EXPLORING THE DYNAMICS OF PORTFOLIO RISK AND RETURN; "SENSEX" V/S "HYPOTHETICAL OPTIMAL PORTFOLIO"

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Abstract

Over the last few years, there has been a rapid change in the Indian securities market. With increased number of institutional investors, in the form of FIIs, Mutual Funds, Hedge Funds etc., the way of investment has also changed. In Indian Stock Markets, "Sensex" is considered to be representative of the entire stock market. Thus, it represents an optimal portfolio in terms of CML. Are there any portfolios, which lie above this CML in Indian stock markets? If yes, what type of financial assets do these high performing portfolios include? Further, it may be of interest to find out whether "Sensex" is actually an optimal portfolio or there can be some other portfolio created out of Sensex stocks, which could give better returns? This paper tries to answer the above questions. It tries to construct "Hypothetical optimal portfolio" using, the return and risk data of BSE 30 stocks, for 5 years, without the procedure of short sales by applying the concept of modern portfolio theory and CAPM by using the Sensex stocks. These Hypothetical Optimal Portfolios created with the help of optimization technique, are then compared with Sensex and top performing mutual funds on the basis of Risk, Return, Sharpe ratio and Risk tolerance. The study concluded that the CAPM has great importance in constructing the hypothetical optimal portfolio and these portfolios are better than Sensex in terms of risk and return. This study also suggested that there are only few outlier portfolios in

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Indian stock market, which includes the gold fund and FMCG funds, give the better return as compare to hypothetical optimal portfolio and the Sensex return was lower than the return of Hypothetical optimal portfolio in all five years. The finding of the study will be of practical value for investors as it provides realistic insights on actual performance of Sensex and Mutual funds and expected performance of Hypothetical optimal portfolio.

KEYWORDS: CAPM, Optimal Portfolio, Modern Portfolio Theory, Capital Market line, Efficient Frontier.

Introduction

The benefit of Portfolio Diversification was introduced by Harry Markowitz (1952) in the Modern Portfolio Theory, where, the concept of "Efficient Frontier" emerged for the first time. Efficient Frontier was considered to be a set of best feasible portfolios, which was derived with the help of modern portfolio theory. The portfolios lying on the Efficient Frontier were considered to be the ones with the best possible combination of risk and return. This work was carried further by Sharpe (1964), Lintner (1965) and Mossin (1966) in the form of Capital Asset Pricing Model (CAPM). CAPM asserts that the selection of portfolio is depend on the risk free rate of return in the market, return of the security, and their standard deviation. According to CAPM optimal portfolio is the point on the Efficient Frontier where the Capital Market Line (CML) is tangent. The combination of 'Risk" and "Return" at optimum portfolio is such that any other portfolio's with similar return are not possible at a lower level of risk and any other portfolios of similar risk will not yield superior returns than this hypothetical optimal portfolio. Thus, this is the optimum level of diversification. The CML is a linear representation with alpha (α) as the risk free rate of return (R_f) and beta (β) as the excess market return relative to the market risk.

Further, the degree to which investors can reduce their risk by diversifying their portfolio depends on the correlation between the securities. Correlation between securities gives us an idea as to how two securities move in relation and dependent with each other and the lower the correlation between them, the greater chance of reducingrisk. The diversified portfolio reduces the level of risk with same level of return or increases the level of return with same level of risk.

Harry Markowitz used statistical analysis and mathematical programming in order to arrange for the optimum allocation of assets within the portfolio. This model is a theoretical framework for the analysis of risk return choices. Decisions are based on the concept of efficient portfolio. The present paper is based on the secondary data for the purpose of constructing "Hypothetical optimal portfolio", a sample of 30 stock listed on Bombay stock exchange(BSE) were selected in this study. The major factors which affect the return of the stock is totally depend on the information and level of market efficiency. Fama (1970 and 1991) gave the formal definition of "Market efficiency". In that study he divided market efficiency into three forms, According to efficient market hypothesis(EMH) weak form state that no investor can derive the future prices with the help of past or current prices. Semi strong form state that the information which is publicly available are reflected in the price of the securities. Strong form state that current market price of the security reflects all the information available. According to some researcher Indian stock markets are in weak form of efficiency and another give the evidence that it is in semi strong form. Therefore, any method of portfolio selection will be affected by the news in the market. But, the technical portfolio selection methods do not incorporate the "news" element in the portfolio selection. Considering the above issues, it is inevitable to find out whether "Sensex" which is considered to be the most representative index of Indian stock market, is fit to be defined as a "Hypothetical Optimal Portfolio" in terms of CAPM? The CAPM is used to determine a required rate of return of an assettheoretically, if that asset is to be marge to an already well-diversified and negatively correlated portfolio, given that assets non-diversifiable risk or systematic risk. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systematic risk or market risk), often represented by the quantity beta (β) in the financial market, as well as the expected return of the market and the expected return of a risk-free asset.

Literature review

Academia has always been fascinated by portfolio creation and evaluation of its performance. There are several researches exploring various aspects of security analysis and portfolio creation. Researchers have studied capital assets pricing model, market efficiency and modern portfolio theory and many other models. The important ones are being included in this literature review.

Black, Jensen and Scholes (1972) examined the monthly return of the portfolio and tested that whether the expected return of the portfolio is linearly related with the beta of portfolio. For accuracy of expected returns of portfolio and beta estimate they combine the securities into portfolios diversify the risk. Authors founds that there is a relation between Beta (β) and expected return is very close to linear and that portfolios with low/high beta have low/high average return. Therefore, with the prediction of Capital assets pricing model the data are dependable. This approach alleviates the statistical problems that arise from measurement errors while estimating beta. **Fama and MacBeth (1973)** in another classical empirical study, examined relation between beta and average return. Furthermore, they studied whether the squared value of beta, the volatility of asset returns can explain the residual variation in average return across assets that are not explained by beta alone. The performance of portfolio on the efficient frontier and off the efficient frontier was studied by **William C. Scheel, et al (1999)** by using the boot strapping and optimizer technique of portfolio creation. They found that there was no clear cut superiority to the on frontier set of portfolios, although lower risk lower risk-return On frontier portfolio was generally found to perform better relative to comparable, Off frontier portfolios than those at higher level of risk. In another study, **Ignacio Vélez-Pareja (2001)** proposed that the optimal portfolio can be found maximizing the slope of the line that joins the point of risk-free return and the efficient frontier. When this maximum tangent is reached, that line is the capital market line (CML) (it is tangent to the efficient frontier) shows the best combination of risk and return. This is a simple procedure with excel solver, that does not require one to calculate the efficient frontier. It is a one point of the frontier. This is the best and optimal combination of risk and return. **YazGulnurMuradoglu*et all* (2002)** this paper investigate the portfolio risk and return of subjective forecasts given in different forms. In this paper efficient frontier was created with the help of human behavior rather past prices. Subjective portfolio was compared with the forecasted portfolio created with time series data. Subjective forecast was given by specialist portfolio managers. The result of this paper was the portfolio performance of subjective forecasted portfolio is much more superior to those of standard time series modeling. And another finding of this study was the portfolio managers are expertise and have the perfect knowledge of the market.**PandeyAnand (2003)**this paper investigate the efficiency of the Indian stock market. From autocorrelation analyses and runs test we are able to conclude that the series

of stock indices in the India Stock Market are biased random time series. The auto correlation analysis indicates that the behavior of stock prices does not confirm the applicability of the random walk model in the India stock market. Thus there are undervalued securities in the market and the investors can always excess returns by correctly picking them. **Xi Yang and DonghuiXu, (2006)**, tested CAPM model by taking 100 companies' stock in Shanghai Stock Exchange from 01.01.2000 to 31.12.2005, they say that the CAPM predicts that the stocks with higher/lower risk will yield high/low expected rate of return is not supported. However, beta return relationship is linear with each other and the non-systematic risk has no effect on the return during the test period, which is consistent with CAPM. Hence, when take 2000 to 2005 as whole period CAPM is not fully invalid. **Gupta and Basu (2007)** suggest that the series do not follow random walk model and there is an evidence of autocorrelation in both markets rejecting the weak form efficiency hypothesis. **Reddy G.Sudarsana, (2011)** this paper examined the validity of capital assets pricing model on security of Bombay stock exchange. According to this research there is a significant relationship between return and risk of the securities. Investors of India have realized higher return by opting higher risky securities. These research also state that the validity of capital asset pricing model coefficients signifies the implication of the CAPM in the Indian stock market is determine the required rate of return of risky stocks. This study was conducted for the period for 2002 to 2007 of 80 companies of BSE 100.

Scope for the study

It is a matter of inevitable curiosity to investigate whether "Sensex" which is considered to be the most representative index of Indian stock market, is fit to be defined as an "Optimal Portfolio" in terms of CAPM? This study will help Indian Investors, particularly those investing in mutual funds or other funds to explore whether, any other portfolios in Indian Stock Markets earn better returns than Sensex or not? This means, they'll be able to understand that are there any other portfolios, which are away from the "Optimal Portfolio point", but still have a better risk return composition? Are there any portfolios, which lie above this CML in Indian stock markets? If yes, the investors will be benefited from identifying such type of financial assets included in these high performing portfolios include? Further, it may be of interest to find out whether "Sensex" is

actually an optimal portfolio or there can be some other portfolio created out of Sensex stocks, which could give better returns?

Objective of research

The study intends to create the "Hypothetical optimal portfolio" which gives the best combination of risk and return with the help of BSE 30 and to identify the performance level of the Sensex, hypothetical optimal portfolio and other portfolio of Indian stock market for the period of January 2008 to December 2012.

The objectives of the study can be stated as:

i. To compare the Risk and Return of Sensex with the Risk and Return of hypothetical optimal portfolio generated using CAPM and modern portfolio theory for the period of 2008 to 2012.

ii. To compare the Risk and Return of Sensex with the Risk and Return of best portfolios that is mutual funds of Indian stock market for the period of 2008 to 2012.

iii. To compare the Risk and Return of top mutual fund portfolio with the Risk and Return of hypothetical optimal portfolio for the period of 2008 to 2012.

iv. To identify an investment opportunity, if any that is superior in terms of risk and return as compared to Sensex and hypothetical optimal portfolio.

v. To evaluate the performance of Sensex, Hypothetical optimal portfolio and top mutual fund portfolio.

Research methodology

As mention in previous section this research amends to identify the risk return combination of different portfolios. For comparing these portfolios and constructing hypothetical optimal portfolio following step were used:

The model

Return Calculation

The financial literature available largely supports use of percentage returns instead of raw closing prices available. Thus, return series is calculated for all 30 companies which are listed in BSE 30 and top 15 open ended mutual funds, by using following equation:

$$R_i = \{((CP_t - CP_{t-1})/CP_{t-1}) \times 100\} \qquad \text{- [Eq 1]}$$

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Where,

R_i is return for the current month, CPtis current month's closing price,

And CP_{t-1} refers to previous month's closing price.

Thus, in all 30 stock, top 15 mutual funds and SENSEX with 60 monthly observations was generated for the period 2008 to 2012.

Standard Deviation

As per the objective of the research, to compared the risk level of different portfolio find out the standard deviation of the portfolio for the period of 2008 to 2012 by using the following equation:

$$s_N = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \overline{x})^2}.$$ - [Eq 2]

Where, X_i each score, X is the mean, N is number of observation.

Variance

Variance explain how far the number from the mean value. It is calculated by following equation,

$$V = \sigma^2$$ - [Eq 3]

Where,

V is variance, σ is standard deviation.

Average return

For comparing the different portfolio, it is requiring the average return of the year, by using the following equation,

$$\text{Average } x = (x_1 + x_2 + x_3, + ... + x_n)/n$$ - [Eq 4]

Where $x_1, x_2, ...x_n$ are different values,

N is number of observation

Portfolio Creation

Portfolio is the basket of investment which is created with the help of risk and return of the individual stock. In these research, there were 5 portfolio created with the help of monthly return of the individual stock. For creating the portfolio the primary step is to find the average return, standard deviation and variance for the individual stock for the year.

Excess return matrix

For creating the portfolio it is important to find out the excess return over the average return by using the following equation:

$$E_r = \{R_i - Average\ R_i\}$$ - [Eq 5]

Where,

E_r is the excess return, R_i is monthly return of the stock, Average R_i is average of 12 month's return.

Covariance matrix

The degree to which investors can diversifying their portfolio risk depends on the correlation between securities. Correlation between securities gives us an idea as to how two securities are dependent and move in relation with each other and the lower the correlation between securities , the greater the potential to reduce risk. For calculating the covariance matrix, first we find out the transpose of the excess return matrix. Covariance matrix was found with the help of matrix multiplication by using the following equation:

$$\text{Cov}(s_1, s_2 \ldots s_n) = \begin{bmatrix} R_{11} & R_{12} & R_{13} & . & . & . & R_{1m} \\ R_{21} & R_{22} & R_{23} & . & . & . & . \\ R_{31} & R_{33} & R_{33} & . & . & . & . \\ . & & & & & & . \\ . & : & : & : & : & : & : \\ . & & & & & & \\ R_{n1} & . & . & . & . & . & R_{nm} \end{bmatrix} \ transpose \ \begin{bmatrix} R_{11} & R_{12} & R_{13} & . & . & . & R_{1m} \\ R_{21} & R_{22} & R_{13} & . & . & . & . \\ R_{31} & R_{33} & R_{33} & . & . & . & . \\ . & & & & & & . \\ . & : & : & : & : & : & : \\ . & & & & & & \\ R_{n1} & . & . & . & . & . & R_{nm} \end{bmatrix} \text{[Eq 6]}$$

Where,

Matrix 1 is the excess return matrix,

Matrix 2 is transpose matrix of excess return matrix,

Cov is covariance between securities.

Portfolio Return

Calculate the average return for the portfolio. It is the scalar product of the weight vector times the return vector (the return vector is the average return for the stocks) by using the following equation:

$R_p = W_1 * R_1 + W_2 * R_2 + \ldots \ldots W_n * R_n$ -[Eq 7]

Then multiplying weight vector matrix to covariance matrix of the stock. The portfolio variance is calculated as the scalar product of the participation or weight vector times the vector obtained

by multiplication of weight vector matrix to covariance matrix. The portfolio standard deviation is the square root of the variance.

Construction of tangent:

Tangent is the point where "capital market line(CML)" touch the "efficient frontier". These line is derive with the help of risk free rate of return in the market. The CML give the relationship between market return and security return. The capital market line (CML) is expressed by the following equation:

$$R_i = R_f + \left\{\frac{R_m - R_f}{\sigma_m}\right\} \times \sigma_P$$

The slope of this line is beta (β). The degree (θ value) of CML was found with the help of following equation:

-[Eq 8]
$$tan\theta = \frac{R_p - R_f}{\sqrt{\sum_m k = 1 \sum_m j = 1 \; w_k \; w_j \; \sigma_{kj}}}$$

Where,

$w_k$is the weight of the security k in the portfolio,$w_j$is the weight of security j in the portfolio,$R_p$is the return of portfolio,$R_f$is the risk free rate of return, which is T-bill

$\sigma_{kj}$is the standard deviation between the stocks

Optimization Techniques

Use Solver to maximize the tangent subject to the conditions that the sum of the weights is one and the weights are nonnegative. These tool generate the result which maximize the return of the portfolio with maxima-minima function. In these tool we use the following conditions:

$$S_1 : S_{30} \geq 0 \qquad \text{-Eq 9}$$
$$\sum W_i = 1 \qquad \text{-Eq 10}$$

Where, $W_i$is the weight of individual stock,

S_1 To S_{30} are the 30 stocks of BSE 30.

Sharpe's portfolio performance measure

As per the objective of the research to compared the performance of the portfolios, in these research Sharpe's ratio was used. Sharpe developed a composite measure to evaluate the outcome or performance of mutual fund but it can also use to evaluate any portfolio. Sharpe measure closely follows capital asset pricing model, dealing with capital market line (CML). The Sharpe's measure used to identify risk adjusted return of portfolio. Sharpe ratio was calculated by using following equation:

- [Eq 11]
$$S = \frac{(R_{port} - R_f)}{\sigma_{port}}$$

Where ,R_{port}refers to portfolio return, R_f refers to risk free return,

σ_{port}refers to portfolio standard deviation

Sample description

The entire sample was collected from 2008-2012 of the 30 stocks, which are listed in BSE 30 for that year, between that period there were 14 time replacement in that stocks. The reason behind the taking this period was to evaluate the performance of different portfolio in the crisis period and after the crisis period. The portfolio optimization technique was applied to these 30 stocks each year. This generated "Hypothetical optimal portfolio" for each year. The returns of these Hypothetical optimal portfolios were compared with the Sensex returns. The point to be noted here is that these optimal portfolios were "Hypothetical Portfolios" and were based on historical data. The next objective of the research was to identify if there were any portfolios in the Indian Stock markets, which generated returns higher than "Sensex" or the "Hypothetical Optimal Portfolios". The idea was to compare whether Sensex is actually the Optimal Portfolio or not. For this, 15 Mutual funds were selected based on their performance.

Findings and discussions

As mentioned in the previous section, this research had two basic objectives. First was to evaluate whether, Sensex 30 give returns higher than the "Hypothetical Optimal Portfolio" generated theoretically by applying optimization technique. The Second was to explore whether the Indian stock markets have investment opportunities that give returns better than the "Hypothetical Optimal Portfolios" generated using modern portfolio technique and CAPM model.

Return calculation

Sensex Risk and Return

The risk and return of Sensex for the period of study is summarized in table 1

Table 1		
Return and Risk of SENSEX From 2008 to 2012		
Year	**Sensex Return**	**Sensex Risk**
2008	-2.0189	10.1429
2009	0.5733	9.6603
2010	1.4540	4.6682

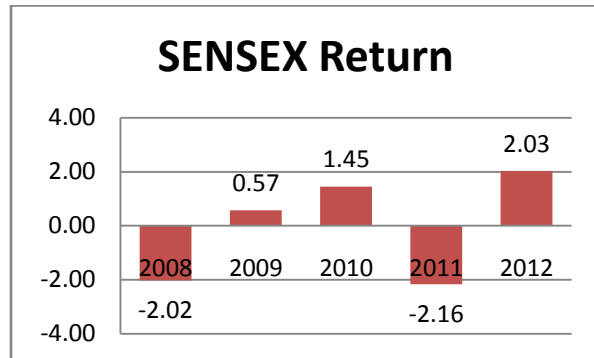| 2011 | -2.1619 | 5.7919 |
| 2012 | 2.0342 | 4.7534 |

Figure 1: Mean returns of SENSEX   **Figure 2:** Standard deviation of SENSEX
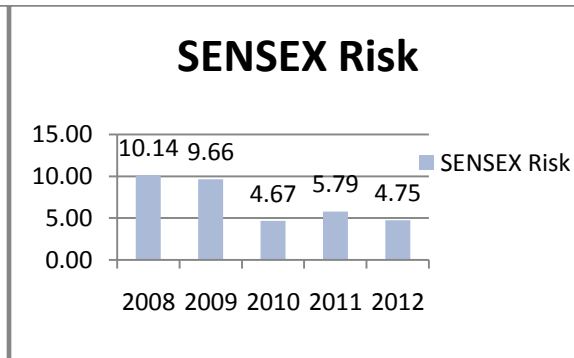
As is evident from table 1 the performances, in terms of mean returns, and risk associated in terms of standard deviation, of SENSEX 30 index for the period of 2008 to 2012. This return was calculated with the help of equation no. 1. Figures 1 and 2 depict same graphically. For the year 2009, 2010 and 2012 it gives positive mean return, but in 2008 and 2011 it gives negative mean return, the reason for these negative return was the impact of subprime crisis

And euro zone crisis on the Indian stock market. During that period the range of mean return of Sensex was -2.02% to 2.03%. In the year 2012 it give highest return with 4.75% level of risk.

Hypothetical Optimal portfolio

Next step was to generate "Hypothetical Optimal Portfolios" and compare their risk and returns with Sensex for each year from 2008 to 2012. The following paragraphs describe the risk and returns of these "Hypothetical Optimal Portfolios".

Table 2 Hypothetical optimal portfolio for the year 2008 to 2012							
Hypothetical optimal portfolio for year 2008				Hypothetical optimal portfolio for year 2009			
S.no.	Name	Weight	Return	S.no.	Name	Weight	Return
1	HUL	1.00	1.67	1	BHEL	0.03	0.15
	Total	**1.00**	**1.67**	2	Infosys	0.62	4.66

Hypothetical optimal portfolio for year 2010				3	MNM	0.28	3.49
1	MNM	0.25	0.80	4	Maruti Suzuki	0.07	0.75
2	ONGC	0.14	0.14	5	TATA Motors	0.004	0.06
3	TCS	0.40	1.55		**TOTAL**	**1.00**	**9.11**
4	TATA Motors	0.18	0.85	**Hypothetical optimal portfolio for year 2012**			
5	Hero Motocorp	0.03	0.04	1	HDFC Bank	0.07	0.29
	TOTAL	**1.00**	**3.39**	2	HUL	0.52	1.15
Hypothetical Optimal Portfolio For Year 2011				**3**	HDFC bank	.02	.04
1	HUL	0.63	1.55	4	SBI	0.07	0.26
2	ITC	0.37	0.49	5	Sun Pharma Ltd	0.05	0.17
	Total	**1.00**	**2.04**	6	Dr. Reddy's Lab	0.22	0.70
				7	ITC	0.06	0.18
					TOTAL	**1.00**	**2.80**

For creating the Hypothetical optimal portfolio from the 30 companies which are listed under BSE 30, put the equation no. 9 and 10 under solver, which give the assets have the highest return with less level of risk. In the year 2008 according to Table 2, HUL is the only company which give the positive return, the mean return of the year portfolio is 1.67% with 8.43% risk.

In the year 2009, five securities are covered under the hypothetical optimal portfolio. According to this portfolio, the mean return of the year is 9.11% with 6.84% risk. In the year 2010, five stocks are covered under hypothetical optimal portfolio. This portfolio gives the mean return for the year 3.39% with 3.69% risk. In the year 2011 there were 2 stocks covered under hypothetical optimal portfolio which are, HUL and ITC. The optimal portfolio gives the mean return of 2.04% with 5.19% risk. In the year 2012, there were 7 stocks are cover The optimal portfolio gives the mean return of 2.80% with 2.26% risk.

Figure 3: Mean returns of hypothetical optimal Portfolio**Figure 4:** Risk of hypothetical Portfolio

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OPTIMAL PORTFOLIO

OPTIMAL PORTFOLIO

As in figure 3 the mean return of Hypothetical optimal portfolio from 2008 to 2012 are shown. According to these in all years optimal portfolio gives the positive return. In 2009 optimal portfolio was given best return as compared to other years. In figure 4, it is shows the standard deviation or Risk of the optimal portfolio. In year 2008 and 2009 it shows the highest level of risk but afterward it shows lesser risk.

Comparison of Return and Risk for Sensex and "Hypothetical optimal portfolio"

As mentioned in the previous section, this research has two primary objectives. First was to compare the risk and return of Sensex and hypothetical optimal portfolio.

Table 3

Comparison of Return And Risk for Sensex and "Hypothetical optimal portfolio"

	Returns		Risk	
YEAR	**SENSEX**	**OPTIMAL PORTFOLIO**	**SENSEX**	**OPTIMAL PORTFOLIO**
2008	-2.0189	1.67	10.14	8.43
2009	0.5733	9.11	9.66	6.84
2010	1.4540	3.39	4.66	3.69
2011	-2.1619	2.04	5.79	5.19
2012	2.0342	2.80	4.75	2.26

Figure 5: Mean returns of SENSEX and Optimal portfolio

Return

	2008	2009	2010	2011	2012
SENSEX	-2.02	0.57	1.45	-2.16	2.03
OPTIMAL PORTFOLIO	1.67	9.11	3.39	2.04	2.80
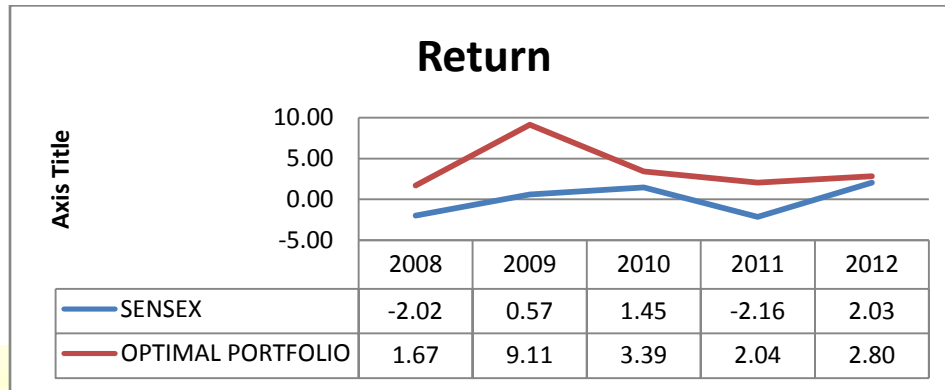
Figure 6: Risk of SENSEX and optimal portfolio

RISK

	2008	2009	2010	2011	2012
SENSEX	10.14	9.66	4.67	5.79	4.75
OPTIMAL PORTFOLIO	8.43	6.84	3.69	5.19	2.26
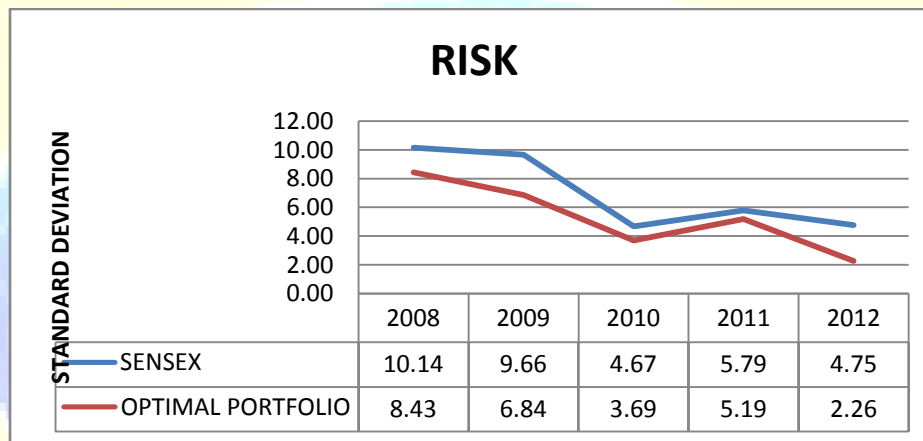
In the table 9, return and risk of Sensex and Hypothetical optimal portfolio was derived, these data is graphically presented in figure 5 and figure 6, and according to figure 5 it is clear that in the return of optimal portfolio is higher than the return of SENSEX 30 in all years from 2008 to 2012, and also in the risk side, figure 6 shown that the risk level of optimal portfolio is less than the risk of SENSEX 30. According to both the figures it is clear that optimal portfolio is the one, which give the best combination of risk and return. Thus, it was observed that "Sensex" was never closer to "Hypothetical Optimal Portfolio" in terms of risk and return. The replacements in Sensex stocks have been considered in the sample. Thus, these shows that even after replacement of few stocks, Sensex returns were lower than that of "Hypothetical Optimal Portfolio"

Comparison of mutual fund return with SENSEX return

As mentioned in the objectives of the research, for comparing the performance of the portfolios of Indian stock market with the hypothetical optimal portfolio and Sensex 30 returns of the different portfolio was calculated. Table 10 shows the returns of mutual funds from Indian stock market. This was calculated with the help of equation no. 1.

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Table 4

Mean Return and Risk of top 15 mutual funds compared with Sensex

Mutual Fund	2008 Return	Risk	2009 Return	Risk	2010 Return	Risk	2011 Return	Risk	2012 Return	Risk
SBI FMCG FUND (D)	-2.96	7.94	4.40	3.75	3.39	3.54	0.60	4.50	3.81	3.89
Reliance Pharma Fund (G)	-2.80	11.53	7.12	9.08	2.41	4.15	-0.85	4.82	2.56	2.70
ICICI prudential FMCG Fund (G)	-4.57	8.01	4.45	6.27	2.34	10.00	1.27	4.47	2.95	3.50
ICICI prudential Discovery-Inst –I	-5.53	11.71	7.76	10.55	2.19	2.80	-2.03	4.97	3.39	4.57
UTI Pharma& Health (G)	-1.99	9.45	4.28	5.06	2.77	4.35	-0.74	4.21	1.90	2.91
ICICI prudential Discovery Fund (G)	-5.82	11.91	7.84	10.54	2.12	3.40	-2.11	4.97	3.30	4.57
Reliance Banking Fund (G)	-3.42	11.25	5.98	13.73	2.12	5.48	-2.95	6.42	4.32	8.01
Birla Sun Life MNC Fund (G)	-4.31	8.77	5.69	5.99	2.45	3.62	-1.06	4.81	3.06	3.86
Franklin InfoTech Fund (G)	-5.05	11.02	7.49	7.17	2.47	4.20	-1.20	6.22	0.13	4.66
SBI Pharma Fund (G)	-2.94	14.80	6.03	13.39	2.24	4.17	-1.20	4.24	2.69	2.31
IDFC Sterling Equity Fund - G	-2.67	7.91	6.42	7.49	2.07	3.74	-1.95	5.08	3.01	4.26
UTI Transport & Logistics (G)	-5.08	8.07	7.41	8.58	2.06	3.94	-1.55	6.61	2.85	5.40
UTI MNC Fund (G)	-4.18	8.39	5.25	5.25	2.03	4.00	-0.43	4.24	2.33	2.85
Quantum Gold Fund	0.94	8.90	1.79	4.59	1.73	4.01	2.42	5.56	0.89	1.92
UTI Gold Exchange Traded Fund	2.28	8.50	1.80	4.60	1.73	3.95	2.42	5.61	0.89	2.12
Sensex	-2.02		0.57		1.45		-2.16		2.034	

For comparing the result of hypothetical optimal portfolio, in these paper India's top 15 open ended mutual funds are selected, with the help of equation no 1 monthly return of these mutual fund are calculated. Table 4 shows the mean return of the year 2008 to 2012 for all 15 mutual funds.

Risk tolerance

<table>
<tr><td colspan="4">Table 5
Tan θ value and Risk free return</td></tr>
<tr><td></td><td colspan="2">Tan θ value</td><td>Risk Free Return</td></tr>
<tr><td>Year</td><td>Value</td><td>θ value</td><td>Rate</td></tr>
<tr><td>2008</td><td>0.19</td><td>10.75 ☐</td><td>.06</td></tr>
<tr><td>2009</td><td>1.32</td><td>52.85 ☐</td><td>.045</td></tr>
<tr><td>2010</td><td>0.90</td><td>41.98 ☐</td><td>.07</td></tr>
<tr><td>2011</td><td>0.38</td><td>20.80 ☐</td><td>.08</td></tr>
<tr><td>2012</td><td>1.20</td><td>50.19 ☐</td><td>.08</td></tr>
</table>

Table 5 shows the value of tan θ, this value help to derive the capital market line. Where the Capital market line tangent to efficient frontier, is the "Hypothetical optimal portfolio". For deriving the CML it's important to find the value of tan θ. This value was calculated with the help of equation no. 8. Table 6 also shows the risk free rate of return, which was taken the mean return of government T-bill rates. Higher the value of tan θ shows that investor is risk averse, mean the person take small risk for gaining large returns and lower the value of tan θ shows that investor is risk taker, mean the person who take more risk for gaining small amount of return.

Comparison of portfolios below & above CML

As mention in the previous section this paper has the primary objective is to compare the risk and return combination of different portfolios of Indian stock market with hypotheticaloptimal portfolio and Sensex. For these purpose generation of CML with CAPM.As evident of Table 6 the performance in terms of risk and return combination and Sharpe ratio of different portfolios. Figure 7 shows the different points of portfolio which was created with the combination of risk

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and return. According to CAPM model CML line is tangent to the point of optimal portfolio. In these figure, it is clear that all other portfolio give the less return as compared to hypothetical optimal portfolio exceptUTI Gold Exchange Traded Fund.The reason for the higher return provided by the UTI gold exchange traded fund was the rapid increases in the gold prices and gold ETF as the investment alternative to gold.

Table 6 Risk and Return of portfolios						
	2008			2009		
Name Of Portfolio	Return	Risk	Sharp Ratio	Return	Risk	Sharp ratio
Sensex	-2.02	10.14	-0.20	0.57	9.66	0.06
Optimal Portfolio	1.67	8.43	0.20	**9.11**	**6.84**	**1.33**
SBI FMCG FUND (D)	-2.96	7.94	-.037	4.40	**3.75**	1.17
Reliance Pharma Fund (G)	-2.80	11.53	-.024	7.12	9.08	0.78
ICICI prudential FMCG Fund (G)	-4.57	8.01	-0.57	4.45	6.27	0.71
ICICI prudential Discovery -Inst –I	-5.53	11.71	-0.47	7.76	10.55	0.74
UTI Pharma& Health (G)	-1.99	9.45	-0.21	4.28	5.06	0.85
ICICI prudential Discovery Fund (G)	-5.82	11.91	-0.49	7.84	10.54	0.74
Reliance Banking Fund (G)	-3.42	11.25	-0.30	5.98	13.73	0.44
Birla Sun Life MNC Fund (G)	-4.31	8.77	-0.49	5.69	5.99	0.95
Franklin InfoTech Fund (G)	-5.05	11.02	-0.46	7.49	7.17	1.04
SBI Pharma Fund (G)	-2.94	14.80	-0.20	6.03	13.39	0.45
IDFC Sterling Equity Fund – G	-2.67	**7.91**	-0.34	6.42	7.49	0.86
UTI Transport & Logistics (G)	-5.08	8.07	-0.63	7.41	8.58	0.86
UTI MNC Fund (G)	-4.18	8.39	-0.52	5.25	5.25	1.00
Quantum Gold Fund	1.13	8.90	0.13	1.79	4.59	0.39
UTI Gold ETF	**2.28**	**8.50**	**0.27**	1.80	4.60	0.39
Risk Free	0.500	0.00	-	0.38	0.00	-

In 2008 hypothetical optimal portfolio gives the return of 1.67% with 8.43% risk and UTI gold exchange traded fund give the return of 2.28% with the 8.5% risk. According to Sharpe ratio it was also cleared that there was a portfolio in the market which give the better return than the return of hypothetical optimal portfolio. According to these the portfolio which has the highest

Sharpe ratio, is the best combination of risk adjusted return. The point under circle is the combination of risk and return of Sensex. In 2008 Sensex gives the negative return of -2.02% with 10.14 % Risk. According to figure 7 it is clear that 3 portfolios were given the more return than Sensex, with less level of risk.

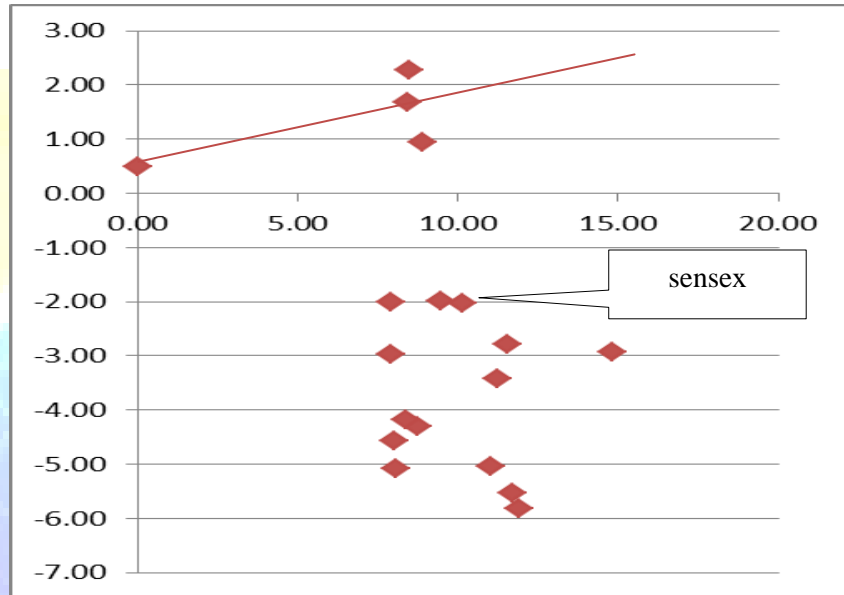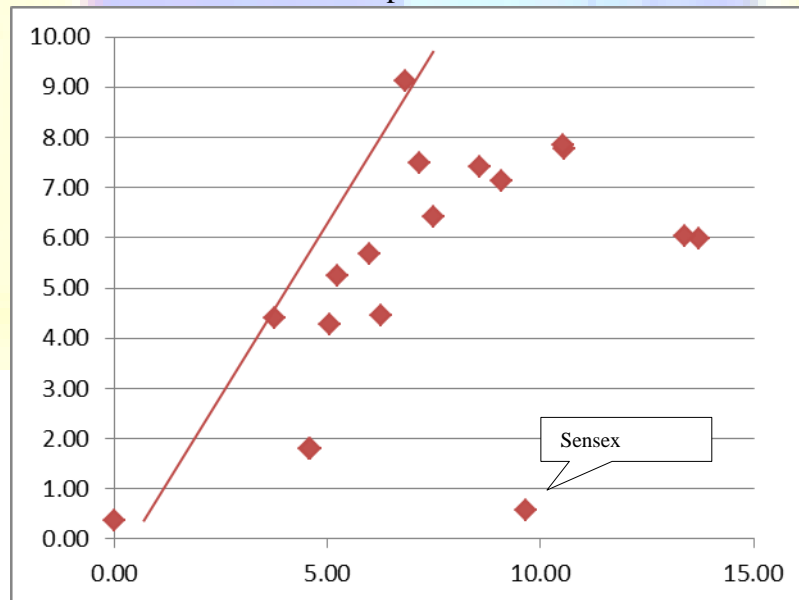**Figure 7:** Risk and Return combination of all portfolios for 2008

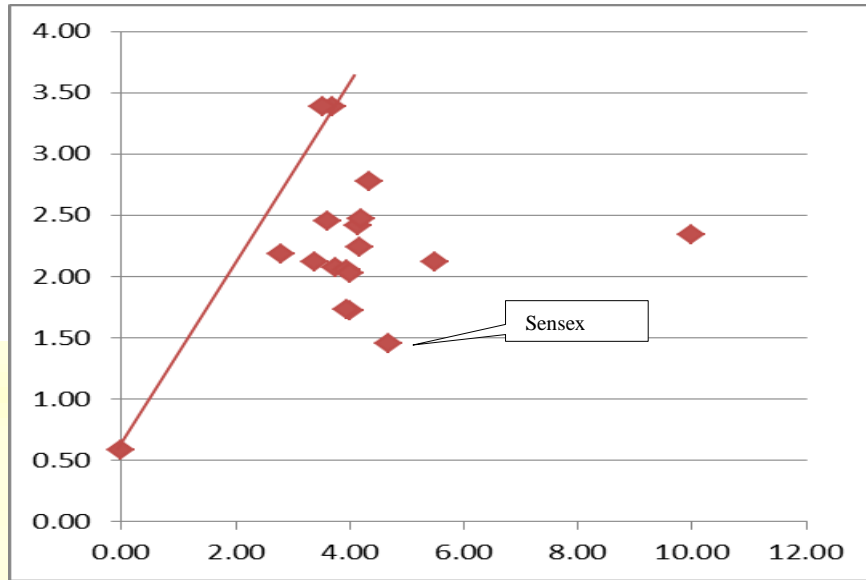**Figure 8:** Risk and Return combination of all portfolios for 2009

In the year 2009,as evident in table 6 the combination of return and risk associated with the different portfolios and Sharpe ratio. Figure 8 shows the different combination of risk and return. As shown in this figure it is noted that all other portfolio are lie below the point of hypothetical optimal portfolio. It means that in 2009 hypothetical optimal portfolio give the best combination of risk and return. It gave the return 9.11% with 6.84% risk. Hypothetical optimal portfolio has the highest Sharpe ratio; these suggested that it is the best risk adjusted return combination. All other portfolio gave lesser return as compared to hypothetical optimal portfolio. As shown in figure 8 point under circle represent the risk and return combination of

Sensex.In the year 2010,As evident in Table 7 the different combinations of risk and return assicoiated with the portfolios and sharpe ratio of that portfolios. Figur 9 show the construction of CML.As shown in figur 9 all the portfolio are situated below the optimal portfolio except SBI FMCG fund.It give the same return with less level of risk, growth in population effect the value of FMCG companies, due to this, it reflact in the return of FMCG funds.In the year 2010 optimal portfolio give the mean return of 3.39% with 3.69% risk, but SBI FMCG give the 3.39% of mean return with 3.54% risk. SBI FMCG fund has the highest sharpe ratio means it is the best risk adjusted combination of assets.

<div align="center">

Table 7 Risk and Return of portfolios

</div>

| Name Of Portfolio	2010			2011		
	Return	Risk	Sharp Ratio	Return	Risk	Sharp ratio
Sensex	1.45	4.67	0.31	-2.16	5.79	-0.31
Optimal Portfolio	3.39	3.69	0.92	2.04	5.19	0.39
SBI FMCG FUND (D)	**3.39**	**3.54**	**0.95**	0.60	4.50	0.13
Reliance Pharma Fund (G)	2.41	4.15	0.58	-0.85	4.82	-0.18
ICICI prudential FMCG Fund (G)	2.34	10.00	0.23	1.27	4.47	0.28
ICICI prudential Discovery - Inst –I	2.19	**2.80**	0.78	-2.03	4.97	-0.41
UTI Pharma& Health (G)	2.77	4.35	0.64	-0.74	**4.21**	-0.18
ICICI prudential Discovery Fund (G)	2.12	3.40	0.62	-2.11	4.97	-0.43
Reliance Banking Fund (G)	2.12	5.48	0.38	-2.95	6.42	-0.46
Birla Sun Life MNC Fund (G)	2.45	3.62	0.68	-1.06	4.81	-0.22
Franklin InfoTech Fund (G)	2.47	4.20	0.59	-1.20	6.22	-0.19
SBI Pharma Fund (G)	2.24	4.17	0.54	-1.20	4.24	-0.28
IDFC Sterling Equity Fund – G	2.07	3.74	0.55	-1.95	5.08	-0.39
UTI Transport & Logistics (G)	2.06	3.94	0.52	-1.55	6.61	-0.23
UTI MNC Fund (G)	2.03	4.00	0.51	-0.43	4.24	-0.10
Quantum Gold Fund	1.73	4.01	0.43	**2.42**	**5.56**	**0.43**
UTI Gold ETF	1.73	3.95	0.44	**2.42**	**5.61**	**0.43**
Risk Free	0.58	0.00	-	0.67	0.00	

As shown in figure 9 point under circle shows the risk and return of Sensex, As compared to the performance of other, it was noted that the return of Sensex was lower then the return of other portfolios. In 2010 ICICI prudential Discovery -Inst -I has the lowest level of risk, 2.80%.

Figure 9: Risk and Return combination of all portfolios for 2010

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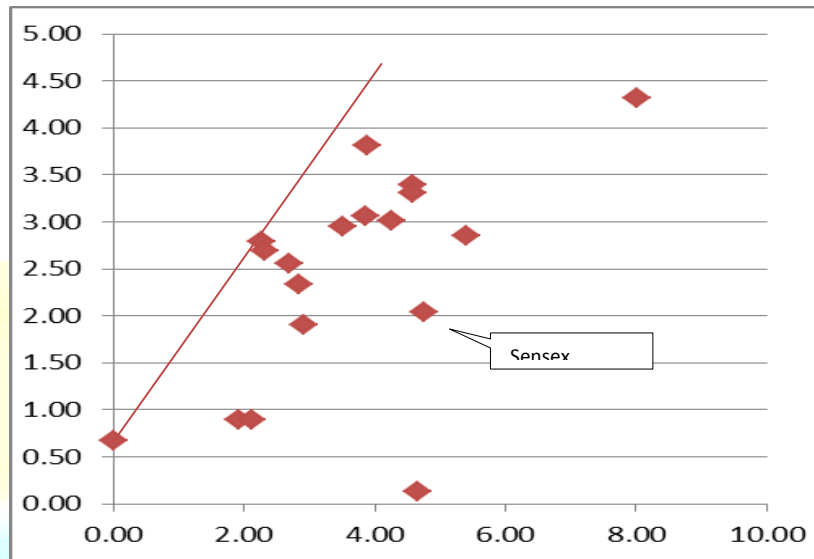**http://www.ijmra.us**

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In the year 2011,As evident in Table 7 the different combinations of risk and return assicoiated with the portfolios and sharpe ratio of the portfolio. Figur 10 show the construction of CML. As shown in figur 10 all the portfolio are situated below the hypothetical optimal portfolio except two, which are quantum gold fund and UTI gold exchange traded fund and with less level of risk.The reason behind it the focus of investor in the gold ETF's.In the year 2011 hypothetical optimal portfolio gives the mean return of 3.39% with 3.69% risk.According to sharpe ratio of the portfolios quantum gold fund and UTI gold traded fund has the highest value of sharpe ratio.

Figure 10: Risk and Return combination of all portfolios for 2011
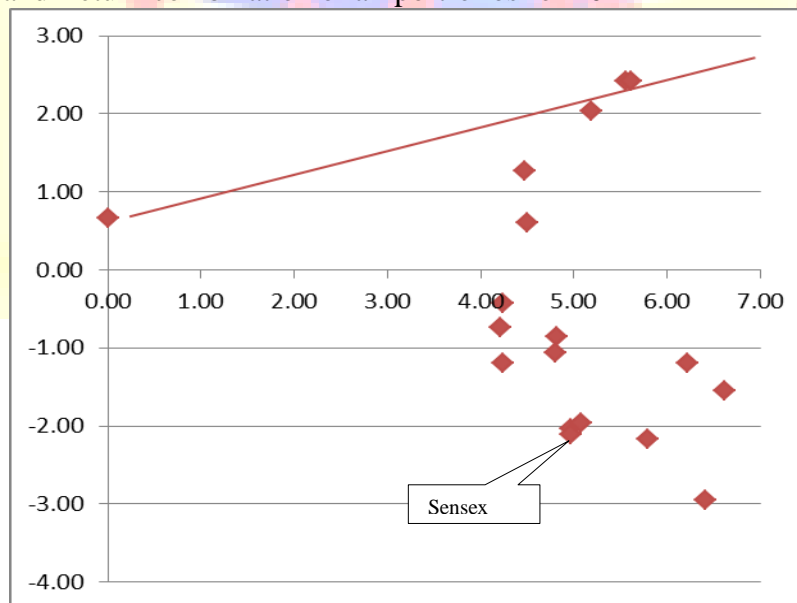
In the year 2012 , as evident in table 8, the combination of return and risk associated with the different portfolios and Sharpe ratio of these portfolios. Figure 11 shows that CML line is tangent to the optimal portfolio.According to this, it is noted that all other portfolio are lie below the point of hypothetical optimal portfolio. It means that it is the best combination of risk and return.In 2012 it give the return 2.80% with 2.26% risk. According to Sharpe ratio evident in table 8 hypothetical optimal portfolio has the highest value of these ratio, state that it is the best risk adjusted combination of assets. In 2012 there are many portfolios which give higher return but according to portfolio evaluation technique, hypothetical optimal portfolio is the best combination of risk and return.

Table 8 Return and Risk of portfolios for 2012			
Name Of Portfolio	**Return**	**Risk**	**Sharp Ratio**
Sensex	2.03	4.75	0.43
Optimal Portfolio	**2.80**	**2.26**	**1.23**
SBI FMCG FUND (D)	3.81	3.89	0.98
Reliance Pharma Fund (G)	2.56	2.70	0.95
ICICI prudential FMCG Fund (G)	2.95	3.50	0.84
ICICI prudential Discovery -Inst –I	3.39	4.57	0.74
UTI Pharma& Health (G)	1.90	2.91	0.65
ICICI prudential Discovery Fund (G)	3.30	4.57	0.72
Reliance Banking Fund (G)	**4.32**	8.01	0.54
Birla Sun Life MNC Fund (G)	3.06	3.86	0.79
Franklin InfoTech Fund (G)	0.13	4.66	0.03
SBI Pharma Fund (G)	2.69	2.31	1.16
IDFC Sterling Equity Fund – G	3.01	4.26	0.71
UTI Transport & Logistics (G)	2.85	5.40	0.53
UTI MNC Fund (G)	2.33	2.85	0.82
Quantum Gold Fund	0.89	**1.92**	0.46
UTI Gold Exchange Traded Fund	0.89	2.12	0.42
Risk Free	0.67	0.00	-

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Figure 11: Risk and Return combination of all portfolios for 2012

Thus, it was observed that the Sensex return was lower than the "Hypothetical Optimal Portfolio" in all the years under study. Also, the returns of all the mutual funds were below the hypothetical optimal portfolio with an exception of some of the mutual funds which are Quantum Gold Fund, UTI Gold Exchange Traded Fund, SBI FMCG fund (D). The interesting thing to note is that the mutual funds that generated higher returns were gold mutual funds and FMCG mutual funds. The probable reason for this could be that gold is the investment avenue for the investor. Many investor shifted their fund allocation from gold to gold ETF's, introduction of gold as a derivative asset in Indian stock market and another reason for that is the rapid increment in the population size of the country, it effects the demand for the fast moving consumer goods (FMCG) companies and also effect the FMCG mutual funds.

Conclusion and implications

In this study, data of 30 companies which are listed on BSE 30 are taken for the purpose of computing Hypothetical optimal portfolio. For creating the optimal portfolio excess returns of the stock was used. With the help of solver hypothetical optimal portfolio was created. The study was based on monthly data for the period January 2008 to December 2012. For creating the hypothetical optimal portfolio capital assets pricing model was used and optimal portfolio was

constructed, according to H.M. Markowitz these optimal portfolio gives the best combination of risk and return. In this research top 15 mutual funds, which gave the highest return from their portfolio in Indian stock market, were also taken for the purpose of comparing the result of mutual fund returns, Sensex and hypothetical optimal portfolio. According to research objectives, to compare the performance of Sensex, Hypothetical optimal portfolio Sharpe ratio was used. The study concluded that the capital assets pricing model is great importance in constructing the hypothetical optimal portfolio. This study also suggested that there are only few outlier portfolios in Indian stock market, which includes the gold fund and FMGC funds, give the better return as compare to hypothetical optimal portfolio and this study also found that the Sensex return was lower than the return of hypothetical optimal portfolio in all five years. It means that in the Indian stock market there are many portfolios which give the better return than Sensex and investors have more opportunity to invest and earn better return from that market. The Sensex return can further be optimizing by varying the weight of stock in Sensex. More Gold, FMCG in the Sensex to optimize for better returns. The finding of the study will be of practical value for investors as it provides realistic insights on actual performance of Sensex and Mutual funds and expected performance of Hypothetical optimal portfolio.

Limitations and scope for further research

Every research has some or the other loophole. Similarly, in this research also there is definitely some further scope. As the CAPM model fails to explain the variation in returns on stocks in Indian Stock Market, this study identifies the gap as, such financial model should be developed which can be better fit into the Indian Stock Market and which could better explain the variations in the stock returns in the emerging Markets like India. The major limitation of this study was:

1. Hypothetical optimal portfolio was constructed with the help of past record.
2. For creating the optimal portfolio only BSE 30 stocks are to be considered. The large range of stocks can change the result.
3. Some other technical tools can also be included while conducting the study that can give more reasonable results.
4. In this study quality and characteristics of Gold and FMCG fund was not considered.

Hence, the research holds some areas which have not been covered in this study.

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