

BUILDING AN EFFICIENT PORTFOLIO USING SHARPE'S SINGLE INDEX MODEL (AN EMPIRICAL STUDY WITH REFERENCE TO BSE - 30)

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ABSTRACT

Investors increase their wealth by diversifying their portfolio and investing their savings across a range of different assets. Since stocks have produced larger returns than any other asset over a decade, they play a significant role in portfolios. But in order to ensure a healthy growth of the portfolio, it is essential to carefully assess and analyse the performance of the stocks before considering investing in any of them. Every investment a person makes includes a risk component. If the risk in the portfolio is not adequately handled, an investor may lose more money than they may possibly gain. Building a stable portfolio requires effective risk management. Any stock that is being thought about for inclusion in the portfolio should be examined. The stock's risk as well as the likelihood of suffering a loss greater than the stated risk should be carefully considered. As it increases the wealth of both individuals and institutions, the stock market is essential to the nation's economy. But if investors don't invest their money properly, it could occasionally wipe out their fortune. One of the finest strategies for managing money is to research stocks, their volatility, and their past prices in order to forecast their future values. The present study attempts to evaluate the performance of the selected public sector companies and build a portfolio using Sharpe's Single Index model for five year period starting from 2018 and ending at the end of 2022.

Keywords: *Volatility, portfolio, diversifying, beta, standard deviation, cut-off point.*

INTRODUCTION

An investor's wealth can be increased and maintained in large part by creating an effective portfolio. An investor constantly looks into potential investment opportunities, and numerous criteria are taken into account when building a portfolio. This may be the case, in particular, if there are many investments. When constructing a portfolio, one must constantly take risk into consideration. The Indian stock markets have made great accomplishments in recent years and have been consistently expanding and moving forward at a breakneck speed. The stocks are evaluated based on their historical performance, but to truly understand which stocks are performing better, we must evaluate them in relation to the market using some efficient tactics that will yield greater returns with the least amount of risk. Risk management is crucial to the creation and maintenance of investors' wealth.

An investor is constantly interested in learning about the potential risk and potential return of a company. When constructing a portfolio based on the risk involved with the chosen equities, a number of criteria are taken into account. Risk has always been a significant factor in portfolio construction decision-making.

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The main goal of diversification is not to increase or decrease the returns, but to minimize the overall risk and get the best possible return with your risk profile. An efficient portfolio is the one which provides the

best expected returns on a given level of risk, or alternatively, the minimum risk for a given expected return. An effective strategy for building an effective portfolio is by using the Sharpe's Single Index model.

SHARPE'S SINGLE INDEX MODEL

According to Sharpe's Single Index model, the stocks of the companies are compared with the indices and predicts the price movement which influences in constructing of an effective portfolio. Constructing a portfolio using Sharpe's Single Index model consists of 5 steps

Step 01 : Calculating excess return to Beta

$$= \frac{(R_i - R_f)}{\beta}$$

Here, R_i represents the returns of the individual stock and R_f is the risk free returns. β represents the Beta of the individual stock.

Step 02 : Ranking

After calculating the excess return to Beta, the stocks are being ranked according to their returns. Stock which shows highest excess return to beta is ranked first whereas the stock which shows the lowest returns to beta is ranked the last.

Step 03 : Cut-off point

The cut-off point is the point where the combination of the top ranked stocks gives the highest possible returns. The cut-off point is represented as follows :

$$C = \frac{\sigma_m^2 \sum \frac{[R_i - R_f] \beta_i}{\sigma_e^2}}{1 + \left[\sigma_m^2 \sum \frac{\beta_i^2}{\sigma_e^2} \right]}$$

Here, R_i represents the returns of the individual stock and R_f is the risk free returns. β_i represents the Beta of the individual stock.

σ_m^2 represents the market variance.

σ_e^2 represents the variance of the individual stock.

Step 04 : Selecting the stocks in the portfolio

Once we determine the cut-off point, the next step is to select the stocks in the portfolio. The top ranked stocks from the research are taken into construction of the portfolio whose combination yields the highest returns.

Step 05 : Weightage of investment

The proportion of investment in every stock differs due to the difference between the excess returns to beta of those individual stocks. The weights or the percentage of the investment in an individual stock is calculated as follows :

$$W = \left[\text{Excess return to Beta} - \text{Cutoff point} \right] \frac{\beta_i}{\sigma_e^2}$$

β_i represents the Beta of the individual stock.

σ_e^2 represents the variance of the individual stock.

PROBLEM STATEMENT

An efficient portfolio is crucial in controlling the risk and rewards that a sane investor demands. The risk and return that a sector offers relative to market risk and return is what is used to evaluate various companies from various industries. A portfolio must include a variety of equities that will significantly affect how well the investor's portfolio performs in order to control risk and returns. The management of the portfolio is significantly influenced by effective risk management. A stock's risk determines whether it should be kept in the portfolio or otherwise removed. Before making an investment in a stock, investors evaluate the risk of the stock. Since the level of risk varies from person to person, some investors prefer to take big risks. However, this risk may cause their wealth to disappear in a certain amount of time, and if measures are not taken, the investor may lose all of the wealth they may have built up. Therefore, risk management is crucial in limiting the risk up to a particular point. A sincere attempt is made in this study to analyse the performance of stocks of the different sectors and build a portfolio from the 30 companies representing BSE using Sharpe's Single Index model.

OBJECTIVES

- To know the risk and return of each stock in BSE.
- To determine the expected return of the portfolio based upon Sharpe's single index model
- To construct portfolio using Sharpe's single index model

SCOPE

The stock of the sample were taken only from BSE Sensex and the returns and the risks were calculated for a period of five year. Portfolio was made by selecting the stocks from the 30 companies representing the BSE Sensex.

METHODOLOGY

A sample of 30 stocks of public sector companies from the Bombay Stock Exchange (BSE) Sensex has been considered for the study.

The data for the study is purely a secondary data collected on the basis of historical prices of the selected stocks from the BSE website for a time period of 5 year for each stock.

The Sharpe's Single Index model approach is taken into consideration for construction of a portfolio out of the selected stocks.

ANALYSIS

Table no. 1 showing rankings of the selected stocks

STOCK	Ri(Avg ret)	Rf	Ri - Rf	Beta	(Ri-Rf)/B	Ranking	B ²	Variance	USR
Maruti	-2.18%	7.32 %	-9.50%	-0.01	9.49	1	0.000100152	1.10735E-05	0.01
NTPC	4.07%	7.32 %	-3.25%	-0.07	0.45	2	0.005219902	3.63579E-05	0.07
Bajaj finance	32.19%	7.32 %	24.88 %	1.08	0.23	3	1.168043459	4.51397E-05	-1.08
Reliance	23.53%	7.32 %	16.22 %	0.74	0.22	4	0.5523077	8.71264E-06	-0.74
ICICI Bank	24.45%	7.32 %	17.14 %	0.95	0.18	5	0.905623945	2.54938E-05	-0.95
TCS	21.53%	7.32 %	14.22 %	1.20	0.12	6	1.435497358	3.04129E-05	-1.20
Asian Paints	23.43%	7.32 %	16.11 %	1.64	0.10	7	2.69025325	3.23518E-05	-1.64
SBI	17.37%	7.32 %	10.06 %	1.48	0.07	8	2.177485025	6.78661E-05	-1.48
Infosys	27.70%	7.32 %	20.39 %	3.22	0.06	9	10.39393083	7.80718E-05	-3.22
Titan	25.57%	7.32 %	18.25 %	2.89	0.06	10	8.373268327	3.3262E-05	-2.89
IndusInd Bank	-2.46%	7.32 %	-9.77%	-1.62	0.06	11	2.621021663	4.73781E-05	1.62
Bajaj Finserv	28.02%	7.32 %	20.70 %	3.49	0.06	12	12.17527036	9.19708E-05	-3.49

LT	11.91%	7.32 %	4.59%	0.97	0.05	13	0.938613955	3.02687E-05	-0.97
HCL Tech	22.15%	7.32 %	14.84 %	3.41	0.04	14	11.61347885	6.62112E-05	-3.41
Tech Mahindra	23.85%	7.32 %	16.53 %	4.25	0.04	15	18.06459487	0.000145749	-4.25
Bharti Airtel	16.03%	7.32 %	8.72%	2.31	0.04	16	5.32099709	8.09742E-05	-2.31
Sun Pharma	14.00%	7.32 %	6.68%	2.32	0.03	17	5.399438154	4.79831E-05	-2.32
Tata Steel	15.73%	7.32 %	8.42%	4.34	0.02	18	18.84056352	9.29085E-05	-4.34
Ultratech	11.79%	7.32 %	4.47%	3.12	0.01	19	9.763801734	3.46833E-05	-3.12
ITC	6.99%	7.32 %	-0.33%	-2.23	0.00	20	4.956234154	4.79985E-05	2.23
Power grid	3.70%	7.32 %	-3.62%	2.28	-0.02	21	5.210678732	9.43242E-05	-2.28
Axis Bank	11.79%	7.32 %	4.47%	-1.27	-0.04	22	1.622502895	2.48058E-05	0.55
ONGC	-2.08%	7.32 %	-9.39%	2.06	-0.05	23	4.259968504	6.57711E-05	-2.06
M & M	15.21%	7.32 %	7.90%	-1.30	-0.06	24	1.685986948	6.40515E-05	1.30
HUL	14.36%	7.32 %	7.05%	-1.01	-0.07	25	1.019279841	1.3824E-05	1.01
Hdfc Ltd	9.11%	7.32 %	1.79%	-0.25	-0.07	26	0.060135025	5.85594E-06	0.25
Kotak Mahindra	13.60%	7.32 %	6.29%	-0.54	-0.12	27	0.289750693	2.68434E-05	0.54
Hdfc Bank	11.59%	7.32 %	4.28%	-0.25	-0.17	28	0.061573963	2.60252E-06	0.25
Bajaj Auto	2.58%	7.32 %	-4.73%	0.13	-0.37	29	0.016818972	1.33055E-05	-0.13
Nestle	21.19%	7.32 %	13.87 %	-0.24	-0.59	30	0.056031355	2.04895E-05	0.24

Average of last 5 years	
Market Return	12.37%
Market SD	0.001617754
Market Variance	3.22934E-06

By giving ranks to various stocks, an individual is able to determine the stocks bestowing higher returns with slighter risk and also assist in discovering that which stock is getting influenced by company's internal matters.

From the above mentioned table, it can be figured out that stocks of Maruti Suzuki India Ltd. stood at the highest rank in Jaxta position to rest of the selected stocks. This describes that stocks of Maruti are yielding negative returns but

have high volatility as they are more dominated and influenced by market risk i.e Beta which stood at a negative of 0.01.

The remaining stocks are also yielding significant returns but are high volatile due to more impact of unsystematic risk which in turn makes the stocks risky in nature.

Table no. 2 showing Cut-off points of selected stocks

STOCK					((R _i -R _f)B _i)/USR		B _i ² /USR		Cut-off point
	R _i - R _f	Beta	Beta ²	USR	B	C	B	C	
Maruti	-9.50%	-0.01	0.0001	0.01	0.09	0.09	0.01	0.01	3.0632E-07
NTPC	-3.25%	-0.07	0.0052	0.07	0.03	0.13	0.07	0.08	4.11143E-07
Bajaj finance	24.88%	1.08	1.168	-1.08	-0.25	-0.12	-1.08	-1.00	-3.92268E-07
Reliance	16.22%	0.74	0.5523	-0.74	-0.16	-0.28	-0.74	-1.74	-9.15996E-07
ICICI Bank	17.14%	0.95	0.9056	-0.95	-0.17	-0.46	-0.95	-2.69	-1.46951E-06
TCS	14.22%	1.2	1.4355	-1.20	-0.14	-0.60	-1.20	-3.89	-1.92872E-06
Asian Paints	16.11%	1.64	2.6903	-1.64	-0.16	-0.76	-1.64	-5.53	-2.44908E-06
SBI	10.06%	1.48	2.1775	-1.48	-0.10	-0.86	-1.48	-7.01	-2.77395E-06
Infosys	20.39%	3.22	10.394	-3.22	-0.20	-1.06	-3.22	-10.23	-3.43237E-06
Titan	18.25%	2.89	8.3733	-2.89	-0.18	-1.25	-2.89	-13.13	-4.02194E-06
IndusInd Bank	-9.77%	-1.62	2.621	1.62	0.10	-1.15	1.62	-11.51	-3.70634E-06
Bajaj Finserv	20.70%	3.49	12.175	-3.49	-0.21	-1.35	-3.49	-15.00	-4.37494E-06
LT	4.59%	0.97	0.9386	-0.97	-0.05	-1.40	-0.97	-15.96	-4.52327E-06
HCL Tech	14.84%	3.41	11.613	-3.41	-0.15	-1.55	-3.41	-19.37	-5.00257E-06
Tech Mahindra	16.53%	4.25	18.065	-4.25	-0.17	-1.71	-4.25	-23.62	-5.53662E-06
Bharti Airtel	8.72%	2.31	5.321	-2.31	-0.09	-1.80	-2.31	-25.93	-5.81817E-06
Sun Pharma	6.68%	2.32	5.3994	-2.32	-0.07	-1.87	-2.32	-28.25	-6.0341E-06
Tata Steel	8.42%	4.34	18.841	-4.34	-0.08	-1.95	-4.34	-32.59	-6.3061E-06
Ultratech	4.47%	3.12	9.7638	-3.12	-0.04	-2.00	-3.12	-35.72	-6.45066E-06
ITC	-0.33%	-2.23	4.9562	2.23	0.00	-1.99	2.23	-33.49	-6.43999E-06
Power grid	-3.62%	2.28	5.2107	-2.28	0.04	-1.96	-2.28	-35.78	-6.32315E-06

Axis Bank	4.47%	-1.27	1.6225	0.55	-0.10	-2.06	2.96	-32.81	-6.6591E-06
ONGC	-9.39%	2.06	4.26	-2.06	0.09	-1.97	-2.06	-34.88	-6.35571E-06
M & M	7.90%	-1.3	1.686	1.30	-0.08	-2.05	1.30	-33.58	-6.61078E-06
HUL	7.05%	-1.01	1.0193	1.01	-0.07	-2.12	1.01	-32.57	-6.8383E-06
Hdfc Ltd	1.79%	-0.25	0.0601	0.25	-0.02	-2.14	0.25	-32.32	-6.89612E-06
Kotak Mahindra	6.29%	-0.54	0.2898	0.54	-0.06	-2.20	0.54	-31.78	-7.09913E-06
Hdfc Bank	4.28%	-0.25	0.0616	0.25	-0.04	-2.24	0.25	-31.54	-7.23732E-06
Bajaj Auto	-4.73%	0.13	0.0168	0.13	0.05	-2.19	-0.13	-31.67	-7.0844E-06
Nestle	13.87%	-0.24	0.056	0.24	-0.14	-2.33	0.24	-31.43	-7.53232E-06

Cut-off point is constructed in order to find out the number of profitable stocks to include in an individual's portfolio which will offer attractive and impressive returns with reasonable risk.

From table 2, it can be concluded that the highest cut-off point stood at 4.11143E-07 of National Thermal Power Corporation Ltd. (NTPC). It implies that only stocks of Maruti and NTPC must be included while constructing a portfolio in order to get outrageous returns with low risk which in turn will further help to enhance a strong profitable and fruitful portfolio.

Table no. 3 showing weights of the selected stocks

STOCK	$(R_i - R_f)/B_i$	Cut-off	3	B_i	USR	6		
	1	2	(1-2)	4	5	(4/5)	3*6	%
Maruti	9.488839	4.11143E-07	9.488839	-0.01001	0.010019	-0.99889	-9.47835	95.47451
NTPC	0.449501	4.11143E-07	0.4495	-0.07225	0.072285	-0.9995	-0.44927	4.525494
						Total	-9.92762	

From table 3, it can be summarized that the excess return to Beta i.e $(R_i - R_f)/B_i$ of Maruti reported at 9.49 percent and NTPC at 0.45 percent with a cut-off point of 4.11143E-07 which in turn states that these two stocks must be incorporated in an individual's portfolio with a weightage of 95.47 percent and 4.53 percent respectively to yield magnificent returns.

CONCLUSION

A remarkable portfolio is demanded by each and every individual in order to yield and produce outrageous returns. In order to construct a strong portfolio, one should include those stocks which are surrendering significant returns with negligible risk factor. The study shows the stocks which are influenced by systematic risk and unsystematic risk. Through the study, it can be concluded that the stocks with influence of systematic risk yield magnificent returns in long term in Jaxta position to the stocks dominated by unsystematic risk.

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