

Optimal portfolio construction in stock markets: Evidence from Indian blue chip stocks

¹Prof. Guntur Anjana Raju, ²Ms. Mrunali Jambotkar

¹Professor, Department of Commerce, Faculty of Commerce and Management Studies; Goa-University, Goa, India.

²Student of Department of Commerce, Faculty of Commerce and Management Studies; Goa-University, Goa, India.

Email - ¹rajuanjana@gmail.com, ²mrunalijambotkar@gmail.com

Abstract: Portfolio Construction is done by emphasising on high returns with diversifiable risk. Investors always prefer to maintain acceptable returns to risk ratio. The present study is a focus to construct an optimal portfolio of selected Blue Chip Stocks of India with the application of Sharpe Single Index Model. In this study a sample of twenty Blue Chip NSE and BSE listed Stocks has been considered. The daily closing share prices of the Stocks for a time span from 1st January 2007 to 31st October 2017 have been used in the study. The characteristics such as returns in association with the systematic and unsystematic risk of selected Stocks were analysed. The analyses concluded that the first ranked nine blue chip Stocks are preferable in the construction of an optimal portfolio and thereby to spread the availability of funds. The analytical findings will be the significant outcome to all the participants of financial markets.

Key Words: Blue Chip Stocks, Sharpe Model, Optimal Portfolio, Risk and Return Analyses

1. INTRODUCTION:

There are ample of investment avenues available to the investors in the Markets. Each investment avenue has its specific nature of returns and risk appetite. The process of working on different investment avenues, identifying its return to risk ratio and parking the availability of funds in a selected investment alternatives is the sequence of Portfolio Construction. While constructing a portfolio, investors are always spotting on two types of risk, one is Company risk (Unsystematic risk) and other is Market risk (Systematic risk). Out of this two, Market risk which is produced by market forces is non-diversifiable and Company risk produced by company's inefficient factors is diversifiable in nature. Portfolio construction always helps to diversify and minimise Company risk and helps to the investors to get better returns from Portfolio. This study has concentrated to construct an Optimal Portfolio of selected Blue Chip Stocks of India by applying a Single Index Model developed by Sharpe.

2. LITERATURE REVIEW:

(P & , 2012), in this study, three large cap sectors of national importance, showing consistency in its performance and receiving active participation from government namely the power sector, the shipping sector and the textile sector were selected for constructing of an optimum portfolio using Sharpe Index Model. The study considers secondary data of five financial years of 18 companies which includes six companies from each sector and all analyses are done in MS Excel. Their findings suggest that five securities are selected for investment which constitutes an optimum portfolio but the final decision of investment should be based upon all the factors that affect the performance of these securities.

(Debasish & Khan, 2012), the study undertook analyses and selection of an optimal portfolio of selected Stocks in manufacturing sectors of India. The daily data of fourteen Stock of NSE Nifty Index have been considered from January 2003 to November 2012. The weight age of investment under each security is determined based on respective beta values, Stock movement variance, unsystematic risk, return on Stock and risk free return. The results exhibit that out of 14 manufacturing sector Stocks only three Stocks namely Hero Motors Corp., Tata Motors and Asian paints constitute an optimal portfolio with Hero Motors Corp. showing a highest proportion of investment of around 58.22%.

(Sarker, 2013), study aims to assist investors in their investment through Single index model. So the purpose of this study is to apply theoretical framework of portfolio management in reality and construct a well-diversified and optimal portfolio. The study uses secondary data and considers closing prices of 164 companies listed in Dhaka Stock Exchange and DSE All share price index for a time frame of 5 years (July 2007 to June 2012). The optimum portfolio of efficient securities was constructed from 33 stocks whose excess return to beta ratio is greater than cut off point giving a return of 6.17%. Under this study Portfolio beta is lower than market beta and portfolio return is much higher than portfolio variance.

(Nalini, 2014), this study presented an approach to portfolio selection using Single index model. The scope of the study was to create investors awareness about the applicability and benefits of SIM approach. The yearly data of fifteen companies from S & P BSE Sensex index was utilized. From the results it was revealed that four securities comprise an optimum portfolio. During the year 2013-2014, similar micro level studies were conducted like “The single index model & the construction of Optimal portfolio: a case of banks listed on NSE India” by (Singh & Jayant, 2014), “Construction of optimal equity portfolio using the Sharpe index model with reference to Banking and Information Technology sectors in India from 2009-2013” by (Ramanathan & Jahnvi, 2014), “Optimal Portfolio Construction in Stock market – an empirical study on selected Stocks (BSE) of automobile Companies” (R & S, 2014), “A Study on Usage of Sharpe’s Single Index Model in Portfolio Construction with reference to CNX Nifty” by (Chauhan, 2014). Although these studies vary with respect to sample taken but the methodology, computations, results and utility value obtained is similar.

(Shah, 2015), focused on the construction of an optimal portfolio for BSE top 15 securities selected based on its market capitalization. The study covers a period of 16 years data ranging from January 2000 to March 2015. It analyses and compares the results of CAPM and Sharpe Index Model of portfolio construction and the results demonstrated that Sharpe Index Model gives superior results over CAPM model as it gives the exact number of securities and weight age of investment under each security. It suggests the portfolio of equities whereas CAPM shows individual securities and even fails to capture the return behaviour of individual security.

(Poornima, 2015), the purpose of this study is to get an insight into Sharpe’s Single Index Model. The sample size comprises of twenty companies from BSE Sensex index and the risk and return of the optimal portfolio is estimated using Sharpe’s Single Index Model. The results revealed that optimal portfolio is constructed from only six companies and it has significant applications for Fund Managers.

(Sathyapriya, 2016), applied the model on companies picked from Infrastructure and Pharmaceutical sectors. A sample of twenty Stocks listed on NSE was included and the daily data from secondary sources was collected for a period of 4 years from 2008 to 2012. The Sharpe single index Model a widely used model for evaluating the performance of mutual funds and portfolio strategies has been used for the analyses. After evaluating and ranking the securities based on excess return to beta ratio, they are compared to cut off point to arrive at an optimal combination of assets for undertaking investment decision.

(Lal & Rao, 2016) Conducted study on CNX Nifty, a market performance index and eleven sector indices at NSE from April 2014 to March 2015. All Analyses was conducted through valid statistical and analytical techniques aimed at constructing an optimum portfolio of five economic sectors of India, accruing a highest returns at a given level of risk. The selection of Stocks is based on risk-return perceptions of investor and Sharpe’s and Treynor’s approach was used to construct a portfolio indicating a highest investment in Pharma sector.

(Sharma, 2017), studied construction of an optimal equity portfolio of large cap companies using Sharpe’s single index model. On the basis of market capitalization top ten Stocks that forms a part of NSE nifty has been selected for a period of April 2010 to December 2016. Out of these ten only four Stocks namely TCS, HUL, ITC and HDFC bank qualifies to be included in the optimal portfolio with maximum proportion of investment in TCS. It was found that only three companies are showing negative return and only two companies are having beta value above ‘1’ indicating a higher volatility in its Stock return then market which is not desirable.

3. STATEMENT OF THE PROBLEM:

The current study has carried out by taking into consideration the selected Blue Chip Stocks of India, in which investors can park their funds either in individual Stock or in portfolio. Optimal Portfolio construction helps to diversify the risk and helps to maximise the overall returns of the portfolio. To a wise investor to reap the benefit continuously need to monitor and manage his portfolio. This study has concentrated on “Optimal Portfolio Construction in Stock Market: Evidence from Indian Blue Chip Stocks”.

4. OBJECTIVES OF THE STUDY:

- To build an Optimal Portfolio of selected Blue Chip Stocks of India with the application of Sharpe Single Index Model.
- To analyse the market performance of selected Blue Chip Stocks of India in terms of risk and returns.
- To provide the alternatives to the investors in the selection process for portfolio construction route.
- To examine the systematic and unsystematic risk attached to the selected Blue Chip Stocks of India.
- To calculate the proportion of funds to be spread in each of the Stock considered for optimal portfolio.

5. RESEARCH METHODOLOGY:

Research methodology is a methodology for collecting all sorts of information and data pertaining to the subject in question through primary and secondary data collection sources and thereby solving the Research Problem.

5.1. Source and Collection of Data

The present Descriptive study focuses on construction of an optimal portfolio through Sharpe Single Index model. The study is based on quantitative data in the form of Secondary sources of data collection. For the purpose of the study, the daily closing prices of Indian twenty blue chip Stocks and NSE Nifty Fifty Index which is taken as a representative of Market performance Index, has been collected from official website of NSE i.e., www.nseindia.com. 91-Days Treasury Bill obtained from Bloomberg database and is taken as a Risk Free Rate of return for the purpose of various computations.

5.2. Period of Study

The Financial data has been taken in the daily closing frequency covering the period ranging from 1st of January 2007 to 31st of October 2017.

5.3. Sample Size

The sample data considered for the study are Indian twenty selected Blue Chip Stocks and NSE Nifty Fifty Index considered as benchmark. The sample size is restricted to daily closing prices of all the variables considered under the present study. The sampling technique adopted is purposive sampling and all the analyses are undertaken through MS Excel.

5.4. Tools and Techniques

The present study applies statistical and financial techniques for analyses and interpretation of the data and thereby to arrive at the results. The following steps were used for the construction of an optimal portfolio under Sharpe Single Index Model.

- I. **Estimate the return on stock:** It is defined as the total gain or loss over a specified period of time. The daily Stock returns and Market returns are computed from the following formula.

$$R_i = \frac{P_1 - P_0}{P_0} \times 100 \quad R_m = \frac{\text{Market Index}_1 - \text{Market Index}_0}{\text{Market Index}_0} \times 100$$

Where,

R_i = Stock Returns

R_m = Market Index Return

P_1 = Stock price of today

Market index₁ = market index of today

P_0 = Stock price of yesterday

Market index₀ = market index of yesterday

Expected or Mean Return on Stock and Market Index

An average return is calculated, the same way a simple average is calculated for any set of return on Stock; the return on Stock are added together into a single sum and then the sum is divided by the count of the return on Stock. In the same way Expected Market returns are calculated. The following formulas are used:

$$\bar{R}_i = \frac{\sum R_i}{N} \quad \bar{R}_m = \frac{\sum R_m}{N}$$

Where,

\bar{R}_i = Expected or mean return of Stock

\bar{R}_m = Expected or mean return on market

R_i = Total sum of Return on Stock

R_m = Total sum of Return on market index

N = number of observations

N = Number of observations

II. Calculation of Beta:

Beta is used to describe the sensitivity of Stock prices with respect to market. It measures the volatility or degree of systematic risk of a security or a portfolio in comparison to the market. For a very well diversified portfolio, unsystematic risk tends to become zero and the only relevant risk is systematic risk measured by beta (β).

$$\beta_i = \frac{COV_{im}}{\sigma_m^2}$$

Where,

β_i = Measures the degree of systematic risk

Cov_{im} = covariance between return on Stock and return on market index

σ_m^2 = variance of return on market index

III. Risk free rate of return (RFR)

Risk free rate of return is the return that an investor can earn on a riskless security, i.e. without behaviour of any risk. The risk free rate of return is the theoretical rate of return of an investment with zero risk. In the present study Annual 91-Days Treasury Bill is taken as a RFR and been computed for daily average RFR rate.

IV. Excess Return to Beta Ratio

This ratio is the indication of reward or risk premium (return earned over and above the risk free rate) to the unevenness of return or risk as measured by Beta. So it's a reward per unit of systematic risk.

$$\text{Excess return to Beta ratio} = \frac{R_i - R_f}{\beta}$$

Where,

R_i = the expected return of stock 'i'

R_f = risk free rate of return

β_i = Beta of stock 'i'

V. Ranking of securities

The Excess Return to Beta Ratio gives a relationship between potential risk and rewards. The ranking of Stocks is done with a highest rank to better performing Stock than the benchmark market index. The Stocks are ranked from highest to the lowest based on the above ratio.

VI. Calculation of Cut-off Rate (C_i)

The distinctive cut-off rate is calculated for each Stock. The highest C_i value is taken as the cut – off point C*. All the Stocks ranked above C* have high excess return to beta than the cut – off C_i and all the Stock below C* has low excess returns to beta. The following formula is used to calculate Cut-off rate.

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

Securities are added to form an optimal portfolio basically whose Excess return to β ratio' exceeds C_i.

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

VII. Construction of an Optimal Portfolio

After selection of the securities, the investors should determine the proportion of investment under each security. The following formulas are used for the same.

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

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

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

6. EMPIRICAL ANALYSIS:

Table 1 Ranking of Stocks based on Excess Returns to Beta ratio

Name of the Company	R _i	Beta(β _i)	β ² σ ² _m	σ ² _{ei}	R _i -R _f	R _i -R _f /β _i	Rank
Maruti Limited	0.1632	0.7502	1.19603	19.5991	0.14424	0.1945141	1
Pidilite Industries Limited	0.0963	0.4899	0.5101	4.33867	0.07734	0.1639992	2
Lupin Limited	0.0685	0.4922	0.51475	5.644	0.04954	0.1040155	3
Cummins India Limited	0.0667	0.6152	0.80433	3.77426	0.04774	0.0851864	4
UPL	0.0791	0.7925	1.33478	6.75562	0.06014	0.0825278	5
Ultra Cement	0.0716	0.7236	1.11267	3.08354	0.05264	0.0705988	6
AurobindoPharma Limited	0.0759	0.8188	1.42483	9.46641	0.05694	0.0687997	7
Bharti Airtel Limited	0.0235	0.8706	1.61077	4.48498	0.00454	0.059789	8
HDFC Bank	0.0678	0.9067	1.74688	4.28533	0.04884	0.0549151	9
Tata Consultancy Services Limited	0.0554	0.7874	1.31762	3.73868	0.03644	0.0462524	10

HCL Technologies	0.0559	0.9054	1.74225	6.19468	0.03694	0.0436262	11
Axis Bank Limited	0.0702	1.2971	3.57545	6.00385	0.05124	0.0403452	12
Mahindra and Mahindra Ltd.	0.0463	0.9829	2.05306	4.23354	0.02734	0.0304012	13
Tata Steel Limited	0.0551	1.3569	3.91315	4.21047	0.03614	0.0212595	14
Tata Motars	0.0402	1.2216	3.17129	6.78497	0.02124	0.018891	15
Reliance Industries Limited	0.0397	1.1429	2.77601	2.819	0.02074	0.0181254	16
NTPC Limited	0.0289	0.7979	1.35292	2.39448	0.00994	0.008159	17
State Bank of India	0.0281	1.1724	2.92113	5.98683	0.00914	0.0078201	18
ICICI Bank Limited	0.0255	1.4082	4.21425	5.47898	0.00654	0.0049212	19
Infosys Limited	0.0005	0.6842	0.99482	4.76295	-0.01846	-0.022507	20

The outcome of Sharpe model framework for all selected Indian Blue Chip Stocks has been reported in the **Table 1**. From the derived result it can be seen that the maximum daily Yield has been highlighted by Maruti Ltd. (0.1632%) and lowest yield seen in Infosys Ltd. (0.0005%). Beta value indicates the degree of Volatility in Stocks returns in association with Market returns. The more than '1' beta value has been seen in the case of Axis Bank Ltd., Tata Steel Ltd., Tata Motors, Reliance Industries Ltd., SBI and ICICI Bank Ltd. and other remaining Stocks has depicted beta values less than one. It means under such case if market moves up by 1% than this Stocks returns tends to move up by more than 1%. Thus if funds are invested in highest beta values Stocks than it is exposed to higher volatility. The ICICI Bank Ltd. is highly prone in market risk (Systematic risk) and Pidilite Industries Ltd. is limited in market risk. Similarly Maruti Ltd. is exposed to highest Company risk (Unsystematic risk) and NTPC at lowest Company risk. In the table the ranking of selected Stocks has been made in relation to excess returns to Beta ratio. From the reported Stock values and their performance it has found that the Maruti Ltd. is best suitable for 1st rank and Infosys Ltd. has placed for last rank.

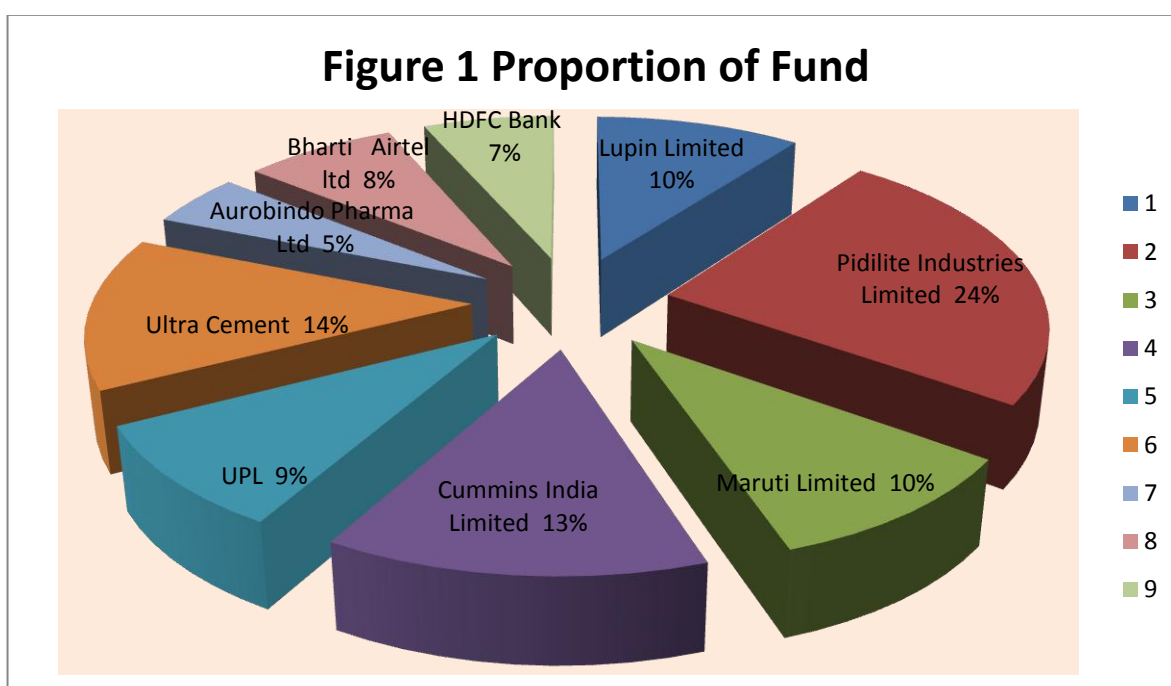
Table 2 Calculation of Stocks Cut-off Values

Name of the Company	$A = \sigma m^2 \sum_{i=1}^N (R_i - R_f / \sigma_{ei}^2) * \beta$	$B = 1 + \sigma m^2 \sum_{i=1}^N \beta_i^2 / \sigma_{ei}^2$	$C_i = \frac{A}{B}$
Maruti Limited	0.0504161	2.116678	0.023818513
Pidilite Industries Limited	0.1705383	5.430633	0.031403028
Lupin Limited	0.0745893	2.405463	0.031008303
Cummins India Limited	0.0223744	1.703224	0.013136527
UPL	0.0654085	2.314259	0.02826325
Ultra Cement	0.2423806	8.600349	0.028182648
AurobindoPharma Limited	0.0850553	2.555977	0.033277044
BhartiAirtel Limited	0.2161302	8.239508	0.026230958
HDFC Bank	0.1305398	3.559146	0.03667728**
Tata Consultancy Services Limited	0.0386834	2.055654	0.018818073
HCL Technologies	0.0058381	1.490115	0.003917913
Axis Bank Limited	0.1085801	3.151504	0.034453422
Mahindra and Mahindra Ltd.	0.2558695	9.085301	0.028163019
Tata Steel Limited	0.1990921	6.847945	0.029073261
Tata Motars	0.2072187	7.315344	0.02832658
Reliance Industries Limited	0.1519805	5.313062	0.028605074
NTPC Limited	0.2142574	7.880361	0.027188783
State Bank of India	0.1743419	5.918558	0.029456827
ICICI Bank Limited	0.1341118	4.328312	0.030984783
Infosys Limited	-0.005635	1.208866	-0.004661576

The above table depicts the Ci values of all Blue chip Stocks. The highest Ci value is 0.036677** of HDFC Bank, which is taken as a cut-off point. It can be observe that all the Stocks ranked above the HDFC bank Stocks and which has excess return to beta ratio higher than the cut off rate was considered for the construction of an optimum portfolio. So only nine Stocks qualify to be included in the optimal portfolio and proportion of funds to be included in each security needs to be calculated. An investor always prefers to diversify his funds in those Stocks which are subject to high returns with a reasonable systematic and unsystematic risk. These are the Stocks which have attracted higher return rewards as compared to other Stocks, thus an investor while constructing a portfolio can opt for these Stocks to spread their investment.

Table 3 Calculation of Proportion of Funds in selected Stocks of Portfolio

Name of the Company	β_i	σ^2_{ei}	$R_i - RFR / \beta_i$	β_i / σ^2_{ei}	C_i	$R_i - RFR / \beta_i - C^*$	Z_i	$X_i = Z_i / \sum Z_i * 100$
Maruti Limited	0.7502	19.5991	0.1945141	0.0382772	0.023818513	0.157836868	0.006041551	10.29929
Pidilite Industries Limited	0.4899	4.33867	0.1639992	0.1129147	0.031403028	0.127321901	0.014376509	24.50825
Lupin Limited	0.4922	5.644	0.1040155	0.0872076	0.031008303	0.067338211	0.005872403	10.01094
Cummins India Limited	0.6152	3.77426	0.0851864	0.1629986	0.013136527	0.048509111	0.007906919	13.47926
UPL	0.7925	6.75562	0.0825278	0.1173098	0.02826325	0.045850554	0.005378719	9.169334
Ultra Cement	0.7236	3.08354	0.0705988	0.2346651	0.026230958	0.033921556	0.007960204	13.5701
AurobindoPharma Limited	0.8188	9.46641	0.0687997	0.0864953	0.033277044	0.032122426	0.00277844	4.736526
BhartiAirtel Limited	0.8706	4.48498	0.059789	0.1941147	0.028182648	0.023111687	0.004486318	7.648019
HDFC Bank	0.9067	4.28533	0.0549151	0.2115821	0.03667728**	0.018237862	0.003858805	6.578271
						Total Sum	0.058659868	100



The table 3 and figure 1 based on selected nine blue chip Stocks indicates the Stocks which should hold a heavy weight. Out of available 100% fund, investors can park around 20.54% of their total available funds in Pidilite Industries Ltd. to get return with a reasonable Systematic and Unsystematic risk, followed by Ultra Cement with 13.57% fund, Cummins India Ltd. with 13.48% fund, Maruti Ltd. with 10.30% fund, Lupin Ltd. 10.01% fund, UPL around 9.17% fund, Bharti Airtel Limited with 7.65% fund, HDFC Bank with 6.58% fund and AurobindoPharma Limited with 4.74% fund.

7. CONCLUSION:

An optimal portfolio indicates better returns with diversifiable risk component to the investors. In the modern era optimal portfolio construction has been simplified by Sharpe Model framework which is an improved model over other portfolio construction model. The empirical study by using the latest daily data in the Sharpe framework has analysed the return performance, beta value, systematic and unsystematic risk. The present study considers nine Blue chip Stocks which are ranked highest for the construction of an optimum portfolio and proportion of funds to be invested in each security has been determined. The result of this study provides a significant contribution to the existing literature and has a great utility value to various investors, portfolio managers and other participants of financial markets. Although the investor evaluates the performance of various Stocks through construction of a portfolio but it should be subject to a frequent revisions due to the changing market trends.

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