



ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2015; 1(13): 21-24
www.allresearchjournal.com
Received: 15-10-2015
Accepted: 17-11-2015

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Construction of optimal portfolio using Sharpe's single index model- A study with reference to banking & IT sector

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Abstract

The main aim of this study is to construct an optimal portfolio using Sharpe's Single Index model. For this purpose monthly closing prices of 10 companies from banking sector and 10 companies from IT sector listed in the Bombay stock exchange (BSE) were selected. Share prices for the period of January 2010 to December 2015 had been considered. Using all the collected data a "cut-off" rate had been calculated and that rate had been considered for the construction of optimal portfolio. The finding of the study is very useful for investors, policy makers, corporations and their financial market participants.

Keywords: cut-off rate, beta, market return, Sharpe's single index model.

Introduction

The security analysis and portfolio management is the most concerned aspect for rational investment and decision making. A portfolio is a set of securities such as stocks, bonds and money market instruments. The process of blending together these assets classes, so as to obtain maximum return with minimum risk is called portfolio construction. It is a very difficult task to find out good investments among various types of investments. In an optimal portfolio every investor need maximum return with a minimum return. This process is done through the construction of an optimal portfolio.

Need for the study

While selecting securities for construction of portfolio, all investors undergoes confusion. All investors face difficulties while deciding about the proportion of investment to be made in each security. In order to help investors, to get out of such difficult situations the Sharpe's Single Index Model may be used to construct an optimal portfolio. This optimal portfolio helps the investor to find a good portfolio. The present study is to establish that by applying this Sharpe's model an individual can construct an optimal portfolio not only with minimum risk but also with a maximum return.

Problem statement

The present study is prepared on the basis of studying the sectors in which an investor can invest their savings in a group of securities or portfolio. By creating a portfolio an investor get maximum return with a minimum rate of risk. Portfolio management deals with the analysis of individual securities as well as with the theory and practice of optimally combining securities into good portfolios. So the banking sector and IT sector had been considered. Therefore, the present study is entitled as "Construction of Optimal Portfolio using Sharpe's single Index model-A study with reference to banking & IT Sector"

Research Methodology

This study is based on secondary data obtained from the website www.moneycontrol.com. Twenty companies from the BSE Sensex index were selected for the study. The tools used are as follows

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1) Estimate the return on stock. The equation to be used

$$R_i = \frac{(P_t - P_o)}{P_o} \times 100$$

where P_t =current year price, P_o =previous year price

2) Excess return to beta ratio = $\frac{(R_i - R_f)}{\beta_i}$

Where R_i =the expected return of stock I, R_f =risk free rate of return, β_i =systematic risk of stock i

3) Cut-off rate C_i is calculated by using the following equation

$$C_i = \frac{\sigma_m^2 \sum_{i=1}^N \frac{(R_i - R_f)}{\sigma_{ei}^2} \times \beta_i}{1 + \sigma_m^2 \sum_{i=1}^N \frac{\beta_i^2}{\sigma_{ei}^2}}$$

Where σ_m^2 =Variance of the market index, σ_{ei}^2 =stocks unsystematic risk.

(All calculations done in MS. Excel).

Objectives of the study

- To construct an optimal portfolio using Sharpe’s single index model by using the selected sectors.
- To help investors in portfolio selection process to make the right choice.
- To calculate the return and risk of the constructed optimal portfolio by using Sharpe’s Single Index Model.
- To get a knowledge about Sharpe’s single Index model.

Limitations of the study

- 1) This study uses yearly data instead of monthly data.
- 2) This studies results may not be universally applicable.

Data Analysis and Interpretation

This part brings out data analysis and interpretations relating to the present study. Secondary data were used for this study. Twenty companies listed in the BSE sensx were chosen. The companies were selected listed below

Table 1.1: Sample Companies Names

No:	Name of Companies
1	Axis Bank
2	State Bank of India
3	HDFC Bank
4	ICICI Bank
5	Yes Bank
6	Kotak Mahindra Bank
7	Bank of Baroda
8	South Indian Bank
9	Canara Bank
10	Union Bank
11	Tata Consultancy Services Limited
12	Wipro Limited
13	Infosys Limited
14	Tech Mahindra
15	L&T Limited
16	Reliance
17	HCL Technologies
18	Honeywell Technologies
19	Ramco systems
20	Mind tree

The above table 1.1 represents the list of sample companies selected for the study. First ten companies are from the banking sector and the remaining ten from IT sector.

Table 1.2: Mean Return of sample companies stock in (%) & Beta values

No:	Name Of Companies	Mean Return in (%)	Beta values
1	Axis Bank	11.83	1.83
2	State Bank of India	26.970	1.28
3	HDFC Bank	3.78	.93
4	ICICI Bank	8.020	1.14
5	Yes Bank	21.218	1.9
6	Kotak Mahindra Bank	12.006	1.07
7	Bank of Baroda	9.729	0.82
8	South Indian Bank	10.280	1.03
9	Canara Bank	6.654	0.82
10	Union Bank	14.463	0.68
11	Tata Consultancy Services Limited	21.046	0.58
12	Wipro Limited	7.586	.53
13	Infosys Limited	6.037	.69
14	Tech Mahindra	22.208	.87
15	L&T Limited	1.182	1.38
16	Reliance	1.941	1.12
17	HCL Technologies	6.0634	0.49
18	Honeywell Technologies	3.4178	1.06
19	Ramco systems	9.6548	0.87
20	Mind tree	8.971	0.75

Source: mean return computed by the author and beta values Collected from each company’s websites.

Table 1.2 shows the mean return of sample companies in percentage and the beta values of the sample companies. A beta value lower than 1 indicates investment with volatility lower than the market. Axis bank has the highest beta

value.ie Axis bank is highly volatile. Similarly State bank of India, ICICI bank, L & T limited, Yes bank, Kotak Mahindra bank limited, South Indian Bank, Reliance and Honeywell have beta values greater than 1.

Table 1.3: Ranking of the stocks based on excess return to Beta ratio

No:	Name of Companies	Ri	Ri-Rf	β	$\frac{R_i - R_f}{B}$	Rank
1	Axis Bank	11.83	4.08	1.83	2.229	10
2	State Bank of India	26.970	19.22	1.28	15.015	3
3	HDFC Bank	3.78	-3.97	.93	-4.269	15
4	ICICI Bank	8.020	0.27	1.14	.237	13
5	Yes Bank	21.218	13.468	1.9	7.088	5
6	Kotak Mahindra Bank	12.006	4.256	1.07	3.978	7
7	Bank of Baroda	9.729	1.979	0.82	2.413	9
8	South Indian Bank	10.280	2.53	1.03	2.4563	8
9	Canara Bank	6.654	-1.096	0.82	-1.3365	19
10	Union Bank	14.463	6.713	0.68	9.8720	4
11	Tata Consultancy Services Limited	21.046	13.296	0.58	22.924	1
12	Wipro Limited	7.586	-0.164	.53	-0.309	20
13	Infosys Limited	6.037	-1.713	.69	-2.483	18
14	Tech Mahindra	22.208	14.458	.87	16.618	2
15	L&T Limited	1.182	-6.568	1.38	4.759	6
16	Reliance	1.941	-5.809	1.12	-5.187	14
17	HCL Technologies	6.0634	-1.6866	0.49	-3.4420	17
18	Honeywell Technologies	3.4178	-4.3322	1.06	-4.0869	16
19	Ramco systems	9.6548	1.9048	0.87	2.1894	11
20	Mind tree	8.971	1.221	0.75	1.628	12

Source: computed by the author

Table 1.4: Cut-off values (Ci) of sample companies stock

Rank	Name of Companies	$\frac{\beta_i^2}{\sigma_{ei}^2}$	$\sum_{i=1}^N \frac{\beta_i^2}{\sigma_{ei}^2}$	C_i
1	Tata Consultancy Services Limited	0.001990996	0.001990996	1.49
2	Tech Mahindra	0.000927422	0.002918418	4.61
3	State Bank of India	0.000554002	0.00347242	3.58
4	Union Bank	0.00132412	0.004796539	2.89
5	Yes Bank	0.003370194	0.008166734	4.45
6	L&T Limited	0.000686672	0.008853406	4.44
7	Kotak Mahindra Bank	0.001179689	0.010033095	4.26
8	South Indian Bank	0.000344546	0.010377641	4.21
9	Bank of Baroda	0.000387252	0.010764892	4.04
10	Axis Bank	0.000422045	0.011186938	4.25
11	Ramco systems	0.000509534	0.011696472	5.01
12	Mind tree	0.000102663	0.011799135	4.97
13	ICICI Bank	0.000575777	0.012374911	4.67
14	Reliance	0.00026613	0.012641041	4.90
15	HDFC Bank	0.000934144	0.013575185	4.30
16	Honeywell Technologies	0.000458381	0.014033566	4.02
17	HCL Technologies	0.000142745	0.000142745	0.32
18	Infosys Limited	0.000636018	0.000778763	1.48
19	Canara Bank	0.000484824	0.001263586	0.69
20	Wipro Limited	0.000573113	0.001836699	0.18

Source: computed by the author

Table 1.4 represents the C_i of sample companies. The C_i values goes on increasing from 4.04 to 5.01. Therefore, the value of 5.01 is considered as the "Cut-off point". The securities which come after the cut-off point will not be

considered for the optimal portfolio construction. Those securities which have value of C_i more or equal to cut off point will be selected in optimal portfolio.

Table 1.5: Proportion of investment proposed

Company name	C_i	Z_i	X_i	Return (%)
Bank of Baroda	4.04	0.000536557	12.00	9.729
Axis Bank	4.25	0.002519375	37.98	11.83
Ramco Systems	5.01	0.003684623	50.02	9.6548

$\sum X_i = 100.00$ Source: computed by the author

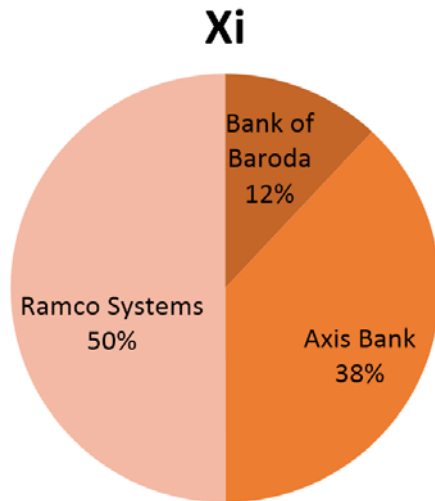


Fig 1.1

The above figure shows the proportion of investment made by the investor. From the figure we can understand 50% of the investment made in Ramco systems, 38% of the investment made in Axis bank and the remaining 12% of the investment in Bank of Baroda.

Findings

The findings of the present study are listed below

- 1) State Bank of India having the highest return ie. 26.970% and the L&T limited having the lowest return ie. 1.182%
- 2) The return from Axis bank has the highest beta value of 1.83 which means it is highly volatile.
- 3) State bank of India, ICICI bank, L&T limited, Yes bank, Kotak Mahindra bank limited, South Indian Bank, Reliance and Honeywell have beta values greater than 1. ie. they are also volatile.
- 4) Ci values goes on increasing from 4.04 to 5.01. Based on the Ci values only three companies were selected.
- 5) Ramco systems having the highest cut off value ie. 5.01. Wipro limited having the lowest cut off value 0.18.

Conclusion

Thus the optimal portfolio is constructed by using the Sharpe's single index model. This method is more adequate. Portfolio is constructed by taking the last five years data. After constructing the portfolio only three companies were selected for the portfolio construction. From banking sector two companies were selected and from IT sector only one company is selected for optimal portfolio construction.

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