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Construction of Optimal Portfolio using Sharpe's Single Index Model: A Study with Reference to Automobiles and Pharmaceutical Sector

Dr. S Poornima¹

HoD & Associate Professor,
Department of Business Administration,
PSGR Krishnammal College for Women,
India

Aruna. P. Remesh²

Research Scholar-M.Phil.,
Department of Business Administration,
PSGR Krishnammal College for Women,
India

Abstract: *The major purpose of this study is to construct an optimal portfolio using Sharpe's single index model by using risk-return analysis of automobile and pharmaceutical sectors. This study includes ten stocks from automobile sector and ten stocks from pharmaceutical sector. Data for a period of five years (2010-2015) had been taken for the study. After analysing the collected data a "cut-off rate" can calculate. This cut-off rate is considered in the construction of optimal portfolio. Every investor prefers maximum return with a minimum risk. This study found out that Ashok Leyland having highest return and Hyundai having lowest return. This paper identifies an optimal portfolio from the selected companies which serves as a guide to function in maximising return.*

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

I. INTRODUCTION

There are different forms of financial products available in the market which gives different rates of return. Every investor invests his funds in a portfolio in order to get maximum return with less risk. The Portfolio management consist all the processes involved in the creation and maintenance of an investment portfolio. A close watch observation of the share prices over a period of time indicates the movement of share prices with the market index. Portfolio management is a difficult process which tries to make investment process more rewarding and less risky.

II. OBJECTIVE OF THE STUDY

- 1) To construct an optimal portfolio by using risk-return analysis of automobile & pharmaceutical sectors by using Sharpe's Single Index model.
- 2) To determine the proportion of investment to be made in the selected securities.

III. RESEARCH METHODOLOGY

This study is based on secondary data obtained from web sources. Twenty companies listed in the BSE Sensex index were selected for the study. Data collected for a period of five years (2010-2015) had been taken. The tools were used are as follows.

(A) Stock return can calculate by using the equation

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

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

(B) Excess return to beta ratio can calculate by using the equation = $\frac{(R_i - R_f)}{\beta_i}$

β_i

Where R_i is the return on stock i , R_f =risk free rate of return, β_i =systematic risk of stock i

(C) The Cut-off rate (C_i) is calculated by using the 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.

IV. DATA ANALYSIS AND INTERPRETATION

Table 1.1 Mean Return Of sample companies stock in (%) & Beta values

No:	Name of companies	Mean Return (%)	Beta Values
1	Ashok leyland	17.713	1.87
2	Hero	9.702	0.81
3	Honda	6.536	1.11
4	Hyundai Motors	1.736	0.94
5	Mahindra& Mahindra	5.010	0.87
6	Maruthi Suzuki	11.364	1.52
7	Tata motors	2.751	1.76
8	Tvs motors	17.492	1.71
9	Scooters India	11.043	0.48
10	Yamaha Motors	11.759	1.34
11	Astra pharmaceuticals	4.619	0.86
12	Aurobindo pharma limited	9.574	1.58
13	Biocon limited	6.971	5.21
14	Cipla limited	9.202	0.98
15	Dabur India limited	4.346	0.37
16	Dr.Reddy's limited	6.734	0.62
17	Glen mark pharmaceuticals	3.294	0.21
18	Novartis	6.328	0.57
19	Ranbaxy limited	9.983	0.37
20	Zandu pharmaceuticals	4.982	1.61

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

Table 1.1 shows the list of sample companies selected for the study and also their mean return in percentage and the beta values of the sample companies.

Table 1.2 Ranking of the stocks based on excess return to Beta ratio

No:	Name of Companies	R_i	$R_i - R_f$	β	$\frac{R_i - R_f}{\beta}$	Rank
1	Ashok Leyland	17.713	9.963	1.87	5.327	4
2	Hero	9.702	1.952	0.81	2.409	5
3	Honda	6.536	-1.214	1.11	-1.093	11
4	Hyundai Motors	1.736	-6.014	0.94	-6.397	18
5	Mahindra& Mahindra	5.010	-2.74	0.87	-3.149	16
6	Maruthi Suzuki	11.364	3.614	1.52	2.377	8
7	Tata motors	2.751	-4.999	1.76	-2.840	15
8	Tvs motors	17.492	9.742	1.71	5.697	3
9	Scooters India	11.043	3.293	0.48	6.860	1
10	Yamaha Motors	11.759	4.009	1.34	2.991	7
11	Astra pharmaceuticals	4.619	-3.131	0.86	-3.640	17

12	Aurobindo pharma limited	9.574	1.824	1.58	1.154	9
13	Biocon limited	6.971	-0.779	5.21	-0.149	10
14	Cipla limited	9.202	1.452	0.98	1.481	6
15	Dabur India limited	4.346	-3.404	0.37	-9.2	19
16	Dr.Reddy's limited	6.734	-1.016	0.62	-1.638	12
17	Glen mark pharmaceuticals	3.294	-4.456	0.21	-21.219	20
18	Novartis	6.328	-1.422	0.57	-2.494	14
19	Ranbaxy limited	9.983	2.233	0.37	6.035	2
20	Zandu pharmaceuticals	4.982	-2.768	1.61	-1.719	13

Source: Computed by the author.

Table 1.3 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	Scooters India	7.48264	0.011741569	0.90
2	Ranbaxy limited	-0.07963933	-0.02408354	0.17
3	Tvs motors	0.005434572	0.011666743	1.09
4	Ashok Leyland	0.00207895	0.002078985	0.81
5	Hero	0.00037138	0.002450373	1.12
6	Cipla limited	0.000351005	0.054916037	0.16
7	Yamaha Motors	0.00103413	0.012775699	0.13
8	Maruthi Suzuki	0.001385699	0.006232171	1.04
9	Aurobindo pharma limited	0.002755	0.016206	0.10
10	Biocon limited	0.041114	0.0545650	0.17
11	Honda	0.00078928	0.00323958	1.05
12	Dr.Reddy's limited	0.000464878	0.055380915	0.90
13	Zandu pharmaceuticals	5.00258	0.055605816	0.20
14	Novartis	0.000159369	0.05555579	0.18
15	Tata motors	0.005434572	0.011666743	0.55
16	Mahindra& Mahindra	0.000706621	0.004846472	0.69
17	Astra pharmaceuticals	0.000675053	0.013450752	0.73
18	Hyundai Motors	0.000900271	0.004139851	1.16
19	Dabur India limited	5.00339	0.054966071	0.17
20	Glen mark pharmaceuticals	1.55058	0.055396421 0.055396421	0.13

Source: Computed by the author.

Table 1.3 represents the C_i of sample companies. The C_i values goes on increasing from 0.18 to 1.16. Therefore, the value of 1.16 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 1.4 Proportion of investment proposed

Company name	Ci	Zi	Xi	Return (%)
Novartis	0.18	0.000244161	28.00	6.328
Tata motors	0.55	0.000594896	8.42	2.751
Mahindra& Mahindra	0.69	0.001219754	44.76	5.010
Astra pharmaceuticals	0.73	0.001093259	12.09	4.619
Hyundai Motors	1.16	0.001553464	6.73	1.736

Source: computed by the author

Xi=100.00

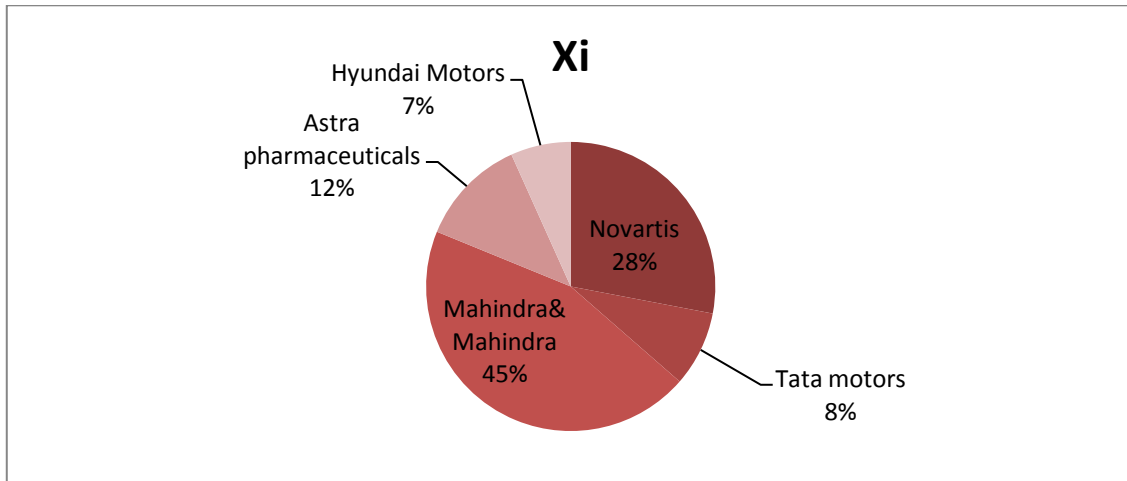


Figure 1.1

The above figure shows the proportion of investment made by the investor. From the figure we can understand 28% of the investment made in Novartis, 8% made in Tata motors, 45% made in Mahindra & Mahindra, 12% made in Astra pharmaceuticals, 7% made in Hyundai motors.

V. FINDING

The findings of the present study are listed below:

- 1) **Ashok Leyland** having the highest return. **17.713%** and the **Hyundai motors** having the lowest return ie. **1.736%**
- 2) **Biocon limited** having the highest beta value of **5.21**, which means it is **highly volatile** than the market.
- 3) Ashok Leyland, Honda, Maruthi Suzuki, Tata motors, TVS motors, Yamaha motors, Aurobindo Pharma limited, and Zandu Pharmaceuticals have beta values greater than one. ie. they are also volatile than the market.
- 4) The cut-off (Ci) values goes on increasing from **0.18 to 1.16**. Based on the cut –off values only five companies were selected for the optimal portfolio construction.
- 5) **Hyundai motors** having the highest cut off value ie. **1.16**.

VI. CONCLUSION

Thus an optimal portfolio is constructed by selecting twenty companies listed in BSE. After calculating the “cut-off “Values of these sample companies only five of them were selected for the optimal portfolio construction. Two from pharmaceutical sector and the remaining three from automobile sector. This study helps the investors to minimize their investment risk and maximize the return of their investment.

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