$. The rate of return that is achieved with no exposure to risk throughout the specified time span = $R(f)$ The correlation of the investment portfolio with the selected market index is denoted by the letter $B$. From the above table (Table 8), it is clear that Jensen's measure is not calculated for NIFTY 50, while comparing the optimal portfolio with the other portfolio's we can easily identify that the optimal portfolio is having the highest Jensen's measure of 0.00268 and so it is proved that it is the best portfolio

M Square measure is an extended and more useful version of the Sharpe ratio. It provides us with the risk-adjusted return of the portfolio by multiplying the Sharpe ratio with the standard deviation of any benchmark market index and then adding risk-free return thereafter to it. This gives us the risk-adjusted return of the portfolio.

$$\text{M squared measure} = \text{SR} * \sigma\text{benchmark} + (\text{rf})$$

Steps in calculating M Square -

The M Square measurement can be computed using the formulas that are shown in the following sentences.

- Calculating the Sharpe ratio is the first step (annualized)
- Multiplying the Sharpe ratio that was obtained in step 1 by the standard deviation of the benchmark is the second step.
- Add the risk-free rate of return to the result obtained in step 2 in the third step.

## 7. Conclusion

An investor must not only look at the overall return of a portfolio but also at the risk of that portfolio in order to accurately evaluate the performance of an investment manager. This is done in order to determine whether or not the investment's return is sufficient to compensate for the risk that it takes on. Investors are able to reduce their overall exposure to risk by diversifying their holdings through the purchase of stock portfolios. By correlating the return on a security to a single market index, the Sharpe single index model has made the process of constructing the best possible portfolio significantly easier.

When considering different investment options, it is essential to balance the potential for loss with the potential for gain. The goal of this research is to identify the optimal investment portfolio, one that maximizes returns while mitigating risk, and that invests in the stocks of companies that are members of the Nifty 50 index traded on the national stock exchange. Specifically, the study will focus on finding a portfolio that creates opportunities for investors to maximize their returns while minimizing their overall exposure to risk.

It is possible that the empirical nature of the study, which applies the most recent data relating to the stock market and sectoral indices, is capable of making a contribution to the existing body of literature on the topic. It is significant in the real world in terms of the methodology applied and the calculations that were done. With the help of this strategy, an ideal sector portfolio can be created for the purpose of investing in the equity stocks of related businesses.

However, the significance of the beta is not consistent with the return of every security, leading one to the conclusion that the performance of the market as a whole is a factor that affects the performance of every security to some degree. Using the information provided by this empirical study, one can, to some extent, forecast the return of an individual security based on the movement of the market and make use of this information. In the final phase, it was discovered that Sharpe's single index market model will work effectively when applied to the information context of the Indian security market. In addition, this helps to demonstrate that the return on securities held by various portfolios is unaffected by the level of systematic risk that is currently prevailing in the market.

## 8. Bibliography/Reference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