



A STUDY ON OPTIMAL PORTFOLIO CONSTRUCTION WITH SPECIAL REFERENCE TO NSE CNX NIFTY PHARMA INDEX

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ABSTRACT

Portfolio is a process of blending together the broad asset classes so as to obtain optimum return with minimum risk is called portfolio construction. In order to reduce the risk, investors need to diversify, spread their portfolio across a broad mix of assets. Diversifying the portfolio can help smooth out market ups and downs and returns from better performing assets help to offset those that aren't performing so well. The present study has empirically examined the portfolio construction with special reference to NSE CNX Nifty Pharma Index. The study applied the Sharpe Single Index model to generate an efficient combination of securities from sample Pharma companies and has come up with a subsequent pattern. The study found that out the sample Pharma companies, Aurobindo Pharma Ltd attracted high risk while Glenmark Pharmaceuticals Ltd experienced the least risk, on the basis of return earned by the companies in the Pharma Index; Aurobindo Pharma Ltd has high return while Lupin Ltd has lowest return. Experimental results have demonstrated the feasible of the investment strategy, portfolio idea and electiveness of the combination assets on the investment strategy.

Keywords: Portfolio performance, Portfolio constructions, Pharma index, Sharpe single index

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1. INTRODUCTION

A portfolio is a grouping of financial assets such as stocks, bonds, commodities, currencies and cash equivalents, as well as their fund counterparts, including mutual, exchange-traded and closed funds. A portfolio can also consist of non -publicly tradable securities, like real estate, art, and private investments. Portfolios are held directly by investors and/or managed by financial professionals and money managers. Investors should construct an investment portfolio in accordance with their [risk tolerance](#) and their investing objectives. Investors can also have multiple portfolios for various purposes. It all depends on one's objectives as an investor. A Portfolio Management refers to the science of analyzing the strengths, weaknesses, opportunities and threats for performing wide range of activities related to the one's portfolio for maximizing the return at a given risk.

2. PORTFOLIO CONSTRUCTION

Portfolio Construction is all about investing in a range of funds that work together to create an investment solution for investors. Building a portfolio involves understanding the way various types of investments work, and combining them to address your personal investment objectives and factors such as attitude to risk the investment and the expected life of the investment. At the time of building the portfolio there are two important factors should consider, first is asset allocation, which is concerned with how an investment is spread across different asset types and regions. The second is fund selection, which is concerned with the choice of fund managers and funds to represent each of the chosen asset classes and sectors. In a diversified portfolio, some securities may not perform as expected, but others may exceed the expectation and making the actual return of the portfolio reasonably close to the anticipated one. Hence, it is a common practice to diversify securities in the portfolio.

3. REVIEW OF LITERATURE

Andrew C. Worthington and Helen Higgs (2004), in their research study entitled “Art as an Investment: Risk, Return and Portfolio Diversification in Major Painting Markets” examine risk, return and the prospects for portfolio diversification among major painting and financial markets over the period 1976-2001. The present study finds that the returns on paintings are much lower and the risks much higher than conventional investment markets.

A study by **Benjamin Bridges, Robert Gesumaria and Michael.V and Leonesio (2010)**, entitled “Assessing the performance of Life-cycle portfolio allocation strategy for retirement Saving –A Simulation Study” concluded that Life-cycle plans with larger portfolio weights assigned to equities have higher average returns, but those gains come at the cost of increased risk of infrequent bad outcomes.

Chevalier and Ellison, Gottesman and Morey (2006) examined the relation between manager education and mutual fund performance. Gottesman and Morey used a data set of 518 mutual funds from 2000-2003 in a non-bullish market to contrast Chevalier and Ellison. The latter had been criticized for examining managers during a bull market from 1988-1994 where the younger managers succeeded because they took on more risk generally than the veterans and thus reaped a greater reward.

Eero J.Patari, Timo H.Leivo and J.V.Samuli Honkapuro (2010) entitled “Enhancement of value portfolio performance using data envelopment analysis” results show that the DEA scale efficiency scores add value to portfolio selection. Though outperformance of the DEA value portfolios in contrast to both comparable glamour portfolio and the stock market average is most evident for shorter (i.e. annual and biannual) holding periods, the absolute performance of the DEA value portfolio can be enhanced by using longer reformation intervals.

Florin Aliu, Drahomira Pavelkova and Bruce Dehning (2017) in their study named “Portfolio risk-return analysis: The case of the automotive industry in the Czech Republic” The results of the study show that the average correlation coefficient tends to decrease when move from manufacturers to suppliers, while increasing when join manufacturers and suppliers in one portfolio. The highest risk is manifested for the portfolio of manufacturers, while the lowest – in the portfolio of auto suppliers.

A study by **Golec (1996)** entitled “The Effects of Mutual Fund Managers’ Characteristics on Their Portfolio Performance, Risk, and Fees” examined whether a mutual fund manager’s characteristics help to explain fund performance, risk, and fees. The results demonstrated that younger managers (less than 46 years old) who had managed for a relatively long time, (more than 7 years) with longer tenure, and MBA degrees had the best risk-adjusted performance.

German Lopez, Joaquin Marhuenda Belen Nieto (2009),in their study titled “The relationship between risk and expected returns with incomplete information” analyses if the quantity of information about an asset determines its return. The results of this study indicate that the market prices the disinformation risk. The researcher found that models which incorporate our attention factor perform better than the traditional CAPM or the Fama and French model, both in time-series analyses and cross-sectional.

Samithamby Senthilnathan (2013) in his research study entitled “Risk, Return and Portfolio Theory – A Contextual Note” attempts to provide a brief theoretical explanation with illustrations on determining the returns and associated risk of shares, and of the portfolio of the shares. The illustrations of tables and figures can significantly contribute to the understanding of a reader in relation to portfolio management of risk and returns.

A study by **Zoran Ivkovic, Clemens Sialm and Scott Weisbenner (2008)** entitled “Portfolio Concentration and the Performance of Individual Investors” tested why some individual investors concentrate their stock portfolios in a few stocks. Finally the researcher concluded individual investors make poor investment decisions. However, our results indicate that, among households with portfolios large enough to diversify among many stocks.

4. OBJECTIVES OF THE STUDY

- To predict the cutoff point and proportion of investment (weight) for sample companies of NSE CNX NiftyPharma Index
- To construct the optimal portfolio for sample companies of NSE CNXNifty Pharma Index

5. STATEMENT OF THE PROBLEM

The portfolio management involves grouping of major products that are developed and sold by businesses into (logical) portfolios. These products are organized according to major line-of-business or business segment. The foundation of Modern Portfolio almost all investors invest in multiple securities rather than one, there must be some benefit in investing in a portfolio of securities. Construction of portfolio is a very important variable in determining success of investment but they had no simple or clear way of construct it. Portfolio construction and measurement has not only the goal to inform about the quality of a portfolio

performance and that's even more important to decompose and analyze the success factors of a portfolio. There are several studies related to construction of portfolio already made in abroad, but studies are limited in India especially studies in construction of optimal portfolio with NSE-CNX Nifty Pharma Index. Hence the present study is made an attempt to construction of optimal portfolio with special reference to NSE-CNX Nifty Pharmaindex.

6. METHODOLOGY OF THE STUDY

There are 10 companies in the NSE-CNX Nifty Pharma Index. For the purpose of the present Study all the companies in the NSE CNX Nifty Pharma Index were selected as sample. List of Sample companies as under

Table 1 List of sample Companies from NSE-CNX Nifty Pharma Index

Sl.No	Name of the Bank
1	Aurobindo Pharma Ltd.
2	Biocon Ltd.
3	Cadila Healthcare Ltd.
4	Cipla Ltd.
5	Divi's Laboratories Ltd.
6	Dr. Reddy's Laboratories Ltd.
7	Glenmark Pharmaceuticals Ltd.
8	Lupin Ltd.
9	Piramal Enterprises Ltd.
10	Sun Pharmaceutical Industries Ltd.

Source: www.nseindia.com

Sources of Data

The data which are required for construction and evaluation of portfolio (index) collected from NSE website www.nseindia.com and other relevant information's are collected from www.moneycontrol.com , www.indiaearnings.com and relevant journals.

Period of the Study

The present study is attempt the construct and evaluation of the optimum portfolio from the companies in the NSE CNX Nifty Pharma index for the period of 1st April 2013 to 31st March 2017.

Tools used for analysis

The present study attempted to construct the optimal portfolio to sample Pharma companies which are under the NSE-CNX Nifty Pharma Index with the help of following tools.

Expected Rate of Return: The average of a probability distribution of possible returns.

$$E(R) = \sum_{i=1}^n P_i \times R_i \quad (1)$$

Variance: A measure of the dispersion of a set of data points around the mean value. It is a mathematical expectation of the average squared deviations from the mean.

----- (2)

Mean: The simple mathematical average of a set of two or more numbers.

Mean = sum of elements / number of elements ----- (3)

Standard deviation: A measure of the dispersion of a set of data from its mean. It can also be calculated as, the square root of variance.

$$\sigma_R = \sqrt{\sum_{i=1}^n \frac{(R_i - \bar{R})^2}{N}}$$

$$\sigma_p = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \sigma_{1,2} \quad \text{--- (4)}$$

Variance (σ^2) on the other hand, equals to average of squares of deviations of individual returns (R_i) from expected returns (\bar{R}). Symbolically,

$$\sigma^2_R = \sum_{i=1}^n \frac{(R_i - \bar{R})^2}{N} \quad \text{--- (5)}$$

Thus, Standard Deviation is equals to the positive square root of variance i.e.

$$\text{Standard Deviation} = \sqrt{\text{Variance}} .$$

Covariance: Covariance describes the nature of relationship between two variables. If X and Y are two securities, then the covariance between the two securities is given by the following

$$\text{cov}_{xy} = \frac{\sum_{i=1}^N [(X_i - \bar{X})(Y_i - \bar{Y})]}{N - 1} \quad \text{--- (6)}$$

Where i = (1, 2, 3...n)

Calculation of Beta (β):The risk of a well-diversified portfolio is represented by its market risk of the securities included in the portfolio. Beta for the security X is calculated by following

$$\beta = \frac{\text{cov}(R_x, R_m)}{\text{Var}(R_m)} \quad \text{--- (7)}$$

Cut off rate: The next step is to determine the stocks for which the excess return to beta ratio is higher than a particular unique cut off point C*. The value of the cut off rate C* is given by:

$$C_i = \frac{\sigma_m^2 \sum (R_i - R_f) \beta_i}{1 + \sigma_m^2 \sum \beta_i^2 / \sigma_{ei}^2} \quad \text{--- (8)}$$

Where

σ_m^2 = Variance in the market index

σ_{ei}^2 = Variance of a stock's movement

From **Table-4** it can be seen that the first four securities have C values exceeding the corresponding $(R_i - R_f) / \beta$ value. The cutoff rate C* is only the top four securities make it to the optimal portfolio.

$$Z_i = \frac{\beta_i (R_i - R_f - C^*)}{\sigma_{ei}^2 \beta_i} \quad \text{--- (9)}$$

Where (Weight)

$$X_i^0 = Z_i / \sum Z_i$$

Limitation of the Study

The present study has the following limitation

- Sample for the present study not cover the all the Pharma companies. Only companies which are under the NSE-CNX Nifty Pharma Index.
- The present study uses various statistical tools like expected rate of return, standard deviation, covariance, beta, optimal portfolio using Sharpe's single index model (cut-off point and weight age) and performance measurement of returns including Sharpe's. All limitation of these tools is also applicable to this study.

Scope for further Research:

The present study uses only 10 companies as sample for construction of the portfolio. There may be possibility to study the construction and performance of the portfolio with other Pharma companies which are list in the NSE. Further there are many index in the National Stock Exchange of India, study may undergone to measure the performance of the porfolio with IT Index, Oil index, NSE 100, NSE 200 and NSE 500 listed companies etc.

10. ANALYSIS AND DISCUSSION

Constructing an optimal portfolio

William Sharpe has developed a model to construct optimal portfolio. The present study tries to form an optimal portfolio using Sharpe's Single Index Model.

Return and Risk of Optimal Portfolio

The expected return, variance, standard deviation, the intercept (Alpha), and the beta for all the 10stocks have been calculated below

Table 2 Risk and Return of Optimal Portfolio

S#	Name of the Companies	Exp. Return	Var _i	Stdev	Alpha	Beta
1	Aurobindo Pharma Ltd.	0.3054	0.1279	0.0353	0.00018	1.5979
2	Biocon Ltd.	0.0706	0.0973	0.0320	0.00074	1.2128
3	Cadila Healthcare Ltd.	0.2119	0.1342	0.0361	0.00017	1.2765
4	Cipla Ltd.	0.1619	0.0576	0.0248	0.00067	0.8949
5	Divi's Laboratories Ltd.	0.1346	0.0699	0.0256	0.00029	0.9723
6	Dr. Reddy's Laboratories Ltd.	0.1236	0.1504	0.0475	0.00068	1.2051
7	Glenmark Pharmaceuticals Ltd.	0.1450	0.1639	0.0393	0.00078	0.7949
8	Lupin Ltd.	-0.0134	0.0994	0.0399	0.00212	1.0966
9	Piramal Enterprises Ltd.	0.1325	0.0648	0.0334	0.00020	0.9986
10	Sun Pharmaceutical Industries Ltd.	0.1571	0.1163	0.0426	0.00048	1.1427

It is understand from the above table that only a few stocks gave low returns. This could be due to volatility and bear hammering in a sluggish secondary market. As the criteria for selection of stocks in the portfolio ignores stocks with negative returns. The Sharpe model will automatically exclude such stocks as its ranking is based on excess returns (returns greater than risk free rate of return).

The above table depicts the fact that, out 10 stocks only four stocks expected returns are higher than the risk free rate of return. Selection of stocks for optimal portfolio it is necessary to rank the stocks from highest to beta ratio.

11. RANKING OF SECURITIES

According to the sharp Model for portfolio optimization, first step is securities are to be ranking based on the excess returns-to-beta ratio. This ratio was calculated for each of the 10 securities using an equation (9).

Table 3 Ranking of Securities Ranking of stocks based on Excess Return to Beta $(R_i - R_f) / \beta$ Risk Free Rate $R_f =$ Bank Rate = 5.45% p.a

S.No	Name of the Companies	Mean Return	Excess Return	Beta β	Excess Ret to Beta
1	Aurobindo Pharma Ltd.	0.216489	0.161989	0.866453	0.187464
2	Cipla Ltd.	0.162987	0.007282	0.795975	0.132620
3	Cadila Healthcare Ltd.	0.212899	0.158499	1.376463	0.127387
4	Glenmark Pharmaceuticals Ltd.	0.145972	0.045416	0.794941	0.112457
5	Sun Pharmaceutical Industries Ltd.	0.158194	0.098497	1.143787	0.082857
6	Divi's Laboratories Ltd.	0.134663	0.079063	0.973282	0.072870
7	Piramal Enterprises Ltd.	0.132458	0.059245	0.997675	0.069783
8	Dr. Reddy's Laboratories Ltd.	0.123745	0.091472	1.215095	0.063615
9	Biocon Ltd.	0.070672	0.078958	1.312788	0.006231
10	Lupin Ltd.	-0.023453	0.093694	1.097698	-0.072625

Table-2 gives returns, risk free rate, beta and excess returns-to-beta ratio. The results of sample companies are arranged in the descending order in accordance with excess returns-to-beta ratio. The rank of the securities is given in the first column of the table. This ratio gives the risk premium (i.e., returns-risk free rate) earned by security for one unit of market risk. According to Sharpe, in an efficient market, only the market risk (systematic risk) will be rewarded. The appropriate measure of systematic risk is beta. Therefore the securities of sample companies have been ranked based on excess returns to-beta ratio.

According to Table-3, Aurobindo Pharma Ltd tops the list, followed by Cipla Ltd, Cadila Healthcare Ltd, Glenmark Pharmaceuticals Ltd., and Sun Pharmaceutical Industries Ltd and so on. It is important to note that the ranking of securities given in the Table-3 is different from that of the ranks given in Table-2.

Table-2 ranks the securities based on absolute returns. It does not relate to the returns to the corresponding risk. But Table-3 demonstrates the returns adjusted for risk. Accordingly the order of rank undergoes change. It is important to note that the top companies earn more returns. This significant the fact that returns plays a vital role in deciding the rank of securities.

Selection of Securities

The next step of constructing the optimal portfolio is to identify the securities included in the optimal portfolio. Though Table-3 gives the ranking of securities according to excess returns-to-beta ratio, selection of securities helps to identify the securities to be included in the optimal portfolio. For this purpose, Sharpe says that the value C (equation 8) is to be calculated for each security. The results of C are presented in Table -4. According to the below table, the value C steadily increased from 3.469 to 5.413. Thereafter, the value steadily declined. According to Sharpe, the highest value of C (10.269) is the cut-off rate. All the

securities with excess returns to beta ratio greater than that of the security at the cut-off point are included in the optimal portfolio. All other securities are let off. The analysis shows the fact that only the first five securities of companies, namely, Aurobindo Pharma Ltd, Cipla Ltd, Cadila Healthcare Ltd, Glenmark Pharmaceuticals Ltd and Sun Pharmaceutical Industries Ltd are eligible for inclusion in the portfolio. If securities beyond the cut-off point are included in the portfolio it will lead to less than optimal returns. Thus, a well-diversified optimal portfolio should be formed only with just four stocks.

Table 4 Determining cut-off rate

Variance of market = 0.04373804

Rank	Name of the Companies	$(R_i - R_f)/\beta$	Var_i	C^*
1	Aurobindo Pharma Ltd.	0.287364	0.002179	3.469709
2	Biocon Ltd.	0.232520	0.000676	3.732320
3	Cadila Healthcare Ltd.	0.127387	0.002235	10.269748
4	Cipla Ltd.	0.112357	0.002649	1.197360
5	Divi's Laboratories Ltd.	0.092847	0.002173	5.413164
6	Dr. Reddy's Laboratories Ltd.	0.082770	0.000699	4.416870
7	Glenmark Pharmaceuticals Ltd.	0.798673	0.000769	5.143324
8	Lupin Ltd.	0.162615	0.002405	2.439723
9	Piramal Enterprises Ltd.	0.006231	0.000974	0.578124
10	Sun Pharmaceutical Industries Ltd.	-0.072625	0.000994	-4.130713

12. FINDINGS OF THE STUDY

The analysis of data has revealed the following important findings:-

- During the period of study, stocks prices of sample companies were by and large, stable. As such, expected returns and risk have also remained stable.
- In the sample Pharma companies, Aurobindo Pharma Ltd attracted high risk with value of (1.5979) while Glenmark Pharmaceuticals Ltd experienced the least risk with value of (0.7949).
- On the basis of returns earned by sample Pharma companies, Aurobindo Pharma Ltd has obtained highest return with value of 0.216489 while Lupin Ltd has obtained lowest return with value of (-0.023453).
- The stocks with high returns are generally having high beta. This shows that higher returns are associated with higher risk.
- Majority of sample Pharma companies in the NSE CNX Nifty Pharma Index yield returns greater than that of the market average.
- On the basis of the analysis, the best combination of securities (Optimal Portfolio) is Aurobindo Pharma Ltd, Cipla Ltd, Cadila Healthcare Ltd, Glenmark Pharmaceuticals Ltd and Sun Pharmaceutical Industries Ltd. Just around five stocks is sufficient to construct an optimal portfolio.

13. SUGGESTIONS FROM THE STUDY

The following are the important suggestion to the prospective investors from this study.

- Investors should study the performance of the stock market in terms of risk, sensitivity and returns.
- To minimize the risk, investing in combination of securities is good rather than investing in a single security.
- The present study suggests a combination of securities that give high rate of returns at minimum level of risk for the investors who wish to make an optimal portfolio.

- The securities in the optimal portfolio are from various Pharma sectors. This establishes the point that diversification into different industrial sectors alone would minimize risk.
- The best performance for all those stocks. It means that there is still some degree of unsystematic risk that any manager can remove by diversification.
- The investor who wants to invest in the Pharma index best to choose the above portfolio for getting better return with minimum risk.

14. CONCLUSION

This study proposes a new investment strategy for classical portfolio problem. In addition, a new combination stock from the Pharma index is proposed for solving the new investment strategy portfolio problem. Experimental results show that the feasible of the investment strategy with optimal portfolio idea and electiveness of the combination assets on the investment strategy. This study applied the Sharpe Single Index model to generate an efficient combination of securities from sample (Pharma companies) of shares and has come up with a subsequent pattern. The analysis of the portfolio provides the rationale for forming an optimal portfolio of the securities instead of buying only a single security.

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