

**COMPARISON OF SENSEX AND NIFTY EQUITIES USING MARKOWITZ THEORY**

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**Abstract**

*Portfolio is collection of bonds, warrants, future contracts, stocks, ETFs, real estate etc., where an investor wants to invest. In this paper we shall see how an investor should go about selecting the one best portfolio to meet his needs. Or, more explicitly, how should an investor go about selecting securities to purchase and deciding how many dollars to invest in each. For the comparison of Sensex portfolio with Nifty portfolio famous Markowitz's Modern Portfolio Theory (MPT) has been used. For the performance evaluation of both of these portfolios Sharpe Index has been used. This paper presents a simplified perspective of Markowitz's contributions to Modern Portfolio Theory. It is to see the effect of duration of historical data on the risk and return of the portfolio and to see the applicability of risk-reward logic.*

*Keywords: Markowitz Portfolio Theory, Sharpe Ratio, Sensex, Nifty, Stocks, BSE, NSE, India*

**INTRODUCTION**

A portfolio is what holds an artist's sketches, a student's projects or a bundle of documents. But in terms of finance; it is the collections of bonds, options, warrants, future contracts, gold ETFs, stocks, real estate, etc. There are the two major stock exchanges of India, BSE & NSE and more than 99% of equities trading happen through these exchanges. BSE has an index called Sensex which consists of top 30 stocks that are traded on BSE whereas the index of NSE is called Nifty which shows the performance of top 50 blue-chip companies of India on daily basis. These are like S&P 500 and Dow Jones of U.S.

An investor before investing anywhere generally makes three decisions i.e. *capital allocation decision, asset allocation decision and securities selection decision*. Capital allocation decision means deciding the amount of money or capital that one is going to invest in assets. An investor can invest some amount of money in risk-free securities to get fixed returns and rest in stock market which gives more returns than bonds market but is also more risky. Asset allocation decision means deciding the asset classes in which one is going to invest and the proportion of total capital to be invested in that asset class. There are different asset classes like bonds, equities, real estate, futures, options, ETF, gold, etc. Last decision that an investor has

to make before actually investing is to decide the securities pertaining to that asset class in which one wants to invest. For example if one decides to invest in bonds asset class then in which bonds to invest and how much to invest in each bond.

Since the main target of this paper is the comparison of Sensex and Nifty portfolios which consists of equities only so the second decision of asset class in our case would be equities asset class and third decision of securities selection in this case would be all 30 as well as 50 securities of Sensex and Nifty respectively. As per market capitalization of equities market Indian stock market represents only about 1% of total equities market around the world as compare to U.S. which accounts to more than 50% of the world equities. Any investor before investing in share market uses one of the three approaches for deciding the stock in which to invest. These approaches are *technical analysis*, *fundamental analysis* and *random selection*. An investor can use one or more than one of these approaches to decide in which stock to invest and in which stock not to invest. Investing can be done either by buying the stock directly from one's own Dematerialized account or through investment in Mutual Fund.

Since the main task of our research is to compare the returns from Sensex and Nifty portfolios hence all the stocks have been selected in both the portfolios. That means Sensex portfolio will consists of top 30 stocks that are traded on BSE and Nifty portfolio consists of top 50 stocks being traded on NSE. Selecting appropriate investment vehicles for an investor's needs must bear in mind the '*horses for courses*' system so well accepted by horse race followers: *a horse that consistently performs well on one course may consistently underperform on the other race courses.*

## Risk and Return

Risk and return are the most important concepts of finance. In fact, they are the foundation of the modern finance theory. Where average rate of return is the sum of the various one-period rates of return divided by the number of periods, risk is the fluctuations in returns caused by the volatility of the share prices. There are two measures of this dispersion: variance and standard deviation. Standard deviation is the square root of variance.

$$\text{Arithmetic Return} = \bar{R} = \frac{1}{n} \sum_{t=1}^n R_t$$

$$\text{Variance} = \sigma^2 = \frac{1}{n-1} \sum_{t=1}^n (R_t - \bar{R})^2$$

Average arithmetic return and standard deviation have been calculated for all the stocks. As explained earlier, standard deviation explains variability and is a measure of total risk. For the

creation of Capital Market Line (CML) treasury bills are taken for the risk-free government security as they are free from risk of default and the variability on its returns is the lowest.

Diversification means investing in more than one security. When investor invests in more than one asset it reduces its risk because if one asset underperforms than the expectations then the other asset will try to compensate that. The effect of diversification is majorly seen when the correlation coefficient between the assets is negative i.e. between -1 and 0. Securities do have a tendency of moving together to some extent, and therefore, risk may not be totally eliminated. Intuitively smart investors knew the benefit of diversification which is reflected in the traditional adage “Do not put all your eggs in one basket”.

Empirical studies suggested that the bulk of the benefit of diversification, in the form of risk reduction, is achieved by forming a portfolio of about ten securities. The information about the expected return and standard deviation helps an investor to make decisions about investments. This depends on the investor’s risk preference. Generally investors would prefer investments with higher rates of return and lower standard deviation.

## LITERATURE REVIEW

Harry Markowitz (1952), in his research paper “*Portfolio Selection*” found that the returns from securities are too inter correlated and diversification cannot eliminate all variance. The portfolio with maximum expected return is not necessarily the one with minimum variance.

Charles Bram Cadsby (1986), in his research paper “*Performance Hypothesis Testing with the Sharpe and Treynor Measure*” propose that asymptotic test statistics are designed to determine whether apparent differences in portfolio performance are statistically significant. Such statistics are potentially useful in that they provide a rigorous method of differentiating between consistently superior or inferior performance and the luck of the draw.

Pitabas Mohanty (2006), in his research paper “*A Dynamic Spreadsheet Model for Determining the Portfolio Frontier*” found that the tangent portfolio has the maximum slope (Sharpe Index), one can directly obtain the portfolio weights of the tangent portfolio by maximizing the slope of the line joining the portfolio frontier and the risk free rate of return.

Sam Savage (2009), in his research paper “*The Flaw of Averages*” constructed the portfolio by looking at the geometric returns of the assets and used conditional Value at Risk (CVaR) for measuring the riskiness of the assets rather than using standard deviation.

Valeriy Zakamulin (2011), in his research paper “*Sharpe (Ratio) Thinking about the Investment opportunity Set and CAPM Relationship*” found that the changes in the characteristics of individual risky assets that preserve the Sharpe ratios and the correlation matrix do not change the investment opportunity set (CML).

Myles E. Mangram (2013), in his research paper “*A Simplified Perspective of the Markowitz Portfolio Theory*” found the impact on portfolio diversification by the number of securities, he found that diversification cannot eliminate all risk i.e. it cannot eliminate systematic risk but unsystematic risk can be eliminated to a large extent by diversification.

A. Mitra & P. Khanna (2013), in their research paper “*A Dynamic Spreadsheet Model for Determining the Portfolio Frontier for BSE 30 stocks*” found that the performance of a portfolio decreases as large historical data is taken into consideration. The empirical results show that short selling increases the risk of the portfolio.

## **OBJECTIVE OF STUDY**

1. To compare the performance of both Sensex and Nifty portfolios.
2. To allow a user to select a set of securities into his portfolio by looking at the change in portfolio risk and portfolio return.
3. To construct Capital Market Line (CML) in order to get more returns than that of efficient frontier if risk-free securities are included in the portfolio.
4. To give recommendations to prospective investors about investment in mutual funds or index funds.

## **Assumptions**

To achieve the above objectives few assumptions are made about the market like:

- 1) Investors are rational (they seek to maximize returns while minimizing risk),
- 2) Investors are only willing to accept higher amounts of risk if they are compensated by higher expected returns,
- 3) Investors timely receive all pertinent information related to their investment decision,
- 4) Investors can borrow or lend an unlimited amount of capital at a risk free rate of interest,
- 5) Markets are perfectly efficient and do not include transaction costs or taxes,
- 6) It is possible to select securities whose individual performance is independent of other portfolio investments.

## **RESEARCH METHODOLOGY**

For the purpose of construction of portfolio, we have analyzed the Sensex 30 stocks and Nifty 50 stocks that are being traded on Bombay Stock Exchange and National Stock Exchange on 1<sup>st</sup> May 2013. Market price for all the stocks has been collected from the secondary sources mainly from Internet (BSE and NSE). The purpose is to predict future performance of stocks based on the past data and accordingly inform prospective investors.

The methodology included the detailed analysis of both the portfolios. It was as follows:

- Finding out the risk and return associated with each stock.
- Calculating the portfolio risk and portfolio return for the purpose of creating a portfolio.
- Following the portfolio theories specifically Markowitz Theory for the construction of portfolio.
- Evaluating the performance of portfolios using the Sharpe's index.
- Selecting the most efficient portfolio.

## ANALYSIS

The indexes to which the returns of each security are correlated are likely to be some securities-market proxy, such as Sensex or Nifty. Since the in-depth technical as well as fundamental analysis has not been done, the main focus of the research was the construction of portfolio of the stocks that the investors have selected based on their perception about the market and comparing the performance of these portfolios.

Many researchers feel that data taken should be as long as possible. Some others feel that it should not be too long as market conditions change very frequently. And whether to take yearly, monthly or daily data, well every option has its own pros and cons. For the purpose of research daily market price of past five years has been taken and an option has been given to investor to decide how many years of data it wants to analyze which could be equal to or less than five.

Portfolio theory provides a normative approach to investors to make decisions to invest their wealth in assets or securities under risk. It is based on few assumptions which would be discussed later. All those assumptions imply one think that investors hold well-diversified portfolios instead of investing their entire wealth in a single or a few assets. One important conclusion of the portfolio theory, as we show later, is that if the investors hold a well diversified portfolio of assets, then their concern should be the expected rate of return and risk of the portfolio rather than individual assets and the contribution of individual assets to the portfolio risk.

The return of a portfolio is equal to the weighted average of the returns of individual assets (or securities) in the proportion of investment value in each asset. It is possible to change the expected rate of return on the portfolio by changing your proportionate investment in each asset.

$$Portfolio\ Return = \sum_{i=1}^n W_i R_i$$

where  $W_i$  is the proportion of total investment in security  $i$

Returns on individual assets fluctuate more than the portfolio return. Thus, individual assets are more risky than the portfolio. Like the risk of individual assets is measured by their variance or standard deviation. The risk of a portfolio of assets is also measured by the same measures but portfolio variance or standard deviation also depends on the co-movement of returns of different assets. This co-movement of two assets is measured by covariance of returns.

$$\text{Portfolio Variance} = \sigma^2 = w_i^2 \sigma_i^2 + w_j^2 \sigma_j^2 + 2 w_i w_j \text{Covariance}(R_i, R_j)$$

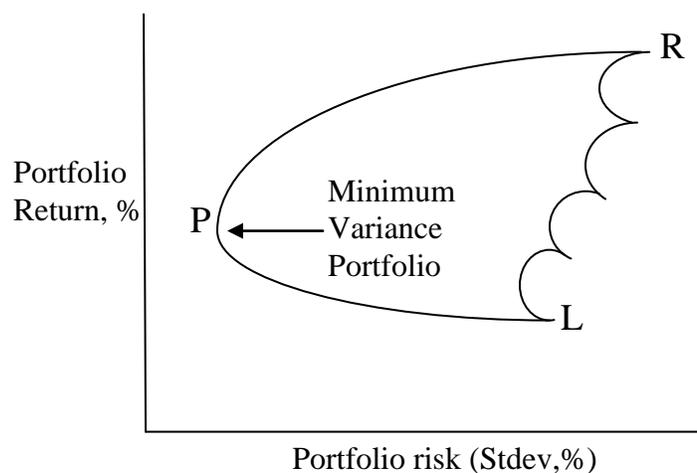
Covariance between two assets can also be written as multiplication of standard deviations of two assets with the degree of correlation between them. Correlation is a measure of the linear relationship between two variables in this case return of two securities. In case of more than two assets covariance matrix of N\*N size is created which shows the covariance between any two assets and is represented by  $\Sigma$ .

$$\text{Portfolio Variance} = W^T \Sigma W$$

The investment or portfolio opportunity set represents all possible combinations of risk and return resulting from portfolios formed by varying proportions of individual securities. It presents the investor with the risk-return trade-off. There are thousands of stocks that are traded on BSE and NSE. A large number of portfolios can be constructed by combining these shares in different proportions. Figure 1 shows the risk and return of all possible portfolios.

An efficient portfolio is one that has the highest expected returns for a given level of risk. The efficient frontier is the frontier formed by the set of efficient portfolios. In Figure 1, the curve starting from portfolio P, which is the minimum variance portfolio and extending to the portfolio R is the efficient frontier. All portfolios on efficient frontier are efficient portfolios. All other portfolios, which lie outside the efficient frontier, are inefficient portfolios.

Figure 1: Efficient Portfolio

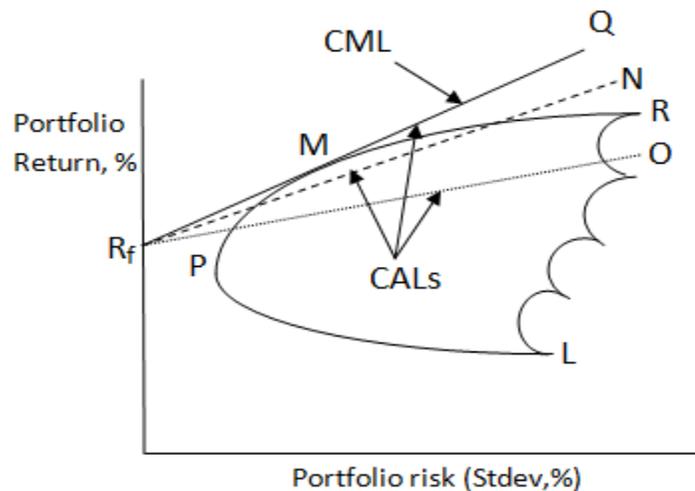


What is the best combination of securities so that the portfolio variance is minimum? The minimum variance portfolio is also called the optimum portfolio. However investors do not necessarily strive for the minimum variance portfolio. A risk-averse investor will have a trade-off between risk and return. Her choice of a particular portfolio will depend on her risk preference. By looking at the efficient frontier investors would decide how much risk they are willing to take to get a return based on its degree of risk aversion. *“Higher the risk an investor will take greater the returns he will get”.*

### Combining the risk-free asset and the risky asset

A risk-free security has a zero variance or standard deviation. The risk-free has no risk of default. The government treasury bills or bonds are approximate examples of the risk-free security as they have no risk of default. Figure 2 illustrates the risk-return relationship for various combinations of a risk-free security and the risky securities, and the resulting portfolio opportunity set.

Figure 2: Capital Allocation Lines



Three lines have been drawn from the risk-free rate to the three portfolios. Each line shows the manner in which capital is allocated. These lines are called capital allocation lines (CAL). The investors can continue upwards until the point of tangency with the investment opportunity set is reached. The portfolios along the line  $R_fMQ$  will be chosen since those portfolios offer higher return for a given level of risk than choosing portfolios along any other line. The capital allocation line,  $R_fMQ$ , is called the capital market line. The capital market line (CML) is an efficient set of risk-free and risky securities, and it shows the risk-return trade-off in the market equilibrium. Portfolio M is the optimum risky portfolio, which can be combined with the risk-free asset. The optimum risky portfolio is the market portfolio of all risky assets where each asset is held in the proportion of its market value.

## Portfolio Performance Evaluation

It was found out from the previous studies that the average portfolio return was not a straightforward measure to evaluate the portfolio performance. There were some risk-adjusted performance measures like Sharpe's measure, Treynor's measure, Jensen's measure, information ratio, M<sup>2</sup> measure, etc. In this research the performance of the portfolio has been measured by using the Sharpe ratio as it takes into account the total risk of a portfolio instead of only systematic risk.

$$\text{Sharpe Index} = \frac{\text{Avg rate of return on portfolio} - \text{Avg rate of return on riskfree investment}}{\text{Standard deviation of portfolio}}$$

From the above formula it can be seen that Sharpe Index reflects the excess return earned on a portfolio per unit of its total risk (standard deviation). Five different portfolios with different years of data with all the BSE 30 securities (Sensex) selected into the portfolio have been constructed. Portfolio return and Portfolio risk for all the portfolios are shown in Table 1. As seen in Graph 1 Market Return and Market Risk of Sensex for last 5 years are obtained at the point where CML becomes tangent of the investment opportunity set of risky assets.

Table 1: Portfolio return and Portfolio risk of Sensex portfolio over different years

PORTFOLIOS	PORTFOLIO RETURN	PORTFOLIO RISK
Portfolio with a data of last 1 year	1.852	5.172
Portfolio with a data of last 2 year	0.683	2.784
Portfolio with a data of last 3 year	3.715	19.907
Portfolio with a data of last 4 year	1.208	7.638
Portfolio with a data of last 5 year	0.602	4.872

Graph 1: Market Return and Market Risk of Sensex portfolio



Weights of different securities of BSE portfolio found by Markowitz theory for different years of data are shown in Table 2 below. Sum of all the weights for each year is one. Negative weight for some of the securities means it is better to short sell that particular security rather than buying it.

Table 2: Weights of Securities of BSE portfolio

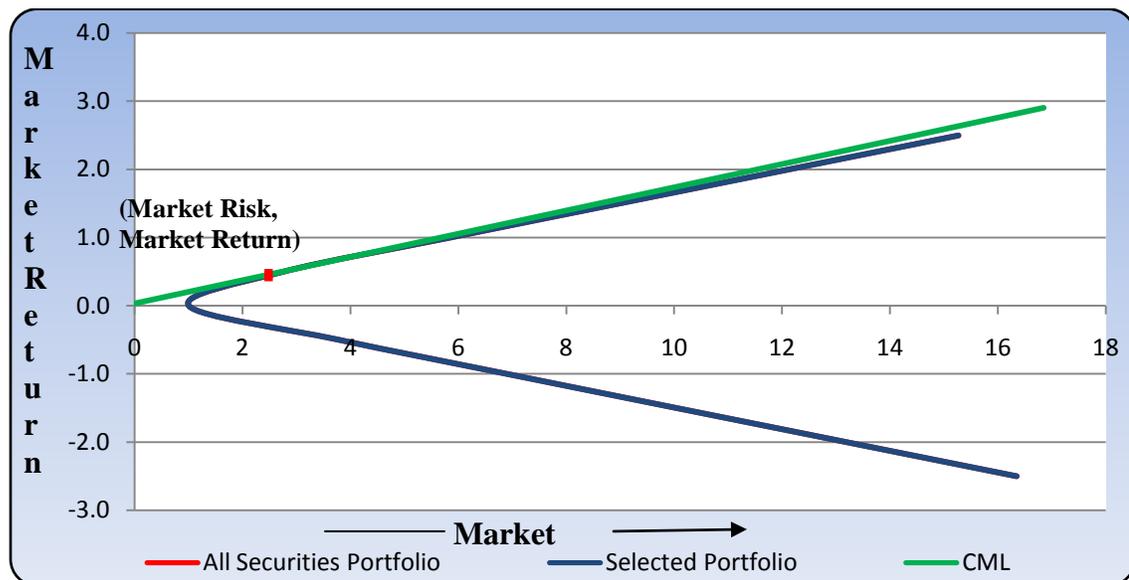
BSE 30 Securities	Weights of securities taking different years of data into consideration				
	1 Year	2 Years	3 Years	4 Years	5 Years
<b>BHEL</b>	-0.2429793	-0.3052288	-0.4984101	-0.8184499	-0.9516730
<b>Bharti Airtel</b>	0.0211049	-0.2993853	0.1352769	-0.6020401	-0.7207754
<b>Cipla Ltd</b>	0.1017639	0.0227680	0.1425339	0.4649293	1.1261256
<b>DLF</b>	0.2348077	0.5218850	0.2180089	-0.0228279	-0.3348852
<b>HDFC Bank</b>	0.1595471	-0.1152758	-0.1552776	-0.0414547	-0.2028574
<b>Hero Motocorp</b>	-0.7960822	-0.1974661	-0.1630005	-0.1673387	0.2822934
<b>Hindalco</b>	-0.3262579	-0.5386265	-0.0907689	0.7694539	0.0293628
<b>HUL</b>	0.3049037	0.8733614	1.4823590	1.2165695	1.2675403
<b>HDFC</b>	0.1609067	0.1520212	-0.2143294	-0.1319098	-0.2611577
<b>ICICI Bank</b>	0.5709568	0.7536983	0.8792333	1.1719704	1.4769484
<b>Infosys</b>	0.0328256	-0.2361711	-0.5015490	0.0023684	0.4291284
<b>ITC</b>	0.3089054	0.6388185	0.0772623	0.3022434	0.2458165
<b>Jaiprakash Associates</b>	0.0936355	0.1640367	-0.1868355	-0.6724263	-0.2945898
<b>Jindal Steel&amp; Power</b>	-0.5472249	-0.5812528	-0.8088350	-0.3629757	-0.1849463
<b>L &amp; T</b>	0.4318696	0.3331168	0.3808998	0.7144512	-0.3515576
<b>M&amp; M</b>	0.5556943	0.0895695	0.9457068	0.2595269	0.4341027
<b>Maruti Suzuki</b>	0.3033257	0.5129219	0.5445557	0.3384295	0.7376551
<b>NTPC</b>	-0.5453295	-0.8012947	-0.8721833	-1.1746691	-1.0812184
<b>ONGC</b>	0.1117813	-0.0120236	-0.2191736	-0.1821565	-0.2782626
<b>Reliance Industries</b>	0.2054902	-0.3666447	-0.2937322	-0.8685118	-0.9612563
<b>SBI</b>	0.0906963	-0.0021712	0.5850247	0.6212548	1.0966060
<b>Sterlite Industries</b>	0.1388559	-0.0991505	-0.4300517	-0.5128777	-0.4924489
<b>Sun Pharmaceuticals</b>	1.0115360	1.4930354	0.1032780	0.1743989	0.1012045
<b>TCS</b>	0.2944110	0.4207376	1.5288779	0.6603704	0.7371013
<b>Tata Motors</b>	-0.1005994	0.0024533	0.0331694	0.2682728	0.2556706
<b>Tata Power</b>	-0.2758713	-0.1568355	-0.2641885	-0.3801991	-0.5907724
<b>Tata Steel</b>	-0.8325052	-0.7375281	-0.8405514	-0.1577690	-0.4675129
<b>Wipro</b>	-0.3218185	-0.4533960	-0.6597171	-0.3371960	-0.7993549
<b>Bajaj Auto</b>	0.2374596	0.2326534	0.0830182	0.7596699	1.1516567
<b>Coal India</b>	-0.3818097	-0.3086268	0.0593983	-0.2911076	-0.3979442

Five different portfolios with different years of data with all the NSE 50 securities (Nifty) selected into the portfolio have been constructed. Portfolio return and Portfolio risk for all the portfolios are shown in Table 3. As seen in Graph 2 Market Return and Market Risk of Nifty for last 5 years are obtained at the point where CML becomes tangent of the investment opportunity set of risky assets.

Table 3: Portfolio return and Portfolio risk of Nifty portfolio over different years

PORTFOLIOS	PORTFOLIO RETURN	PORTFOLIO RISK
Portfolio with a data of last 1 year	1.247	2.819
Portfolio with a data of last 2 year	0.493	1.472
Portfolio with a data of last 3 year	2.715	10.995
Portfolio with a data of last 4 year	0.948	4.300
Portfolio with a data of last 5 year	0.422	2.289

Graph 2: Market Return and Market Risk of Nifty portfolio



Weights of different securities of NSE portfolio found by Markowitz theory for different years of data are shown in Table 4 below. Sum of all the weights for each year is one. Negative weight for some of the securities means it is better to short sell that particular security rather than buying it.

Table 4: Weights of Securities of BSE portfolio

NSE 50 Securities	Weights of securities taking different years of data into consideration				
	1 Year	2 Years	3 Years	4 Years	5 Years
ACC	0.04184331	0.05586148	0.03094767	0.00625375	0.00548778
Ambuja Cement	0.07752836	1.06447559	1.03005961	-0.08356836	-0.00124879
Asian Paints	-0.07018213	0.08448168	-0.04847432	0.07632856	0.01939875
Axis Bank	-0.08838580	0.08047248	-1.03241956	-0.07653853	-0.00360414
Bank of Baroda	0.00001469	-0.06625271	0.05649107	0.08562756	0.00511405
Bharti Airtel	0.07080319	-0.08979216	-0.03419623	0.08537562	0.00350355
BHEL	1.09343695	-0.01599366	-0.00446737	-0.09265826	0.08463747
BPCL	-0.03314963	-0.01841208	-0.01881627	0.08762856	0.03607525
Cairn India	0.07513501	-0.00953505	-0.03155798	0.08962653	0.00396136
Cipla	-0.02413517	-0.02362193	1.02748021	0.00346366	0.00761373
DLF	-0.04029610	0.03697586	-0.06109437	-0.08647432	-0.00109571
Dr Reddy's Lab	0.00183132	0.01524548	-0.04159032	1.01241956	0.01195184
GAIL India	0.02917816	-0.02413095	-0.05495971	0.00649107	0.07536957
Grasim Industries	0.08819518	0.09508846	0.07193139	-0.03962363	0.00290048
HCL Technologies	0.04707098	0.04356087	0.00475319	-0.00673787	-0.00096495
HDFC Bank	0.87575895	0.00798152	-0.04250581	-0.01162487	0.08203262
Hero Motocorp	-0.03819064	-0.02700902	0.30300517	-0.03579348	0.09724151
Hindalco	0.01242234	-0.03030435	-0.04840174	1.02802991	-0.00353435
HUL	0.03129233	0.01352608	0.03272883	0.06943247	0.01303037
HDFC	0.01880174	0.02584438	-1.01930987	0.04903642	0.00040316
ICICI Bank	0.05082004	0.03000046	0.03896694	-0.05495971	-0.00697118
IDFC	-0.08245315	-0.08547905	0.03589553	0.02193139	-0.00200269
IndusInd Bank	-0.40117160	-0.04326569	0.02789395	-0.08847432	0.00294404
Infosys	0.74796320	-0.01594807	-0.07199412	-1.01241956	0.00997004
ITC	0.00551055	0.00786207	1.08202557	0.00649107	0.00429869
Jaiprakash Associates	-0.08346315	-0.07202662	-0.07094767	-0.03962363	-0.00712324
Jindal Steel & Power	0.04285188	-0.03520761	1.00005961	-0.00673787	-0.00017041
Kotak Mahindra Bank	0.02216967	-0.02550572	-0.08847432	-0.01162487	0.02564267
L & T	0.00308049	0.00525472	-1.01241956	-0.03579348	0.00148729
Lupin	0.01023252	0.00160392	0.00649107	1.02802991	0.00252299
M & M	-0.05286077	-0.04935507	-0.03419623	0.06943247	-0.00098763
Maruti Suzuki	-0.05216899	-0.00531462	-0.00446737	0.04903642	0.00305187
NDMC	0.00178921	1.06835809	-0.01881627	-0.05495971	0.01671764
NTPC	0.04184331	0.05598148	-0.03155798	0.02193139	0.00733776
ONGC	0.07752836	-1.00454559	1.02748021	-0.08847432	0.00146381
PNB	0.07018213	0.08428168	-0.06109437	-1.01241956	0.00303402
Power Grid Corp	-0.08838580	0.08047248	0.10814024	0.00649107	0.30313489
Ranbaxy Labs	0.00104690	-0.06665271	-0.05754951	-0.03962363	0.00185777
RIL	0.00803190	-0.08956216	0.02071939	0.00446737	0.00200414
Reliance Infra	-1.00834388	-0.01544366	-0.05904759	-0.01881627	-0.00403815
SBI	0.03314307	-0.01871208	0.04842501	0.06665251	0.09576665
Sesa Goa	0.07513162	-0.00956505	-1.01033483	-0.08956796	-0.00015365
Sun Pharma	-0.02413719	-0.00233193	-0.04998404	-0.01544996	0.00248578
TCS	0.04029026	-0.03697586	0.03052723	0.01871418	-0.00084664
Tata Motors	0.00183262	0.01524548	-1.01479307	-0.00956535	0.00118396
Tata Power	-0.02917643	-0.02413095	-0.03168964	-0.02334243	0.00059255
Tata Steel	0.08819873	0.09508846	0.03365893	0.05578671	-0.00302185
Ultratech	0.04707811	-0.04356087	0.02907895	0.01524308	0.00639929
Bajaj Auto	0.00639055	0.00798152	-0.07451992	-0.02413425	0.00548778
Coal India	0.02603600	-0.02700902	1.08292027	0.09508496	0.08965826

### Comparison of Sensex and Nifty Portfolios

Looking at the sharpe index of both the portfolios one can easily find that as the number of securities increase in a portfolio the sharpe index rises which shows that the more diversified the portfolio is the better will be its performance.

Table 5 shows the comparison of Sharpe Index of both the portfolios over different time periods of data. It can also be seen that as the time period of historical data the sharpe index falls which shows fall in performance of the portfolio over the years.

Table 5: Sharpe Index of Sensex and Nifty portfolios over different years of data

PORTFOLIOS	SHARPE INDEX OF SENSEX	SHARPE INDEX OF NIFTY
Portfolio with a data of last 1 year	0.352	0.431
Portfolio with a data of last 2 year	0.234	0.313
Portfolio with a data of last 3 year	0.185	0.244
Portfolio with a data of last 4 year	0.154	0.213
Portfolio with a data of last 5 year	0.116	0.170

### RESEARCH FINDINGS

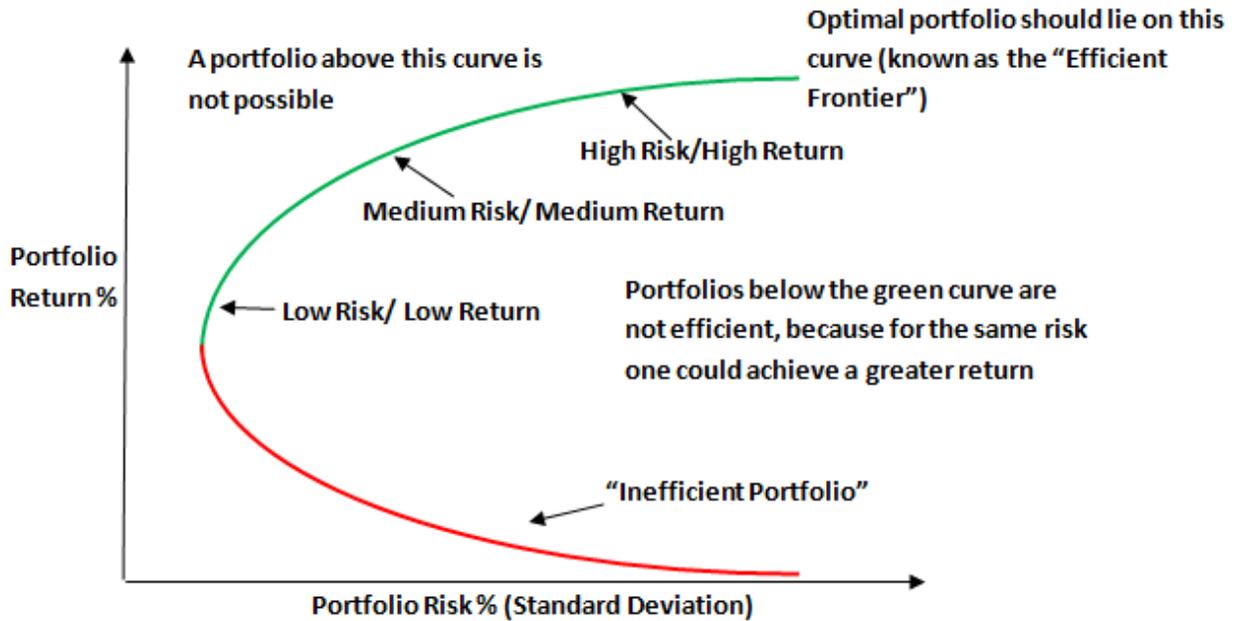
Since all the securities in both the portfolios are equities only and we know that securities of same asset class have the tendency of moving together. This is also shown by the degree of correlation between the stocks. After running the regression on the past data of 5 years is observed that all the value in the  $\Sigma$  matrix i.e. all the correlation coefficients are positive which shows that there is a significant amount of correlation among all the equities.

If the portfolio return and risk for the last five years of both the Sensex and Nifty portfolios are observed carefully it will be found that the amount of risk one has to take to get the same amount of return which is shown by Sharpe Index is decreasing as lesser data is being taken into consideration.

Because there are more number of securities in Nifty portfolio as compared to Sensex portfolio, the sharpe index of Nifty portfolio is more than the corresponding sharpe index of Sensex portfolio for any year. This shows the effect of diversification on the portfolio, *more diversified the portfolio is more will be its returns per unit of risk and more will be its sharpe index.*

First and the foremost important thing that one should always keep in mind before investing in the market is that never invest in the inefficient portfolio and always invest in the efficient portfolio. It will be clearer from the Figure 3.

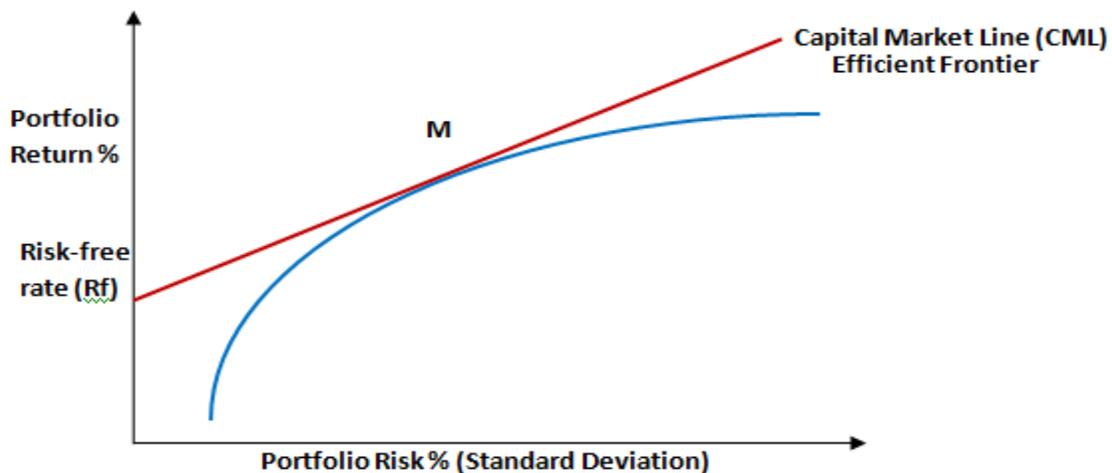
Figure 3: Portfolio Risk & Return



Since the tangent portfolio has the maximum slope (Sharpe Index), one can directly obtain the portfolio weights of the tangent portfolio by maximizing the slope of the capital allocation line joining a market portfolio and the risk free rate of return. This line is known as capital market line. It can be seen in Figure 4.

Another most important learning from the project is that an investor will always invest at the composition of point M, which is market portfolio if he wants to increase his returns more than the returns of efficient frontier by investing some of the money in the risk free security. This can be seen in Figure 4.

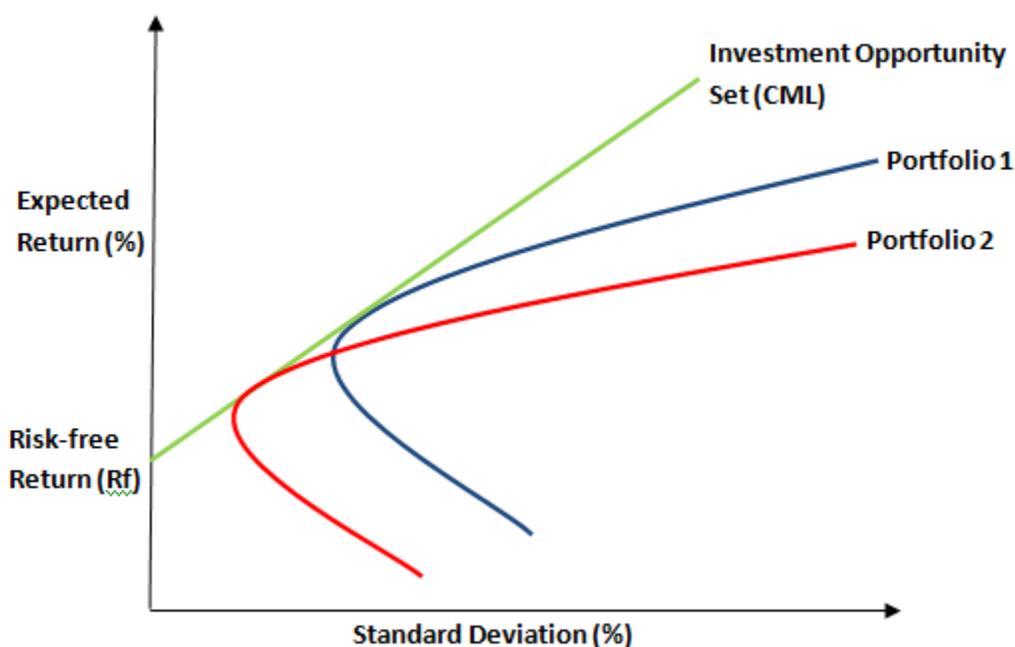
Figure 4: Portfolio Risk, Return & Risk Free Rate



Another important thing to note is that the portfolio return will always be less than market return. The reason for the same is that the market portfolio contains all the securities that are present in the market hence will offer the maximum diversification.

It was realized that the changes in the characteristics of individual risky assets that preserve the Sharpe ratios and the correlation matrix do not change the investment opportunity set (CML). It can be observed in Figure 5.

Figure 5: CML Graph



If an investor believes in the efficiency of market and wants to invest in index funds rather than in any mutual fund then he should invest in the index fund with larger number of securities to get maximum diversification benefit.

## CONCLUSION

It is observed that Point M represents the portfolio of stocks that the investor will hold even if he invests some amount of money in risk free security. An investor irrespective of his risk tolerance would never choose any other point on the efficient frontier except M. If the investor has a fair degree of risk aversion he might choose a point between Rf and M and invest some of its money in risk-free security and rest in stocks as per the weight at point M. And, if the investor is less risk averse then he might choose a point closer to M or even beyond M. In this case investor will borrow some money at the risk-free rate and invest in stocks as per the weight of

market portfolio i.e. point M. The benefit of doing this is that an investor will get more returns for the same amount of risk taken if he invests at any point on CML rather than investing at any point on efficient frontier because CML lies above the efficient frontier.

### LIMITATIONS OF THE STUDY

- Since this study covers a period from 1<sup>st</sup> May 2008 until 30<sup>th</sup> April 2013, its conclusions may not be true for other time periods.
- Before beginning the research it was assumed that markets are perfectly efficient, but in actual they are not.
- It was also assumed that investors can borrow or lend an unlimited amount of capital at a risk free rate of interest might also does not hold true in the real life scenario.
- The detailed analysis has been done only for BSE 30 stocks and NSE 50 stocks and not for all the stocks.
- Not much of technical and fundamental analysis has been done for the selection of securities; main focus was on creating the portfolio of randomly selected securities.
- Short selling is not allowed in India but it has not been taken into consideration.

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