



OPTIMAL PORTFOLIO CONSTRUCTION USING SHARPE'S SINGLE INDEX MODEL - A STUDY OF SELECTED CEMENT INDUSTRY STOCKS FROM BSE

Dr.S.Vinoth*

T.Jayashree*

*Associate Professor, RVS Institute of Management Studies and Research, Coimbatore.

Abstract

The major aim of this research is to develop an optimal portfolio among top twenty one Indian cement industry stocks with the assistance of the Sharpe single index model. Portfolio development is a critical procedure of the investors for interest in the equity market. A decent mix of portfolio will give most extreme return for a specific level of risk. In this exploration, 21 stocks especially from Cement Industry and these stocks are constituent of the BSE Sensex record. The everyday prices for every one of the stocks for the time of Jan first 2012 to May 31st 2017 have been considered. The proposed strategy details an exceptional cut off point (Cut off rate of return) and chooses stocks having abundance of their normal return over risk free rate of return outperforming this cut-off point. Level of interest in each of chose stocks is then settled on the premise of particular weights doled out to each stock contingent upon separate beta value, stock volatility unsystematic risk, return on stock and risk free return opposite to the cut off rate of return. The study finds that only three company stocks constitute the optimum portfolio and these are Gujarat Sidhee Cement Ltd, Rain Industries Ltd and, Barak Valley Cements Ltd. with ideal proportion of investment of 33.32%, 33.33% and 33.35% respectively. This research findings and suggestions would be helpful to investors.

Keywords: Return, Beta, Cut-Off Point, Portfolio Construction, Return On Portfolio.

I. Introduction

Individual investors and portfolio managers were investing in equity stocks for capital appreciation and for dividend income. The investors aim at maximizing the return, with differing attitudes towards risk. Overall, the general target is to invest into an optimal portfolio, adopting differing approaches. The present study endeavors at choosing an optimal portfolio for investment in Indian stocks having a place with particular monetary divisions. The important writing has been surveyed, and the methodology of the study has been encircled in like manner.

Markowitz was the first who established framework of "Modern Portfolio Theory" to measure risk. He gave diagnostic instruments to examination and choice of optimal portfolio. This portfolio approach won him Nobel Prize in 1990. The work done by Markowitz was reached out by William Sharpe. He disentangled the sum and sort of info information required to perform portfolio analysis. He made the various and complex calculations simple which were basic to accomplish optimal portfolio. This rearrangements is accomplished through single index model. This model proposed by Sharpe is the easiest and the most generally utilized one.

The investigation concentrates on discovering an optimal portfolio utilizing Sharpe's single index model. This paper is developed around building an optimal portfolio by adjusting the positive and negative relationship existing between the securities and thus getting returns nearer to the expected outcomes. For this study, the stocks from the top 21 Cement Companies are included since these sectors are of prime importance for real growth of an economy.

II. Statement of Problem

The portfolio should not be built in view of the brand character, current execution and so on in light of the fact that that would not help investors in accomplishing the expected return. The principle objective of portfolio construction is broadening and to keep up the consummate negative relationship between the securities. Also, holding a few stocks is constantly superior to holding one. The optimum portfolio gives the investors a superior lucidity to put the correct extent of cash in the correct stock and it encourages the investors to get most extreme comes back with insignificant risk. India is the second biggest maker of cement in the world. No big surprise, India's cement industry is an indispensable piece of its economy, giving work to more than a million people, straightforwardly or in a roundabout way. As far back as it was deregulated in 1982, the Indian cement industry has pulled in gigantic speculations, both from Indian and also foreign investors. India's demand over cement has been increased due to government's push for considerable infrastructural development both in rural and urban, inciting 45 million tons (MT) of cement required in the accompanying three to four years. Recent times, equity investors are also investing more towards cement industries. Hence, Cement companies have been considered for the study.



III. Objective of the Study

The primary objective is to construct an optimal stock portfolio among selected stock from the selected cement companies in India.

The specific objectives are:

1. To present a review of past works relating to optimum portfolio construction and analysis.
2. To build an optimum stock portfolio among selected stocks belong to the cement companies in India, using Sharpe Single Index model.
3. To calculate the proportion of investment to be made into each of the stock that is included in the optimal stock portfolio that is constructed using Sharpe index model.

IV. Review of Literature

The literature has different studies for investigations of an optimal portfolio, applying models, for example, that of Markowitz, Sharpe and others. Utilizing the Mean Variance (MV) proficient portfolio, the optimal holding time frame was examined taking Istanbul stocks for the period January 2000 to November 2004. The outcomes demonstrated that MV effective speculation portfolio performed better for long term period (Ulucan, 2007). The relationship among risk and return has been used as a piece of creating ideal course of action of stocks in various studies.

Many investigations have chosen Sharpe Single Index Model to build an optimal portfolio, for its straightforwardness and useful esteem. For example, four investigations are alluded here in which this model has been utilized.

One is by Varadarajan (2011) who developed an optimal portfolio comprising of five stocks. An example of thirty organizations having a place with different parts was decided for examine and the information essential for this examination was gathered from auxiliary sources. It was discovered that exclusive four organizations were incorporated into portfolio construction. The study reasoned that William Sharpe's Single Index Model will be practical and material to the Indian market where financial investors can build a portfolio for enhancing the normal profits for their venture (Dileep and Rao, Kesava 2013).

A sample of six top performing IT companies traded in BSE has been chosen. The data related to the daily returns of the securities and the market index has been collected through secondary sources. Information has been gathered for a time of three years i.e. 2009 to 2011. It was discovered that the optimal portfolio has been built with five organizations by Andrade, Pratibha Jenifer (2012).

Meenakshi and Sarita (2012) expressed that Sharpe's single index model is of extraordinary significance and the structure of Sharpe's single index model display for ideal portfolio development is extremely straightforward and valuable. Nanda, Mahanty, and Tiwari (2012) chose stocks from the groups to construct a portfolio, limiting portfolio risk and contrast the profits and that of the benchmark record i.e. Sensex. Saravanan and Natarajan (2012) utilized Sharpe single index model keeping in mind the end goal to build an ideal arrangement of 4 organizations from NSE (National Stock Exchange of India) and utilized NSE NIFTY as market index.

Frank J Fabozzi, Harry M Markowitz, Francis Gupta (2008), expressed that the primary target of portfolio determination is the gathering and development of the portfolios to expand returns expected on them with a specific level of risk. Investors for the most part utilize demonstrating strategies on the recorded information and in view of their future expected returns, the optimal portfolio choice is done and this permits figuring the investment risk and return for a portfolio. Also, the theory of portfolio selection shifts from individual risk to the entire portfolio risk and shows the possibility of combining risky assets to produce an optimum portfolio.

V. Methodology

This is a descriptive study in which statistical data is analyzed for portfolio construction. The method of data collection is secondary. The secondary sources include websites like Bombay Stock Exchange (BSE), and few databases like EBSCO and Pro quest. The sampling method used is simple random sampling method and the sample size is limited to twenty. These companies are specific to Cement Industry. The analysis is based on the financial data (closing price of stock) of twenty companies for previous five years i.e., from Jan 1st 2012 to May 31st 2017.

VI. Tools used for Discussion

Return

The total gain or loss experienced on an investment over a given period of time, calculated by dividing the asset's cash distributions during the period, plus change in value, by its beginning-of-period investment value is termed as return.

Return = (Today's price - Yesterday's price) / (Yesterday's price)

Market Return

Market Return is the return on the market portfolio of all traded securities.

Return = (Today's Index - Yesterday's Index) / (Yesterday's Index)

Beta Coefficient

Beta coefficient is the relative measure of non-diversifiable risk. It is an index of the degree of movement of an asset's return in response to a change in the market's return.

$$\text{Beta} = \text{Correlation} * \frac{(Y)}{(X)}$$

Where, (Y) = Standard Deviation of Individual stock (X) = Standard Deviation of Market

Efficient Portfolio

A portfolio that maximizes return for a given level of risk or minimizes risk for a given level of return is termed as an efficient portfolio.

Correlation

A statistical measure of the relationship between any two series of numbers representing data of any kind is known as correlation.

Risk-free Rate of Return (RF)

Risk-free rate of return is the required return on a risk free asset, typically a three month treasury bill. The risk free rate of return taken is 7%

Excess Return to Beta Ratio = $R_i - R_j / \beta_i$

Where, R_i = the expected return on stock i ; R_j = the return on a riskless asset

β_i = the expected change in the rate of return on stock associated with one unit change in the market return.

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

Where, σ_m^2 = variance of the market index; σ_{ei}^2 = variance of a stock's movement that is not associated with the movement of market index i.e. stock's unsystematic risk.

$$X_i = Z_i / \sum_{i=1}^N Z_i$$

$$Z_i = \beta_i / \sigma_{ei}^2 (R_i - R_f / \beta_i - C^*)$$

Where, C^* = the cut-off point.

Excess Return to Beta Ratio

Excess return to beta ratio shows the return from the investment in excess to the risk taken by the investor.

Risk free Rate of Interest, = 7%

The individual returns are calculated and excess return to beta is found using the formula. Then the stocks are ranked according to the excess return to beta ratio.

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VII. Analysis

Table No.1: Calculation of Excess Return to Beta Ratio

Sl. No	Securities	Ri		Ri-Rf/	Rank
1	ACC LIMITED	4.99	1.41	31.75	19
2	AMBUJA CEMENTS LTD	5.62	1.27	40.26	18
3	ANDHRA CEMENTS LTD	3.99	1.41	24.78	20
4	BARAK VALLEY CEMENTS LTD	18.97	1.12	164.65	3
5	BIRLA CORPORATION LTD	14.99	1.61	90.10	12
6	BURNPUR CEMENT LTD	6.82	1.01	62.64	17
7	DALMIA BHARAT LTD	37.31	2.47	148.76	6
8	GUJARAT SIDHEE CEMENT LTD	29.77	0.45	652.37	1
9	INDIA CEMENTS LTD	15.42	2.15	69.45	16
10	JK LAKSHMI CEMENT LTD	30.52	1.86	161.36	4
11	JKCEMENT LTD	29.02	1.96	145.34	7
12	KCPLTD	20.01	1.43	136.37	9
13	PANYAM CEMENTS & MINERAL INDUSTRIES LTD	9.45	1.21	73.74	14
14	PRISM CEMENT LTD	15.44	2.01	74.50	13
15	RAIN INDUSTRIES LTD	16.08	0.37	423.15	2
16	RAMCO CEMENTS LIMITED	20.88	1.27	160.96	5
17	SAURASHTRA CEMENT LTD	26.88	2.84	92.75	11
18	SHREE CEMENT LTD	23.55	1.67	138.38	8
19	SHREE DIGVIJAY CEMENT COLTD	15.16	2.00	73.35	15
20	UDAIPUR CEMENT WORKS LTD	15.49	-0.34	-0.02	21
21	ULTRATECH CEMENT LTD	14.77	1.35	105.97	10

It can be seen from the table that Dalmia Bharat Limited yielded the maximum return (37.31) among the companies selected and Andhra Cements Ltd yielded lowest return of 3.99. The Beta is a measure of the systematic risk associated with stock returns and higher beta value signify that the volatility in stock return is high and thus not always desirable. It can be seen from table-1 that Saurashtra Cement Ltd, Prism cement Ltd, India Cements Ltd, Dalmia Bharat Ltd and Shree Digvijay Cement Co Ltd with beta of 2.84, 2.01, 2.15, 2.47 and 2.00 respectively, the other beta values are less than 1.0. The lowest beta is observed for Udaipur Cement Works Ltd with value of -0.34.

According to the Sharpe model the excess return of any stock is directly related to its excess return to beta ratio. It measures the additional return on a security (excess of the risk less asset return) per unit of systematic risk. The ratio provides a relationship between potential risk and reward. For the calculation of this ratio, the risk free return (Rf) is taken as the rate of return on the 91- days Treasury bill which is found to be 5% for the period under study. Ranking of the stocks are done on the basis of their excess return to beta. Based on the excess return to beta ratio the scrip's are ranked from 1 to 21, with Gujarat Sidhee Cement Ltd being in the first rank followed by Rain Industries Ltd and Barak Valley Cement Ltd. Udaipur Cement Works Ltd being in the last.

Table No.2: Calculated Values of Cut-off point for the selected companies

Securities	R_i	$(R_i - R_f)\beta/\sigma^2$	$\Sigma(R_i - R_f)\beta/\sigma$	$\sigma^2 m \Sigma(R_i - R_f)\beta$	$\beta^2/\sigma^2 e$	$\Sigma\beta^2/\sigma^2$	$1 + \sigma^2 m \Sigma\beta^2/\sigma^2 e$	C_i
GUJARAT SIDHEE CEMENT LTD	29.77	3.52	224.14	13838.73	0.01	3.37	209.17	66.16
RAIN INDUSTRIES LTD	16.08	2.60	282.31	17430.11	0.01	4.13	255.94	68.10
BARAK VALLEY CEMENTS LTD	18.97	7.78	279.21	17238.95	0.07	4.04	250.50	68.82*
JK LAKSHMI CEMENT LTD	30.52	30.01	161.82	9990.88	0.23	2.49	154.91	64.50
RAMCO CEMENTS LIMITED	20.88	18.89	89.30	5513.39	0.16	1.79	111.54	49.43
DALMIA BHARAT LTD	37.31	46.86	271.43	16758.83	0.37	3.97	246.29	68.04
JKCEMENT LTD	29.02	31.33	120.63	7447.84	0.27	2.06	128.16	58.11
SHREE CEMENT LTD	23.55	31.77	42.78	2641.02	0.30	1.01	63.26	41.75
KCPLTD	20.01	14.22	176.04	10868.71	0.15	2.64	163.98	66.28
ULTRATEC H CEMENT LTD	14.77	14.13	11.97	739.11	0.22	0.48	30.62	24.14
SAURASHTRA CEMENT LTD	26.88	31.32	207.36	12802.76	0.43	3.07	190.55	67.19
BIRLA CORPORATION LTD	14.99	11.18	131.81	8138.19	0.20	2.26	140.75	57.82
PRISM CEMENT LTD	15.44	14.14	56.91	3513.86	0.31	1.31	82.14	42.78

PANYAM CEMENTS & MINERAL INDUSTRIES LTD	9.45	2.53	224.57	13865.47	0.09	3.60	223.30	62.09
SHREE DIGVIJAY CEMENT COLTD	15.16	13.26	220.62	13621.30	0.29	3.36	208.76	65.25
INDIA CEMENTS LTD	15.42	13.50	70.41	4347.15	0.31	1.63	101.50	42.83
BURNPUR CEMENT LTD	6.82	0.50	279.71	17269.88	0.08	4.12	255.34	67.63
AMBUJA CEMENTS LTD	5.62	-0.97	11.00	679.33	0.22	0.70	44.45	15.28
ACC LIMITED	4.99	-2.16	-2.16	-133.47	0.26	0.26	16.96	-7.87
ANDHRA CEMENTS LTD	3.99	-2.09	222.05	13709.52	0.14	3.51	217.52	63.03
UDAIPUR CEMENT WORKS LTD	15.49	0.43	222.48	13736.30	0.00	3.51	217.72	63.09

The selection of the stocks depends on a unique cut-off rate such that all stocks with higher ratios of excess return to beta are included and stocks with lower ratio are left out. The cumulated values of C_i start declining after a particular C_i and that point is taken as the cut-off point and that stock ratio is the Cut-off ratio C . The highest value of C_i is taken as the cut-off point that is C^* . From table-2 it is seen that Barak Valley Cements Ltd has the highest the cut-off rate of $C^* = 68.82$. All the stocks having C_i greater than C^* can be included in the portfolio.

Table No.3: Proportion of Investment Proposed

Rank	Scrip Name	C_i	Z_i	X_i
1	GUJARAT SIDHEE CEMENT LTD	66.16	67.99	33.32%
2	RAIN INDUSTRIES LTD	68.10	68.03	33.33%
3	BARAK VALLEY CEMENTS LTD	68.82*	68.06	33.35%
			204.08	100.0%

After determining the securities to be included in the optimal portfolio, we have to determine the proportion of investment in each of these stocks. Only those stocks with Excess return to beta ratio more than C^* are to be selected in the optimal portfolio. It can be observed from table-2 that only three stocks qualify to be included in the optimal portfolio on this criterion. These are Gujarat Sidhee Cement Ltd, Rain Industries Ltd and Barak Valley Cements Ltd with cut-off point (C_i) of 66.16, 68.10 and 68.82, respectively as displayed in table-2.

By using Sharpe index model, Zi value was positive for this three companies Gujarat Sidhee Cement Ltd, Rain Industries Ltd and Barak Valley Cements Ltd. i.e., 67.99, 68.03 and 68.06. We are able to find out the proportion of investments to be made for each of the two stocks included in the optimal portfolio. The maximum investment should be made in Barak Valley Cements Ltd with a proportion of 33.35%, Rain Industries Ltd with investment proportion of 33.33% and , Gujarat Sidhee Cement Ltd with investment proportion of 33.32%. Evidently, the companies chosen for the investments are growing at a steady rate in the recent years.

Table No.4: Return on Portfolio

Securities	Xi	Returns (in %)	Return on portfolio %
GUJARAT SIDHEE CEMENT LTD	33.32%	29.77	9.92
RAIN INDUSTRIES LTD	33.33%	16.08	5.36
BARAK VALLEY CEMENTS LTD	33.35%	18.97	6.33
Total Return on portfolio	Xi =100.00		21.61

Table 4 represents the proportion of investment, individual security return and the returns on portfolio. The returns on portfolio are calculated based on the proportion of investment in each security. The highest return on portfolio is from the Gujarat Sidhee Cement Ltd i.e.29.77% followed by Barak Valley Cement Ltd 18.97% and the lowest is Rain Industries Ltd i.e. 16.08%. Total return from the optimal portfolio is 21.61%. When one looks at the individual returns from the stocks in the above portfolio, it may be observed that the Gujarat Sidhee Cement Ltd security returns are higher than the portfolio return. On the other hand, Barak Valley Cements Ltd and Rain Industries scrip's returns are less than the portfolio return. Thus, the inclusion of stocks in a portfolio is beneficial to companies despite the fact that expected returns from individual stocks is less. Thus, the Sharpe's Single Index Model is useful to investors and helps the fund managers in deciding about the securities to be included in his portfolio to derive the best benefits of diversification.

VIII. Concluding Remarks

Risk and return play an important role in making any investment decisions. This study aims at analyzing the opportunity that are available for investors as per as returns are concerned and the investment of risk thereof. Constructing an optimal portfolio is a challenging task for the individual as well as the institutional investors. This paper made an attempt to construct an optimum portfolio using the Sharpe's Single Index Model. Among the twenty one sample companies, only three were selected namely Gujarat Sidhee Cement Ltd, Rain Industries Ltd and Barak Valley Cements Ltd are included in the Optimal Portfolio constructed in this study with maximum suggested investment in Gujarat Sidhee Cement Ltd. Our study is based on the Sharpe Single index model and thus limited to the lacunas of this model.

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