

A Study on Sharpe's Single Index Model and Its Application to Build an Optimal Portfolio with Selected Stocks of Nifty 50 Index

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Abstract

The primary goal of an investor is to generate enough returns with minimum risk. The investor should have complete knowledge of the investment in order to achieve the goals of achieving high returns. If an investor does not achieve reasonable returns with the agreed risk, then it is better not to invest in those securities, according to an analysis using Sharpe's single index model. Therefore, Sharpe's single index model helps an investor choose a portfolio before making an investment decision. The main objective of this project is to evaluate selected stocks from a variety of sectors using Sharpe's single index model, which helps the investor to determine the rate of return and build a portfolio in nifty terms. The project report includes monthly closing prices of 18 companies comprising 3 firms from 6 sections, selected from 1st January 2016 to 31st December 2020 along with the closing price of the NSE Index. Using Sharpe's single index model, computed the required rate return and risk for the selected concerns. Every investor experiences dilemma for selecting various stocks for his portfolio. Investors will run into difficulties while deciding how much money to invest in each security. Sharpe's single index can be used to create the best portfolio and help investors escape confusion. The study concludes that investment in securities is better than investing in banks to get maximum returns.

Keywords: Sharpe's Single Index Model, Optimal Portfolio Construction, Cut off rate, Systematic Risk and Unsystematic Risk, Return and Risk Analysis.

INTRODUCTION

Industry Profile

Investment is the employment of funds on asset like stocks, bonds, real estate, mortgages with the aim of earning income or increase in value that is capital appreciation or capital growth over the years.

The investment mainly focuses on two attributes namely time and risk. The recent trend tells that present investment consumption is sacrificed to get a return in future. The sacrifices that has to be borne is certain but the return in the future may be uncertain. This attribute explains about the risk factor involved in investment. If the investor wants higher return on whatever securities he has invested, he is also willing to incur a higher risk at the time of investment. Every investor seeks to minimise the risk of his investment by combining several securities in the right way. The securities are bought and sold in the platform called financial market. They assist in the raising of funds for various financial institutions for future expansion.

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Stock Exchange

Stock exchange is an association which facilitates the exchange of securities between stockbroker and trader. The origin of the stock exchanges can be traced back to the latter half of 19th century in India. The first stock exchange in India was established in 1875 and was named as Bombay stock exchange (BSE) in Bombay [1]. It then established operations in Calcutta, Madras and Ahmedabad. All these four places were main centers for trade and commerce activities. Till 1990's the Indian secondary market contains regional stock exchange with BSE, but after the transformations of 1991 the Indian secondary market essential a three tier form that is Bombay stock exchange, Regional stock exchange, and all India stock exchange. It covers National stock exchange of India (NSEI) and Over the counter exchange of India (OTECI) [2].

Securities and Exchange Board of India (SEBI)

The Security and Exchange Board of India (SEBI) is a regulatory agency that was created in 1988. The primary goal of the SEBI was to protect the interests of investors. The different roles of the stock market are administered by SEBI which include the registered stocks and the entire stock market is being controlled here. Company's pool debt from public capitalized in the registered security where in SEBI assistances investors by lessening the fraud.

Bombay Stock Exchange (BSE)

The Bombay Stock exchange came to exist in the year 1875. BSE is the oldest Stock Exchange in Asia. More than 5,000 companies are listed in BSE. BSE traces its history to 1855 when one Parsi and four Gujarati stockbrokers would gather under banyan tree in front of Mumbai's town hall. The place of meetings changed several times as the number of brokers regularly increased. Bombay Stock 3 Exchange eventually relocated to Dalal Street, and in 1875 it officially established itself as "The Native Share and Stock Brokers Association." On August 31, 1957, the Indian government designated BSE as the first stock exchange under the Securities Contract Regulation Act. In 1995, the Bombay Stock Exchange switched to an electronic trading platform. The conversation of transition is completed by 50 days. The automated screen-based Electronic trading platform is called BSE Online Trading (BOLT). BOLT was introduced in 1995, to facilitate efficient processing of an order driven system with jobbers [3]. Jobber is a dealer who trades on his personal account and hence offers a two-way quote. The ask price is the price at which the trader is willing to trade, and the bid price is the price at which the trader is willing to buy. In October 1996, SEBI allowed BSE to spread BOLT network outside Mumbai, some regional stock exchanges became the members of BSE and servers as sub broker of BSE. BSE Sensex, BSE small cap, BSE mid cap, and BSE 500 are the indices of the Bombay Stock Exchange.

National Stock Exchange (NSE)

National Stock Exchange was started in the year 1992 and is situated in Mumbai. It is the major stock exchange in the country in terms of daily total turnover. National Stock Exchange is the first Dematerialized electric exchange in the country. The NSE was the country's first exchange to use a contemporary, fully automatic screen-based electronic trading system. NSE is based on Nifty Index. It is an index of 50 huge companies on NSE of India. Nifty is also a representative of all main companies about stock values of NSE. More than 1600 companies are listed in NSE. NSE has recognized with diversified shareholdings which include domestic and Global Investors. The wholesale debt market sector and the capital market segment are the two divisions of the NSE. The capital market segment includes equities and convertible securities. The wholesale debt market segment includes Public sector Undertakings and government bonds. The trading participants in the capital market segments are connected by satellite to a central computer in Mumbai. The 1st exchange in the world to employ the satellite technology is NSE. This permitted NSE to achieve a nation-wide reach [4]. The NSE has chosen for an order driven system. When an order is placed by a trading fellow, the computer automatically picks a unique order number for the transaction. The individuality of the person is not exposed when he has placed an order or when his order is pending. Associates are required to deliver the securities and cash with in certain day. The pay-out day is the following day. In

NSE all traders are guaranteed by the National Securities Clearing Corporation (NSCC). The NSCC is founded in 1976 and it provide service like clearing settlement, risk management and provide counter party services.

Securities Market

Primary Market

The primary market is the part of the capital market where fresh securities are traded, such as capital issued by companies listed on the stock exchange. The primary market's principal function is to increase the company's long-term finance, and participants include financial institutions, mutual funds, underwriters, individual investors, etc.

Secondary Market

The secondary market, also known as the security market, is where newly issued securities are traded among investors. This includes both the equity and debt markets. In the secondary market, the company is not involved in the transaction and is dealing with securities that were already issued. The secondary market's purpose is to create a continuous and available market for investors to trade securities. Stock brokers participating in the secondary market are mutual funds and financial institutions. In the secondary market, price is determined by supply and demand forces.

THEORETICAL BACKGROUND

Background of the Study

Investment plays an important role in investing in a number of securities, such as equity, debentures, etc., for the benefit of the investor. Investor perception is not the same at all the time it's fluctuating. The individual should have full information of the investment so that he can manage and deal with the loss. Investing in securities is better than investing in banks to get maximum returns. The investment involves risk and return. It's not just about investing; the investor needs to be smart enough to take a decision to invest in large number of securities in the stock market without any trouble. The investor needs to construct the accurate portfolio for a good investment [5]. The best alternative to investing in individual assets is to purchase a portfolio of securities. As quoted by Warren Buffet "instead of putting all eggs on one basket it is healthier to differentiate in order to lessen the risk". Investor can avoid hazard by creating a healthier portfolio.

Sharpe's Single Index Model

The Sharpe single index model was introduced by William Sharp in 1963. This is a simple asset pricing model that calculates a stock's risk and return. This strategy suggests that rather than buying individual stocks, an investor should invest in a portfolio. Their purpose is to create a portfolio that would help to reduce risk. The Sharpe Single Index model is used to generate the Optimum Portfolio, which takes into account a variety of factors such as portfolio returns, volatility, standard deviation, and stock weighting William Sharpe developed this model mainly because when an investor expects a high return, he usually undergone for losses due to the huge risk involved in investing in security and that leads to negative returns. This is the main goal for introducing the portfolio theory. Sharpe's Single Index Model Selecting a Cut-Off Rate to Include Securities in the Portfolio [6]. He explained the simple regression equation, which states that when stocks are added to the portfolio, the portfolio can provide personal security to the stock market that has risk. As the number of stocks increases, the risk in the portfolio decreases somewhat, where the systematic risk is a fraction of the risk that cannot be reduced even after adding a large number of securities to the portfolio. The inputs included to calculate the market's expected return and variance are residual variance, beta. These are uncertain risks to personal security. To govern the association between each pair of securities by comparing single index with return on individual security Sharpe's single index model is used rather than Markowitz model. The Markowitz model is more time consuming.

Assumption

- Return on market risk and return on individual securities are interrelated to each other.
- The investors who have invested all have uniform expectation.
- The market return on the stocks and the error term are not connected.
- For a uniform investment tenure risk and return should be calculated for each individual stock.

Expected Return

Expected returns are revenues or losses that investors supposed to earn based on projected rates of return. First calculate the monthly return of every stock.

Monthly Return (R) = ((Closing share price of current month–Opening share price of current month)/Opening share price of current month) *100

$$\text{Expected return } \bar{R} = \sum R / N$$

Where, R is Return on a Monthly Basis

N is Number of Monthly Returns

Standard Deviation

The meaning of standard deviation is a statistic that valued the dispersion of a data set relative to an average and is computed as the square root of the variance. The formula for calculating

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

Where, R is Return on a Monthly Basis

$\bar{R}$ is Expected return of the Security

N is Number of Monthly Return

Co-Variance

Covariance measures the directional relationship between returns on two assets. The formula for calculating co-variance

$$\sigma_{xy} = [(x - \bar{x})(y - \bar{y})] / N$$

Return on Portfolio

Portfolio return discusses the gain or loss of an investment portfolio with a variety of investments.

$$R_P = \sum R_i * X_i$$

Where X_i is Investment proportion

R_i is expected return of one security

Portfolio Risk

A portfolio risk is the mixture of assets or units in the investment you have that may fail to meet financial goals. The formula for calculating

$$\sigma_p = (\sum X_i Q) \sigma_m^2 + (\sum X_i^2 \sigma_{ei})^2$$

Where X_i is Proportion of investment

σ_m^2 = variance of market

σ_{ei}^2 = unsystematic risk or residual value

Sharpe's Optimal Portfolio

- To compute the excess return to beta ratio for each 18 companies.

$$\text{Excess return to beta ratio} = (R_i - R_f)_i$$

Where

R_i = the expected return on individual stock

R_f = risk free rate of return

β_i = Systematic risk of individual stock

- After that securities should be ranked in the systematic manner.
- Cut-off rate is calculated by the following equation (Surti, 2013)

$$Ci = \frac{\sigma_m^2 \sum_{i=1}^N (R_i - R_f) Q_i}{1 + \sigma_m^2 \sum_{i=1}^N \frac{Q_i^2}{\sigma_{e_i}^2}}$$

- The particular point is selected as cut off point after which Ci (Cumulative value) starts declining.
- The securities having value of Ci more or equal to cut off point were nominated in the optimal portfolio.

Construction of Optimal Portfolio

Portfolios are formed by combining various securities such as securities, bonds and money market instruments. The above investment strategies combine with each other to create a better portfolio to achieve maximum returns with minimal risk. Diversification reduces risk by investing in different sectors [7]. This guarantees the expected return on the portfolio. An investor can actively choose to diversify to balance securities with the goal of generating maximum returns.

The proportion of funds that as to be invested each nominated stock are found by using the formula

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

Percentage of investment in each stock

$$Z_i = \frac{\beta_i (R_i - R_f) - C^*}{\beta_i}$$

Objectives of the Study

- To get an understanding into Sharpe's single index model.
- To build an optimum portfolio empirically using the Sharpe's single index model.
- To find out return and risk of the optimum portfolio created by using Sharpe's single index model.

RESEARCH METHODOLOGY

Statement of Problem

The study is based on building an optimum portfolio by using Sharpe's single index with reference to the stock selected from nifty. The main objective of every investor is to maximize the return with lowest risk. Before investing into stock market investor should have appropriate information about the market. In order to lessen the risk, the investor should differentiate the securities into different portfolio to earn maximum return. Sharpe's Single index model helps in building an optimum portfolio for the investors on the basis of the risk and return analysis.

Need of the Study

Every investor experiences dilemma for selecting various stocks for his portfolio. Investor will face problem while determining the percentage of investment to be made in each security. Sharpe's single

index may be used to build an optimum portfolio to support investor to get out of confusion. This study assists the investor in discovering a portfolio that best suits his requirements. By adopting this model an individual can build an optimal portfolio with supreme return for lowest risk [8].

SCOPE OF THE STUDY

A study on Sharpe's single index model is constructed on 5 years data collected from the Yahoo Finance website starting from 2016–2020 [9]. The study based on 3 companies which are selected on the basis of higher capitalization from 6 sectors which are listed in Nifty that are Oil and gas, mining, Chemicals, Pharmaceutical, IT and Bank are selected on the basis of primary, secondary and service sector basis. Beta, standard deviation, return, excess return to beta ratio, cut off point are taken for study.

Research Methodology Secondary Data

For the analysis, secondary data was gathered from the NSE website, journals, and papers. The secondary source data comes from official websites for stock prices and market indices, as well as some Internet resources.

Tools

- Construction of optimal portfolio using Sharpe's single index model.

Limitations

- The study is based on the historical data available in the website. The accuracy of the study depends on the accuracy of the data available on the website.
- The data available is massive for analysis.
- The project size is limited so for the study only included oil and gas, mining, chemical, pharmaceuticals, IT and Bank [10].

DATA ANALYSIS

Interpretation

The investor can expect the expected return from the market is 0.93. From the above data the standard deviation found to be 5.46, and hence the return may fluctuate from +6.39 to -4.53. In a better case an investor can expect a return of 6.39 and in worst case a loss of -4.53. The 5.46 standard deviation is measure of the volume of variation of asset value. A low standard deviation means that utmost of the numbers are close to the average on the other hand numbers are more spread out (Table 1).

Table 1. Showing monthly Returns of Nifty

Date	OPEN	CLOSE	X	$(X - \bar{X})$	$(X - \bar{X})^2$
1/1/2016	7924.55	7563.55	-4.56	-5.49	30.09
2/1/2016	7589.50	6987.05	-7.94	-8.87	78.64
3/1/2016	7038.25	7738.40	9.95	9.02	81.32
4/1/2016	7718.05	7849.80	1.71	0.78	0.60
5/1/2016	7822.70	8160.10	4.31	3.38	11.45
6/1/2016	8179.20	8287.75	1.33	0.40	0.16
7/1/2016	8313.05	8638.50	3.91	2.99	8.91
8/1/2016	8654.30	8786.20	1.52	0.59	0.35
9/1/2016	8793.60	8611.15	-2.07	-3.00	9.03
10/1/2016	8666.15	8638.00	-0.32	-1.25	1.57
11/1/2016	8653.15	8224.50	-4.95	-5.88	34.62
12/1/2016	8244.00	8185.80	-0.71	-1.64	2.68

Date	OPEN	CLOSE	X	$(X - \bar{X})$	$(X - \bar{X})^2$
1/1/2017	8210.10	8561.30	4.28	3.35	11.21
2/1/2017	8570.35	8879.60	3.61	2.68	7.17
3/1/2017	8904.40	9173.75	3.02	2.10	4.39
4/1/2017	9220.60	9304.05	0.91	-0.02	0.00
5/1/2017	9339.85	9621.25	3.01	2.08	4.34
6/1/2017	9603.55	9520.90	-0.86	-1.79	3.21
7/1/2017	9587.95	10077.10	5.10	4.17	17.40
8/1/2017	10101.05	9917.90	-1.81	-2.74	7.52
9/1/2017	9937.65	9788.60	-1.50	-2.43	5.90
10/1/2017	9893.30	10335.30	4.47	3.54	12.52
11/1/2017	10390.35	10226.55	-1.58	-2.51	6.28
12/1/2017	10263.70	10530.70	2.60	1.67	2.79
1/1/2018	10477.55	11027.70	5.25	4.32	18.67
2/1/2018	11044.55	10492.85	-5.00	-5.93	35.11
3/1/2018	10479.95	10113.70	-3.49	-4.42	19.58
4/1/2018	10151.65	10739.35	5.79	4.86	23.61
5/1/2018	10783.85	10736.15	-0.44	-1.37	1.88
6/1/2018	10738.45	10714.30	-0.22	-1.15	1.33
7/1/2018	10732.35	11356.50	5.82	4.89	23.87
8/1/2018	11359.80	11680.50	2.82	1.89	3.58
9/1/2018	11751.80	10930.45	-6.99	-7.92	62.71
10/1/2018	10930.90	10386.60	-4.98	-5.91	34.92
11/1/2018	10441.70	10876.75	4.17	3.24	10.48
12/1/2018	10930.70	10862.55	-0.62	-1.55	2.41
1/1/2019	10868.85	10830.95	-0.35	-1.28	1.63
2/1/2019	10851.35	10792.50	-0.54	-1.47	2.17
3/1/2019	10842.65	11623.90	7.21	6.28	39.38
4/1/2019	11665.20	11748.15	0.71	-0.22	0.05
5/1/2019	11725.55	11922.80	1.68	0.75	0.57
6/1/2019	11953.75	11788.85	-1.38	-2.31	5.33
7/1/2019	11839.90	11118.00	-6.10	-7.03	49.38
8/1/2019	11060.20	11023.25	-0.33	-1.26	1.60
9/1/2019	10960.95	11474.45	4.68	3.75	14.10
10/1/2019	11515.40	11877.45	3.14	2.21	4.90
11/1/2019	11886.60	12056.05	1.43	0.50	0.25
12/1/2019	12137.05	12168.45	0.26	-0.67	0.45
1/1/2020	12202.15	11962.10	-1.97	-2.90	8.39
2/1/2020	11627.45	11201.75	-3.66	-4.59	21.08
3/1/2020	11387.35	8597.75	-24.50	-25.43	646.54
4/1/2020	8584.10	9859.90	14.86	13.93	194.12
5/1/2020	9533.50	9580.30	0.49	-0.44	0.19
6/1/2020	9726.85	10302.10	5.91	4.98	24.84
7/1/2020	10323.80	11073.45	7.26	6.33	40.09
8/1/2020	11057.55	11387.50	2.98	2.05	4.22
9/1/2020	11464.30	11247.55	-1.89	-2.82	7.96
10/1/2020	11364.45	11642.40	2.45	1.52	2.30
11/1/2020	11697.35	12968.95	10.87	9.94	98.82
12/1/2020	13062.20	13981.75	7.04	6.11	37.33
<i>Rm</i>	0.93	σm^2	29.77	σm	5.46

Source: NSE Website

Source: Author's Calculations

Interpretation

The Expected return, Variance, Standard Deviation and Beta of all Selected stocks will be shown in above data. When choosing one single data for example, Bharat Petroleum Corporation; The expected return an investor can expect from Bharat Petroleum Corporation is 0.71. From the above data the standard deviation found to be 10.54, and hence the return may vary from +11.25 to -9.83. In a better case an investor can expect a return of 11.25 and in a worst case a loss of 9.83. The beta calculates the change in price of stock in response to the change in market price. When the value of beta exceeds 1, it means that the price of the security is more volatile than the market, whereas when the value of beta falls below 1, it means that the price of the security is less volatile than the market (Table 2).

Table 2. Showing Mean Return, Variance, Standard deviation and Beta of Selected Stocks

S.N.	Selected Stocks	Mean Returns	Variance	Standard Deviation	Beta
1	Bharat Petroleum Corporation	0.71	111.17	10.54	1.24
2	Gujarat Gas Ltd	1.84	105.16	10.25	1.04
3	Petro net LNG Ltd	0.54	47.70	6.91	0.77
4	Hindustan Zinc Ltd	0.22	55.24	7.43	0.68
5	JSW Steel	1.17	140.41	11.85	1.57
6	TATA Steel Ltd	0.66	125.19	11.19	1.46
7	Pidilite Industries Ltd	1.33	46.17	6.79	0.54
8	Aarti Industries Ltd	1.74	101.15	10.06	1.15
9	Vinati Organics Ltd	3.39	156.85	12.52	0.70
10	Divi's Laboratories Ltd	1.25	112.36	10.60	0.46
11	Cadila Healthcare Ltd	0.54	61.30	7.83	0.52
12	Aurobindo Pharma Ltd	0.52	131.44	11.46	1.10
13	Tata Consultancy Services	1.51	48.75	6.98	0.68
14	Infosys	1.50	55.83	7.47	0.59
15	Wipro	0.85	52.27	7.23	0.47
16	HDFC Bank	1.70	48.19	6.94	1.07
17	ICICI Bank	1.61	93.89	9.69	1.42
18	State Bank of India	0.59	121.66	11.03	1.47

Source: Compiled by Author

Interpretation

The Figure shown the average return of 18 companies for which the optimal portfolio was created using Sharpe's single index model and the chosen Nifty stocks. From the Figure 1 it is clear that Vinati Organics Ltd is yielding better return of 3.39 when compared to other selected stocks and on the other side Hindustan Zinc Ltd is earning minimum return of 0.22 (Table 3).

Table 3. Showing the Mean Returns of Selected Stocks

Selected Stocks	Mean Return	Selected Stocks	Mean Return
Bharat Petroleum Corporation	0.71	Divi's Laboratories Ltd	1.25
Gujarat Gas Ltd	1.84	Cadila Healthcare Ltd	0.54
Petro net LNG Ltd	0.54	Aurobindo Pharma Ltd	0.52
Hindustan Zinc Ltd	0.22	Tata Consultancy services	1.51
JSW Steel	1.17	Infosys Ltd	1.5
Tata Steel Ltd	0.66	Wipro Ltd	0.85
Pidilite Industry Ltd	1.33	HDFC Bank	1.7
Aarti Industries Ltd	1.74	ICICI Bank	1.61
Vinati Organics Ltd	3.39	State Bank of India	0.59

Source: Compiled by Author

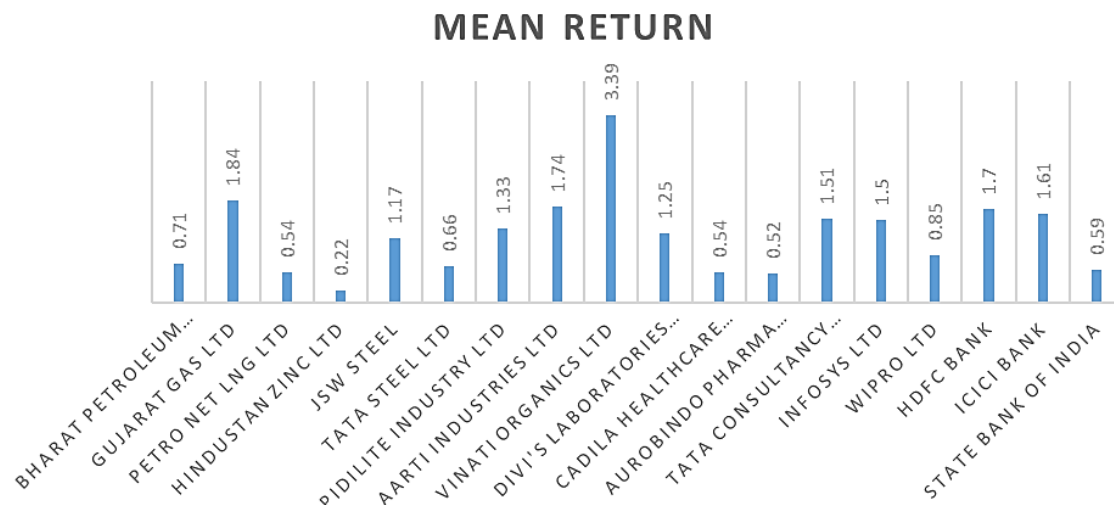


Figure 1. Showing Mean Return of Selected Stocks.

Interpretation

Figure 2 characterizes that beta value of 18 companies stock return. Beta calculate the stock's volatility, the mark to which its value varies in relation to the total stock market. From the Figure it is clear that State Bank of India has high beta value of 1.47 it indicates high volatility in the market and also, we can see Divi's laboratories has least beta value of 0.46 this indicates beta value is less than 1 have lower volatility in the market (Table 4).

Table 4. Showing Beta Value of Selected Stocks

Selected Stocks	Beta	Selected Stocks	Beta
Bharat Petroleum Corporation	1.24	Divi's Laboratories Ltd	0.46
Gujarat Gas Ltd	1.04	Cadila Healthcare Ltd	0.52
Petro net LNG Ltd	0.77	Aurobindo Pharma Ltd	1.1
Hindustan Zinc Ltd	0.77	Tata Consultancy Services	0.68
JSW Steel	0.68	Infosys Ltd	0.59
Tata Steel Ltd	1.46	Wipro Ltd	0.47
Pidilite Industry Ltd	0.54	HDFC Bank	1.07
Aarti Industries Ltd	1.15	ICICI Bank	1.42
Vinati Organics Ltd	0.7	State Bank of India	1.47

Source: Compiled by Author

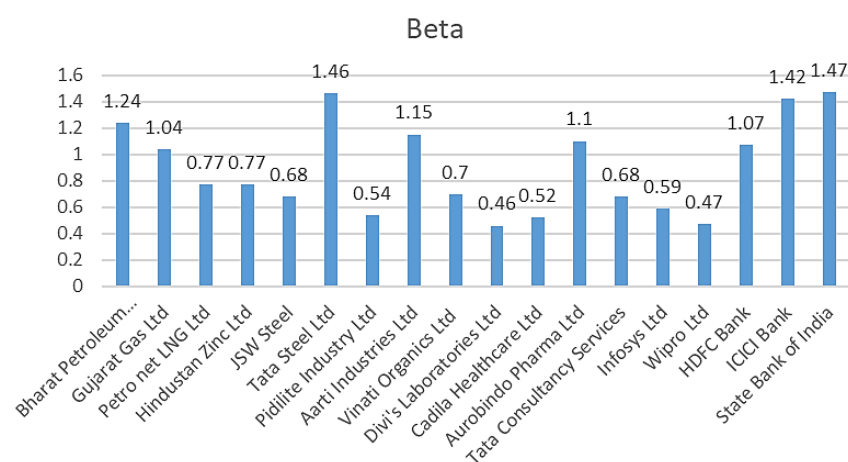


Figure 2. Showing Beta Value of Selected Stocks.

$$\text{Systematic Risk} = \beta^2 * \sigma m^2$$

$$\text{Unsystematic Risk } (ei^2) = \sigma i^2 - \text{Systematic Risk}$$

$$\text{Total Risk} = \beta i^2 * \sigma m^2 + ei^2$$

Interpretation

The companies stated in the table shows the selected stocks and their respective systematic and unsystematic risk values are calculated. When issuing securities, particular risk arise that affect the firm. The Unsystematic risk is controllable. The residual value is high in Vinati Organics Ltd that is 142.26. The systematic risk is uncontrollable due to some factors. The highest value of systematic risk is found in JSW Steel that is 73.23 and Divi's Laboratories Ltd has the lowest that is 6.25 (Table 5).

Table 5. Showing Systematic and Unsystematic Risk

Selected Stocks	σi^2	βi^2	σm^2	$\beta i^2 * \sigma m^2$	σe^2
Bharat Petroleum Corporation	111.17	1.54	29.77	45.85	65.32
Gujarat Gas Ltd	105.16	1.08	29.77	32.15	73.01
Petro net LNG Ltd	47.7	0.59	29.77	17.56	30.14
Hindustan Zinc Ltd	55.24	0.46	29.77	13.69	41.55
JSW Steel	140.41	2.46	29.77	73.23	67.18
Tata Steel Ltd	125.19	2.13	29.77	63.41	61.78
Pidilite Industry Ltd	46.17	0.29	29.77	8.63	37.54
Aarti Industries Ltd	101.15	1.32	29.77	39.30	61.85
Vinati Organics Ltd	156.85	0.49	29.77	14.59	142.26
Divi's Laboratories Ltd	112.36	0.21	29.77	6.25	106.11
Cadila Healthcare Ltd	61.3	0.27	29.77	8.04	53.26
Aurobindo Pharma Ltd	131.44	1.21	29.77	36.02	95.42
Tata Consultancy Services	48.75	0.46	29.77	13.69	35.06
Infosys Ltd	55.83	0.35	29.77	10.42	45.41
Wipro Ltd	52.27	0.22	29.77	6.55	45.72
HDFC Bank	48.19	1.14	29.77	33.94	14.25
ICICI Bank	93.89	2.02	29.77	60.14	33.75
State Bank of India	121.66	2.16	29.77	64.30	57.36

Source: Compiled by authors by taking various values

Interpretation

The table describe excess return and excess return to beta ratio. The difference between risk-free rate of interest and expected return on stock is said to be an excess return. In the above calculation risk-free rate of interest is taken from 365day Treasury bill is found to be 3.84% p. a where in 0.32 will be the Risk-free rate of interest monthly. The excess return to beta ratio is used to determine the additional return on a stock for each unit of systematic risk. Vinati Organics Ltd has high excess return to beta ratio that is 4.39. Hindustan Zinc Ltd has the lowest return that is -0.15. This ratio shows the linking between reward from a company stock and potential risk. The selected stocks are ranked on the basis of excess return to beta ratio which reveals that Vinati Organics ranked first where in Hindustan Zinc Ltd is last. (Table 6)

Table 6. Showing Stocks Ranked based on Excess Return of Beta Ratio

Selected Stocks	Ri	Rf	$Ri - Rf$	βi	$Ri - Rf / \beta i$	Rank
Bharat Petroleum Corporation	0.71	0.32	0.39	1.24	0.31	13
Gujarat Gas Ltd	1.84	0.32	1.52	1.04	1.46	6
Petro net LNG Ltd	0.536	0.32	0.216	0.77	0.28	14
Hindustan Zinc Ltd	0.217	0.32	-0.103	0.68	-0.15	18

Selected Stocks	R_i	R_f	$R_i - R_f$	β_i	$R_i - R_f/\beta_i$	Rank
JSW Steel	1.173	0.32	0.853	1.57	0.54	11
Tata Steel Ltd	0.661	0.32	0.341	1.46	0.23	15
Pidilite Industry Ltd	1.325	0.32	1.005	0.54	1.86	4
Aarti Industries Ltd	1.739	0.32	1.419	1.15	1.23	8
Vinati Organics Ltd	3.394	0.32	3.074	0.7	4.39	1
Divi's Laboratories Ltd	1.251	0.32	0.931	0.46	2.02	2
Cadila Healthcare Ltd	0.536	0.32	0.216	0.52	0.42	12
Aurobindo Pharma Ltd	0.521	0.32	0.201	1.1	0.18	17
Tata Consultancy Services	1.505	0.32	1.185	0.68	1.74	5
Infosys Ltd	1.495	0.32	1.175	0.59	1.99	3
Wipro Ltd	0.849	0.32	0.529	0.47	1.13	9
HDFC Bank	1.702	0.32	1.382	1.07	1.29	7
ICICI Bank	1.614	0.32	1.294	1.42	0.91	10
State Bank of India	0.593	0.32	0.273	1.47	0.19	16

Source: Compiled by authors by taking various values

Interpretation

The table characterizes the cut off value of selected stocks in Nifty. The square value of beta divided by the unsystematic risk and its cumulative value is calculated to find out Cut off value. The C_i value is goes on increasing till certain level and thereafter starts diminishing. The value of 1.2183 is therefore regarded as the cutoff point. For the purpose of building an ideal portfolio, the stocks that were obtained after the cut-off point will not be considered (Table 7).

Table 7. Showing Cut off value of Selected Stocks

Selected Stocks	$(R_i - R_f)\beta_i/\sigma^2$	$\sum(R_i - R_f)\beta_i/\sigma^2$	β_i^2/σ^2	$\sum\beta_i^2/\sigma^2$	C_i
Vinati Organics Ltd	0.0151	0.0151	0.0034	0.0034	0.4082
Divi's Laboratories Ltd	0.0040	0.0191	0.0020	0.0054	0.4898
Infosys Ltd	0.0153	0.0344	0.0077	0.0131	0.7368
Pidilite Industry Ltd	0.0145	0.0489	0.0077	0.0209	0.8974
Tata Consultancy Services	0.0230	0.0719	0.0131	0.0340	1.0637
Gujarat Gas Ltd	0.0217	0.0936	0.0148	0.0488	1.1360
HDFC Bank	0.1038	0.1974	0.0800	0.1288	1.2156
Aarti Industries Ltd	0.0264	0.2238	0.0213	0.1501	C*1.2183
Wipro Ltd	0.0054	0.2292	0.0048	0.1549	1.2160
ICICI Bank	0.0544	0.2836	0.0599	0.2148	1.1417
JSW Steel	0.0199	0.3035	0.0366	0.2514	1.0649
Cadila Healthcare Ltd	0.0021	0.3056	0.0051	0.2565	1.0535
Bharat Petroleum Corporation	0.0074	0.3130	0.0236	0.2800	0.9981
Petro net LNG Ltd	0.0055	0.3185	0.0196	0.2996	0.9559
Tata Steel Ltd	0.0081	0.3266	0.0345	0.3341	0.8882
State Bank of India	0.0070	0.3336	0.0377	0.3717	0.8231
Aurobindo Pharma Ltd	0.0023	0.3359	0.0127	0.3844	0.8036
Hindustan Zinc Ltd	-0.0017	0.3376	0.0111	0.3955	0.7868

Source: Compiled by authors by taking various values

Interpretation

By using Sharpe's single index model on the 18 companies, 8 companies have been chosen for the best portfolio creation. Once the investment concerns are identified, it is crucial to consider the investment percentage to be placed in each security. For the optimal portfolio securities are ranked from 1 to 8. Figure 3 shows the percentage of investment to be made by an investor in order to earn

extreme returns. The Figure represents that 27% of investment is to be made in Vinati Organics Ltd followed by Divi's Laboratories Ltd 13%, Infosys Ltd and Pidilite Industry Ltd 12% for each, Tata Consultancy Ltd 11%, Gujarat Gas Ltd 9%, HDFC Bank and Aarti Industries Ltd 8% each (Table 8).

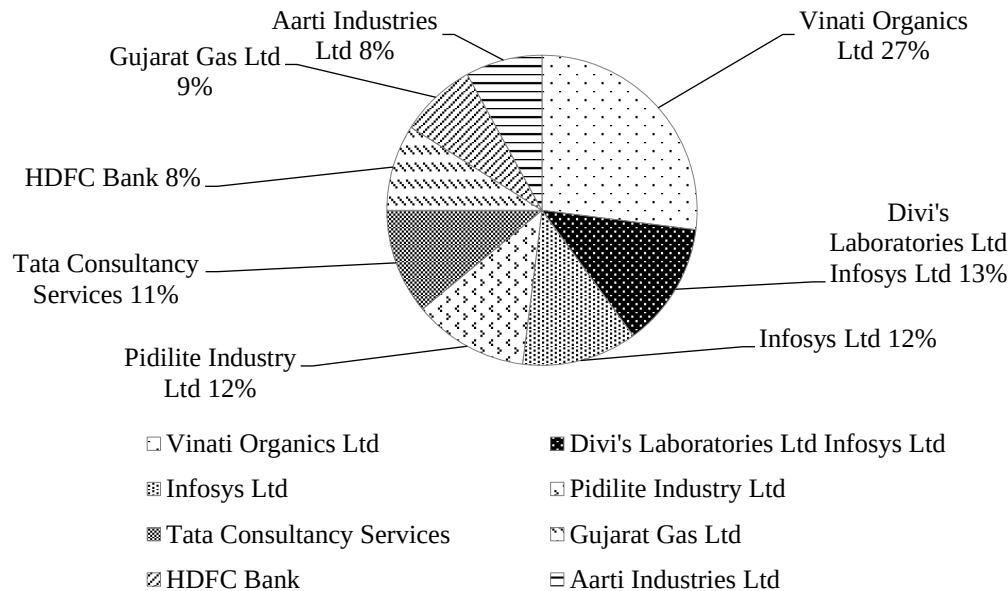


Figure 3. Showing Proportion of selected stocks for the construction of optimum portfolio.

Table 8. Showing Proportion of Selected stocks for the creation of optimal portfolio

Selected Stocks	$Q_i/\sigma e^2 i$	$R_i - R_f/Q_i - c^*$	Z_i	X_i
Vinati Organics Ltd	0.0049	3.1717	5.3483	0.2747
Divi's Laboratories Ltd	0.0043	0.8017	2.4610	0.1264
Infosys Ltd	0.0130	0.7717	2.4244	0.1245
Pidilite Industry Ltd	0.0144	0.6417	2.2660	0.1164
Tata Consultancy Services	0.0194	0.5217	2.1198	0.1089
Gujarat Gas Ltd	0.0142	0.2417	1.7787	0.0914
HDFC Bank	0.0751	0.0717	1.5716	0.0807
Aarti Industries Ltd	0.0186	0.0117	1.4985	0.0770
			19.4684	1.0000

Source: Author's Calculations

Interpretation:

The optimal portfolio companies of 8 stocks. An investor should invest in diversified portfolio instead of investing in individual security because individual security involves high risk. In the above calculation with reasonable portfolio risk that is 5.54 an investor can earn agreed portfolio return that is 2.02 (Table 9).

Table 9. Showing Portfolio Risk and Risk

Selected Stocks	R_p	σ_p
Vinati Organics Ltd	2.02	5.54
Divi's Laboratories Ltd		
Infosys Ltd		
Pidilite Industry Ltd		
Tata Consultancy Services		

Gujarat Gas Ltd		
HDFC Bank		
Aarti Industries Ltd		

Source: Author's Calculations

MAJOR FINDINGS

Findings

- Vinati Organics Ltd has the maximum return of 3.39 and the Hindustan Zinc Ltd has the minimum return of 0.22. If a stakeholder is willing to make high return, he should study the risks involved in stocks. If a stock has a high return, the risk associated in the stock should be high as well, and if the return is lower, the risk associated in the stock should be lower as well.
- The standard deviation of Vinati Organics Ltd highest is 12.52 and the lowest is Pidilite Industry Ltd that is 6.79.
- JSW Steel has maximum beta value of 1.57 which means it's extremely unstable. Other than JSW Steel 8 companies have beta value more than 1 this indicates these are the companies more volatile but they are less volatile than JSW Steel and remaining 9 companies have beta less than 1 this tells they are less volatile.
- Only 8 stocks are capable of being included in the construction of an optimal portfolio based on the cut-off value.
- The proportion of investments to be made is 27% in Vinati Organics Ltd followed by Divi's Laboratories Ltd 13%, Infosys and Pidilite Industry Ltd 12% each, Tata Consultancy Services 11%, Gujarat Gas Ltd 8% and HDFC Bank is 8%.

Suggestions

- Investors should monitor the performance of securities on a daily basis. It will help them to take appropriate decisions on capital investment.
- Vinati Organics Ltd is suggested to the investor because it earns a higher rate of return and has a good market performance, whereas Hindustan Zinc Ltd is not recommended because it earns a low rate of return and has a poor market performance.
- The investor should monitor his portfolio investment by determining market conditions in order to acquire the best possible return in the market.
- As the individual risk of Vinati Organics Ltd is high thus it is not better option to invest on this security and the investor who wish to take less risk should select HDFC Bank for investment option.
- Based on the analysis return yielding on portfolio is 2.02 with the portfolio risk of 5.54. it is right for the investor to invest in this portfolio which will produce high return with sensible risk.
- Vinati Organics Ltd, Divi's Laboratories Ltd, Infosys Ltd, Pidilite Industry Ltd, Tata Consultancy Service, Gujarat Gas Ltd, HDFC Bank, and Aarti Industries Ltd are companies with a high cut-off value, investors can invest on these stocks.
- Rather than investing in individual securities, investors should select a portfolio of securities consisting of 8 stocks from various sectors. It assists the investor to manage the risk.

CONCLUSION

Investment plays an important role for individuals to invest their savings and achieve maximum returns. The investment sector is at high risk as the market is unstable. Investors' knowledge of the equities they own may not be complete. Investors invest in stocks based on their future potential. Therefore, Sharpe's model helps investors choose the best portfolio for investment. The banking sector is critical in today's economy because it aids in the creation of fresh capital as well as the development process. Chemical manufacturing is connected to India's economic growth, which is

predicted to enhance demand for oil and gas, making the sector more investment-friendly. Medical Industries influence more in the expansion of Indian economy, IT sector also developing eventually, this will lead to technical advancement in the society. This model is advised to develop a portfolio as it is reliable compared to other methods. Risk is variable, as are the returns to an investor who chooses to invest in a portfolio based on this research.

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