

A Study on Portfolio Construction- The Diversification Method of Investments

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ABSTRACT

Investment is the employment of funds on assets with the aim of earns income or capital appreciation. All investment involves a return and risk. To make wise decisions in investment, there is a need for information / knowledge on security analysis and portfolio management. Any rational investor, before investing his or her investible wealth in the stocks, analyses the risk related with the particular stock. The actual / real return he receives from a stock may vary from his expected return and the risk is expressed in terms of variability of return. A portfolio is a collection of financial investments like stocks, bonds, commodities, cash, and cash equivalents, including closed-end funds and exchange-traded funds. Portfolio construction refers to a process of selecting the optimum mix of securities for the purpose of achieving maximum returns by taking minimum risk. A portfolio construction process allows for a holistic approach to investing, which can improve the possibility for better investment outcomes. If an investor plans for the portfolio investment, he/she is required to take an in-depth look at all current assets, investments, and debts if any. An investor has to decide on the extent of risk and volatility he/she willing to take, and what returns he/she wants to generate for establishing a risk-return profile. Portfolio construction helps the investors constructing investment portfolios to maximise expected returns and minimise risk. This study focuses on optimal portfolio construction using Sharpe's single index model by selecting fifteen companies from NSE (National Stock Exchange). To conclude, out of fifteen securities twelve securities were selected through calculating cut-off rate. At the end the cut off-rate was used to find out the proportion of money to be invested in those of twelve securities.

1. Introduction

Portfolio

A portfolio investment is ownership of a stock, bond, or other financial asset with the expectation that it will earn a return or grow in value over time, or both. Portfolio investment may be divided into two main categories: Strategic investment involves buying financial assets for their long-term growth potential or their income yield, or both, with the intention of holding onto those assets for a long time. The tactical approach requires active buying and selling activity in hopes of achieving short-term gains.

Indian Stock Market (NSE)

The National Stock Exchange of India Limited (NSE) is the leading stock exchange of India, located in Mumbai. The NSE was established in November 1992 as the first dematerialized electronic exchange in the country. NSE was the first exchange in the country to provide a modern, fully automated screen-based electronic trading arrangement which offered easy trading facility to the investors spread across the extent and width of the nation.

Beta

Beta is the measure of a stock's sympathy of returns to changes in the market. It is a measure of systematic risk. Beta is the tool to measure systematic risk. Beta of stock is a number that describe correlated volatility between benchmark index and security.

Sharpe Single Index Model

The single index model is based on the assumption that stocks vary together because of the common society in the stock market and there are no effects past the market that account the stocks co-movement. The expected return, standard deviation and co-variance of the single Sharpe index model correspond to the joint movement of securities.

$$R_i = \alpha_i + \beta_i R_m + e_i$$

R_i – expected return on security, α_i - alpha co-efficient, β_i - beta co-efficient, R_m - the rate of return on market index, e_i - error term

Sharpe had provided model for the selection of appropriate securities in a portfolio. The selection of some stock is directly associated to its excess return-beta ratio.

$$\frac{R_i - R_f}{\beta_i}$$

R_i = the expected return on stock, R_f = the return on a riskless asset, β_i = the expected vary in the rate of return

After determining the securities to be particular, the portfolio manager should find out how much should be invested in every security. The percentage of funds to be invested in each security can be estimated as follows.

The primary expression indicates the weights on every security and they sum up to one. The next shows the relative investment in every security. The residual variance or the unsystematic risk has a role in determining the amount to be invested in each security.

The Steps for fining out the stocks to be included in the optimal portfolio are as:

- Find out the “excess return to beta” proportion for each & every stock under consideration
- Rank them from the highest to lowest
- Proceed to calculate C_i for every the stocks according to the ranked order using the following formula,

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

After determining the securities to be chosen, the portfolio manager should find out how much should be invested in each security.

The Percentage of fund to be invested in each security can be estimated as follows,

$$Z_i = (\beta_i / \sigma_m^2) * [(R_i - R_f / \beta_i) - C^*]$$

2. Review of literature

Desai, Radhika and Surti, Manisha constructed an optimal portfolio using fifty companies which were listed on the NSE and the time duration of the study is three years. Among the fifty companies only ten companies were selected for the optimum portfolio. The proportion of investment made in each security has been calculated using the Sharpe’s Single Index Model. The volatility of security has been analysed. The research provides direction to investors regarding performance of securities. Once the performance is analysed and optimum portfolio of securities is constructed, it enables the investor to take appropriate decisions.

Debasish, Satya Swaroop and Khan, Jakki Samir selected a sample fourteen stocks from the various manufacturing sectors like automobiles, cement, paints, textiles oil& refineries and these are traded in the NSE. The daily data for all the stocks for the period Jan 2003 to November 2012 has been considered. Percentage of investment in each of selected stock is decided based on respective beta value, stock movement variance unsystematic risk, and return on stock risk free return. Among the fourteen selected companies an optimal portfolio using Sharpe’s Single Index Model constituted only three stocks. The proportion of investment to be made was also calculated using Single Index Model. Thus, the literature survey made for the present study showed that there is enough scope for studying the utility of Sharpe’s Single Index Model under the Indian conditions especially considering the securities of companies traded through the BSE which is one of the oldest stock exchange in

6. Data Analysis & Interpretation

Table 1.1: Ranking the securities

SECURITES	Ri	BETA(β)	ALPHA(α)	Ri-Rf	$\frac{R_i - R_f}{\beta}$	RANK
RELIANCE INDUSTRIES	0.148	1.114	0.022	0.134	0.120	4
HDFC BANK	0.096	1.002	-0.017	0.096	0.096	6

the world and which is considered as one of the major attractions to any investor, either individual or institutional.

Chauhan constructed a portfolio using top ten stocks of NIFTY. In the study, it was found to be an easy and simple method to calculate optimal portfolio. In this method, fewer numbers of variables are used as compared to Markowitz Model. It is named Single Index Model as it uses only a single index for portfolio construction.

3. Research Methodology

Research methodology is collective term for the structured process of conducting research. There are many different methodology used in various type of research and the term is usually measured to include research design data gathering and data analysis.

4. Research Objectives

- To construct an optimum using Sharpe index model for NSE listed securities.
- To get a practical knowledge as the idea embedded in Sharpe index model.
- To calculate the proportion of investment to be made in to each of stock that is included in the optimal portfolio.

5. Research Design

A research design specifies the method and procedures for conducting a particular study. The research design is a broad structure that describes how the entire research project is carried out. The descriptive research design is used in this report. Descriptive research design is typically concerned with describing problem and its answer. It is additional specific and purposive study. Before precise attempts are complete for descriptive study, the well-defined problem must be on hand. Descriptive study rests on single or more hypotheses.

Sample

Fifteen companies included in NSE Nifty have been selected for this study.

Sample Period

Daily data of fifteen securities have been collected during the period of three years ending 2019.

Limitations of the Study

- Any problem with the data can lead to huge change as this study is based on secondary method.
- Only fifteen companies’ stocks have been selected in this study, hence the results of this study may not be universally applicable.

HUL	0.107	0.716	0.067	0.107	0.150	2
KOTAK MAHINDRA BANK	0.126	0.960	0.071	0.126	0.131	3
ITC LTD	0.057	0.861	-0.041	0.057	0.066	9
BHARTI AIRTEL	0.074	1.035	0.015	0.074	0.072	7
MARUTI SUZUKI	0.053	1.246	-0.018	0.053	0.042	10
AXIS BANK	0.086	1.268	0.014	0.086	0.068	8
ASIAN PAINT LTD	0.101	0.905	0.050	0.101	0.112	5
ONGC	-0.040	0.975	-0.095	-0.040	-0.041	13
ULTRATECH CEMENT	0.037	1.236	-0.033	0.037	0.030	12
COAL INDIA	-0.034	0.675	-0.073	-0.034	-0.051	14
TITAN COMPANY	0.193	0.992	0.137	0.193	0.194	1
INDIAN OIL CORP	-0.080	1.292	-0.154	-0.080	-0.062	15
BAJAJ AUTO LTD	0.037	0.895	-0.013	0.037	0.042	11

Table: 1.2.1: Calculation of cut-off rate

Rank	Securities	Ri	Bi	σ^2ei	Ri-Rf	(Ri-Rf) β	$\frac{(Ri-Rf)\beta}{\sigma e^2}$	$\frac{\sum(Ri-Rf)\beta}{\sigma e^2}$
1	TITAN COMPANY	0.1929	0.9918	4538.25	0.1788	0.1773	0.1787590	0.1787590
2	HUL	0.1072	0.7157	3291.24	0.0930	0.0666	0.0930250	0.2717840
3	KOTAK MAHINDRA BANK	0.1257	0.9599	1084.83	0.1116	0.1071	0.1115830	0.3833670
4	RELINCE INDUSTIRS	0.1482	1.1135	1418.03	0.1340	0.1492	0.1340272	0.5173942
5	ASIAN PAINT	0.1012	0.9052	1472.88	0.0870	0.0788	0.0870070	0.6044012
6	HDFC BANK	0.0962	1.0024	3333.16	0.0820	0.0822	0.0820490	0.6864502
7	BHARTI AIRTEL	0.0742	1.0347	1803.58	0.0600	0.0621	0.0600146	0.7464648
8	AXIS BANK	0.0861	1.2684	2298.33	0.0720	0.0913	0.0719780	0.8184428
9	ITC LTD	0.0569	0.8613	1345.85	0.0428	0.0368	0.0427530	0.8611958
10	MARUTI SUZUKI INDIA	0.0526	1.2457	2122.23	0.0385	0.0479	0.0384810	0.8996768
11	BAJAJ AUTO LTD	0.0373	0.8950	1872.89	0.0231	0.0207	0.0231499	0.9228267
12	ULTRA TECH CEMENT	0.0374	1.2359	1934.92	0.0232	0.0287	0.023208	0.9460347-
13	ONGC	-0.0397	0.9755	3141.83	-0.0539	-0.0526	-0.053880	0.8921547
14	COAL INDIA	-0.0344	0.6746	5777.68	-0.0485	-0.0327	-0.048510	0.8436447
15	INDIAN OIL CORP	-0.0802	1.2920	1434.27	-0.0944	-0.1220	-0.094391	0.7492529

Table: 1.2.2: Calculation of cut-off rate

Rank	Securities	Ri	β_i	σ^2ei	β^2	$\frac{\beta^2}{\sigma^2ei}$	$\frac{\sum\beta^2}{\sigma^2ei}$
1	TITAN COMPANY	0.1929	0.9918	4538.25	0.9837	0.0002	0.0002
2	HUL	0.1072	0.7157	3291.24	0.5122	0.0002	0.0004
3	KOTAK MAHINDRA BANK	0.1257	0.9599	1084.83	0.9215	0.0008	0.0012
4	RELINCE INDUSTIRS	0.1482	1.1135	1418.03	1.2400	0.0009	0.0021
5	ASAIN PAINT	0.1012	0.9052	1472.88	0.8194	0.0006	0.0027
6	HDFC BANK	0.0962	1.0024	3333.16	1.0049	0.0003	0.0030
7	BHARTIAIRTEL	0.0742	1.0347	1803.58	1.0707	0.0006	0.0035
8	AXIS BANK	0.0861	1.2684	2298.33	1.6087	0.0007	0.0042
9	ITC LTD	0.0569	0.8613	1345.85	0.7418	0.0006	0.0048
10	MARUTI SUZUKI INDIA	0.0526	1.2457	2122.23	1.5519	0.0007	0.0055

11	BAJAJ AUTO LTD	0.0373	0.8950	1872.89	0.8009	0.0004	0.0060
12	ULTRATECH CEMENT	0.0374	1.2359	1934.92	1.5273	0.0008	0.0067
13	ONGC	-0.0397	0.9755	3141.83	0.9516	0.0003	0.0070
14	COAL INDIA	-0.0344	0.6746	5777.68	0.4551	0.0001	0.0071
15	INDIAN OIL CORPORATION	-0.0802	1.2920	1434.27	1.6692	0.0012	0.0083

Table: 1.2.3: Calculation of cut-off rate

Rank	Securities	$\sigma^2 m^* \sum \beta^2 / \sigma^2 e_i$	$1 + \sigma^2 m^* \sum \beta^2 / \sigma^2 e_i$	c^* (Cut-off rate)
1	TITAN COMPANY	0.00013	1.0001	0.00002258
2	HUL	0.00022	1.0002	0.00003427
3	KOTAK MAHINDRA BANK	0.00071	1.0007	0.00009129
4	RELINCE INDUSTIRS	0.00121	1.0012	0.00015201
5	ASAIN PAINT	0.00153	1.0015	0.00018282
6	HDFC BANK	0.00171	1.0017	0.00019703
7	BHARTI AIRTEL	0.00205	1.0021	0.00021682
8	AXIS BANK	0.00246	1.0025	0.00023964
9	ITC LTD	0.00277	1.0028	0.00025533
10	MARUTI SUZUKI INDIA	0.00320	1.0032	0.00026824
11	BAJAJ AUTO LTD	0.00344	1.0034	0.00027455
12	ULTRA TECH CEMENT	0.00390	1.0039	0.00028296
13	ONGC	0.00408	1.0041	0.00027328
14	COAL INDIA	0.00412	1.0041	0.00027001
15	INDIAN OIL CORP	0.00479	1.0048	0.00022091

Interpretation: From table 1.2.3 the highest cut off rate is 0.00028296. Hence the securities whose cut off rate is above the highest cut off rate those are selected in the portfolio and rests are rejected. Here in this case twelve securities are selected in the portfolio.

Table: 1.3.1: Calculation of proportion

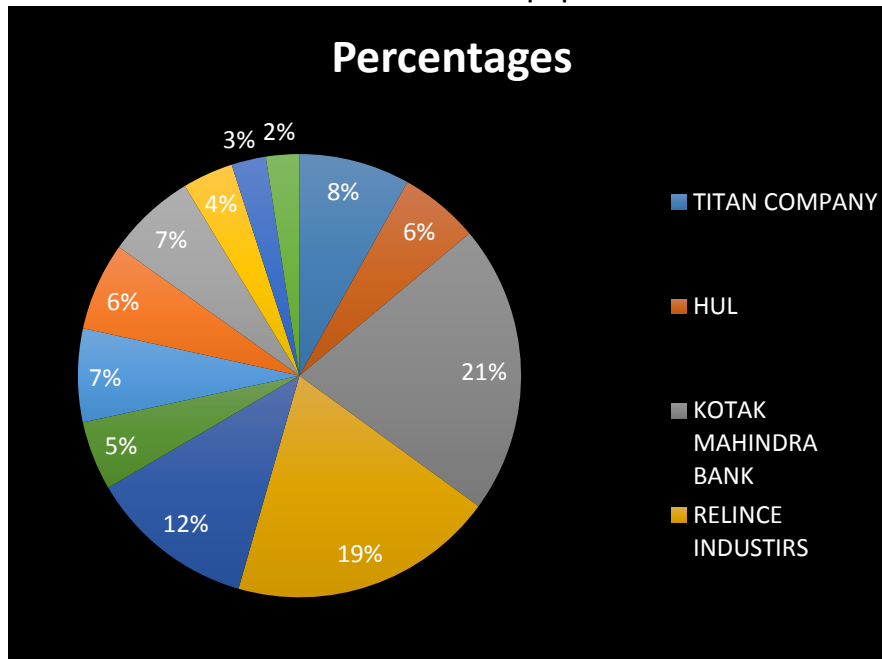
SECURITIES	$\frac{\beta}{\sigma^2 e_i}$	$\frac{R_i - R_f}{\beta - c^*}$	Zi
TITAN COMPANY	0.00021855	0.180	0.00003933
HUL	0.000217442	0.130	0.00002820
KOTAK MAHINDRA BANK	0.000884872	0.116	0.00010261
RELINCE INDUSTIRS	0.000785278	0.120	0.00009429
ASAIN PAINT	0.000614584	0.096	0.00005890
HDFC BANK	0.000300745	0.082	0.00002453
BHARTI AIRTEL	0.00057372	0.058	0.00003311
AXIS BANK	0.000551857	0.056	0.00003116
ITC LTD	0.000639946	0.049	0.00003159
MARUTI SUZUKI INDIA	0.000586995	0.031	0.00001797
BAJAJ AUTO LTD	0.000477847	0.026	0.00001223
ULTRA TECH CEMENT	0.000638709	0.018	0.00001181

Table: 1.3.2: Calculation of proportion

Securities	Zi	XI	Xi (%) (Proportion)
TITAN COMPANY	0.00003933	0.08097	8.096648
HUL	0.00002820	0.05806	5.806328
KOTAK MAHINDRA BANK	0.00010261	0.21125	21.1245
RELINCE INDUSTIRS	0.00009429	0.19413	19.41302

ASAIN PAINT	0.00005890	0.12126	12.12592
HDFC BANK	0.00002453	0.05050	5.050344
BHARTI AIRTEL	0.00003311	0.06817	6.817197
AXIS BANK	0.00003116	0.06415	6.415404
ITC LTD	0.00003159	0.06503	6.502741
MARUTI SUZUKI INDIA	0.00001797	0.03699	3.698842
BAJAJ AUTO LTD	0.00001223	0.02517	2.516918
ULTRA TECH CEMENT	0.00001181	0.02432	2.432141
TOTAL	0.00048573	1.000000	100%

Chart: 1.1: Calculation of proportion



Interpretation: From table 1.3.2 and Chart 1.1, the largest investment should be made in security of KOTAK MAHINDRA BANK (21.01245%) and the smallest in security is ULTRA TECH CEMENT (2.432141%).

7. Findings

- The TITAN COMPANY has the highest return of 0.1929% and The INDIAN OIL CORPORATION has the lowest return of -0.080. If the investor wants to make a maximum return without considering the risk aspect then investment can be total on those securities which yield high returns.
- The return from INDIAN OIL CORPORATION has the highest beta value of 1.292 which means that it is highly volatile.
- The excess return to beta ratio measures the extra return on a security per unit of systematic risk (β). The TITAN COMPANY's stock return has the highest excess return to beta ratio of 0.1802 and that of INDIAN OIL CORPORATION'S stock return is the lowest at -0.0731. This ratio provides the relationship between budding risk and reward involved in a security's return.
- The INDAIN OIL CORPORATION stock return has the highest unsystematic risk (σ_{ei2}) of 5777.682 and HUL has the least risk of 1084.82. It is the single risk

affecting the firm due to certain factors affecting only the company issuing such security. It is the avoidable risk.

- From 15 securities, 12 securities are selected for the investment which is based on cut-off rate (C^*). Which is selected on the basis of highest cut-off and further proportions are done. The highest cut-off is of UTLRA TECH CEMENT which is 0.00028296.
- By using Sharpe Index Model, Out of total 15 companies, only 12 securities are selected for the portfolio which are Titan Company, HUL, Kotak Mahindra Bank, Reliance Industries, Asian Paint, HDFC Bank, Bharti Airtel, Axis Bank, ITC Ltd, Maruti Suzuki India, Bajaj Auto Ltd, and Ultra Tech Cement.

8. Conclusion

Risk and return play a main role in making some 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. Out of 15 companies taken for the study, 3 companies are showing negative return and the other 12 companies are showing positive returns. Risk is high in one company compare to other companies and also with negative return. Still an investor should consider all relevant factors before including such twelve securities in his/her portfolio.

References

- [1]. Dr. Poornima and Aruna Remes, "A study on optimal portfolio construction using sharpes single index model with special preference to selected sectors listed in NSE", National Journal of Advanced Research, 2(3), pp-28-31.
- [2]. Dr. Simranjit Kaur Sandhar and Dr. Neetika Jain, Ruchi Kushwah, "Optimal Portfolio Cnstruction: A Case Study of NSE", JETIR Journal, 5(8), pp-512-521.
- [3]. Andrade, Pratiba Jenifer, "Construction of Optimal Portfolio of Equity, using Sharpe's Single Index Model: A Case Study of IT Sector", International Journal of Applied Financial Management Perspectives, 1(2), pp: 86-88.
- [4]. Varadarajan, P. & Ganesh, "Construction of Equity Portfolio of Large Cap Companiesof Selected Sector in India with reference to the Sharpe Index Model", International Journal of Physical and Social Sciences, 2 (1), pp: 37-50.
- [5]. Tripathy, Sasikantha, "Forecasting through Single Index Model: A Study on Selected Indian Banks", DRIEMS, 1 (1), pp: 8-13.
- [6]. Dileep, S. & Kesava Rao, G.V, "A Study on Sustainability of William Sharpe's Single Index Model", IJAMBU,1 (1), pp: 48-54.
- [7]. Kumar, Arun S. S. and Manjunatha K., " A Study on Construction of Optimal Portfolio using Sharpe's Single Index Model", International Journal of Research in Commerce, IT and Management, 3 (4), pp: 88-98.
- [8]. Mandal, Niranjana, "Sharpe's Single Index Model & its Application to Construct Optimal Portfolio: An Empirical Study", Great Lake Herald, 7 (1), pp: 1-19.
- [9]. Sarker, Mokta Rani, "Optimal Portfolio Construction: Evidence from Dhaka Stock Exchange , Bangladesh", World Journal of Social Sciences, 3 (6), pp: 75-87.
- [10]. Gopalakrishna Muthu, M., "Optimal Portfolio Selection using Sharpe's Single Index Model", Indian Journal of Applied Research, 4(1), pp: 286-288.
- [11]. https://www1.nseindia.com/products/content/equities/indices/historical_index_data.htm
- [12]. https://www1.nseindia.com/index_nse.htm
- [13]. <https://www.investopedia.com/terms/p/portfolio-investment.asp>
- [14]. <https://www.apm.org.uk/resources/what-is-project-management/what-is-portfolio-management/>