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PORTFOLIO CONSTRUCTION USING THE SHARPE INDEX MODEL WITH REFERENCE TO SUGAR AND METAL SECTOR ON INDIA

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ABSTRACT

The main aim of this research is to construct optimum portfolio through Sharpe index model. The portfolio is constructed to help the investor to reduce the risk. In this study two sector sugar and metal are chosen for constructing the portfolio. Ten companies are selected from each of these sectors and ranked according to single index model. The cut-off points are then calculated and securities are selected for construction of optimal portfolio. Proportion of investment in each security in the portfolio is found out. This analysis will help the investor to invest in security which would yield more return with minimum security.

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INTRODUCTION

The stream which deals with managing various securities and creating an investment objective for individuals is called portfolio management. Portfolio management refers to the art of selecting the best investment plans for an individual concerned which guarantees maximum returns with minimum risks involved. Portfolio theory was proposed by Harry M. Markowitz of University of Chicago. According to Markowitz's portfolio theory, portfolio managers should carefully select and combine financial products on behalf of their clients for guaranteed maximum returns with minimum risks. Portfolio theory helps portfolio managers to calculate the amount of return as well as risk for any investment portfolio. William Sharpe then came up with a single index model through which portfolio is constructed efficiently. This model is very much easy to find out the optimum portfolio. It is a simple asset pricing model commonly used in the finance industry to measure risk and return of a stock. India has been known as the original home of sugar and sugarcane. Indian mythology supports the above fact as it contains legends showing the origin of sugarcane.

India is the second largest producer of sugarcane next to Brazil. Presently, about 4 million hectares of land is under sugarcane with an average yield of 70 tonnes per hectare. India is the largest single producer of sugar including traditional cane sugar sweeteners, khandasari and Gur equivalent to 26 million tonnes raw value followed by Brazil in the second place at 18.5 million tonnes. Even in respect of white crystal sugar, India has ranked No.1 position in 7 out of last 10 years. India is the world's second largest populated country, representing about 17.31% of the global population. Aggressive growth in the food and beverage industries will lead to the increasing demand for sugar. High sugar content in confectionaries, including chocolates, pastries and ice-creams, will drive the domestic demand for sugar. Metal industries are the indispensable part of an economy; they form the backbone of industrial development of any country. The steel sector in India is has been growing rapidly. India is the fifth largest producer of crude steel. Export growing at the rate of 20% where as import is double the rate. The key supplier for metal industry is automobile industry, telecom, power, consumer durable, and defence. The custom duty on primary and secondary metals has been reduced from 15 percent to 10 percent. The sugar and metal sector are the two sector sector where investment opportunities are larger and safer for an investor which will further grow in future. Both the industry is

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growing in India. The study focuses on construction of optimum portfolio consisting of these sector stocks using single index model.

Need for Study

Construction of portfolio is very important. The portfolio is constructed to diversify the risk. The portfolio construction gives the investor an optimum return from their investment. All the saving if invested in one security the risk is very high and the return from the security is not guaranteed so it is better for the investor to select two or more securities to invest through portfolio construction. This paper is designed to show the return that we get if correlation coefficient is positive and negative. Through Sharpe index model we can construct portfolio for any number of securities. The growth in sugar and metal sector is growing nicely it is better for the investor to select good company for their investment through proper portfolio construction.

Objectives

- To observe the performance of nineteen company of both sugar and metal sector
- Construction of portfolio for the nineteen company
- The find out the company that will give maximum return with minimum risk
- To analyze risk and return for these companies and to select stocks to be included in the portfolio
- To find out the volatility happening in the market with respect to the above 19 company.
- To find out the proportionate money to be invested in each company.

Scope of the Study

The data which are taken to design the portfolio are real data taken from NSE website and the portfolio is constructed on the basis of excess return to beta ratio. The scope of the study is that if the investment is made on maximum return security then the return will be relatively higher.

Limitation

- Only nineteen company is selected for constructing the portfolio
- Security is selected on the basis of risk and return ration alone
- The stock prices considered are last four years data.
- The factor like economic, social, political are not consider for constructing portfolio.

Review and Literature

Hiroshi konno (May 1991), Describes about the portfolio optimizing model using mean absolute deviation risk. The difficulties in markowitz model are eliminated through the mean absolute deviation method. A large optimization problem consisting of more than 1000 stock= k can also be solved through this paper. Marian Hristache, Anatoli Juditsky, and Vladimir Spokoiny Volume 29, Issue 3 (2001), 593-623, discusses the importance of single index model. Single-index

modeling is widely applied in, for example, econometric studies as a compromise between too restrictive parametric models and flexible but hardly estimable purely nonparametric models. By such modeling the statistical analysis usually focuses on estimating the index coefficients. The average derivative estimator (ADE) of the index vector is based on the fact that the average gradient of a single index function is proportional to the index vector. Unfortunately, a straightforward application of this idea meets the so-called "curse of dimensionality" problem if the dimensionality of the model is larger than 2. Vinnie Jauhari (2012), explains about strategic growth challenges for the Indian hotel industry. As the tourism industry is growing, Indian and global firms face new challenges which need to be addressed.

This study involved obtaining practitioner insights by conducting an industry round table discussion with senior managers who are in leadership positions with international and national hotel brands. This paper has policy implications for both industry practitioners and government bodies setting up governing mechanisms for this industry segment. Gunjan M. Sanjeev, Kanika Gupta, Rumki Bandyopadhyay (2012), they provide a practitioners' perspective on financial challenges prevalent in the Indian hospitality industry. The study involves the collection of primary data through structured interviews. This paper provides some very useful qualitative analysis of the contemporary challenges and their possible solutions prevalent in the Indian hospitality sector. The findings will be useful for hoteliers, policy makers and researchers to deliberate on the issues raised. They highlighted some of the financial challenges faced by the Indian hospitality industry like high financing costs, multiplicity of taxes charged, licensing and legal issues, working capital issues and eroding margins. Myong Jae Lee, SooCheong (Shawn) Jang (2007), investigates the effect of a diversification strategy by hotel companies on corporate financial performance and stability, using 36 publicly traded hotel companies.

Accounting measures, market measure, and risk-adjusted performance measure were employed to gauge financial performance. This study supported the nature of the trade-off between financial performance and stability in the company diversification, and also implied that the market diversification strategy by hotel companies does not function as a means to improve financial performance. Richard B. Spurgin (2001), investigates how to game Sharpe ratio. This article describes a derivative structure that can induce an upward bias in the measurement of the Sharpe ratio. The structure accomplishes this by shifting returns from the highest monthly return each year to the lowest one. The objective of this article is to demonstrate how adding derivatives can appear to improve risk-adjusted return without actually doing so. Michael Stutzer (2000), discusses about portfolio performance index. The probability decay rate is t proposed here as a new portfolio "performance index." In the widely analyzed special case in which returns are normally distributed, the new performance-index-maximizing portfolio is the same as the popular Sharpe-ratio-maximizing portfolio. The results of the two approaches generally differ. B.P.S. Murth, Yoon K. Choi, Preyas Desa (1997), investigates shortcomings of two popular indices of performance Jensen's alpha and the Sharpe index. They

propose a new measure of performance that seeks to address the limitations of the earlier indices. The new index is calculated by employing a well known method in operations research called data envelopment analysis. They compare the results with traditional indices of performance.

MATERIALS AND METHODS

This study is descriptive in nature. Data collected is secondary data. No primary data is used in this study. Source of data is from websites like NSE, RBI and also from other databases. Sampling method is probability sampling. The sampling technique is simple random sampling. Sample population is total companies listed in NSE which is 1646 as of July, 2012. Sample size is 20 companies listed in NSE. Nineteen companies from SUGAR and METAL sector. The study is based on past four year's data from April 1, 2012 to March 31, 2016.

Research Tools

Beta Coefficient

Beta coefficient is the relative measure of non-diversifiable risk.

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

Where, $\sigma(Y)$ is the Standard Deviation of Individual Stock.
 $\sigma(X)$ is the Standard Deviation of Market.

Return

Return is the total gain or loss on an investment over a period of time.

$$\text{Return} = \frac{\text{Today's market price} - \text{Yesterday's market price}}{\text{Yesterday's market price}} \times 100$$

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 steps in constructing the portfolio using the Sharpe Method are as follows. (All calculations are done using MS Excel).

Find the excess return to β ratio

$$\text{Excess Return} - \text{Beta Ratio} = \frac{R_i - R_f}{\beta_i}$$

Where,

R_i is the expected return on stock

R_f is the return on a riskless asset

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

Arrange the calculated excess return to β ratios in the descending order.

Find the cut-off point using the formula below

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

Decide how much to be invested in each security

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

Where, X_i is the proportion of investment of each stock, and

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

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

DISCUSSION

First standard deviation, return, variance is calculated for all nineteen company. Then the correlation is calculated. The return indicator denotes that PONNI Sugar Company has greater return than the other company followed by other companies. None of the company has beta greater than the value of one which shows that it is more risky. To find out the security for yielding good return the Sharpe index model is used. The excess return to beta is first calculated and then based on the ratio the company is ranked as shown in Figure 2. The value of R_f is assumed as 8.12%. From Figure 2 we could find that the RENUKA SUGAR Company is in first followed by rest of the company and HINDALCO stands last.

Table 1. Return, Standard deviation and Beta of each stock

Company	Average Return(RI)	α	β
S&p CNX nifty	0.000253905		
Tata Steel	0.000252938	0.000195106	0.227768
Bhushan	0.000823072	0.000832363	-0.03659
Gujarat Mineral	0.000412087	0.000391445	0.081298
Hindalco	0.000311207	0.000308256	0.011624
Jsw Steel	0.000627304	0.000628597	-0.00509
National	-0.000189319	-0.000194981	0.022302
Sail	-0.000122337	-0.000113154	-0.03617
Sesa Goa	-0.000185872	-0.000190136	0.016794
Welspun	-0.000253968	-0.000258811	0.019075
Kcp Sugar	0.000200146	0.00020829	-0.03208
Banari sug	-7.9093E-05	-6.91082E-05	-0.03932
Dwarikesh	0.000310849	0.000329057	-0.07171
Kotari sug	-0.000323358	-0.000320158	-0.01261
Parry	0.000623274	0.000635755	-0.04916
Ponni sugar	0.001494839	0.00150293	-0.03187
Rajsree	0.000123931	0.000137497	-0.05343
Renuka sugar	-0.001081057	-0.001080508	-0.00216
Sakthi sugar	-0.000408288	-0.000399548	-0.03442
Simbha sugar	0.000335628	0.000347571	-0.04704

Cut-off point

The selection of securities depends upon the cut-off point. The stock with maximum cut-off point is chosen. The stocks above this value have high excess return to beta ratio and stocks below this value have less excess return to beta ratio. The stocks with high excess return to beta ratio are included in constructing portfolio. Cut-off point increases up to certain value then it starts reducing. The point when it reaches maximum is chosen as cut-off ratio (Fisher & Jordan). Here we can see the cutoff point is 1.979868664 (From Figure 3) and the corresponding company is PARRY sugar limited. The company above PARRY is selected for construction of portfolio.

calculated by using Z_i and X_i -proportion of money to be invested in each stock. Proportion of investment is shown in Table 5. It indicates weights on each security. Thus with help of Sharpe index model optimal portfolio is constructed and proportion of investment in each stock is found. Here in the portfolio the companies are from both AUGAR and Metal sector. The maximum investment should be made to Kotari Sugars Private Limited at 32% and followed by JSW STEEL and Renuka Sugar. It is shown in the Table 5. This shows companies in the SUGAR sector are growing at steady rate when compared to companies in the metal sector. These metal sectors have future scope of investment as scenario in that industry is rapidly changing. Proportion of investment is shown in the Figure 6.

Table 2. Excess Return to Beta Ratio

Company	(Ri-Rf)/B	New Ranking
S&P Cnx Nifty		
Tata Steel	-0.355393154	Renuka Sugar
Bhushan	2.196450008	Jsw Steel
Gujarat Mineral	-0.993722882	Bhushan
Hindalco	-6.959049437	Kotari Sug
Jsw Steel	15.82272863	Kcp Sugar
National	-3.64939363	Ponni Sugar
Sail	2.248362377	Sakthi Sugar
Sesa Goa	-4.846142324	Sail
Welspun	-4.270294578	Bhushan
Kcp Sugar	2.525161919	Banari Sug
Banari Sug	2.066860846	Simbha Sugar
Dwarikesh	1.127961202	Parry
Kotari Sug	6.466861604	Rajsree
Parry	1.639139641	Tata Steel
Ponni Sugar	2.501244045	Gujarat Mineral
Rajsree	1.517434756	National
Renuka Sugar	38.11410699	Welspun
Sakthi Sugar	2.370783468	Sesa Goa
Simbha Sugar	1.719203387	Hindalco

Table 3. Cut-Off point for 20 companies

New Ranking	(Ri-Rf)* β	(RiRf)* β / $\sigma^2 e_i$	$\sigma^2 m^*(\sum(Ri-Rf)*\beta)/\sigma^2 e_i$	$\beta^2/\sigma^2 e_i$	$1+(\sigma^2 m^* \sum \beta^2/\sigma^2 e_i)$	Ci
Renuka Sugar	0.0001	0.0700	2.40098E-05	0.0018	1.00000063	0.000024010
Jsw Steel	0.0004	0.2568	0.000112089	0.0162	1.000006201	0.000112088
Bhushan	-0.0065	-3.7787	-0.001183937	0.7704	1.000270445	0.00013204
Kotari Sug	0.0010	1.1098	-0.000803292	0.1716	1.000329306	1.00004532
Kcp Sugar	2.5251	3.056	1.047522591	1.245	1.000756473	1.046730768
Ponni Sugar	0.0025	2.649	1.048431307	1.0594	1.001119778	1.04725861
Sakthi Sugar	0.0028	2.7810	1.049385127	1.1730	1.001522101	1.047790285
Sail	0.0029	2.8266	1.05035459	1.2573	1.001953345	1.048306885
Bhushan	0.0029	1.6922	1.05093499	0.7704	1.00221759	1.048609605
Banari Sug	0.0031	4.4654	1.052466511	2.1604	1.002958578	1.049361892
Simbha Sugar	1.7192	1.678.2	1.628062723	2.1596	1.003699293	1.62206224
Parry	1.6391	1.050	1.988244083	1.5482	1.00423029	1.979868664
Rajsree	0.0043	3.729	1.989523058	2.4574	1.005073143	1.979480868
Tata Steel	-0.0184	-15.530	1.984196654	0.7704	1.005337388	1.973662451
Gujarat Mineral	-0.006	-4.339	1.982708261	0.2307	1.005416543	1.972026693
National	-0.0018	-0.8422	1.982419394	0.2314	1.00549591	1.971583747
Welspun	-0.0015	-0.9881	1.982080473	0.23140	1.005575277	1.971091094
Sesa Goa	-0.0013	-0.6715	1.981850149	0.1385	1.005622805	1.9707689
Hindalco	-0.0009	-0.81866	1.981569369	0.1176	1.005663152	1.970410634

Optimal Portfolio

Based on the cut-off rate stocks should be selected for construction of optimal portfolio. Optimal portfolio consists of stocks with high return. Here 12 stocks are included in the portfolio. After constructing portfolio then how much should be invested in each stock is to be estimated. These top companies are shown in Table 4. Portfolio investment is

FINDINGS

The performance of companies from both sectors like SUGAR and METALS are calculated. Based on this it is found that many companies in SUGAR sector offer high returns. Here portfolio is made up of companies in SUGAR sector because of its good performance.

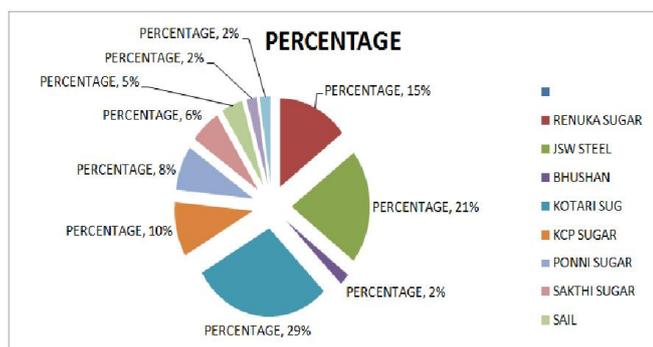
Table 4. Selection of Securities

Company	CI
Renuka Sugar	0.0000240
Jsw Steel	0.0001121
Bhushan	0.0001320
Kotari Sug	1.0000453
Kcp Sugar	1.0467308
Ponni Sugar	1.0472586
Sakthi Sugar	1.0477903
Sail	1.0483069
Bhushan	1.0486096
Banari Sug	1.0493619
Simbha Sugar	1.6220622
Parry	1.9798687

Table 5. Proportion of investment in each security

Company	Percentage
Renuka sugar	16.32322647
Jsw steel	23.44341156
Bhushan	2.421117666
Kotari sug	32.43334936
Kcp sugar	11.24166811
Ponni sugar	9.202177205
Sakthi sugar	7.073146962
Sail	4.955786628
Bhushan	2.421117666
Banari sug	2.537597737

Proportion of Investment

**Figure 6. Proportion of investment in pie chart**

While companies in STEEL sector have low return except few companies like JSW, BHUSHAN, SAIL. These METAL company are performing better when compared to even other good metal companies like Gujarat minerals, hindalco etc. Among SUGAR companies Rajsree ltd has low excess return to beta ratio and its performance is low when compared to other companies in sugar sector companies in the Hotels sector. All the stocks have beta value less than one than is less than market beta. Based on the alpha values it is found that 20% of companies have no assured return for risk because of negative alpha value. In that most of the companies are from metal sector. The KOTARI sugar company has high return when compared to all the other companies. So it is better to invest 29% of money for investment in KOTARI sugar limited.

Implications for the Practitioners

Based on the calculations it is recommended that proportion of investment should be more in KOTARI sugar limited at 29%.

It offers maximum return with minimum risk among the selected companies. Investor should give first priority to invest in this company. In order to diversify the portfolio investor can invest in other companies such as SAIL, BHUSHAN, KCP SUGAR, and PONNI SUGAR. This diversification will help the investor to reduce the risk. The current situation for this sector is not steady but investors can invest in this sector in future as few companies are in rapidly growing stage. Further investors have to be cautious while investing in other companies in the metal as well as sugar company.

Conclusion

Nineteen companies selected from two sectors resulted in portfolio consisting of eleven companies from both SUGAR and METAL sector. Only those eleven companies meet the criteria according to Sharpe index model. Portfolio has mix of companies from SUGAR and METAL sector. Investing in share market involves many factors and it is challenging depending upon various situations. Investors have to earn maximum return with reduced risk. Their investment criteria depend upon their capability and different forces in the share market. This portfolio construction will be helpful for the investors to take good investment decisions. It also support to make high return investment in the future in companies from metal sector based on the current changing trends in the market. There is no restriction to invest in only companies from one sector; they can diversify their venture in other sectors also to earn high returns.

Scope for further study

- The study analyses securities in sugar and metal sectors only. Further research can be done involving all sectors which would be a more optimal portfolio rather than from specific sectors.
- Sharpe Index model has its own limitations so in order to construct an optimal portfolio sharpe index model alone is not sufficient. Portfolio construction can be done with consideration of other models

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