Risk Management through Efficient Portfolios

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ABSTRACT

Risk Management is the process of identification, analysis and either acceptance or mitigation of uncertainty in investment decision-making. Inadequate risk management can result in severe consequences for companies as well as individuals. Risk management is a two-step process - determining what risks exist in an investment and then handling those risks in a way best-suited to investment objectives. It is the process of analyzing risk exposure and attempting to minimize it through various means, including diversification of portfolio. Portfolio is none other than Basket of Stocks. Portfolio Management is the professional management of various securities (shares, bonds and other securities) and assets (e.g., real estate) in order to meet specified investment goals for the benefit of the investors. A portfolio is planned to stabilize the risk of non-performance of various pools of investment. The best way of constructing a portfolio is selecting stocks of different sectors. Sectoral diversification is one of the best strategies to reduce the risk. The present study deals with analysis of risk and return of portfolios constructed for five different sectors. Portfolio constructed in this study includes only stocks and no other investment avenues are included. The sectors selected for the study are the best five sectors for investment at present. Here an attempt is made by the authors to analyze the risk and return of various portfolios by using Markowitz model and William Sharpe model. The purpose of the study is to find out the efficient portfolios which help the investors to maximize their return for a given level of risk.

Key words: Risk management, diversification, and portfolio.

Introduction

Any rational investor, before investing his or her investable wealth in the stock, analyses the risk associated with the particular stock. The actual return he receives from a stock may vary from his expected return and the risk is expressed in terms of variability of return. The down side risk may be caused by several factors, either common to all stocks or specific to a particular stock. Risk consists of two components, the systematic risk and unsystematic risk.

The systematic risk is caused by factors external to the particular company and uncontrollable by the company. The systematic risk affects the market as a whole. In the case of unsystematic risk, the factors are specific, unique and related to the particular industry or company. Investor in general would like to analyze the risk factors and a thorough knowledge of the risk helps him to plan his portfolio in such a manner so as to minimize the risk associated with the investment. Portfolio analysis considers the determination of future risk and return in holding various blends of individual securities. A portfolio is a collection of securities. Since it is rarely desirable to invest the entire funds of an investor in a single security, it is essential that every security be viewed in a portfolio context. Thus, it seems logical that the expected return of a portfolio should depend on the expected return of each of the security contained in the portfolio. Construction of an efficient portfolio is the best strategy to reduce the risk. An efficient portfolio is the one which offers maximum return for a given level of risk. Portfolio investor is the one who invests in more than one security. The securities may be the different investment avenues or the shares of different companies of the same industry or companies of different industries. It is true that investment in more than one industry is the best way to reduce the risk. It is called as pectoral diversification. This will reduce the risk because of the fact that the one industry is different from another industry. The loss in one industry would be compensated by the gains in the other industry or industries. The present study is an attempt to analyze the risk and return of various portfolios constructed for this study. The study covers five industries like banking industry, automobile industry, FMCG industry, oil and gas industry and IT industry.

Objectives of the Study

The main objective of the study is to analyze the performance of various portfolios constructed for this study. In order to achieve the main objective, the subsidiary objectives framed are:

1. To compare the performance of various portfolios in terms of their returns
2. To analyze the performance of various portfolios based on their risk
3. To offer meaningful suggestions to the investors about the best securities to be included in their portfolio.

Methodology

The entire study is based on secondary data extracted from websites like Bombay Stock Exchange (BSE), Reserve Bank of India (RBI), books and journals. The analysis is based on stock returns of 5 companies each from 5 industries like banking industry, automobile industry, FMCG industry, oil and gas industry and IT industry. The study period is from 31st

March 2008 to 31st March 2013.The yearly returns are calculated based on the average monthly returns. The sample industries are selected based on the industries preferred by the investors for their investment at present. The companies selected under each industry are the top companies of the respective industry.

Scope of the Study

The study deals with the comparison of performance of various portfolios based on the risk and return of each portfolio. Five portfolios of five different industries are constructed under this study. The five industries chosen for the study are the industries which are most preferred by the investors for their investment at present. Under each industry the top five companies are selected for the purpose of creating a portfolio of each industry. The companies covered are: State Bank of India, ICICI, Union Bank of India, Punjab National Bank, Bank of Baroda, Tata Motors, Maruthi Suzuki, Mahindra and Mahindra, Ashok Layland, HMT, TCS, Infosys, Wipro, HCL Technologies, MPhasis, HUL, Colgate, ITC, Nestle, Britannia, ONGC, Bharath Petroleum, Essor Oil, Indian Oil Corporation, Hindustan Petroleum Ltd. The study covers a period of five years from March 31st 2008 to 31st March 2013. For the purpose of measuring the performance each portfolio, only risk and return factors are taken into consideration.

Tools used for analysis

Return of the stock is being calculated by using the following formula.

$$Return = \frac{ClosingPrice - OpeningPrice}{OpeningPrice} * 100$$

Beta Coefficient is given by;

$$\beta = CorrelationCoefficient * \frac{\sigma(Y)}{\sigma(X)}$$

$Where, \sigma(Y) = $ Standard deviation of individual stock

$\sigma(X) = $ Standard deviation of market

Risk free return is the average risk free return of five years from 1st April, 2008 – 31st March, 2013.

Systematic Risk: $\sigma_m^2 * \beta_i^2$

$$Where, \sigma_m^2 = Variance\ of\ the\ market\ return$$

Unsystematic Risk: $\sigma_i^2 - \sigma_m^2 * \beta_i^2$

$$Where, \sigma_i^2 = Variance\ of\ the\ stock\ return$$

Markowitz model

This model is widely used for the purpose of calculating the risk and return of the portfolio. Return of the portfolio under method is simply the weighted average returns of the securities included in the portfolio. As mentioned earlier, there are two types of risks like systematic risk and unsystematic risk. But under this model risk is not classified into systematic and unsystematic risk. Instead of that the total risk of the portfolio is calculated by taking into account the covariance between the returns of various securities which are included in the portfolio.

Portfolio return: $R_p = \sum_{i=1}^{N} X_i R_i$

Portfolio risk:

$$\sigma_p^2 = X_1^2 \sigma_1^2 + X_2^2 \sigma_2^2 + X_3^3 \sigma_3^3 + 2X_1 X_2 r_{12} \sigma_1 \sigma_2 + 2X_2 X_3 r_{23} \sigma_2 \sigma_3 + 2X_1 X_3 r_{13} \sigma_1 \sigma_3$$

Techniques of Portfolio Evaluation

Sharpe's Measure: Under this technique the excess return to total risk ratio of the portfolios is calculated for each portfolio and portfolios are ranked according to their excess return to total risk ratio. Standard Deviation is used as total risk and the difference between market return and risk free return is taken as excess return/

Treynor's Measure: According to this technique the excess return to systematic risk ratio of the portfolios is calculated for each portfolio and portfolios are ranked according to their excess return to systematic risk ratio. Beta is used to represent the systematic risk.

Data analysis and Interpretation

Table 1: Actual returns of portfolios as per Markowitz Model (Data of five years from 2008-09 to 2012-2013)

Portfolio/year	2008-09	2009-10	2010-11	2011-12	2012-13	Average	Rank
	Figures are in percentage						
Bank Portfolio	0.68	6.59	1.58	-1.67	0.34	1.50	5
Auto Portfolio	8.91	9.23	1.08	-1.73	-0.54	3.39	1
IT Portfolio	0.77	8.68	0.83	-0.05	0.72	2.19	3
FMCG Portfolio	9.29	2.69	-0.16	2.81	0.85	3.10	2
OIL Portfolio	7.92	3.56	-0.01	-1.51	0.57	2.11	4

It is clear from Table 1 that the performance of bank portfolio was good only during the period 2009-10. In all other years the performance was less than 1%. The performance of Automobile Industry came down after 2009-10. The performance of IT Portfolio was less than 1% in the year 2008-09 and again during the period 2010-11 to 2012-13, the

performance was less than 1%. FMCG stocks performed well during 2008 -09, 2009-10 and 2011-12. Oil Industry portfolio performance was good during 2008-09 and 2009-2010. Among the five portfolios constructed, Automobile Industry Portfolio offers the highest return, i.e., 3.39% and Bank Portfolio offers the least average returns. Therefore Automobile industry is the best performer and the Bank portfolio is the least performer.

Table 2: Actual returns of portfolios as per Shape Single Index Model (Data of five years from 2008-09 to 2012-2013)

Portfolio/ Year	2008-09	2009-10	2010-11	2011-12	2012-13	Average	Rank
	Figures are in percentage						
Bank Portfolio	-1.45	8.30	2.29	-1.66	0.06	1.51	5
Auto Portfolio	8.91	9.23	1.08	-1.73	-0.54	3.39	1
IT Portfolio	0.77	8.68	0.13	-0.05	1.50	2.21	3
FMCG Portfolio	9.29	2.69	-0.16	2.81	0.85	3.10	2
OIL Portfolio	7.92	3.56	-0.01	-1.51	0.57	2.11	4

It is crystal clear from Table 2 that the according to Sharpe Single Index Model, Automobile Industry is the best performer and the Bank portfolio is the least performer. Performance of bank portfolio was good only during the period 2009-10. The performance of Automobile Industry was good in the year 2008-09 and 2009-10. The performance of IT Portfolio was good only in the year 2009-10. FMCG stocks performed well during 2008 -09, 2009-10 and 2011-12. Oil Industry portfolio performance was good during 2008-09 and 2009-2010.

Table 3: Risk of portfolios based on Markowitz Model (Data of five years from 2008-09 to 2012-2013)

Portfolio/year	2008-09	2009-10	2010-11	2011-12	2012-13	Average	Rank
Bank Portfolio	14.00	12.80	6.36	9.99	10.68	10.77	2
Automobile portfolio	47.17	15.65	6.40	12.07	8.69	18.00	5
IT portfolio	24.16	10.24	6.91	22.08	3.89	13.46	3
FMCG portfolio	31.83	6.47	5.46	3.09	3.69	10.11	1
Oil portfolio	35.07	13.42	11.26	7.42	8.07	15.05	4

Table 3 shows the fact that according to Markowitz model, among the five portfolios constructed automobile portfolio has the highest risk, followed by Oil Industry Portfolio, IT Portfolio, Bank Portfolio and FMCG portfolio has the lowest risk.

Table 4: Sharpe Index of portfolios (Data of five years from 2008-09 to 2012-2013)

Portfolio/year	2008-09	2009-10	2010-11	2011-12	2012-13	Average	Rank
Bank Portfolio	-0.12	0.63	0.32	-1.93	-0.02	-0.23	5
Automobile portfolio	0.18	0.57	0.08	-0.17	-0.09	0.12	3
IT portfolio	0.02	0.82	0.08	-0.01	1.23	0.43	1
FMCG portfolio	0.28	0.37	-0.08	0.82	0.16	0.31	2
Oil portfolio	0.22	0.24	-0.02	-0.24	0.04	0.05	4

It is understood from Table 4 that according to Sharpe Index portfolio evaluation technique, Portfolio constructed by IT companies is the best portfolio because it gives the highest excess return to total risk (standard deviation). It is closely followed by FMCG portfolio. The excess return to total risk ratio of bank portfolio is negative and it is the worst performer compared to all other portfolios constructed in this study.

Table 5: Treynor Index of portfolios (Data of five years from 2008-09 to 2012-2013)

Portfolio/year	2008-09	2009-10	2010-11	2011-12	2012-13	Average	Rank
Bank Portfolio	-1.59	6.70	2.24	-1.30	-0.10	1.19	2
Automobile portfolio	3.28	5.88	0.88	-1.13	-0.48	1.69	1
IT portfolio	0.52	10.02	-23.20	-0.38	7.32	-1.14	3
FMCG portfolio	6.15	-55.24	-1.90	17.63	2.80	-6.11	4
Oil portfolio	7.65	2.56	-0.31	-1.76	0.31	1.69	1

As per the above table it is clear that according to Treynors's measure, there are two best portfolios; Automobile Industry portfolio and Oil Industry portfolio. These two portfolios have the equal excess return to systematic risk (beta) ratio. IT industry portfolio and FMCG Industry portfolio has negative excess return to beta ratio and FMCG industry is the worst performer compared to all other portfolios.

Table 6: Correlation coefficient between the returns of various shares

Company	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	1	0.81	0.87	0.84	0.75	0.37	0.32	0.44	0.48	0.74	0.22	0.31	0.17	0.33	0.50	0.24	0.23	0.14	0.09	0.23	0.45	0.24	0.51	0.55	0.62
2		1.00	0.78	0.75	0.75	0.55	0.32	0.51	0.54	0.75	0.28	0.94	0.76	0.59	0.58	0.13	0.05	0.29	0.14	0.28	0.44	0.25	0.32	0.74	0.47
3			1.00	0.86	0.84	0.30	0.23	0.39	0.48	0.71	0.28	0.32	0.24	0.28	0.51	0.18	0.11	0.11	0.08	0.24	0.35	0.21	0.44	0.53	0.53
4				1.00	0.76	0.28	0.25	0.41	0.48	0.61	0.28	0.35	0.21	0.28	0.37	0.21	0.23	0.15	0.11	0.39	0.39	0.22	0.45	0.64	0.47
5					1.00	0.33	0.25	0.24	0.46	0.49	0.28	0.28	0.18	0.19	0.40	0.29	0.37	0.20	0.11	0.29	0.31	0.23	0.47	0.45	0.41
6						1.00	0.92	0.17	0.84	0.37	0.28	0.71	0.44	0.35	0.38	0.21	0.18	0.81	0.85	0.43	0.80	0.89	0.94	0.40	0.26
7							1.00	0.05	0.84	0.29	0.28	0.78	0.37	0.30	0.29	0.15	0.12	0.83	0.94	0.45	0.75	0.93	0.71	0.40	0.10
8								1.00	0.29	0.50	0.28	0.23	0.37	0.51	0.50	0.17	0.25	0.03	-0.07	0.33	0.11	0.10	0.16	0.43	0.32
9									1.00	0.53	0.28	0.74	0.45	0.46	0.53	0.13	0.20	0.70	0.76	0.47	0.67	0.80	0.63	0.51	0.20
10										1.00	0.28	0.32	0.21	0.36	0.62	0.03	0.12	0.14	0.14	0.18	0.44	0.26	0.37	0.48	0.49
11											1.00	0.80	0.47	0.37	0.28	0.10	0.02	-0.79	0.83	0.33	0.77	0.84	0.64	0.38	0.14
12												1.00	0.61	0.55	0.42	0.10	0.06	0.67	0.69	0.49	0.55	0.70	0.53	0.47	-0.03
13													1.00	0.65	0.42	0.17	0.08	0.37	0.28	0.29	0.29	0.33	0.27	0.37	0.02
14														1.00	0.67	-0.08	-0.01	0.22	0.14	0.29	0.28	0.21	0.12	0.49	0.11
15															1.00	-0.06	0.18	0.13	0.16	0.29	0.29	0.30	0.22	0.41	0.28
16																1.00	0.61	0.31	0.12	0.43	0.12	0.17	0.27	0.07	0.22
17																	1.00	0.26	0.12	0.57	0.05	0.11	0.25	0.10	0.10
18																		1.00	0.82	0.47	0.61	0.82	0.60	0.30	0.06
19																			1.00	0.36	0.71	0.93	0.68	0.27	0.04
20																				1.00	0.14	0.34	0.29	0.38	-0.01
21																					1.00	0.80	0.79	0.47	0.53

21																						1.00	0.75	0.36	0.18
23																							1.00	0.35	0.56
24																								1.00	0.32
25																									1.00

Note: 1: SBI, 2: ICICI, 3: Punjab National Bank, 4: Bank of Baroda, 5: Union Bank of India, 6: Maruthi Suzuki, 7: Tata Motors, 8: Mahindra and Mahindra, 9: Ashok Leyland, 10: HMT, 11: TCS, 12: Wipro, 13: Infosys, 14: HCL, 15: MPhasis, 16: HUL, 17: Colgate, 18: Britannia, 19: Nestle, 20: Indian Oil Corporation, 21: ONGC, 22: Bharath Petroleum, 23: Essar Oil, and 23: Hindustan Petroleum Limited.

Table 6 shows the correlation coefficient between the returns of various shares of the companies under study. Correlation coefficient is one of the most effective statistical tools which could be effectively used to decide about what best two shares need to be combined to construct the minimum risk portfolio. As per the past literature review, it is found that the shares which are perfectly negatively correlated, it is possible to reduce the risk to zero. One of the important findings of the study is that among the companies under study, returns of most of the companies are strong positively correlated and none of the pairs of shares have perfect negative correlation. Only few pairs of shares like MPhasis and HUL, HCL and HUL, HCL and Colgate, TCS and Colgate, Mahindra and Mahindra and Nestle, Wipro and HPL, IOC and HPL are weak negatively correlated.

Findings of the Study

The performances of various portfolios constructed are first evaluated based on the returns of each portfolio. The portfolios are ranked based on the average returns of five years calculated by using Markowitz Model and it is found that Automobile industry is the best performer and the Bank portfolio is the least performer. Almost every year of the study period, the performance of the bank portfolio is comparatively poor than the performance of the other portfolios.

Sharpe Single Index Model assumes that the investors are compensated only for bearing systematic risk. Because according to this model, unique risk is diversifiable and an efficient portfolio manager could reduce this diversifiable risk to zero level. With this reason, under this model, unsystematic risk is totally neglected while calculating the return of security or portfolio. Accordingly under this model, compensation for unique risk is negated. According to Sharpe Single Index Model, Automobile Industry is the best performer and the Bank

portfolio is the least performer. Later, portfolios are ranked according to their respective risk calculated based on Markowitz Model. According to Markowitz model, among the five portfolios constructed automobile portfolio has the highest risk and FMCG portfolio has the lowest risk.

An attempt is made in this study to evaluate the portfolios by using portfolio evaluation techniques. The techniques used in this study are Sharpe's Measure and Treynor's Measure. According to Sharpe's Measure, Portfolio constructed by IT companies is the best portfolio because it gives the highest excess return to total risk. The excess return to total risk ratio of bank portfolio is negative and it is the worst performer compared to all other portfolios constructed in this study. According to Treynors's measure, there are two best portfolios; Automobile Industry portfolio and Oil Industry portfolio. These two portfolios have the equal excess return to systematic risk ratio. FMCG industry is the worst performer compared to all other portfolios under study.

One of the important findings of the study is that among the companies under study, returns of most of the companies are strong positively correlated to each other and none of the pairs of shares have perfect negative correlation. Negatively correlated shares are MPhasis and HUL, HCL and HUL, HCL and Colgate, TCS and Colgate, Mahindra and Mahindra and Nestle, Wipro and HPL, IOC and HPL.

Conclusion

It is well known fact that putting all the eggs in one basket is riskier than putting them in different baskets. Accordingly Portfolio investment is always better than investment in single asset or in single company. But creation of an efficient portfolio requires lot of research on fundamentals and other factors which are having an impact on the performance of various companies and assets. Formula methods are only one of the methods which can be used as a one of the techniques to evaluate the performance of a company or performance of the shares in the share market. They are not the ultimate answers to the questions of an investor. Portfolio investment helps an investor to diversify the risk of his investment. Investment in the companies of a same industry does not reduce the risk, instead of that he has to construct a portfolio consisting of shares or assets of different industries so as to facilitate sectoral diversification. It is proved in this study that the returns of companies come under same industry are perfectly positively correlated. As an investor, one should not invest in two companies whose returns are perfectly positively correlated or positively correlated. The reason is that if the returns are perfectly positively correlated, instead of reducing the risk investment, risk of the investment would be accumulated by adding shares which are

perfectly positively correlated. If the portfolio is efficiently constructed and managed by an investor, definitely it will satisfy all the objectives of investment of an investor.

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