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INTRODUCTION

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STATEMENT OF THE PROBLEM

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RESULTS & DISCUSSION

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BOOKS

- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.

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CONSTRUCTION OF OPTIMAL EQUITY PORTFOLIO WITH APPLICATION OF SHARPE SINGLE INDEX MODEL: A COMPARATIVE STUDY ON FMCG AND AUTO SECTORS

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ABSTRACT
Indian securities market is an exceedingly unpredictable and sensitive market where portfolio construction is exceptionally critical to get great returns. Accordingly the primary concentration of this research is to build an ideal value portfolio with the assistance of Sharpe index model. In this study, FMCG and AUTO sectors have been thought about for building the ideal portfolios. Thirty companies have been selected and excess return to beta ratio has been calculated and ranked the companies based on that ratio. Ideal portfolios built for FMCG sector and AUTO sector independently and thought about both the portfolios as far as portfolio return and risk. The cut-off point was ascertained in view of the most astounding worth and cut-off point should be used to calculate the proportion of money to be invested in each stocks. This exploration discoveries and proposals would be useful to investors for putting resources into FMCG and AUTO sector and to choose which sector could give most elevated return at low risk.

KEYWORDS
volatile market, portfolio, risk taking investors, sharp single index model, variance, beta, standard deviation, unsystematic risk, excess return to beta ratio and cut off rate.

INTRODUCTION
Among various Investment avenues one of the most romantic Investments is equity Investment, which results most attractive returns with tolerable risks. Equity investment involves purchase of equity shares of different companies. Investment in one stock may result high risk. So the investor needs to select more stocks in order to reduce risk. In the market plenty of equity shares are trading. Hence, investor may face a problem of selection of stocks for his portfolio form of investment. A portfolio is a combination of securities. Any portfolio constructed, either by an individual investor or a fund manager is expected to meet the investor's goals. A rational investor aims at attaining maximum return with minimum risk. It is, therefore, important to construct a portfolio using either of the two popular approaches, namely, traditional and modern.

In the traditional approach, investor's needs in terms of income and capital appreciation are evaluated and appropriate securities are selected to meet the needs of the investor. In the modern approach, Markowitz model is used in selection of securities based on to the risk and return analysis. Markowitz laid foundation for quantifying risk and his contribution is popularly known as 'Modern Portfolio Theory'. He has provided analytical tools for analysis and selection of optimal port-folio. He won Nobel Prize for this contribution to portfolio management in 1990. But, William Sharpe extended the work done by Markowitz. He considered market index while analyzing the portfolio. He simplified the amount and type of input data required to perform portfolio analysis. He made the numerous and complex computations easy which were essential to attain the optimal portfolio. He developed the Single Index Model to make these computations easy and construct an optimal portfolio. Till today, fund managers use this model in portfolio analysis and construction.

LITERATURE REVIEW
Saravanan and Natarajan (2012) From the empirical analysis, it was concluded that returns on either individual securities or on portfolio comprises of securities of different companies listed in Nifty 50 stocks under various sectors are asymmetrical and heterogeneous. The optimal portfolio consists of four stocks selected out of 50 short listed scrips, giving the return of 0.116. Further it helps to elicit that return on securities of different portfolio is independent of the systematic risk prevailing in the market.

Mandal, Niranjan (2013) found that there is a significant difference between the total risk of the optimal portfolio calculated under two different mechanisms found in SIM and Markowitz's model. The total risk of the optimal portfolio is 2.87% (in terms of SD) under SIM and the total risk of the portfolio is found to be 1.79% (in terms of SD) in Markowitz's model taking the necessary input from SIM.

Sarker, Mokta Rani (2013) conducted a study to construct an optimal portfolio using Sharpe's Single Index Model considering no short sales. The study has been conducted on individual securities listed in Dhaka Stock Exchange, where short sales are not allowed. The monthly closing prices of one hundred and sixty four companies listed in Dhaka Stock Exchange and share price index for the period of July 2007 to June 2012 have been considered in this study. This method formulates a unique cut-off point, selects stocks having excess return to beta ratio surpassing this cut-off point and determines the percentage of investment to be made in in each of selected stocks. The optimum portfolio consists of thirty three stocks selected out of one hundred and sixty four stocks giving the return of 6.17%. From this empirical analysis to some extent, an investor can forecast individual securities return through the market movement and can make use of it.

Ms. Apurva and A Chauhan (2014) said that Portfolio management is the crucial decision for any investor. It is important to decide where to invest and how much to invest. The present study focuses on constructing the optimal portfolio with the help of Sharpe Single Index model. Sharpe Single index model uses various inputs such as excess return to beta ratio, unsystematic risk, market return and variance etc to construct the optimal portfolio. In present study, portfolio is constructed from stocks of CNX nifty. Data is collected from top ten companies of CNX nifty based on their weights for the time period of August 2014. Out of 10 stocks, 4 stocks are selected for investing namely State Bank of India, Tata Motors Ltd, Housing Development Finance Corporation Ltd, Reliance Industries Ltd. Sharpe model suggest investors to invest major portion of their money (54.14%) in State Bank of India.

J. Francis Mary and G. Rathika (2015) stated that Risk and return plays an important role in making any investment decisions. Decision include Investment should be done or not and which securities should be included in portfolio. Determining efficient portfolios within an asset class (e.g., stocks) can be achieved with the Single index (beta) model proposed by Sharpe. Sharpe's single-index model was applied by using the monthly closing prices of 10 companies listed in NSE and CNX PHARMA price index for the period from September 2010 to September 2014. From the empirical analysis it can be concluded that out of 10 companies only one company is selected for investment purpose on the basis of Cut-off point which is -0.11182.

Chintan A. Shah (2015) said that Sharpe model gives exact number of securities along with weightage for investment, while this is not possible in CAPM model. CAPM model only suggest different securities where investor can invest but it does not give a particular portfolio and weightage to investment in different securities.

Dr. S Poornima and Aruna. P. Remesh (2016) The 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.

M Sathyapriya (2016) this study illustrates an analysis of four years' asset value, from 2008 to 2012, of companies picked from Infrastructure & Pharmaceutical sectors. In this regard, Sharpe Index Model is used, which is regularly employed to assess the performance of mutual funds and portfolio strategies. The stock performance of 20 companies from Infrastructure and Pharmaceuticals, 10 from each are taken and calculated. It is found that Pharmaceutical sector performs 80% better than that of Infrastructure sector. Performance of Infrastructure sector is comparatively poorer than Pharma as only one company is selected for the portfolio, i.e., GMR, which constitutes just 7% of the investment share.

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 context, especially considering the securities of companies traded through the NSE which is one of the largest stock exchange in the world and which is considered as one of the major attractions to any investor, either individual or institutional.

NEED FOR THE STUDY

Every investor undergoes confusion while selecting securities for his portfolio. He also faces dilemma while deciding about the proportion of investment to be made in each security. To help investors get out of such chaotic situations the Sharpe's Single Index model may be used to construct an optimal portfolio. This helps the investor to find a portfolio that best suits his needs. The present study is undertaken to prove that by applying this model an individual can construct a portfolio with maximum return for a given level of risk.

STATEMENT OF THE PROBLEM

An investor considering investment in securities is faced with the problem of choosing from among a large number of securities and how to allocate those funds over a group of securities. The hurdle that exists is that the investor has a problem of deciding which securities to hold and how much to invest in each of them. Though Markowitz Model enables an investor to arrive at an optimal portfolio, the Single index model is helpful in avoiding the difficulty of data input and time cost consideration. Therefore, the present study is entitled, 'Construction of optimal equity portfolio with application of Sharpe single index model -A comparative study on FMCG and AUTO sectors'.

OBJECTIVES OF THE STUDY

The following are the objectives of the study:
1) To get a practical knowledge about the idea embedded in Sharpe's index model
2) To calculate return and risks of selected stocks in the FMCG and AUTO sectors
3) To calculate beta values for all selected stocks in both sectors and identify aggressive stocks and defensive stocks
4) To construct an optimal portfolio with FMCG sector stocks and AUTO sector stocks and compare two portfolios empirically using the Sharpe's Single Index Model

SCOPE OF THE STUDY

The rational investors never ignore the risk factor while taking investment decisions. The investors prefer to invest in a group of securities which is known as a portfolio in order to diversify the risk. There are different investment avenues for investors to invest. While some investment avenues involve huge risk others may be either less risky or risk less avenues. Therefore, it is essential to educate the investor about the investment alternatives and the risk and return from those investments. As the scope of investment avenues with varying degrees of risk is vast, the scope of the present study is relating to equity portfolio construction with FMCG stocks and AUTO stocks from the NSE.

RESEARCH METHODOLOGY

The study is mainly based on secondary data. The present study had been undertaken to construct optimal portfolios from the FMCG stocks and AUTO stocks and compare the portfolio returns and risks of two portfolios using Sharpe single index model. For this purpose, took NSE as reference stock market. Nifty 500 index has been taken as bench mark market index for the purpose of measuring market return and market variance. A sample of 30 Stocks in NSE's FMCG and AUTO Indices were taken for portfolio analysis. Purposive sampling method is followed to select stocks to compare portfolio return and risks of FMCG and AUTO sectors. Monthly closing values of stocks and market index for eight years from April 2009 to March 2017 had been taken for calculation of mean return, risk and other data inputs for the portfolio construction. This period is chosen to identify the performance of stocks after the world financial crisis 2008 which affected drastically stock markets at international level. 91 **days treasury bills yields** average return for same period has been used as proxy for risk-free rate sourced from "RBI". April 1, 2017 has been taken as base date for the selection of stocks in indices. Required data were collected from the sources of www.nseindia.com / www.moneycontrol.com. Collected data were analysed with the help of Microsoft Excel software for the calculation of mean return, standard deviation, variance, covariance, correlation, beta, alpha and residual variance or random error term.

DATA ANALYSIS AND INTERPRETATION

Measurements of market index return, risk, variance and risk free rate of return:

INDEX	RETURN %	RISK %	VARIANCE	91 DAYS T - BILL RETURN
CNX NIFTY 500	1.4800	6.0880	37.0636	7.2044

Measurement of return, risk, alpha, beta and residual variance for individual stocks in FMCG sector and comparing them in the sector

TABLE I

SECURITY	RETURN	RISK	BETA	ALPHA	RESIDUAL VARIANCE
MARET	1.4800	6.0880			
BRITTANIA INDUSTRIES	2.9184	7.8220	0.3883	2.3437	55.5952
COLGATE POLMOLIVE	1.6903	6.1213	0.1280	1.5008	36.8634
DABUR INDUSTRIES	1.9832	5.9876	0.2746	1.5768	33.0563
EMAMI	3.3491	10.3464	0.9223	1.9841	75.5180
GLAXO SMITHKLINE	2.3691	7.7365	0.3592	1.8375	55.0716
GODREJ CONSUMER DURABLES	2.9573	7.8986	0.6305	2.0242	47.6545
GODREJ INDUSTRIES	3.1376	13.5809	1.7236	0.5867	74.3296
HUL	1.6153	6.5682	0.1654	1.3706	42.1283
ITC	1.7541	5.8979	0.2909	1.3236	31.6492
MARICO	2.5908	6.2686	0.3377	2.0911	35.0694
P&G	2.6791	7.1791	0.3711	2.1299	46.4353
TATA GLOBEL BEVERAGES	1.3722	8.7963	0.8134	0.1684	52.8544
UNITED BREVERIES	2.9693	12.1358	0.9441	1.5720	114.2423
UNITED SPIRITS	2.0819	13.4280	0.9402	0.6905	147.5499

INTERPRETATION

From the above table we can find that Emami company stock offering highest mean return (3.34%) and followed by GODREJ INDUSTRIES (3.13%).TATAGLOBAL BEVERAGES providing lowest return (1.37%) in FMCG sector, when come to risk among all FMCG companies Godrej industries having highest risk (13.58%) and followed by US (13.42%). ITC bearing lowest risk (5.89%). Among all FMCG stocks Godrej industries having highest beta value (1.72) and followed by united Breweries, United Spirit and Emami. Colgate has lowest beta. Britannia has highest alpha value and Tata global beverages has lowest Alpha value. United spirit has highest unsystematic risk and ITC has lowest unsystematic risk.

Measurement of return, risk, alpha, beta and residual variance for individual stocks in AUTO sector and comparing them in the sector:

TABLE II

SECURITY	RETURN	RISK	BETA	ALPHA	RESIDUAL VARIANCE
MARKET	1.4800	6.0880			
AMARRAJA	4.6550	11.1032	1.0956	3.0335	78.7912
APPOLO TYRES	3.3876	13.0114	1.1179	1.7330	122.9744
ASHOKE LEYLAND	3.1833	13.5642	1.5169	0.9384	98.7076
BAJAJ AUTO	2.7383	9.7701	1.1608	1.0202	45.5098
BHARATFORGE	3.1113	11.6378	1.3122	1.1692	71.6183
BOSCH	2.3768	7.5843	0.6119	1.4713	43.6469
EICHER	5.6286	10.7951	0.8860	4.3173	87.4387
EXIDE	2.2111	9.5099	1.0230	0.6971	51.6508
HERO	1.4586	7.8760	0.6439	0.5057	46.6657
MRF	4.3880	11.7266	1.1470	2.6905	88.7529
M&M	2.3399	8.4984	0.9318	0.9608	40.0381
MARUTHI	2.6789	10.5243	1.2509	0.8276	52.7657
MOTHERSON SUMI	3.5157	9.4394	0.7432	2.4158	68.6285
TVS MOT	4.7727	14.1304	1.3811	2.7287	128.9701
TATA MOTORS	3.5340	13.3399	1.5499	1.2403	88.9240
TATA DVR	3.1034	13.5010	1.5715	0.7776	90.7435

INTERPRETATION

From the table we can observe that EICHER MOTORS offering highest mean return (5.6286%) and followed TVS MOTORS (4.77%) and AMARRAJA (4.65%). At the same time we can say that HERO MOTORS offering lowest mean return (1.45%) than others. TVS MOTORS having highest risk (14.13%) and followed by ASHOKE LEYLAND (13.56%). BOSCH has lowest risk (7.58%). Among all AUTO stocks TATA DVR having highest beta value and followed by TATA MOTORS. BOSCH has lowest beta. EICHER has highest alpha value and HERO has lowest Alpha value. TVS MOT has highest unsystematic risk and M & M has lowest unsystematic risk.

PORTFOLIO ANALYSIS FOR AUTO SECTOR STOCKS

Ranking of FMCG stocks on the basis of excess return to beta value where R$_f$ = 7.2044% p.a. = 0.6004% per month is taken.

We can assign ranks under SIM by calculating risk premium to beta ratio. Risk premium means the difference between mean return of a security and risk free rate of return. We assign first rank to a stock which is having high risk premium to beta ratio, next rank will give to next highest risk premium to beta ratio, like that we will assign ranks to all stocks. The following table shows calculations for assigning ranks:

TABLE III

SECURITY	RETURN %	BETA	$(Ri - Rf)$	$\left(\dfrac{Ri - Rf}{Bi}\right)$	RANK
COLGATE POLMOLIVE	1.6903	0.1280	1.0899	8.5149	1
HUL	1.6153	0.1654	1.0149	6.1378	2
BRITTANIA INDUSTRIES	2.9184	0.3883	2.3180	5.9696	3
MARICO	2.5908	0.3377	1.9904	5.8945	4
P&G	2.6791	0.3711	2.0787	5.6016	5
DABUR INDUSTRIES	1.9832	0.2746	1.3828	5.0356	6
GLAXO SMITHKLINE	2.3691	0.3592	1.7687	4.9239	7
ITC	1.7541	0.2909	1.1537	3.9663	8
GODREJ CONSUMER DURABLES	2.9573	0.6305	2.3569	3.7382	9
EMAMI	3.3491	0.9223	2.7487	2.9802	10
UNITED BREVERIES	2.9693	0.9441	2.3689	2.5092	11
UNITED SPIRITS	2.0819	0.9402	1.4815	1.5758	12
GODREJ INDUSTRIES	3.1376	1.7236	2.5372	1.4720	13
TATA GLOBEL BEVERAGES	1.3722	0.8134	0.7718	0.9488	14

Calculations for determining the cut off rate 'C*'

The major problem in the portfolio construction is selection of stocks those stocks would be included in the portfolio and how much proportion of funds to be invested in each stock. For this purpose we should calculate C_i values for all stocks and should determine cut-off point (C^*) in order to decide which stocks could include into portfolio and which stocks should exclude from the list of stocks. We determine C^* by selecting highest C_i value in the list of C_i values. We select all the stocks above the C^* into portfolio and eliminate all stocks below C^* from the list of stocks for the portfolio construction.

C_i values for all the stocks according to the ranked order are computed using the following formula:

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

$\sigma 2ei$ = unsystematic risk
β = beta value of individual security
σm = market index risk
$R_i - R_f$ = excess return

Measurement of C_i values for the stocks in FMCG sector:

TABLE IV

SECURITY	RANK	$\left(\frac{Ri-Rf}{Bi}\right)$	$\frac{((Ri-Rf)Bi)}{\sigma_{ei}^2}$	$\frac{\beta_i^2}{\sigma_{ei}^2}$	$\sum_{i=1}^{n}\frac{((Ri-Rf)Bi)}{\sigma_{ei}^2}$	$\sum_{i=1}^{n}\frac{\beta_i^2}{\sigma_{ei}^2}$	Ci values
COLGATE	1	8.5149	0.0038	0.0004	0.0038	0.0004	0.1380
HUL	2	6.1378	0.0040	0.0006	0.0078	0.0011	0.2767
BRITANNIA	3	5.9696	0.0162	0.0027	0.0240	0.0038	0.7782
MARICO	4	5.8945	0.0192	0.0033	0.0431	0.0071	1.2669
P&G	5	5.6016	0.0166	0.0030	0.0597	0.0100	1.6143
DABUR	6	5.0356	0.0115	0.0023	0.0712	0.0123	1.8130
GLAXO S C	7	4.9239	0.0115	0.0023	0.0828	0.0146	1.9881
ITC	8	3.9663	0.0106	0.0027	0.0934	0.0173	2.1075
GODREJ C D	9	3.7382	0.0312	0.0083	0.1245	0.0257	2.3659
EMAMI	10	2.9802	0.0336	0.0113	0.1581	0.0369	2.4742
U B	11	2.5092	0.0196	0.0078	0.1777	0.0447	**2.4780**
U SPIRITS	12	1.5758	0.0094	0.0060	0.1871	0.0507	2.4084
GODREJ IN	13	1.4720	0.0588	0.0400	0.2460	0.0907	2.0903
TATA G B	14	0.9488	0.0119	0.0125	0.2578	0.1032	1.9806

X_i and Z_i are to be determined to know how much funds needs to be invested in each security using the following formula:

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

Where,
X_i = proportion of investment

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

$\sigma 2 ei$ = unsystematic risk
β = beta value of individual security
$R_i - R_f$ = excess return
C^* = cut off point

Calculation of Z_i and X_i for the selected securities in the optimal portfolio:

TABLE V

SECURITY	$\left(\frac{Ri-Rf}{Bi}\right)$	$\frac{\beta_i^2}{\sigma_{ei}^2}$	$\left(\frac{Ri-Rf}{Bi}\right)-C^*$	Zi	Xi %
COLGATE	8.5149	0.0004	6.0369	0.0027	0.0401
HUL	6.1378	0.0006	3.6599	0.0024	0.0355
BRITANNIA INDUSTRIES	5.9696	0.0027	3.4916	0.0095	0.1415
MARICO	5.8945	0.0033	3.4165	0.0111	0.1660
P&G	5.6016	0.0030	3.1236	0.0093	0.1385
DABUR	5.0356	0.0023	2.5577	0.0058	0.0872
GLAXO SMITH KLINE	4.9239	0.0023	2.4460	0.0057	0.0857
ITC	3.9663	0.0027	1.4883	0.0040	0.0595
GODREJ CONSUMER DURABLES	3.7382	0.0083	1.2603	0.0105	0.1571
EMAMI	2.9802	0.0113	0.5022	0.0057	0.0846
UNITED BREWERIES	2.5092	0.0078	0.0312	0.0002	0.0036
				∑ Zi =0.0669	∑Wi = 1

Measurement of portfolio beta, alpha and portfolio residual variance:

TABLE VI

SELECTED SECURITY IN THE OPTIMAL PORTFOLIO	ALPHA	BETA VALUE	PROPORTION OF INVESTMENT	σ^2_{ei}	Xi*αi	Xi*βi	Xi*σei^2
COLGATE	1.5008	0.1280	0.0401	36.8634	0.0602	0.0051	1.4784
HUL	1.3706	0.1654	0.0355	42.1283	0.0487	0.0059	1.4957
BRITANNIA	2.3437	0.3883	0.1415	55.5952	0.3317	0.0550	7.8692
MARICO	2.0911	0.3377	0.1660	35.0694	0.3472	0.0561	5.8230
P&G	2.1299	0.3711	0.1385	46.4353	0.2949	0.0514	6.4299
DABUR	1.5768	0.2746	0.0872	33.0563	0.1375	0.0240	2.8830
GLAXO SMITH KLINE	1.8375	0.3592	0.0857	55.0716	0.1574	0.0308	4.7177
ITC	1.3236	0.2909	0.0595	31.6492	0.0787	0.0173	1.8824
GODREJ CONSUMER DURABES	2.0242	0.6305	0.1571	47.6545	0.3181	0.0991	7.4883
EMAMI	1.9841	0.9223	0.0846	75.5180	0.1678	0.0780	6.3862
UNITED BREWERIRS	1.5720	0.9441	0.0036	114.2423	0.0057	0.0034	0.4154
			∑Wi = 1. 00		αp = 1.948	B$_P$ = 0.4259	σ$_{ep}^2$ = 46.8693

Measuring portfolio return and risk for FMCG sector, according to Sharpe Single Index Model:

According to Sharpe single index model to calculate portfolio return and risk, we can apply the following equations:

For portfolio return

$R_P = \alpha_p + B_P R_m$

R_P = portfolio return

α_p = portfolio specific return

B_P = beta of the portfolio

R_m = market return

For portfolio variance

$\sigma_p^2 = B_p^2 \sigma_m^2 + \sigma_{ep}^2$

σ_p^2 = portfolio variance

σ_m^2 = market variance

σ_{ep}^2 = portfolio residual variance

Portfolio risk = σ_p

$\sigma_p = \sqrt{\sigma_p^2}$

By substituting the above inputs we can measure the portfolio return and risk:

Portfolio return

$R_P = 1.948 + (0.4259 * 1.4800)$

$R_P = 2.5783 \%$

Portfolio variance

$\sigma_p^2 = (0.4259)^2 \, 37.0636 + 46.8693$

$\sigma_p^2 = 6.7229 + 46.8693$

$\sigma_p^2 = 53.5922$

$\sigma_p = 7.3207 \%$

PORTFOLIO ANALYSIS FOR AUTO SECTOR STOCKS

Ranking of AUTO stocks on the basis of excess return to beta value where R$_f$ = 7.2044% p.a. = 0.6004% per month is taken:

TABLE VII

SECURITY	RETURN	BETA	$(Ri - Rf)$	$\left(\dfrac{Ri - Rf}{Bi}\right)$	RANK
EICHER MOTORS	5.6286	0.8860	5.0282	5.6750	1
MOTHERSON SUMI	3.5157	0.7432	2.9153	3.9225	2
AMARRAJA BATTERIES	4.6550	1.0956	4.0546	3.7007	3
MRF	4.3880	1.1470	3.7876	3.3022	4
TVS MOTORS	4.7727	1.3811	4.1723	3.0210	5
BOSCH	2.3768	0.6119	1.7764	2.9033	6
APPOLO TYRES	3.3876	1.1179	2.7872	2.4931	7
BHARAT FORGE	3.1113	1.3122	2.5109	1.9134	8
TATA MOTORS	3.5340	1.5499	2.9336	1.8928	9
M&M	2.3399	0.9318	1.7395	1.8668	10
BAJAJ AUTO	2.7383	1.1608	2.1379	1.8416	11
ASHOKE LAYLAND	3.1833	1.5169	2.5829	1.7028	12
MARUTHI	2.6789	1.2509	2.0785	1.6616	13
TATA DVR	3.1034	1.5715	2.5030	1.5927	14
EXIDE INDUSTRIES	2.2111	1.0230	1.6107	1.5745	15
HERO MOTORS	1.4586	0.6439	0.8582	1.3329	16

Calculations for determining the cut off rate 'C*':

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TABLE VIII

SECURITY	RANK	$\left(\dfrac{Ri-Rf}{Bi}\right)$	$\dfrac{((Ri-Rf)Bi)}{\sigma_{ei}^2}$	$\dfrac{\beta_i^2}{\sigma_{ei}^2}$	$\sum_{i=1}^{n}\dfrac{((Ri-Rf)Bi)}{\sigma_{ei}^2}$	$\sum_{i=1}^{n}\dfrac{\beta_i^2}{\sigma_{ei}^2}$	Ci values
EICHER	1	5.6750	0.0510	0.0090	0.0510	0.0090	1.4169
MOTHERSONSUMI	2	3.9225	0.0316	0.0080	0.0825	0.0170	1.8752
AMARRAJA	3	3.7007	0.0564	0.0152	0.1389	0.0323	2.3446
MRF	4	3.3022	0.0489	0.0148	0.1879	0.0471	2.5363
TVS MOTORS	5	3.0210	0.0447	0.0148	0.2325	0.0619	2.6170
BOSCH	6	2.9033	0.0249	0.0086	0.2574	0.0705	**2.6422**[*]
APPOLO TYRES	7	2.4931	0.0253	0.0102	0.2828	0.0806	2.6281
BHARAT FORGE	8	1.9134	0.0460	0.0240	0.3288	0.1047	2.4976
TATA MOTORS	9	1.8928	0.0511	0.0270	0.3799	0.1317	2.3946
M&M	10	1.8668	0.0405	0.0217	0.4204	0.1534	2.3311
BAJAJ AUTO	11	1.8416	0.0545	0.0296	0.4749	0.1830	2.2621
ASHOK LEYLAND	12	1.7028	0.0397	0.0233	0.5146	0.2063	2.2062
MARUTHI	13	1.6616	0.0493	0.0297	0.5639	0.2359	2.1448
TATA DVR	14	1.5927	0.0433	0.0272	0.6072	0.2631	2.0930
EXIDE	15	1.5745	0.0319	0.0203	0.6391	0.2834	2.0591
HERO	16	1.3329	0.0118	0.0089	0.6510	0.2923	2.0389

Calculation of Zi and Xi for the selected securities in the optimal portfolio:

TABLE IX

SECURITY	$\left(\dfrac{Ri-Rf}{Bi}\right)$	$\dfrac{\beta_i^2}{\sigma_{ei}^2}$	$\left(\dfrac{Ri-Rf}{Bi}\right)-c^*$	Zi	Xi %
EICHER	5.6750	0.0090	3.0328	0.0272	0.3819
MOTHERSON SUMI	3.9225	0.0080	1.2803	0.0103	0.1445
AMARRAJA	3.7007	0.0152	1.0585	0.0161	0.2262
MRF	3.3022	0.0148	0.6601	0.0098	0.1372
TVS MOTORS	3.0210	0.0148	0.3788	0.0056	0.0786
BOSCH	2.9033	0.0086	0.2612	0.0022	0.0314
				∑ Zi =0.0713	∑Wi = 1

Among auto sector stocks, EICHER MOTORS got highest proportion of investment (38%) and followed by AMARARAJA BATTERIES (23%).

Measurement of portfolio beta, alpha and portfolio residual variance:

TABLE X

SELECTED SECURITY IN THE OPTIMAL PORTFOLIO	ALPHA	BETA VALUE	PROPORTION OF INVESTMENT	σ_{ei}^2	Xi*αi	Xi*βi	Xi*σei²
EICHER	4.3173	0.8860	0.3819	87.4387	1.6487	0.3384	33.3921
MOTHERSON SUMI	2.4158	0.7432	0.1445	68.6285	0.3492	0.1074	9.9194
AMARRAJA	3.0335	1.0956	0.2262	78.7912	0.6861	0.2478	17.8211
MRF	2.6905	1.1470	0.1372	88.7529	0.3692	0.1574	12.1791
TVS MOTORS	2.7287	1.3811	0.0786	128.9701	0.2144	0.1085	10.1337
BOSCH	1.4713	0.6119	0.0314	43.6469	0.0462	0.0192	1.3712
			∑Wi = 1. 00		αp = 3.3138	Bp = 0.9787	σep² = 84.8165

Measuring portfolio return and risk for AUTO sector, according to Sharpe Single Index Model:

By substituting the above inputs we can measure the portfolio return and risk:

Portfolio return

$R_P = 3.3138 + (0.9787 * 1.4800)$

$R_P = 4.7623 \%$

Portfolio variance

$\sigma_P^2 = (0.9787)^2\ 37.0636 + 84.8165$

$\sigma_P^2 = 35.5015 + 84.8165$

$\sigma_P^2 = 120.3180$

$\sigma_P = 10.9690 \%$

Comparison of portfolio return and risks for FMCG sector stocks and AUTO sector stocks:

TABLE XI

PORTFOLIOS	PORTFOLIO RETURN	PORTFOLIO RISK
FMCG SECTOR	2.5783%	7.3207%
AUTO SECTOR	4.7623 %	10.9690%

FINDINGS

1. Sharpe single index model gives an easiest model for portfolio construction, which requires less number of inputs (3n +2) when compared to Markowitz model.
2. From the study it was found that AUTO sector stocks offering high returns than the FMCG sector stocks and also they were bearing high risks.
3. In the FMCG sector EMAMI offering highest mean return and TGB having lowest mean return. GODREJ INDUSTRIES bearing highest risk and ITC bearing lowest risk.
4. In the AUTO sector EICHER MOTORS offering highest mean return and HERO MOTORS having lowest mean return. TVS MOTORS bearing highest risk and BOSCH bearing lowest risk.
5. Except GODREJ INDUSTRIES all FMCG stocks listed as defensive stocks and majority of the AUTO sector stocks listed as aggressive stocks.
6. In the FMCG sector BRITANNIA INDUSTRIES having highest ALPHA value and TGB having lowest ALPHA value.
7. In the AUTO sector EICHER MOTORS having highest ALPHA value and HERO having lowest ALPHA value.

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8. In the FMCG sector UNITED SPIRTS having highest unsystematic risk and ITC having lowest unsystematic risk.
9. In the AUTO sector TVS MOTORS having highest unsystematic risk and M&M having lowest unsystematic risk.
10. In the list of FMCG stocks UNITED SPIRITS, GODREJ INDUSTRIES and TATA GLOBAL BEVERAGES are excluded from list of stocks for optimal portfolio construction, remained 11 stocks are included in the list of stocks for optimal portfolio construction.
11. In the list of AUTO stocks EICHER, AMARRAJA, MOTHERSON, BOSCH, TVS MOTORS and MRF are included in optimal portfolio; remained 10 stocks are excluded from list of stocks for optimal portfolio construction Portfolio with AUTO sector stocks providing highest return (4.76%) and risk (10.96%) when compared to portfolio with FMCG sector stocks which consists portfolio return (2.57%) and portfolio risk (7.32%).

RECOMMENDATIONS

So far it is clear that the construction of optimal portfolio investment by using Sharpe's Single Index Model is easier and more comfortable than any other portfolio models. Thus two optimal portfolios are constructed by selecting thirty companies, 14 companies from FMCG sector which are constituents of NIFTY FMCG INDEX listed in NSE and 16 companies from AUTO sector which are constituents of NIFTY AUTO INDEX listed in NSE. After calculating the "cut-off "Values for the FMCG sector sample companies out of 14 companies, eleven were selected for the optimal portfolio construction, they are COLGATE, HUL, GLAXO SMITH CLINE, BRITANNIA, ITC, MARICO, P&G, DABUR, GODREJ CONSUMER DURABLES, EMAMI and UNITED BREWERIES. In the sample of AUTO sector companies, out of 16 companies, six were selected for the optimal portfolio construction; they are EICHER, AMARRAJA, MOTHERSON, BOSCH, TVS MOTORS and MRF. In the two portfolios, portfolio with AUTO sector companies offering highest return (4.76%) and bearing highest risk (10.96%). Portfolio with FMCG sector companies offering lowest return (2.57%) and bearing lowest risk (7.32%). From the above remarks it can be suggested that to the individual investors and portfolio managers to take investment decisions to invest in FMCG stocks for moderate expected return and risk, while so to invest AUTO sector stocks for high return with high risk. This study helps the investors to minimize their investment risk and maximize the return of their investment. It can be suggested to risk aversors to invest in portfolio with FMCG stocks. It can be suggested to risk takers; who expect high return with high risk, to invest in portfolio with AUTO stocks.

Investing in individual securities is associated with high risk, where as investing in a portfolio of securities helped to spread the risk over many securities and thus reducing overall risk involved. Portfolios, which are combinations of securities, tend to spread risk over many securities and thus help to reduce the overall risk involved. This method of construction of optimal portfolio is very effective and convenient as revision of the optimal portfolio can be an ongoing exercise. The existence of a cut-off rate is also extremely useful because most new securities that have an excess return-to beta ratio above the cut-off rate can be included in the optimal portfolio.

SCOPE FOR THE FURTHER RESEARCH

The present study has been taken on the topic of construction of optimal portfolios with the FMCG sector and AUTO sector stocks. Here there is a scope for the further research that is to construct and Compare optimal port folios with other sectoral stocks like public sector banks and private sector banks and metals and media. In this paper the researcher used the sharpe single index model for optimal portfolio construction. So here there is possibility to study on optimal portfolio construction with the capital asset pricing model.

CONCLUSION

Thus, this study helps the investors to minimize their overall risk and maximize the return of their investment over any period of time. The optimal portfolio thus developed proved to be the best investment option in NSE, but the daily market fluctuation based on international financial queues and emotions resulted in security price fluctuations beyond the predicted risk levels.

LIMITATIONS OF THE STUDY

The limitations of the present study are:

1. The study uses monthly prices instead of daily data
2. Only thirty companies have been selected for conducting this study.
3. The results of the study may not be universally applicable

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