Do the Best Performing Mutual Funds in India Lie on Capital Market Line (CML)? An Investigation

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Abstract

Portfolio theory has received an astounding amount of attention from investors (both individual and specialized), researchers, and academicians in order to understand the behavioral patterns underlying the best investment practices. Subsequent to the seminal development of portfolio theory by Professor Harry Markowitz, the world of investments has been inundated with studies that have sought to simultaneously both expand and enrich the body of work surrounding investments. Among the many innumerable studies, the work carried out by Professor William Sharpe (Professors, Harry Markowitz and William Sharpe have been recipients of the prestigious of Nobel Prize) has been accepted as one of the most foremost contributions in the field of Finance. The development of Capital Market Theory and the allied contributions surrounding the concepts of Capital Market Line (CML) and Security Market Line (SML) have revolutionized the manner in which the investing activities used to be carried out earlier.

In keeping with the theory of diversification, it now almost unanimously acknowledged that it is possible for an investor to remain entirely indifferent to the diversifiable risk (also known as unsystematic risk) and instead, focus entirely on the non-diversifiable risk (or the systematic risk). In this backdrop, it will not be hard to imagine the popularity of Mutual Funds (MFs) that exhibit the characteristics of a well-diversified portfolio. It is also common to see investors comparing the performance of their mutual funds with a broad-based parameter, which is inexorably represented by a market index. In recent times, we have also seen constitution of many investment based award functions that seek to reward the fund managers, who have generated maximum returns on their respective funds (Statman, 1987).

*Without suspecting the capabilities of fund managers, who have been successful in churning out highly attractive rates of return even in the most testing times; there exists a very strong need to examine the veracity of these phenomena by tracing back to the underlying theoretical rationale. The present study therefore seeks to investigate if the performance of '*the best mutual funds' *is consistent with the behaviour exhibited by a typical CML. A satisfactory response to this question will go a long way in expanding the frontiers of knowledge surrounding the linkage of the actual behaviour exhibited by a well-diversified portfolio in relation with its theoretically expected behavior.*

The objective of this study is to understand the characteristics exhibited by the best performing MFs in India. If indeed, the best performing MFs are efficient, then it may be construed that these lie on the CML. This may be

achieved by examining the portfolio returns for the sample comprising of best MFs using both CML and SML equations. An acceptance of the null hypothesis of no-difference between the values of mean return derived under CML and SML respectively would imply that the portfolio points are efficient. A rejection of the null would imply that portfolio points are not efficient and therefore these points do not lie on the CML.

The above study begins with an introduction focusing on the underlying behaviour of a well-diversified investment, which is followed with a discussion on capital market theory explaining the rationale and working of CML and SML. The discussion then proceeds with building the sample and description of the methodology. It concludes with a comprehensive review of results followed by summary and conclusion.

Keywords : *Mutual Funds; Capital Market Line (CML); Security Market Line (SML)*

Introduction

Even the earliest versions of portfolio theory emphasise upon the benefit of diversification as the ultimate objective that must be achieved by every investor (Markowitz, 1952). To begin, a portfolio is said to be well diversified when any of the following conditions are satisfied:

a) Ability of a portfolio to yield a higher return for the same degree of risk; or

b) Ability of a portfolio to yield same return for lower degree of risk

A line passing through all such points on a risk-return map is known as the efficient frontier. A well-diversified portfolio envisages maximizing returns for an acceptable degree of risk that may be consummated by an investor in keeping with the investor's risk propensity. While the concept of total portfolio risk is successful in capturing the inherent volatility from a series of values of portfolio return; the same has been criticized for failing to capture the portion of risk that is non-diversifiable. This component of risk also called as the systematic risk is now recognized as the single-most important factor while evaluating the performance of a portfolio (Fischer & Jordon, 2006).

Sharpe's measure of portfolio risk does a better job in capturing both systematic (non-diversifiable) as well as unsystematic (diversifiable) measures of risk. It is useful to recollect the measurement of portfolio risk given by Sharpe, which is stated as follows.

$$\sigma_p^2 = \left[\left(\sum_{i=1}^{n} X_i \beta_i \right)^2 \sigma_m{}^2 \right] + \left[\sum_{i=1}^{n} X_i^2 e_i{}^2 \right] \qquad \text{Eq. 1.1}$$

where

σ_p^2 = Total portfolio risk as measured by variance

X_i = Proportion of investment in each security assigned as weights

â = Beta of security i representing the systematic risk

$\acute{o}^{2}{}_{m}$ = Variance of Market Returns

$e_i{}^2$ = Unsystematic risk of security i

n = Number of securities in a portfolio

Capital Market Theory

Building upon the portfolio approach advocated by Sharpe, the capital market theory seeks to build upon the same by seeking to determine the pricing of an asset. The theory seeks improvisation of the concept of efficient frontier highlighted by Markowitz.

An efficient frontier is described as a curve drawn on a risk-return map that connects all the efficient points. To recollect, all points are efficient so long as any of the two conditions described below are satisfied.

a) Ability of a portfolio to yield constant returns for a reduced degree of risk.

b) Ability of a portfolio to yield higher returns for a constant degree of risk.

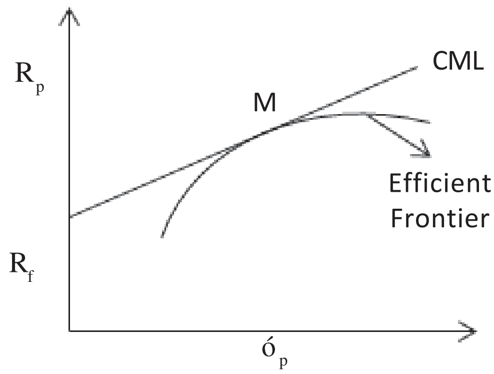


Figure 1.1 : Efficient frontier curve

If we introduce the risk-free asset into the portfolio and develop a portfolio that combines both risky and risk-free asset, with the additional qualification that the investor is in a position to both lend and borrow at the risk-free rate, a new straight line is derived, which starts from the intercept $R_{f.}$ This straight line that connects the various portfolio points comprising of risky and risk-free assets is known as **capital market line** (Sharpe, 1964).

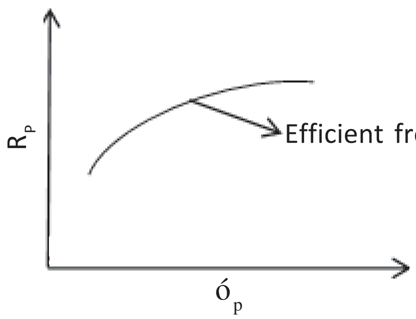


Figure 1.2 : Capital Market Line
(CML (riskless lending and borrowing)

It is argued that every investor (conservative as well as aggressive) would seek to achieve point M, where his returns are maximized at that level of risk. No other point is as efficient as point M. Introduction of riskless lending and borrowing enables all the investors to achieve their desired point M, at which the efficient frontier is tangential to CML.

While going above point M is also possible; it simultaneously exposes the investor to higher risk while yielding higher returns. Alternatively, investors should not be looking at any point below M as their ability to derive higher returns would not have been exploited. To appreciate the two possibilities mentioned above, consider the following example.

R_p (return on risky asset) = 10%

R_f (return on risk-free asset) = 7%

ó$_p$ (standard deviation of risk asset) = 12%

Assuming that the investor invests 60% of the investible wealth in risky portfolio and the balance in risk-free asset, the return and risk on the portfolio will be as follows

$$R_p = (X_r R_m) + [(1 - X_r)(R_f)] \qquad \text{Eq. 1.2}$$

where

R_p = expected return on portfolio

X_r = proportion of investible funds in risky asset

R_m = expected return on risky asset

R_f = expected return on risk-free asset

$$\sigma_p = (X_r \sigma_m) \qquad \text{Eq. 1.3}$$

where

ó$_p$ = expected portfolio risk

ó$_m$ = expected risk on risky portfolio

Substituting the above values, the values of portfolio return and portfolio risk are observed as 8.8% and 7.2% respectively. Here, the investor is able to invest his funds at the risk-free rate.

Conversely, it should also be possible for the investor to use borrowed funds and invest the same in risky asset. In such a scenario, the return on the portfolio will be transformed as shown below.

$$R_p = (X_r R_m) - [(X_r - 1)(R_f)] \quad \text{Eq. 1.4}$$

For the same set of values if the investor invests 120% of his investible wealth in risky asset, it implies that he is borrowing 20% of the funds at the risk-free rate. The metric to compute risk remains the same as shown above.

Substituting this information leads to portfolio return and risk values of 12% and 14.4% respectively. It is thus clear that while returns have increased, the investor has also been exposed to higher degree of risk. The CV increases from 0.81 to 1.2 when the investor borrows to invest the borrowed money in the risky asset.

An investor thus should strive to attain point M at which he could earn the maximum return at an acceptable level of risk. This then leads to formation of an equation for CML, which is described below.

$$R_e = R_f + \left(\frac{R_m - R_f}{\sigma_m}\right) x \ \sigma_p \quad \text{Eq. 1.5}$$

where

R_e = return on efficient portfolio

R_m = return on market index

R_f = return on risk-free asset

$ó_m$ = standard deviation on market portfolio

$ó_p$ = standard deviation on efficient portfolio

It is reasonable to imagine that every fund would like to be classified as an efficient portfolio, where the returns on the same are comparable or perhaps, even exceed the market performance, which in reality, though, is a rarity!

CML is best described as a possibility in a utopian market scenario, where all the investors (individual and specialized) would seek to achieve point M (Figure 1.2). In the absence of this, ultimately, even the best performing MFs may not find a place on CML. Thus, we have the concept of Security Market Line (SML) that is characteristic of all the portfolios, whether efficient or not. The SML establishes that the return on any portfolio is directly proportional to its associated systematic risk measured by its beta. Higher the beta, higher will be the expected return for a portfolio.

SML is a special case of CML, which can be mathematically derived from CML. SML, is represented by the following equation. As this equation helps in establishing the relationship between the required return of a security (portfolio) with its corresponding beta, it is also popularly known as Capital Asset Pricing Model (CAPM).

$$R_i = R_f + [(R_m - R_f)(\beta_i)] \qquad \text{Eq. 1.6}$$

where

R_i = return on asset (security or portfolio, efficient or not)

R_m = expected return on market index

R_f = return on risk-free asset

ó$_i$ = beta of security/portfolio

Graphically, the SML may be shown as given below.

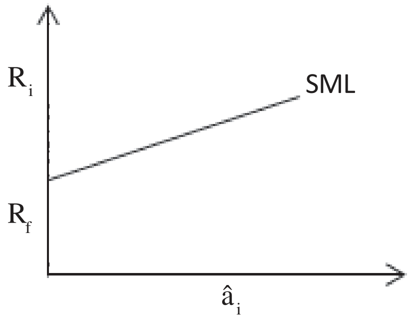


Figure 1.3 : Securities Market Line (SML)

Mathematic Proof: SML is a Special Case of CML

We use the following statistical equations for computing the values of beta and covariance

$$\beta_i = \frac{\mathrm{Cov}(i, m)}{\sigma_m^2}$$

$$\mathrm{Cov}(i, m) = (r)(\sigma_p)(\sigma_m)$$

$$(\text{given that } r = +1)$$

Substituting the above equations in CML (Eq. 1.5) yields SML (Eq. 1.6). It is for this reason that SML is also known as a special case of CML.

The above chart explains that investors' required return will increase for an increase in the degree of systematic risk. It is reasonable to imagine that investors individually, as also 'inefficient' fund managers will find it very difficult to attain the status of efficient portfolio implying that they have to contend with required returns in keeping with their ability to assume systematic risk (Chandra, 2009).

Sample and Methodology

In keeping with the objective of this study, a sample of the best performing mutual funds was selected. The sample was selected based on 1 year returns as on October 28, 2013 reflected in moneycontrol.com (Moneycontrol, 2013). From an available list of 16 MFs, the top 10 were selected on the basis of their 1 year return values (AMFI India). All the funds represent the growth option where investors have an ability to derive the benefit of capital appreciation by comparing the NAV (NAV is computed as the ratio of Net market value of fund's investments over the number of units outstanding) value at the time of New Fund Offer (NFO) and the most recent NAV. It is also assumed that the dividends are reinvested by the mutual funds. As the objective of the study is to compare the actual performance of the funds in comparison with their theoretically expected performance, the sample size does not pose any constraint, and therefore looks justified.

The sample of funds selected represents the equity schemes. As the objective is to superimpose the theoretical models of CML and SML upon the actual funds' performance, it is envisaged that equity scheme mutual funds do not present any underlying bias, which might be present in other categories of funds.

The methodology involves computation of returns based on an observed set of daily NAV values using the equations presented for CML and SML (see equations 1.5 & 1.6). While the CML equation computes return on a portfolio by making an implicit assumption that the set of portfolio points are *'efficient'*, the SML equation on the other hand lends applicability to virtually every point of portfolio, whether efficient or not.

As demonstrated earlier, SML is also known as a special case of CML. While CML captures the total risk as measured by standard deviation, the SML on the other hand captures only the systematic risk as measured by the beta.

It is, therefore, essential to consider both total risk as well as systematic risk surrounding the portfolio (Reilly & Brown, 2006).

Analysis of Results

An application of the equations of CML and SML yielded the following results.

Table 1.1 : Annualized returns based on CML & SML Equations

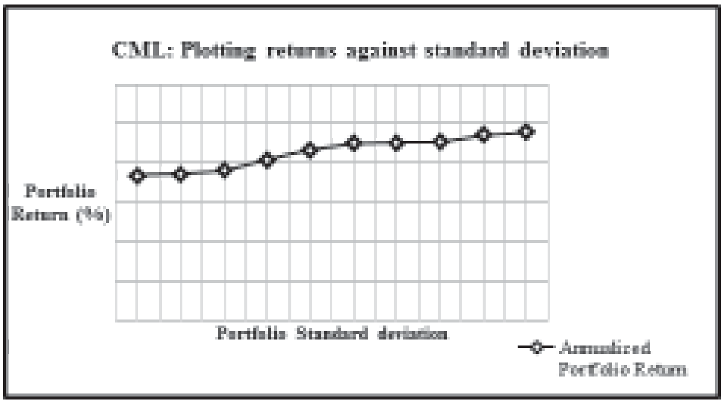
Mutual Fund		Annualized Returns*		Standard deviation	Beta
		CML	SML		
1	BNP Paribas	22.61%	21.93%	19.51%	0.7727692
2	Canara-Robeco	22.64%	22.20%	19.55%	0.7880245
3	ICICI Prudential	23.95%	23.36%	21.29%	0.8520812
4.	Birla Sun Life Gen-next	23.58%	21.86%	20.81%	0.7690694

5	ICICI Prudential Dynamic Plan	20.43%	19.20%	16.60%	0.6212349
6	ICICI Pru Exp & Others –RP	18.39%	14.55%	13.88%	0.3633171
7	Tata Ethical Fund	19.01%	17.29%	14.70%	0.5157323
8	UTI MNC Fund	18.64%	16.74%	14.21%	0.4848472
9	Axis Long-term	22.53%	21.33%	19.40%	0.739398
10	BNP Paribas Tax advantage	21.66%	20.89%	18.24%	0.7154172

(Source: Computed data)

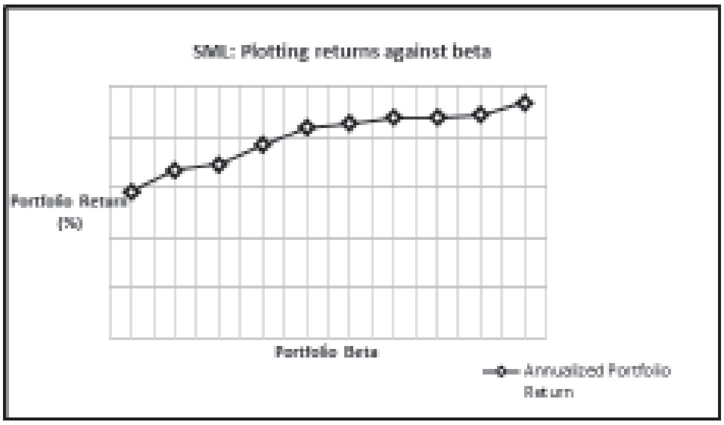
* Risk-free rate and risk-premium are assumed to be 6% and 7% respectively

While the CML return values are to be read in relation with their respective standard deviation values, SML return values need to be read in relation with their respective beta values. It is also useful to visualize the pictorial representation of the CML and SML, which have been depicted below.



(Source: Computed data)

Exhibit 1.1 : Charting CML for best performing Indian MFs



(Source: Computed data)

Exhibit 1.2 : Charting SML for best performing Indian MFs

Looking at the above exhibits, it becomes clear that portfolio returns display a greater degree of sensitivity in relation to beta values than standard deviation. If this is true, then it is the SML that does a better job in capturing the performance of a well-diversified portfolio, which is here represented by best performing Indian MFs.

If indeed the performance of the portfolio that is captured by SML is distinct from that of CML, we would then expect the difference between the values of mean return arrived under CML and SML to be statistically significant. This can be achieved by conducting a test of differences between means with dependent samples (Levin & Rubin, 2006). The following hypothesis may be formulated.

H_0: $\mu_1 = \mu_2$ (insignificant difference between mean returns under CML and SML)

H_1: $\mu_1 \neq \mu_2$ (significant difference between mean returns under CML and SML)

The result output as derived from MS Excel is displayed below :

Table 1.2 : Statistical results for mean differences between CML and SML

Parameters	CML	SML
Mean	0.2135	0.1993
Variance	0.0004	0.0008
Observations	10.0000	10.0000
Pearson Correlation	0.9688	
Hypothesized Mean Difference	0.0000	
Degrees of freedom	9.0000	
t Stat	4.4654	
P(T<=t) two-tail	0.0016	
t Critical two-tail	2.2622	

(Source: Excel Analysis)

As the observed *t-statistic* value is 4.4654 (significant at 1% as p d$\leqslant$ 0.01), which is greater than the critical value of 2.2622, we reject the null-hypothesis and accept the alternate hypothesis. It is therefore prudent to conclude that there exists a statistically significant difference between the mean returns yielded under CML and SML.

The above result helps in reinforcing the notion that in the context of a real portfolio, SML, which measures the sensitivity of returns of a portfolio (security) in relation to its beta, ultimately does a fair job in capturing the performance of a portfolio.

Summary & Conclusion

In this study, an attempt was made to examine whether the best performing MFs in India depict the characteristics exhibited by a portfolio point that lies on CML. Such an examination is warranted to observe if the sample of MFs is efficient in keeping with the observation of all the portfolio points lying on the CML.

We began by establishing the underlying theoretical framework surrounding the investment behaviour of investors. In this context, the reader will observe an unbroken chain of contributions starting from Markowitz portfolio theory to the derivation of SML from CML. While a typical CML seeks to embody the perfect investment behaviour, where all investors (conservative and aggressive) seek to achieve the point M, where CML is tangential to efficient curve; in reality it is the SML that holds good for almost every portfolio. This is because even the most efficient portfolio, having fully exploited the benefits of diversification, remains susceptible to systematic risk. To validate the above notion, we superimposed the CML and SML equations on selected sample of MFs and investigated if there is any evidence of statistically significant difference between the observed mean returns. An acceptance of the null would have meant that the portfolio returns exhibited by Indian MFs are similar to the characteristics exhibited by the portfolio points lying on the CML. Since the null was rejected, we concluded that even while the sample of MFs are deemed as 'best performers', it will be erroneous to classify these funds as efficient.

In this study, a simplistic approach involving comparison of mean returns derived from CML and SML equations has been employed to see whether the sample portfolio points lie on the CML. As ultimately, SML is simply a mathematical derivation of CML, theoretically at least, one would expect the returns to be similar. The rejection of null of no-difference provided conclusive evidence that even the best performing MFs do not lie on the CML. This approach is different from the popular and commonly employed approaches like Sharpe ratio as the objective of the latter is to examine the performance of the portfolio, which is useful for investors seeking to choose the best performing funds amongst all the competing funds. In that sense, the scope of the present study is vastly distinct as it seeks to empirically examine the popularly held theoretical notion of the underlying difference between CML and SML.

Ultimately, markets support fund managers who display greater mettle in responding to systematic risks. Thus, fund managers who do a better in developing and managing portfolios in keeping with their investors' ability to absorb systematic risk stand a better chance in outperforming competition and earn the best fund manager title. Finally, from this study, the principle that mangers should ultimately expend much of their time and effort in managing systematic risks gets emphatically reinforced.

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