Towards Risk Adjusted Performance Appraisal of Indian Mutual Funds

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Abstract

This paper is based on the study of mutual funds in India which is understood to be one of the most vibrant in the money market. This paper analyses a set of representative schemes from heterogeneous group of different fund houses. There are well established criteria to judge their performance absolutely and also in relative terms. This paper deals with the analysis of risk-returns parameters of different mutual fund schemes and the relation between the risk preference of the investors and the risk adjusted performance (RAP) measure based on real time data. Various tests are applied to evaluate the performance of mutual funds based on well established measures and those tests have been used to rank the funds accordingly. Some hypotheses are constructed and tested to find out whether there are significant differences in their absolute and RAP. The paper also proposed an easy and practical path to solve an optimal portfolio problem containing the various mutual fund schemes. The analysis is carried out with the help of William Sharpe’s single index model and result could of use to substantial investors who are choosing an optimum portfolio of various mutual funds.

Keywords: Mutual fund, Risk adjusted performance, Sharp index, Optimal portfolio.

I. Introduction

Mutual fund investment in India has come across a long way since its inception. Starting from a modest beginning way back in 1963 with the formation of government sponsored Unit Trust of India [I], [XII], [XVII] it has evolved as a major industry in recent times involving about 38 mutual funds, more than 850 schemes, asset under management of Rs. 7500 billions and more than 30 million investors. It is the most popular investment vehicle to access equity and debt market covering different types of investors. Due to enormous options available in terms of the number of funds, multiple schemes, their different investment objectives, style and various portfolio compositions, it becomes very difficult to choose the “best fund” or
“portfolio of the top rated funds” for the investors. Moreover, despite the availability of a large pool of alternatives an investor may actually be left with limited options due to the existence of similar, clone-type of funds with identical profiles. Risk confronted by an investor can be substantially reduced, and thus an investor can be better-off by choosing a combination of schemes instead of a single one for a given level of return. This paper deals with some practical problems in this context and solutions have been suggested based on empirical findings.

Initially, a selected set of seven heterogeneous mutual funds are considered. Time series data has been taken in to account for the last five years covering economic cycles. Analysis of the risk and return for the selected mutual fund schemes is carried out using certain measures like Sharpe Ratio [XVIII], Treynor Ratio and Jensen’s Alpha [VI], [IX]. Year wise returns of the selected schemes are compared primarily with S&P CNX NIFTY returns to understand the performance. The schemes have been ranked and a composite ranking for them is obtained which can help an investor to select the best fund in the future. Present work includes testing of hypothesis by using Paired-t test for identical mean and Jobson-Korkie test applicable for equal Sharpe ratios of any two combinations of these seven representative schemes. The test projected that there is actually little significant difference among the schemes, as well as with that of the benchmarks.

An effort has been made to construct an optimal portfolio for an investor using Sharpe’s Single Index Model. It also gets restricted as here again we come up with only one fund, i.e. Birla Sun Life dynamic bond fund. This can only be justified by considering very low standard deviation in comparison to other equity based funds [XV] which experienced unprecedented volatility and value erosion in the last one and half years of severe recession.

The rest of the paper is organised as follows. The next section briefly covered the theoretical background from the literature. The third section presents the empirical investigation with fund data selection, methods adopted for schemes comparison and results. The final section summarizes the conclusions.

II. Literature Review and Theoretical Background

[XVIII] has classified the range of mutual fund investment styles into two broad categories: The characteristics-based style analysis (such as value, growth, small-cap, large-cap, income, balanced etc.), which is based on portfolio’s and benchmark’s current and/or historical holdings and its security weights and is considered to be the most powerful and comprehensive approach. The returns-based style analysis is a statistical technique that was originally proposed by Sharpe under the name of effective asset mix and attribution analysis. The approach is based on a multi-index model, which suggests that a portfolio’s return is related linearly to the return on a series of factors. [IV] showed that size and value help in accounting for differences in fund performance. [VII] used an alternative approach based on fund’s holdings to evaluate fund performance. They also found that stock characteristics do better than factor loadings in explaining the cross-sectional behaviour of average returns.
Ex-post calculation of the return on a portfolio, or an investment fund, is the first element employed to determine its performance [VI], [XI]. Performance of Indian mutual funds during the period 1991-2003, has been analysed in [II] and [XVII]. The performance was benchmarked against S&P CNX 500 and both unconditional and conditional measures of performance were used as measures of past fund performance. The workers found the evidence that conditional measures of past fund performance predict the future fund returns significantly. [VIII] who in their article “Analysis of differences in style” were associated with differences in performance, have adopted a style classification based on two dimensions: market capitalization and value-growth orientation. The classification adopted by them draws upon the academic research on behaviour of stock returns and is widely used in the mutual fund industry. [VIII] confirmed that size (small, mid, and large) and book-to-market (value, growth) are useful descriptors of fund styles. Further, their study brings out that most mutual funds adopt investment styles that cluster around a broad market benchmark. Few funds take extreme positions away from the index, but those who do are more likely to favour growth stocks and past winners. The bias toward glamour and the tendency of poorly performing value funds to shift styles may reflect agency and behavioural considerations. After the adjustment for style, there was evidence that the growth managers on average outperformed the value managers. Though a fund’s factor loadings and its portfolio characteristics generally yield similar conclusions about its style, an approach using portfolio characteristics predicts funds better. [XI] argument was from simple performance measurements to performance attribution. [XVII] was one contributions which possibly first attempted to understand the characteristics and performances of Indian mutual funds in details as book format. Portfolio performance without reckoning the risk exposure do not provide fair and true picture. Modern Portfolio Theory (MPT) [IV] and the Capital Asset Pricing Model (CAPM) [XIX] have established the link that exists between the risk and return of an investment quantitatively. Various studies cited in the references have not only examined performance in terms of rate of return but also evaluated portfolio performance in terms of risk-adjusted rate of return (i.e. through Treynor and Sharpe’s indices). [III], [XIV] attempt was towards risk adjusted relative measure of performance in the mutual fund market.

**The Sharpe Measure** [XX]: This ratio measures the excess return (or risk premium) of a portfolio compared with the risk-free rate, with respect to the total risk of the portfolio (measured by its standard deviation this time). This measure is based on the total risk. It enables the relative performance of portfolios that are not very diversified to be evaluated. The unsystematic risk taken by the manager is included in this measure. This measure is also suitable for evaluating the performance of a portfolio that represents an individual’s total investment.

**The Treynor Measure** [VI]: This indicator measures the relationship between the return on the portfolio, above the risk-free rate, and its systematic risk.

**The Jensen Measure** [IX]: Jensen’s alpha is defined as the differential between the return of the portfolio in excess of the risk-free rate and the return explained by the market model. The Jensen measure is based on the CAPM.
Security Market Line (SML) [X]: The CAPM is a model for pricing an individual’s security or a portfolio. For individual securities, we make use of the security market line (SML) and its relation to expected return and systematic risk (beta) to show how the market must price individual securities in relation to their security risk class. The SML enables us to calculate the reward-to-risk ratio for any security in relation to that of the overall market.

The last effort made in this work is construction of optima portfolio. [XIII] argument was in favour of using Sharpe’s single-index model (SSIM) instead of constructing efficient frontier based on Markowitz where extensive calculations is required. In SSIM the ratio is calculated for all the assets from which the investor is liable to choose. The results are classified from the highest value to the lowest value. The higher the value of the ratio, the more desirable it is to hold the security in the portfolio. As a result, if a security is held in an optimal portfolio, then all the securities for which this ratio is higher are also held in the portfolio. In the same way, if a security is excluded from the portfolio, then all the securities with a lower ratio will also be excluded. There is therefore a threshold value above which we select securities, and below which we exclude them. This value is denoted by $C_i$. The procedure is therefore simple to implement, as long as we know the value of $C_i$. We can then select the securities to include in the portfolio and calculate the proportions to hold. $C_i$ is calculated through an iterative procedure, by successively introducing the securities from the list into the portfolio and by calculating the $C_i$ value associated with a portfolio containing $i$ securities. $C_i$ is expressed as follows

$$ C_i = \frac{\sigma_M^2 \sum_{j=1}^{i} (E(R_j) - R_T)\beta_j}{\sigma_M^2 \sum_{j=1}^{i} \frac{\beta_j^2}{\text{var}(r_j)}} $$

(1)

With the notation being the same as that used to present the single-index model. We stop adding securities when the ratio associated with the candidate security is lower than the value of $C_i$ that was calculated for the portfolio. At the end of this procedure we know the list of assets that will figure in the optimal portfolio. What remains is to determine the proportion to attribute to each of them. Denoting by $x_i$ the proportion of asset $i$ to hold, we have:

$$ x_i = \frac{z_i}{\sum_j z_j} $$

where

$$ z_i = \frac{\beta_i}{\text{var}(z_i)} \left( \frac{E(R_i) - R_T}{\beta_i} - C_i \right) $$

(2)
Jobson-Korkie Test [VI], [XVI]: The second test is that proposed by [VI] which tests for the equality of the Sharpe ratios of any two portfolios. The test statistic can be formulated as:

$$z = \frac{\sigma_a (\mu_b - R_f) - \sigma_b (\mu_a - R_f)}{\sqrt{2\sigma_a^2\sigma_b^2 - 2\sigma_a\sigma_b\sigma_{ab} + (1/2)\mu_a^2\sigma_b^2 + (1/2)\mu_b^2\sigma_a^2 - \frac{\mu_a\mu_b}{2\sigma_a\sigma_b}\left(\sigma_{ab}^2 + \sigma_a^2\sigma_b^2\right)}}$$

(3)

Where $\sigma_a$ is the standard deviation of portfolio $a$, $\sigma_b$ is the standard deviation of portfolio $b$, $\sigma_{ab}$ is the covariance of $a$ and $b$, $\mu_a$ is the average return of portfolio $a$, $\mu_b$ is the average return of portfolio $b$, $R_f$ is the risk-free rate of return (assumed to be zero), $T$ is the number of observations.

A significant $z$ statistic would reject the null hypothesis of equal risk-adjusted performance and would suggest that one of the investment strategies outperforms the other. It can be seen as a strong evidence of a difference in risk-adjusted performance observing a statistically significant $z$ score between two portfolios.

**III. Empirical Investigations**

Data Selection

Table 1: Details of the selected fund schemes

| Name Of The Scheme                  | Inception Date | Corpus  | Objective                                                                 |
|-------------------------------------|----------------|---------|---------------------------------------------------------------------------|
| HDFC Top 200                        | 03-09-1996     | 4755.96 | To generate long term capital appreciation from a portfolio of equity investments among the largest quoted Indian Companies. |
| HDFC Prudential Dynamic Plan        | 31-10-2002     | 1652.21 | Aims to provide periodic returns and capital appreciation over a long period of time, from a judicious mix of equity and debt investments, with the aim to prevent/minimise any capital erosion. |
| Sundaram Bnp Paribas Select Midcap  | 31-07-2002     | 1684.66 | To achieve capital appreciation by investing in a diversified basket of midcap stocks |
| Birla Sunlife Dynamic Bond Funds     | 01-02-1994     | 2860.88 | To generate optimal returns with high liquidity through active management of the portfolio by investing in high quality Debt and Money Market instruments. |
| Reliance Growth                     | 08-10-1995     | 5854.51 | The primary investment objective of the scheme is to achieve long term growth of capital through a research based investment approach. |
| Franklin India Bluechip Fund        | 01-12-1993     | 2439.09 | Aims to provide medium to long term capital appreciation. |
| Reliance Vision Fund                | 08-10-1995     | 3710.58 | The primary investment objective of the scheme is to achieve long term growth of capital by investment in equity & equity related securities through a research based investment approach. |
In this paper various schemes are evaluated and seven representative schemes with diverse portfolio combinations are selected. Data are taken for the 5 years from 2004 to 2009 (till 30th September). Then the risk return payoff for all the schemes for the entire time period and that on yearly basis is calculated. Based on popular available measures like NAV (Net Asset Value), SHARPE, TREYNOR & JENSON’S ALPHA, selected schemes are ranked accordingly. Nifty is used as a benchmark for comparing the relative performance of the schemes. This paper also tried to project overvalued and undervalued schemes based on SML of CAPM. Further William Sharpe Single Index Model is used to find an optimal portfolio.

FUND’S SELECTION:

Based on fund’s objective, total corpus, inception date, portfolio combination, investment styles, seven representative schemes are selected. These schemes involve equity, balanced and debt funds.

FUND INVESTMENT STYLE:

While investing, most funds have a particular strategy. Most of the investor generally invests only in Blue Chip companies. On the other hand, some focus on high-risk start up companies that have the potential for high growth. Many studies cited in the references reveal that investment style can play an important role in mutual fund’s return. There is considerable debate within the investment community about the effectiveness of the various styles. Mutual funds are classified based on both the size of the companies invested in and the investment style of the manager.

TIME PERIOD:

Since mutual funds scheme need to be tested under different economic condition (both boom and recession) and should have consistent performance history. Five years NAV data have been considered. This data covers the heartbeat of money market for both the boom period of 2004-2005 and the recession period of 2008-2009 (till 30th September). And for NIFTY index, data has been collected for the same time period. In this paper, 365 days Govt. Treasury bill data for the period 2004-2009 has also been considered.

DATA SOURCE:

NAV data for the 7 representative funds have been collected from NAV INDIA. Data for NIFTY index and Govt. Treasury bill data have been collected from BLOOMBERG.

Methodology:

We first work out the annual rolling rates of return, every year for each of the fund schemes, going back five years to absorb the experience of both the bull and the bear markets. We do the same for the market using the appropriate index, like the NIFTY.
Initially we have considered the crude method of performance evaluation like taking the annual yearly return of all the fund schemes for each year and then ranked the schemes based on the higher to lower return. The method is applied based on the rolling return to nullify the random fluctuation within the year. A ranking of the mutual fund schemes can be done based on the rolling return.

Then more advanced method of risk adjusted return will be applied (viz. Sharpe Index, Treyner Index and Jenson Alpha). By calculating the risk adjusted return of all the schemes based on them and ranking them accordingly we can get a relative ranking of these schemes. Based on these ranking an investor can make his choice. An effort is then made to test the significance of the difference between the mean and Sharpe ration of each pair of every scheme. A null hypothesis is constructed to test the equality of the mean between the pairs. T-test statistics is applied for this. Any rejection of the null hypothesis due to high t value would mean that null hypothesis is rejected, i.e. there exist significant difference in the mean return between the schemes. Same method is applied for testing the equality of Sharpe ration by the Jobson-Korkie test. Here also any higher value of the modified z score would mean that the Sharpe ratio of the schemes is significantly different.

Finally an effort is made to construct an optimal portfolio by choosing different combination of the schemes following Sharpe single index model. Here the first task is to measure the impact of the market return on the return of a stock through a regression equation. The two parameters, $\alpha$ and $\beta$ of the regression equation are to be determined, devoid of any autocorrelation through successive corrective iterations if needed. Here, we are not looking for any optimal lag structure as such; an acceptable value of the D-W statistic for the final round of the Cochrane-Orcutt method for autocorrelation correction served our purpose. We also need the Mean Squared Errors for each equation for us to follow the stipulations of the model. The next step would be to forecast the market rate of return and its variance for the holding period. The forecast for the market rate is needed to estimate the expected value of the return from each scheme in the holding period. The variance forecast for the market rate is needed to determine the schemes to be included in the final set from the starting set after some prolonged calculations. They involve, first the calculation of excess return from the scheme divided by its beta estimate, the excess being the expected rate of return less a measure of the return from the risk-less asset. The nearest one could come to this parameter is the return/yield from the Treasury bill of appropriate duration, preferably the yearly one. This value is then used to rank the assets, the highest one coming first, and so on. Next we go through a set of calculations involving the beta, the residual variance ($\sigma^2_{ei}$) from each scheme and the market variance ($\sigma^2_m$). This would eventually give us a value, termed $C$, which...
needs to be compared with the corresponding excess return over beta value. If the $C$ value is less, the first asset is to be included in the portfolio; if not, then put everything in the Treasury bill. For the asset ranked second in the excess return over beta scale, do the same, and if it is greater than the corresponding $C$-value, include the second scheme in the portfolio. Carry on this calculation until a scheme is reached whose $C$-value is greater than its excess return over beta value. Reject this one from the optimal portfolio and all the subsequent ones. Designate the $C$-value just above it as $C^*$. Thus, we have reached the list of the schemes to be included in the optimal set, but the determination of the corresponding weights in the total investable fund is another matter.

To determine the percentage of the fund to be invested in a particular asset, we need to solve an equation involving the value of $C^*$, the beta value of the selected scheme, the value of the part of the scheme’s variance not explained by the market, ($\sigma_{\epsilon}^2$), and also its excess return over beta. This would give us the complete portfolio of the selected assets and their weights, which can be used to work out the portfolio expected return, the portfolio risk, and also the portfolio beta. If the portfolio beta is around unity, it would imply that the portfolio is a good reflection of the stock market as a whole and therefore its expected return would vary similarly to the market-index return. If the beta value is less than unity, it implies a conservative portfolio and if it is well above unity, say 1.2 or more, it implies an aggressive portfolio. Portfolio beta value of 1.1 implies that the expected return from the portfolio is likely to increase (decrease) by eleven percent if the market return was to increase (decrease) by ten percent from its forecast value, already used for the model. The portfolio risk can be calculated in its ‘systematic’ and ‘unsystematic’ components. It is theoretically possible to reduce the ‘unsystematic’ part of the total risk to zero by appropriate diversification. The ‘systematic’ part indicates the irreducible minimum the portfolio risk could ever be, the market itself being the basis of that risk.

This single-index model can be extended by bringing in more indices, but its computational and conceptual advantage from the Markowitz model would gradually disappear with the increase in the number of indices used. The extreme case of the single-index underlines the advantage clearly and it is this version of the Sharpe model which has been used almost universally. Another special feature of the Sharpe model merits special mention. As we saw above, the Markowitz model is entirely based on the historical data, without any attempt to foresee or forecast a relevant parameter or value in the future, involving the holding period for the investment. Sharpe model specifically brings in the expected future values of the market return and its variance and they are the essential elements determining the various parts of the optimality calculations. This very feature of the model is another crucial factor.
Results and Interpretations

Table 2: NAV Presentation (Absolute Yearly Return)

| SCHEME                      | CODE | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  |
|-----------------------------|------|-------|-------|-------|-------|-------|-------|
| NIFTY                       |      | 8.798 | 34.12 | 39.86 | 53.18 | -51.84| 53.69 |
| HDFC TOP 200 FUNDS          | A    | 25.519| 52.95 | 37.62 | 53.17 | -45.49| 81.80 |
| HDFC PRUDENCE FUND          | B    | 23.937| 46.23 | 33.34 | 42.7  | -42.54| 68.77 |
| SUNDARAM BNP PARIBAS SELECT MIDCAP | C | 34.103| 57.27 | 58.42 | 62.32 | -58.94| 88.64 |
| BIRLA SUNLIFE DYNAMIC BOND FUNDS | D | 0.976 | 5.117 | 5.935 | 8.896 | 14.65 | 6.85  |
| RELIANCE GROWTH FUND        | E    | 41.120| 67.62 | 3.816 | 74.68 | -54.6 | 78.09 |
| FRANKLIN INDIA BLUECHIP FUND | F   | 22.715| 39.18 | 45.2  | 46.1  | -48.07| 69.75 |
| RELIANCE VISSION FUND       | G    | 18.202| 51.86 | 45.12 | 55.62 | -52.26| 68.25 |

Table 3: Composite Ranking based on yearly Absolute Return

| CODE OF THE SCHEME | CODE OF THE SCHEME | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | TOTAL SCORE | RANKING |
|--------------------|--------------------|------|------|------|------|------|------|--------------|---------|
| A                  | B                  | C    | D    | E    | F    | G    | NIFTY |              |         |
| 3                  | 4                  | 2    | 7    | 1    | 5    | 6    | 6\7 | 6\7 | 3\4 | 3\4 | 4\5 | 6\7 | 19 | 2 |
| 3                  | 5                  | 2    | 7    | 1    | 2    | 3    | 6\7 | 6\7 | 3\4 | 3\4 | 4\5 | 6\7 | 27 | 5 |
| 4                  | 6                  | 1    | 1    | 7    | 1    | 2    | 5    | 5    | 4    | 4    | 4    | 4    | 19 | 2 |
| 5                  | 7                  | 2    | 7    | 1    | 2    | 3    | 5    | 5    | 3    | 3    | 3    | 3    | 35 | 7 |
| A                  | B                  | C    | D    | E    | F    | G    | NIFTY |              |         |
| 3                  | 4                  | 2    | 7    | 1    | 5    | 6    | 6\7 | 6\7 | 3\4 | 3\4 | 4\5 | 6\7 | 19 | 2 |
| 3                  | 5                  | 2    | 7    | 1    | 2    | 3    | 6\7 | 6\7 | 3\4 | 3\4 | 4\5 | 6\7 | 27 | 5 |
| 4                  | 6                  | 1    | 1    | 7    | 1    | 2    | 5    | 5    | 4    | 4    | 4    | 4    | 19 | 2 |
| 5                  | 7                  | 2    | 7    | 1    | 2    | 3    | 5    | 5    | 3    | 3    | 3    | 3    | 35 | 7 |

Based on this Absolute yearly return across the years, we observe that the ranking of the funds widely differ across the years. For example Birla Sunlife Dynamic Bond scheme is ranked last between 2005-1007 as equity market flourished, but rebound back to top spot in 2008, when the market corrected severely. We have used the
cardinal scale ranking to arrive at a composite score, based on which we have ranked the schemes. This indicates Sundaram BNP paribus Select madcap has immersged as top fund, while Birla Sunlife Dynamic Bond scheme lagged this list.

Table 4: Overall Ranking based on yearly Absolute Return

| ACROSS THE YEAR | ABSOLUTE RETURN | RANKING |
|-----------------|-----------------|---------|
| NIFTY           | 165.862         | 6/7     |
| A               | 318.500         | 3       |
| B               | 245.902         | 4       |
| C               | 357.408         | 2       |
| D               | 51.166          | 7       |
| E               | 395.066         | 1       |
| F               | 232.965         | 6       |
| G               | 242.374         | 5       |

Table 5: Yearly Annualized Rolling Return

| YEAR | 2005 | 2006 | 2007 | 2008 | 2009 |
|------|------|------|------|------|------|
| NIFTY| 30.218 | 49.447 | 36.6 | 0.504 | -18.965 |
| A    | 46.295 | 59.644 | 34.63 | 4.625 | -7.861 |
| B    | 43.810 | 42.861 | 32.63 | -1.853 | -7.246 |
| C    | 71.745 | 77.260 | 35.03 | -3.804 | -18.236 |
| D    | 5.293  | 5.407  | 7.228 | 11.178 | 13.962 |
| E    | 76.963 | 58.919 | 43.97 | 6.331 | -17.827 |
| F    | 36.100 | 55.967 | 35.39 | -2.292 | -11.021 |
| G    | 51.234 | 56.431 | 40.57 | -3.048 | -16.136 |

In order to remove the drawback of using single point to point NAV return, we use yearly Rolling Return of NAV data and take the Arithmetic Mean of these returns to rank the schemes. Rolling return figures shows that all the equity schemes have positive return for 2005-2007, and negative return for 2009, which give us a indication that they closely resembles the movement of Nifty, which also shows similar tends.
Fig 1. Movements of NAVs compared to Nifty

This is a comparative graph showing the movement of the NAV in comparison to the movement of the benchmark 50 share NIFTY index over the years. This shows that NAV value of HDFC Top 200 moves almost in tandem with the benchmark index.
Rolling return shows a change in the composite ranking of the schemes from annualized return. Here Reliance Growth fund replace Sundaram BNP paribus Select madcap for the Top spot, while Birla Sunlife Dynamic Bond scheme move one step up from the last spot in the composite ranking. More significantly it Top the list in the last two years when the equity market corrected severely. The equity market’s rebound in the last few months is not fully reflected in the performances of these funds.

Investors while investing in mutual fund schemes or for that that mater in any financial instrument are not only concerned about the return from the investment, but also also consider the risk associated with it. That is why everybody don’t paly the casino or buy lottery as investment although the possibility of winning large is always there. So while evaluating any investment instrument including Mutual fund schemes we have to consider the risk associated with it. In statistical terms Risk is measure by the deviation of actual return from the expected return and Standard deviation of the actual return from the mean return is used as the indicator of risk.

**Risk- Adjusted Return**

**Jense's Alpha:** A measure of performance on a risk-adjusted basis. Alpha takes the volatility (price risk) of a mutual fund and compares its risk-adjusted performance to a benchmark index.

The excess return of the fund relative to the return of the benchmark index is a fund's alpha. Alpha help us to decompose the total return into market return and excess return so that we can evaluate weather the return is due to market factor or superior stock selection. This helps us to identify the fund managers' charisma to outperform the market. Jenson’s alpha shows that Reliance Growth outperform the market by
21.907% whereas Birla Sun Life Dynamic Bond has alpha of only 2.45. But we have to take note of the fact that Nifty can’t be an ideal benchmark form Evaluating a bond fund like Birla Sun Life Dynamic Bond.

| Table 7: Jenson’s Alpha |
|------------------------|
| **A** | **B** | **C** | **D** | **E** | **F** | **G** |
|-------|-------|-------|-------|-------|-------|-------|
| 2005  | 19.7785 | 19.9619 | 55.5181 | -4.4157 | 59.5818 | 8.329 | 10.932 |
| 2006  | 17.1442 | 3.79444 | 47.2798 | -8.7867 | 27.2494 | 11.3787 | 2.00818 |
| 2007  | -0.9149 | -1.3258 | 8.17608 | -1.4825 | 12.4447 | 0.56717 | 4.96038 |
| 2008  | 4.38605 | -3.2797 | -5.298 | 4.94404 | 8.06056 | -3.2651 | -0.2115 |
| 2009  | 10.1931 | 8.70548 | -13.579 | 14.7773 | -3.747 | 2.08327 | -6.1887 |

| Table 8: Jenson's Alpha Rank |
|-----------------------------|
| **A** | **B** | **C** | **D** | **E** | **F** | **G** |
|-------|-------|-------|-------|-------|-------|-------|
| 2005  | 4 | 3 | 2 | 7 | 1 | 6 | 5 |
| 2006  | 3 | 5 | 1 | 7 | 2 | 4 | 6 |
| 2007  | 5 | 6 | 2 | 7 | 1 | 4 | 3 |
| 2008  | 3 | 6 | 7 | 2 | 1 | 5 | 4 |
| 2009  | 2 | 3 | 7 | 1 | 5 | 4 | 6 |
| **Total Score** | 17 | 23 | 19 | 24 | 10 | 23 | 24 |
| **Rank** | 2 | 4 | 3 | 6 | 1 | 4 | 7 |

| Table 9: Across the Year (2005-2009) Jenson’s Alpha And Ranking |
|-------------------------|
| **Name** | **Jenson’s Alpha** | **Ranking** |
| A          | 10.094          | 3            |
| B          | 4.551           | 5            |
| C          | 21.731          | 2            |
| D          | 2.451           | 7            |
| E          | 21.907          | 1            |
| F          | 3.949           | 6            |
| G          | 9.356           | 4            |
Fig 2. Histogram of Jenson’s Alpha

**Treynor Index:** Treynor ratio is the risk adjusted measure of return based on the systematic risk. Therefore it considers the excess return over the risk free rate adjusted for the beta of the fund. By analysing the Treynor ration of our selected 7 mutual fund schemes. This ratio shows wide variation over the time period, as Birla Sunlife Dynamic bond comes last for the boom period 2005-2007 period but emerged toper in the recession of 2008 and 2009. By considering the composite score and ranking them we found that Reliance growth comes in the top sport. But when we run this analysis by considering the entire time period of 2005-2009, Birla Sunlife Dynamic Bond Top the list. This indicates that last two years of under performance of equity and extreme volatility out weight the three years of bull run.

Table 10: Treynor Index

| Year | A     | B        | C    | D     | E       | F       | G    |
|------|-------|----------|------|-------|---------|---------|------|
| 2005 | 45.397| 48.2789  | 94.5905 | -4.5612 | 95.7123 | 33.7283 | 55.3278 |
| 2006 | 68.8362 | 55.564 | 110.419 | -7.6393 | 83.4856 | 63.0923 | 71.7627 |
| 2007 | 39.1797 | 38.5925 | 49.5425 | 10.8122 | 54.1596 | 40.7068 | 47.7217 |
| 2008 | 3.52207 | -4.3845 | -7.0752 | 164.217 | 7.72152 | -4.3114 | -4.1403 |
| 2009 | -23.279 | -24.256 | -55.937 | 70.0263 | -38.276 | -31.385 | -34.966 |
Table 11: Treynor Index Rank

| Year | A | B | C | D | E | F | G |
|------|---|---|---|---|---|---|---|
| 2005 | 5 | 4 | 2 | 7 | 1 | 6 | 3 |
| 2006 | 4 | 6 | 1 | 7 | 2 | 5 | 3 |
| 2007 | 5 | 6 | 2 | 7 | 1 | 4 | 3 |
| 2008 | 3 | 6 | 7 | 1 | 2 | 5 | 4 |
| 2009 | 2 | 3 | 7 | 1 | 6 | 4 | 5 |
| **Total Score** | 19 | 25 | 19 | 23 | 12 | 24 | 18 |
| **Rank** | 4 | 5 | 3 | 6 | 1 | 7 | 2 |

Table 12: Across the Year (2005-2009) Treynor Index and Ranking

| NAME | TREYNOR INDEX | RANKING |
|------|---------------|---------|
| A    | 29.881        | 4       |
| B    | 24.608        | 6       |
| C    | 46.261        | 2       |
| D    | 87.577        | 1       |
| E    | 44.353        | 3       |
| F    | 23.506        | 7       |
| G    | 29.475        | 5       |

Fig. 3. Histogram of Treynor Index

Sharpe Index: Sharpe ratio is the risk adjusted measure of return based on the total risk. Therefore it considers the excess return over the risk free rate adjusted for the risk taken to generate it. The Sharpe ratio tells us whether a portfolio's returns are due to smart investment decisions or a result of excess risk.
Analysis of Sharpe ratio also depict trend similar to Treynor index. Here also on the considering the entire time period Birla sunlife emerge as a top, mainly due to very low risk taken by it in the entire period. All the equity and equity oriented fund despite generating fabulous return in the first three years score low due to excessive risk.

Table 13: Sharpe Index

|    | A     | B     | C      | D      | E     | F     | G     |
|----|-------|-------|--------|--------|-------|-------|-------|
| 2005 | 1.70286 | 0.83495 | 1.13472 | -1303.4 | 0.16066 | 1.41473 | -1.2356 |
| 2006 | 4.85961 | -0.336 | 1.2815 | -147 | -0.6718 | 5.69712 | -0.4523 |
| 2007 | 2.11759 | -0.5926 | 0.22674 | -33.361 | 0.20909 | 2.20106 | -0.1585 |
| 2008 | 0.12814 | -0.1457 | -0.3578 | 0.36322 | 0.431 | -0.3835 | -0.4485 |
| 2009 | -0.8365 | 0.41242 | -0.4001 | 1.18024 | 0.0885 | -1.8313 | -0.051 |

Table 14: Sharpe Index Rank

|    | A | B | C | D | E | F | G |
|----|---|---|---|---|---|---|---|
| 2005 | 1 | 4 | 3 | 7 | 5 | 2 | 6 |
| 2006 | 2 | 4 | 3 | 7 | 6 | 1 | 5 |
| 2007 | 2 | 6 | 3 | 7 | 4 | 2 | 5 |
| 2008 | 3 | 4 | 5 | 2 | 1 | 6 | 7 |
| 2009 | 6 | 2 | 5 | 1 | 3 | 7 | 4 |
| Total Score | 14 | 20 | 19 | 24 | 19 | 18 | 27 |
| Rank | 1 | 5 | 3 | 6 | 3 | 2 | 7 |

Table 15: Across the Year (2005-2009) Sharpe Index and Ranking

| NAME | SHARPE INDEX | RANKING |
|------|--------------|---------|
| A    | 0.773        | 3       |
| B    | 0.685        | 5       |
| C    | 0.727        | 4       |
| D    | 0.816        | 1       |
| E    | 0.798        | 2       |
| F    | 0.633        | 7       |
| G    | 0.658        | 6       |

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Although an investor has enormous option to choose in case of mutual fund investment in India, are these fund schemes really different. We have try to analyze this problem by running Jobson Korkie test of equal Sharpe ratio for any two investment options. Our result shows that when we consider risk adjusted return instead of simple return for comparing the schemes the difference between them significantly get reduced. This further proves when we consider the co-relation between these schemes and that of with the market. We find that there exist extreme high positive correlations almost tending towards +1 within themselves and with the market. His makes an investor’s choice of investment quite restrictive as most of them have similar risk –return profile, and leave very little chance to construct a portfolio quite different from that of the market.

**SML:** The SML is the geographical representation of the CAPM. It displays the expected rate of return for an overall market as a function of systematic risk (beta). We can use SML line to assess whether an instrument have a good rate of return relative to its risk by plotting it with respect to SML line.
Table 16: Constructing Optimal Portfolio by Sharpe Single Index Model

| Fund Code | Alpha   | EXP.RET (Ri) | EXCESS RET. (Ri-Rf) | Bi     | unsystematic risk (sigma_ei^2) | excess ret. to beta | RANKING |
|-----------|---------|--------------|---------------------|--------|--------------------------------|---------------------|---------|
| A         | 8.82030 | 27.28285484  | 19.78285484         | 0.97171366 | 0.44551                         | 20.359              | 5       |
| B         | 12.46447 | 29.36970755  | 21.86970755         | 0.88974945 | 0.70823                         | 24.580              | 3       |
| C         | 15.37370 | 30.79835107  | 23.29835107         | 0.81182353 | 2.461                           | 28.699              | 2       |
| D         | 17.32380 | 18.00784988  | 10.50784988         | 0.03600252 | 0.01619                         | 291.864             | 1       |
| E         | 9.20858  | 25.95094604  | 18.45094604         | 0.88117716 | 1.9193                          | 20.939              | 4       |
| F         | 4.92593  | 23.07062144  | 15.57062144         | 0.95498376 | 0.65788                         | 16.305              | 7       |
| G         | 8.62820  | 26.43501068  | 18.93501068         | 0.93720082 | 0.99898                         | 20.204              | 6       |
Table 17: Jobson Korkie Test

| Fund Code | Excess ret. To beta | (Ri-Rf) Bi/sigma_ei^2 [1] | Bi^2/sigma_ei^2 [2] | cumulative[1] | Cumulative[2] | C* | Z* |
|-----------|---------------------|---------------------------|----------------------|---------------|---------------|----|----|
| D         | 291.864             | 23.358078                 | 0.0800306            | 23.3580       | 0.08003061    | 278.281 | 30.193364 |
| C         | 28.699              | 7.686                     | 0.2678006            | 31.044        | 0.34783128    | 88.2579 | -19.647106 |
| B         | 24.580              | 27.475                    | 1.1177923            | 58.519        | 1.46562364    | 39.8212 | -6.9976510 |
| E         | 20.939              | 8.471                     | 0.4045606            | 66.990        | 1.87018425    | 35.7451 | -32.294127 |
| A         | 20.359              | 43.149                    | 2.1194303            | 110.139       | 3.98961465    | 27.5793 | -6.7740422 |
| G         | 20.204              | 17.764                    | 0.8792422            | 127.903       | 4.86885686    | 26.2484 | -8.7744995 |
| F         | 16.305              | 22.602                    | 1.3862619            | 150.505       | 6.25511876    | 24.0460 | -9.7256292 |

\[ \text{SIGMA}_{m^2}=256 \]

\[ \text{Rm}=19 \]

NIFTY has been taken as the market index and daily index figures for the period January 1, 2005 to September 30, 2009 have been obtained. Risk free return has been taken to be the Average Gsec yield between the same periods. The expected return, variance, correlation with the market, unsystematic risk, the intercept and the beta for all the 7 mutual fund schemes have been calculated.

All the schemes have expected returns higher than the risk free rate of return. For determining which of these schemes will be included in the optimal portfolio it is necessary to rank the schemes from highest to lowest based on excess return to beta ratio.

The next step is to determine the schemes for which the excess return to beta ratio is higher than a particular unique cutoff point \( C^* \). The value of the cutoff rate \( C^* \) is given by

\[
C_i = \frac{\sigma_m^2 (R_i - R_f) \beta_i}{1 + \sigma_m^2 \beta_i^2 / \sigma_{\xi}^2}
\]

where: \( \sigma_m^2 \) is the variance in the market index, \( \sigma_{\xi}^2 \) is the variance of a stock’s movement that is not associated with the movement of the market index: this is the stock’s unsystematic risk. From table it can be seen that the only one scheme, Birla Sunlife Dynamic Bond have C values exceeding the corresponding \( (R_i - R_f) / \beta \) value. So only one scheme make it to the optimal portfolio. Once the composition of the optimal portfolio is known, the next step is to calculate the percentage to be invested in each security.
IV. Conclusion

In this paper we have tried to find the solution to the pertinent three issues related to mutual funds investment problems in Indian money market. We have approached this problem by initially selecting seven popular and best performing mutual funds schemes with different fund objectives, portfolio composition, and risk appetite. By applying popular risk return evaluation techniques, we have ranked these schemes using various methods. The findings are intuitive and somewhat revolutionary in the sense that in the booming bull market of last four-five years, a pure debt fund, Birla sun life dynamic bond fund emerged as top fund with highest Sharpe ratio value. This is even counter-intuitive in the sense that generally we know equity always outperform debt in the long run. However here we need to remember that last year was an abnormal year in the history of the economy and investing as we confront greatest depression during the last 80 years. Following this all the equity mutual funds perform dismal and witness unprecedented volatility. So we can interpret our findings as a special case in the context of the general investment theory.

The observation substantiate the general believe that although India is flooded with different type of numerous mutual fund schemes, actually most of them are “me to” product and investors have little scope to chose really. We observe very high positive correlation almost tending towards +1 between themselves and with the representative benchmark index. This leaves very little scope of diversification or contrarian scheme selection for investors.

Effort to construct an optimal portfolio by choosing multiple schemes of different risk-return combination following Sharpe’s Single Index Model also get somewhat restricted as we come across only one scheme that to again a debt fund, Birla sun life dynamic bond fund with 100% weightage. No other schemes qualify in the optimal portfolio construction. This result may be put into context considering risk averse nature of investors and sever fall and extreme volatility observed in the NET ASSEST VALUE of the equity and equity oriented mutual fund schemes in 2008-2009.

Our endeavor can contribute to the practical world for evaluating mutual fund schemes and constructing real life optimal portfolio for investors. These may be particularly relevant in the bear phase of stock market when returns are not so high and investor’s have limited risk appetite. These may again be extended to very risk averse investors in normal time also. Further studies are required to be done with a larger number of mutual fund schemes and different time periods to evaluate whether this holds true under any other circumstances.
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