Chapter 4
Survey of Literature on Portfolio Optimization

One of the longest-standing debates on the process of investment has been about portfolio optimization. In order to have a comprehensive review of literature, ongoing debates on the proper model and appropriate strategy for construction and management of optimal portfolios are separately reviewed in Part A and Part B, respectively.

Part A
Optimal Portfolio Construction

The question of how to construct optimal portfolios is an unresolved issue in financial research. The first formal attempt to develop a methodology for determining the optimal portfolio has been done by Markowitz in 1952. The Markowitz approach has been criticised because of the number of inputs required to solve portfolio problem and the computational complexity of portfolio optimization. Many studies have been conducted to overcome these problems.

4.1 The Markowitz Portfolio Theory

Markowitz (1952) developed the portfolio theory or modern portfolio theory. In general, portfolio theory is grounded on diversification concept which aims to reduce the total risk of portfolio without sacrificing portfolio return. He rejected the rule that investors should maximise expected returns because it never implied the superiority of diversification. In addition, he rejected the law of large numbers which states that the investor should diversify his funds among all those securities which give maximum expected return. This rule does not consider the intercorrelation of securities returns. He mathematically formulated the concept of diversification but emphasised that the adequacy of diversification does not depend only on the number of securities held. The components of portfolio must be related to different sectors, if most of the stocks which are components of portfolio related to the same industry they are more likely to do poorly at the same time. He demonstrated that the portfolio risk comes from covariances of the securities which are portfolio constituents and it should be avoided to invest in securities with high covariance among themselves. He stated that the firms in different industries have a lower covariance than firms within the same industry and if allocation is done across different industries, it minimises the portfolio risk in different economic situations. He quantified risk variable under certain assumptions. He formulated
portfolio risk and showed that the risk of the portfolio may be less than the risk of each security in the portfolio taken individually. He developed the expected return-variance of return (E-V) rule which states that the investors would be interested to select portfolio with maximum expected return for a given variance or minimum variance for a given expected return. He introduced the efficient frontier and provided mathematical framework in which risk and return can be optimised according to risk profile of each investor.

Sharpe (1964) remarked that Markowitz developed an analysis based on the expected utility maxim and proposed a general solution for the portfolio selection problem. Sharpe (1966) stated that the portfolio theory defines efficient techniques for portfolio selection by predictions about the performance of each security. He also stated that the portfolio theory emphasises on both expected return and risk and optimal portfolio is selected among the efficient portfolios based on investor’s preferences about risk and expected return.

Levy and Sarnat (1970) remarked that Markowitz portfolio selection provides a positive explanation and normative rules for the diversification of risky assets but effectiveness of diversification to reduce risk depends on the correlations among security returns. They argued that in the absence of perfect positive correlation, diversification could reduce risk but in the presence of perfect positive correlation, no amount of diversification can reduce risk. They suggested that in the presence of high positive correlation within an economy, risk reduction might be facilitated by diversification through international securities and construction of optimal international portfolio.

Ross (1978) argued that Markowitz approach is the first analytic attempt to select portfolio based on risk–return trade-off. He opined that this model stresses the role played by covariances among assets in determining the proportions of optimal portfolio.

Bowen (1984) stated that in the Markowitz portfolio selection, there is an attempt to search for a set of assets with high expected returns and low covariance of returns through diversification to produce a portfolio which promises to be profitable and not far from expectations.

Michaud (1989) argued that mean-variance optimization model provides a convenient framework for integrating investor constraints and objectives by construction of optimal portfolio. He argued that practical value of mean-variance model can be enhanced by appropriate adjustments of the inputs and imposition of constraints based on fundamental investment considerations. He recommended to include transaction and liquidity cost constraints. He emphasised that any available reliable information on the structure of the optimal prior should be included in the definition of the optimization problem.
Haugen and Baker (1990) stated that Markowitz portfolio model determines the optimal relationship between portfolio volatility and expected return. They opined that Markowitz model provides the accurate answer to minimum volatility question and it has superior tracking ability in the estimation period (in the past) and remarkable high predictive power in future period as well. Bodie et al. (1995) remarked that the Markowitz model can be viewed as a principal step in portfolio management as it introduces the efficient frontier of risky assets. Elton and Gruber (1997) argued that Markowitz formulated the portfolio selection problem as a choice of the mean and variance of portfolio. They stated that the main message of the modern portfolio theory is that assets could not be selected only based on individual characteristics but the co-movement of each asset with all the other assets must be taken into account. Chan et al. (1999) stated that the concept of portfolio mean-variance optimization forms the backbone of modern portfolio theory. They argued that portfolio optimization can yield substantial benefits in terms of risk reduction but the benefits promised by portfolio optimization depend on how accurately the moments of the distribution of returns can be predicted. Steinbach (2001) stated that Markowitz mean-variance approach offered the first systematic treatment of the conflicting objectives of high profit versus low risk. Rubinstein (2002) stated that Markowitz model is the first mathematical formalization of diversification in investment decisions. He remarked that the most important aspect of Markowitz model is considering the variance of entire portfolio instead of variance of assets individually. Chandra (2005) stated that Markowitz’s portfolio theory is the first formal attempt to quantify the risk of a portfolio and provide a methodology to determine the optimal portfolio. Plessis and Ward (2009) demonstrated that passive investment strategy, following a trading rule based on Markowitz optimal portfolio theory outperformed the South African Stock Market in the medium to long term. They argued that Markowitz optimization model provides the basis of a useful trading rule strategy. Fabozzi et al. (2012) remarked that Markowitz quantified the concept of diversification by the statistical notion of covariances between individual security returns and formulated the portfolio risk. They also argued that portfolio selection theory provides a framework to specify risk of investment and formalizes the interaction of the returns and risks across individual assets. Mandal (2013) stated that Markowitz model is a classic attempt to incorporate the concept of diversification in a portfolio as a risk-reduction mechanism.
4.2 Disadvantages of Markowitz Approach

Although Markowitz model is considered as a principal step in portfolio management, some theoretical and practical criticisms have been levelled against it in literature. The Markowitz portfolio theory has been criticised because its application requires computation of covariance for each combination of potential securities that are candidates for investment. Further, the construction of efficient frontier needs lengthy calculations which may not add value for investors. Markowitz (1959) argued that analyses based on semivariance tend to produce better portfolios than those based on variance because variance considers extremely high and extremely low returns equally undesirable. Therefore, the analysis based on variance seeks to eliminate both extremes but an analysis based on semivariance concentrates on reducing losses. He stated that the superiority of variance with respect to cost, convenience and familiarity does not preclude the use of semi-variance. He contended that if all distributions of returns are symmetric or have the same degree of asymmetry, the variance and semivariance produce the same set of efficient portfolios. He discussed the pros and cons of replacing the variance by alternative risk measures such as standard deviation, semivariance, expected value of loss, expected absolute deviation, probability of loss and the maximum loss in mean-risk approach. He concluded that there is always a portfolio efficient in terms of expected return and semivariance which is at least as good as the best portfolio based on analysis using expected return and variance. In addition, he concluded that portfolios selected on the basis of expected loss, expected absolute deviation and probability of loss are not to be trusted because they can be foolishly speculative even when apparently conservative. He argued that the assumption that a utility function exists rules out maximum loss as a measure of risk. Sharpe (1963) highlighted considerable number of inputs, the large required computing time and memory space as flaws of Markowitz standard quadratic programming problem. Elton et al (1976) outlined the difficulty in estimating required inputs particularly correlation matrices, the time and cost necessary to generate efficient portfolios and the difficulty of educating portfolio managers to use risk return trade-offs as the obstacles to the implementation of Markowitz approach. Black and Litterman (1992) stated that quantitative models have not helped in portfolio management. They argued that implementation of these models often induces unrealistic portfolios and these unreasonable results have limited the utility of these models to the practical problems. For example, they pointed out that these models result in assigning unreasonably high weights for the low capitalization stocks and insignificant weights/ no weights/negative weights to other stocks.
They attributed the difficulties in these models to two reasons; first, the expected returns are very difficult to estimate, therefore, a set of auxiliary assumptions is required to enhance the views of investor and second, the sensitivity of optimal portfolio asset weights to return assumption used. They argued that combination of these two problems causes the standard model has no way to distinguish between the views of investor from auxiliary assumptions so constructed optimal portfolio does not contain views of investor. They claimed that in practice, despite the obvious conceptual attractions of a quantitative approach, a few portfolio managers accept these models have a main role in their asset allocation decisions. Chopra and Ziemba (1993) argued that mean-variance optimization is very sensitive to errors in the estimates of the inputs. They showed that small changes in the inputs parameters can result in large changes in the composition of the optimal portfolio. They showed that errors in estimate of means are the most important followed by errors in variances, and errors in covariance are the least important in terms of their influence on portfolio optimality. They opined that using forecasts that do not accurately reflect the relative expected returns of different securities can substantially degrade mean-variance performance. They claimed that the relative impact of errors in means, variances and covariances depends on the investor’s risk tolerance. They demonstrated that for a risk tolerance of 50, errors in means are about eleven times as important as errors in variances and errors in variances are about twice as important as errors in covariances. They concluded that for investors with moderate to high risk tolerance, the cash equivalent loss for errors in means is an order of magnitude greater than that for errors in variances or covariances.

Some unrealistic assumptions of modern portfolio theory have been widely challenged in literature.

Steinbach (2001) argued that mean-variance approach has received comparatively little attention in the context of long-term investment planning. He stated that although Markowitz did consider true multi-period models where the portfolio may be re-adjusted several times during the planning horizon, these considerations used a utility function based on the consumption of wealth over time rather than mean and variance of the final wealth. He employed multi-period mean-variance approach based on scenario trees He concluded that multi-period mean–variance problems behave much like their single-period counterparts in many respects. In addition, he opined that the absence of transaction cost as one of assumptions in portfolio theory causes serious errors when many transactions are performed, as in continuous-time models. Furthermore, he claimed that the assumptions of the investor about the future, which are represented by probability distributions of the asset returns, either
based on assessments of financial analysts or estimated from historical data (or both) are never exact.

In modern portfolio theory the asset returns are assumed to have normal probability distribution. Many studies show that financial returns do not follow a normal distribution or any symmetric distribution. Beedles (1979) showed that the returns distribution of market portfolio is not symmetric and it has skewness. He also demonstrated that this skewness is unstable over time. Longin (2005) stated that real financial data tend to exhibit extreme price changes such as stock market crashes that seem incompatible with the assumption of normality. He showed that normal distribution tends to underestimate the weight of extreme returns contained in the distribution tails.

In modern portfolio theory, decision criterion is based on the expected return and standard deviation. Several studies support that the higher moments of returns distribution should be considered in the portfolio analysis. Lai (1991) stated that in the continuous-time models asset prices follow a diffusion process, therefore, the higher moments are irrelevant to the investor’s decision and mean-variance approach provides optimal portfolio selection. However, in discrete time models the mean-variance approach becomes inadequate and the higher moments must be considered to portfolio selection. He stated that in the presence of skewness, investor’s preference among multiple objectives such as maximizing portfolio expected return and skewness and minimizing risk of portfolio can be incorporated into polynomial goal programming approach to solve portfolio selection problem. He contended that an inefficient mean-variance portfolio may be optimal in the mean-variance-skewness content. Jondeau and Rockinger (2006) argued that mean-variance criterion which is two-moment optimization strategy provides a good approximation of the expected utility maximization when returns distribution shows moderate non-normality, but under situation of large departure from normality, the mean-variance criterion may fail to approximate the expected utility correctly. They suggested that when returns distribution has more severe departure from normality, the three-moment or four-moment optimization strategies may provide a good approximation of the expected utility. Xiong and Idzorek (2011) modelled the non-normal returns of multiple asset classes and incorporated these returns into the mean-conditional value at risk (M-CVaR) optimization framework. They found that both skewness and kurtosis affect the M-CVaR optimization and result in substantial different allocation in comparison with mean-variance optimizations.
4.3 Developments in portfolio theory

Markowitz efficient frontier is determined in the absence of risk free asset. The model for determining efficient frontier in the existence of risk free asset was originally developed by Tobin (1958). He argued that risk-averse investors show liquidity preference as behaviour towards uncertainty. He extended Markowitz’s work by adding a risk free asset to the portfolio problem. His efforts resulted in Tobin separation theorem. He proposed that portfolio selection problem can be separated into two steps; first step is to find optimal portfolio of risky assets, and second step is to temper the risk by borrowing or lending at the risk free rate depending on investor’s attitude towards risk. He argued that the combination of risky portfolio on the efficient frontier and risk-free asset can result in portfolios with superior risk-return profiles than portfolios on the efficient frontier.

Several algorithms have been developed to produce solutions based on the mean–variance model. In addition, various studies have been carried out to simplify Markowitz’s assumptions in an attempt to operationalize the model. Amongst the prominent results of these simplifications are the diagonal model and linear programming approximation of Sharpe (1963), the multi-index models of Cohen and Pogue (1967), Jacob’s limited diversification model (1974) and the simple criteria of Elton et al. (1976).

Sharpe (1963) developed the single index model to simplify Markowitz model in order to make it more practical to use. He introduced the model which is based on calculation of expected covariance for each stock relative to the market index instead of calculation of expected covariance for each pair of stocks. He contended that the findings obtained by applying limited number of parameters in his own approach in comparison with the large number of estimates in Markowitz model, may appear relatively analogous. Phillips and Seagle (1975) stated that in Sharpe model the returns on various securities are assumed to be related only through common correlations with the market return. Elton et al. (1976) stated that Sharpe single index model generates variance–covariance structure by assuming that the only joint movement between securities comes about because of a common response to market movements.

Cohen and Pogue (1967) studied a specialized multi-index model to select portfolios. They used standard industrial classification to categorise the stocks in their sample into the related industries. In this approach, firms were classified based on final product such as steel or chemical. By comparing the single index model and multi index model they concluded that the single index model has more appropriate properties than multi-index model. The single
index model is preferred because of its simple application and low expected risk. On the contrary, Affleck-Graves and Money (1976) contended that portfolios based on multi-index model are more similar to portfolios using Markowitz approach than to the single index model. They argued that the more indices included in multi-index model, the more realistic the model is.

Jacob (1974) introduced a mean-variance portfolio selection model for the small investor. She suggested that it may be optimal for the individual to accept some unsystematic risk if there are compensating advantages in terms of reduction of total risk and lower transactions costs. Her model allows explicit control over the number of securities to be held by the investors, while incorporating the effects of unsystematic risk.

Elton et al. (1976) introduced a simple criteria technique to simplify Markowitz model, assuming that the correlation between all pairs of securities is the same. They assumed that a good estimate of all pairwise coefficients is a single number; therefore, a simple decision which does not involve mathematical programming can be used to reach an optimal solution to the portfolio problem. They argued that a simple numerical solution technique which is under the assumption of constant correlation coefficient is more accurate than Sharpe linear programming approximations (1967) and reach the same solution to the portfolio problem as the exact quadratic programming method.

Black and Litterman (1992) introduced an approach which is combination of the mean-variance optimization framework of Markowitz and the capital asset pricing model (CAPM) of Sharpe. They showed how the opinion of the investor can be incorporated into optimization problem in order to construct a portfolio which is more desirable for the investor. They contended that their approach allows to distinguish between the views of investors and the set of expected excess returns used to derive the portfolio optimization. They argued that their approach produces optimal portfolios that start at a set of neutral weights and then tilt in the direction of the investors’ views. Therefore, by adjusting the confidence in the investors’ view, the investors can control how strongly the views influence the portfolio weights. Moreover, by specifying a ranking of confidence in different views, the investors can control which views are expressed most strongly in the portfolio. Kempf and Memmel (2005) stated that expected returns can hardly be estimated from time series data and these estimation errors lead to a suboptimal portfolio composition and thus to the poor portfolio performance. They stated that covariance matrices can be estimated much more precisely than the expected returns and the estimation risks of the investors are expected to be reduced. They claimed that global minimum variance portfolio has the smallest risk, because
its composition depends only on the covariance matrix of stock returns and therefore all investors who optimize the trade-off between expected return and risk of their portfolios should then combine the global minimum variance portfolio with the risk-free asset. They applied ordinary least squares (OLS) methodology to derive the conditional distributions of the estimated portfolio weights and estimated return parameters and showed that the weights of the global minimum variance portfolio are equal to regression coefficients.

4.4 Asset Pricing Models

The asset pricing models have played a crucial role in the evaluation of portfolio performances. One of the ways to evaluate portfolio performance is calculation excess returns as the difference between portfolio returns and returns from return-generating models. Asset pricing models or return-generating models describe the prices or expected returns of securities. They prescribe functional relations between expected returns and risk measures of securities. Jensen (1968) used CAPM as return-generating model to evaluate performance of portfolios. Among various asset pricing models capital asset pricing model (CAPM) of Sharpe (1964), Lintner (1965) and Mossin (1966), Fama and French three-factor model (1993) and Carhart four-factor model (1997) have been widely used in literature to evaluate performance of portfolios.

Sharpe (1964), Lintner (1965) and Mossin (1966) independently introduced the capital asset pricing model (CAPM). Their model describes the linear relationship between expected return of security or portfolio with systematic risk of security or portfolio. They argued that the market presents investors with two prices which are the price of time and the price of risk. The price of time compensates the investors for placing money in any investment over a period of time and the price of risk compensates the investors for taking on additional risk. They measured the risk of security by covariance of security return with the market return and to quantify this relative covariance they used the beta parameter which is measure of sensitivity of security return to the market return.

Black (1972) explored the nature of capital market equilibrium under two different assumptions that are more restrictive than assumptions of Sharpe, Lintner and Mossin CAPM. In the first assumption, he assumed that there is no riskless asset and that no riskless borrowing or lending is allowed. In second case, he assumed that there is a riskless asset and that long positions in the riskless asset are allowed but that short positions in the riskless asset are not allowed. He assumed in both cases that investors can take unlimited long or short positions in the risky assets. He found that in both cases the expected return on any risky
asset is a linear function of its beta, just as it is without any restriction on borrowing. He showed that if there is a riskless asset, then the slope of the line relating the expected return on a risky asset to its beta must be smaller than it is when there are no restrictions on borrowing. He stated that the empirical findings are not consistent with Sharpe, Lintner and Mossin CAPM and argued that they are consistent with the model in which borrowing is restricted. He concluded that the line relating the expected return on an efficient portfolio to its beta is composed of two straight line segments and the segment for lower risk portfolios has a greater slope than the segment for the higher risk portfolios. After the introduction of the CAPM, many other extensions of this single-factor pricing model are introduced.

Merton (1973) developed an intertemporal model of the capital market which is consistent with the expected utility maximization and the limited liability of assets. He stated that single period maximizer does not consider events beyond the present period but the intertemporal maximizer in selecting his portfolio takes into account the relationship between current period returns and returns that will be available in the future. He argued that in case of changing investment opportunities, the CAPM no longer holds intertemporally and showed that portfolio behaviour for an intertemporal maximizer will be significantly different when he faces a changing investment opportunity set instead of a constant one.

The intertemporal CAPM (ICAPM) is a multifactor model and in contrast to the static CAPM in which investor maximize his terminal utility at the end of a particular time period, the ICAPM assumes that time flows continuously and the investor maximizes the utility over a whole time. Merton suggested that there is at least another factor besides the market that systematically affects the returns on securities. ICAPM considers all the required state variables which are needed to describe the characteristics of the investment opportunity set. The number of factors will be equal to the one plus number of state variables that drive the investment opportunity set through time.

Ross (1976) proposed the arbitrage pricing theory (APT) which is a general theory of asset pricing and as an alternative to the CAPM introduced by Sharpe, Lintner and Mossin. He argued that the expected return of a financial asset can be modelled as a linear function of the asset’s sensitivities to the various macro-economic factors or theoretical market indices. In the APT, the sensitivity to changes in each factor is represented by a factor-specific beta coefficient.

The APT is a multifactor model and due to having flexible assumptions can be considered as a substitute for the CAPM. In the APT, the number and nature of factors is likely to change
over time and between economies; therefore, this issue is essentially empirical in nature and it is the responsibility of the investors to identify the factors affecting on price of stocks.

Breeden (1979) developed an intertemporal capital asset pricing model permitting both stochastic consumption-goods prices and stochastic investment opportunities. He argued that the relation of an asset’s return with aggregate consumption precisely measures its relevant risk, whereas the return’s relation to aggregate wealth is not an adequate measure of an asset’s risk; therefore, measured beta of securities relative to changes in the aggregate real consumption rate rather than relative to the market. He utilized the same continuous-time economic framework as that used by Merton (1973) and showed that Merton’s multi-beta pricing equation can be collapsed into a single-beta equation and expected excess return on any security is proportional to its covariance with respect to aggregate consumption alone.

The Breeden’s model, which is known as the Consumption CAPM (CCAPM), is an extension and generalization of Merton’s (1973) continuous-time model. It is a single factor pricing model which unlike the CAPM the beta of the CCAPM is not measured in respect to aggregate market wealth and the risk of asset is determined by covariance of asset return with aggregate consumption.

Stulz (1981) developed an international capital asset pricing model (International CAPM) which admits differences in consumption opportunity sets across countries and has no barriers to international investment. He assumed that the markets are fully integrated and argued that the real expected excess return on a risky asset is proportional to the covariance of the return of that asset with changes in the world real consumption rate.

Cox et.al (1985) developed a continuous time general equilibrium model of a simple but complete economy and used it to examine the behaviour of asset prices. They presented a partial differential equation which asset prices must satisfy. They showed that the solution of this equation determines the equilibrium price of a given asset in terms of the underlying real variables in the economy. They argued that by combining this solution with probabilistic information about the underlying variables, one can answer a wide variety of questions about the stochastic structure of asset prices.

Cochrane (1991) introduced a production-based asset pricing model which is analogous to the standard consumption-based model of Breeden (1979). He used producers and production functions in the place of consumers and utility functions. He argued that his model ties stock returns to marginal rates of transformation which are inferred from investment data through a production function. He used the production-based model to examine forecasts of stock
returns by business-cycle related variables and the association of stock returns with subsequent economic activity.

Fama and French (1993) proposed the three-factor model to describe stock returns. They found that the cross-section of stock returns shows little relation to either the market beta of CAPM or the consumption beta of CCAPM. On the other hand, they showed that the variables such as firm size, leverage, earning to price and book to market ratios have explanatory power for the cross-section of stock returns but in combinations, size and book to market equity seem to absorb the apparent roles of leverage and earning to price ratio in stock returns. They also used time-series regressions and argued that a market factor and risk factors related to size and book to market equity largely capture the common variation in stock returns through time.

The Fama and French three-factor model is widely used in literature to select portfolios and evaluate portfolio performance. It is also used to measure abnormal returns in event studies and estimate the cost of capital.

The results of many empirical studies showed that the static CAPM is unable to explain satisfactorily the cross section of average returns on stock because it assumes that betas remain constant over time and the return on the value weighted portfolio of all stocks is a proxy for the return on aggregate wealth.

Jagannathan and Wang (1996) introduced the conditional CAPM which is different from CAPM and it has three betas and resembles the multifactor model of Ross (1976). They assumed that the CAPM holds in a conditional sense, that is, betas and the market risk premium vary over time. They also included the return on human capital when measuring the return on aggregate wealth. They argued that the conditional version of the CAPM explains the cross section of stock returns well.

Carhart (1997) developed a four-factor model in order to explain returns. He extended Fama and French’s (1993) three-factor model by adding price momentum factor which captures Jegadeesh and Titman’s (1993) one-year momentum. He argued that his model is consistent with a model of market equilibrium with four risk factors. He showed that the four-factor model explains the considerable variation in returns. He found that the four-factor model substantially improves, on the average, pricing errors of the CAPM and the three-factor model. He stated that the three-factor model is superior to CAPM in reducing the average pricing errors but its errors are strongly negative for last year’s loser stock portfolios and strongly positive for last year’s winner stock portfolios. He argued that the four-factor model
eliminates almost all the patterns in pricing errors, therefore, describes well the cross-sectional variation in average stock returns.

Acharya and Pedersen (2005) developed liquidity-adjusted capital asset pricing model. They offered a simple theoretical framework that illustrates several channels through which liquidity risk can affect asset prices. They showed that the return of security increases with covariance between security’s illiquidity and the market illiquidity, decreases with the covariance between the security’s return and the market illiquidity, and decreases with the covariance between security’s illiquidity and market return. They found that a persistent negative shock to a security’s liquidity results in low contemporaneous returns and high predicted future returns. They argued that the liquidity-adjusted CAPM explains the data better than the standard CAPM while still exploiting the same degree of freedom.

4.5 Portfolio Performance Evaluation

Portfolio evaluation is a crucial stage in portfolio management. Evaluation models originate from the theories of portfolio management. According to modern portfolio theory, in the process of performance evaluation, investors must be concerned with return and risk as well. A variety of evaluation techniques are employed in literature. The basis of these performance measures is that the return of a portfolio is adjusted for the risk it bears over the time period under consideration. Typically, the adjustment is either based on the Security Market Line (SML) or the Capital Market Line (CML). The measures developed by Sharpe (1966) and Modigliani (1997) are based on CML, whereas the measures proposed by Treynor (1965) and Jensen (1968) are based on SML.

Treynor (1965) argued that return achieved in mutual, trust and pension funds is subject to wide market fluctuations which are not under the control of investment managers. He stated that other kind of risk is available in diversified fund which is produced by fluctuations in the particular securities held by the fund. He opined that these risks result in some problems: First, the outcome of investment manager is troubled by fluctuations in the market and this trouble is not solved by averaging return because most of the time, market trends dominate average return and also measures of average return do not allow for different investor risk aversion. Second, fluctuations in one or a few stocks are important for investors and that is why they do diversification. He remarked that in order to have a practical evaluation model, a measure of management performance must deal efficiently with these issues. He introduced a method to rate performance of fund managers which transcends variation in individual investors’ attitudes toward risk. He developed an evaluation model which can quantitatively
compare the performance of mutual, trust and pension funds in spite of market fluctuations and different risk policies. He argued that the critical dimension of the quality of the investment management is evaluated by this model. He measured the performance of the fund by the ratio of portfolio return in excess of the risk free rate to the volatility of the fund as an approximate measure of fund risk.

Sharpe (1966) attempted to extend Treynor’s work and evaluated the predictive ability of Treynor measure. He defined reward to variability ratio whose numerator is the difference between average return of fund and pure interest rate and its denominator is standard deviation. He introduced this ratio as a measure of performance which disregards risk per se and concentrates on the relationship between fund reward and the risk actually borne. He showed that performance evaluation can be done by meaningful measure which considers both risk and average return. He made a comparison between reward to variability ratio and reward to volatility ratio of Treynor. He argued that if mutual funds hold highly diversified portfolios, Treynor ratio ranks the funds similar to Sharpe ratio because the returns on all diversified portfolios move with the market. Therefore, the volatility of fund return respect to market can be a good proxy of total variability of the fund return. In this situation Treynor ratio as a measure of past performance which mirrors reward to variability ratio with lower cost is superior measure. But if mutual funds hold some relatively undiversified portfolios, the results of ranking are not the same. He contended that the Treynor ratio cannot capture the portion of variability that is due to lack of diversification. In this situation, Treynor ratio is an inferior measure of past performance but because of the mentioned inability, it may be superior measure for predicting future performance.

Jensen (1968) considered the portfolio performance from two dimensions which are the ability of portfolio managers to increase portfolio return through successful prediction of future security prices and the ability of portfolio managers to minimise the risk of portfolio through efficient diversification. He considered the lack of a comprehensive understanding of the nature and measurement of risk as a major difficulty to evaluate the portfolio performance in these two dimensions. He emphasised that in the performance evaluation of the portfolios the effects of differing in risk levels on those portfolios returns must be considered. He used capital asset pricing model (CAPM) which is developed by Sharpe (1964), Lintner (1965) and Mossin (1966) to formulate the measure of portfolio performance in order to evaluate predictive ability of portfolio managers. He argued that this measure evaluates the ability of managers to earn higher returns through successful prediction of security prices relative to returns which we could expect given the level of their portfolio risks. He contended that
Treynor measure and Sharpe measure are relative measures of performance which rank portfolios but his measure is an absolute measure of performance which quantifies additional returns that could be obtained by successful prediction of security prices. He measured the forecasting ability of portfolio managers by difference values between portfolio returns and the returns predicted by the CAPM at specified level of portfolio risks.

Fama (1972) developed an analytical method to distinguish the part of portfolio return which is due to selectivity ability of portfolio manager to select the best securities of a given level of risk from the part which is due to market timing ability to successfully predict the general market price movements and to measure the effects of foregone diversification when portfolio manager applies inadequate diversification. He subdivided the portfolio return into two parts --the return from selectivity and the return from bearing risk and made finer subdivisions of both parts. He decomposed selectivity return into diversification return and net selectivity. He elaborated portfolio performance by decomposition of portfolio return to four components --risk free return, return from market timing, return from foregone diversification and return from net selectivity.

Modigliani and Modigliani (1997) developed the measure of risk-adjusted performance (RAP) that is grounded in modern portfolio theory. They argued that total return is an inadequate measure of the portfolio performance because it ignores risk and for evaluating portfolio performance risk differential must be considered. They claimed that RAP compares portfolio performance after appropriately adjusting the portfolio return for risk. They stated that RAP provides a simple answer to the question whether returns adequately compensate investor for the risk that he bears. They explained that the basic idea behind RAP is to use the market opportunity cost of risk to match all portfolios risks to that of the market benchmark and then measure the returns of these risk-matched portfolios. They stated that in the RAP evaluation the portfolios are measured on a risk-equivalent basis. They argued that RAP adjusts every portfolio to the level of risk in its unmanaged benchmark and then measures the performance of this risk-equivalent portfolio. They used the market opportunity cost of risk and the financial operation of leverage viz. borrowing and lending to adjust the risk of portfolio returns simply and accurately. They showed that the portfolio and its benchmark (market portfolio) must have the same risk to be compared in terms of basis points of risk-adjusted performance. They proposed to lever or de-lever a portfolio, that is, shift it up or down the capital market line so that portfolio standard deviation is identical to that of the market portfolio and presented the resulting risk-adjusted return as the ranking variable. They contended that this procedure produces the same ranking as obtained by applying the Sharpe
Ratio but this measure is easier to understand by the average investor than the Sharpe ratio. They argued that RAP can be directly compared to the market portfolio return and the higher value of RAP shows the superiority of the portfolio performance.

### 4.6 Comparison of Markowitz and Sharpe approaches

Frankfurter et al. (1976) demonstrated that under conditions of uncertainty, the Sharpe approach appears less subject to erratic behaviour when relevant historical data are limited. However, Sharpe approach’s advantage over the Markowitz model reduces when more data are available. They illustrated that the Sharpe approach outperformed the standard Markowitz approach in its ability to discriminate against inefficient portfolios and to select efficient ones. They showed that under conditions of uncertainty, the Sharpe approach has potential advantages over the Markowitz approach.

Affleck-Graves and Money (1976) found that in Markowitz approach the lower the upper bound, the wider the diversification is. So, for the same level of risk the higher the upper bound, the greater the expected return on the portfolio will be. They compared Markowitz and single index model and argued that Markowitz approach provides results which are significantly superior to those obtained using single index model. They showed that portfolios obtained by single index model are more diversified compared to portfolios obtained by Markowitz approach when upper bound equals to one in both models. They concluded that the investor desiring to apply a risk-return approach to portfolio selection should attempt to employ the basic Markowitz formulation; if this is impossible, an index model maybe used. They emphasised that the constructed portfolio based on single index model may be extremely conservative. Nevertheless, if the total amount to be invested is very large, the imposition of low upper bound is inevitable to ensure that the proportion of funds to be invested in any one security will be realistic and not too large for practical application. In this situation single index model may be more reliable.

Bowen (1984) stated that because of the numerous inputs required; it is difficult to apply the Markowitz model and opined that Sharpe single index model helps to alleviate this difficulty. He outlined the difference between theory and practice of portfolio analysis in the context of risk. He also pointed out some issues regarding the assumptions of general portfolio theory and described some practical problems to implement the portfolio theory. He concluded that because of existing semantic and statistical barriers, the regular businessman avoids grappling the portfolio theory approach.
Varian (1993) reviewed the history of the quantitative revolution in finance which has been accomplished by Markowitz modern portfolio theory, Sharpe single index model and Capital Asset Pricing Model (CAPM) and Miller’s fundamental contribution to the theory of corporate finance. He argued that there are common strands of theory and empiricism running through the works of these three economists and the fruitful relationship between theory and data results in success. Omet (1995) argued that the results of Markowitz approach and Sharpe single index model are the same; but, he opined that Sharpe single index model is more practical than the Markowitz approach in construction of optimal portfolio. Mehta (2008) compared the Markowitz and Sharpe’s approaches to portfolio construction in the Indian context and concluded that Markowitz’s model is better than Sharpe’s approach to reduce portfolio risk. However, he found that there is no significant difference in average returns of portfolios constructed using the two approaches. He suggested that the Sharpe's single index model is suitable to construct optimal portfolio for aggressive investors since it is simple and easy to use as compared to Markowitz's mean-variance model. Bekhet and Matar (2012) investigated the risk-adjusted performance of portfolios constructed using the Markowitz and Sharpe single index approaches in Amman market and argued that there is no significant difference between these two approaches and the numbers of stocks in the portfolios do not affect the results. According to literature, Markowitz mean-variance approach and Sharpe single index model are the best approaches to construct optimal portfolio. Therefore, it is necessary to know whether there is any difference between these two approaches. Some of the studies that were conducted to compare the optimal portfolio using Markowitz and Sharpe single index approaches have come to conflicting conclusions. While some of the studies have concluded that there is difference in the characteristics of the portfolios constructed using Markowitz and Sharpe model, others have concluded that there is no difference in the characteristics of the portfolios. Very few studies have investigated this issue in the Indian context. Therefore, this study can provide fruitful information to the literature which may be helpful for portfolio managers to construct portfolios.
Part B
Portfolio Management Strategies

The active and passive portfolio management strategies are two basic strategies that are used to manage portfolios. According to Elton et al. (2010), active managers can be divided into three groups: market timers, sector selectors and security selectors. One of the long-lasting debates in portfolio management is superiority of active strategy over passive strategy. Many researches have been carried out to identify whether active strategy is superior to passive strategy. Conflicting conclusions have been achieved by these studies.

4.7 Review of International Studies

Friend et al. (1962) conducted an extensive study on mutual fund industry in the US. They investigated the growth of investment companies and the performance of mutual funds. They found that, on the average, mutual funds earned lesser annual return than their composite benchmark over their study period. They argued that mutual funds did not differ appreciably from what would have been achieved by an unmanaged portfolio consisting of the same proportions of common stocks, preferred stocks, corporate bonds, Government securities and other assets as the composite portfolios of the funds. They showed that about half of the funds performed better, and half worse, than the unmanaged portfolio.

Treynor and Mazuy (1966) examined the ability of investment managers to anticipate major turns in the stock market. They argued that if management is right more often than wrong in its attempts to outguess the market, the characteristic line pattern will be curved. They studied the performance of fifty seven mutual funds for a period of ten years from 1953 to 1962 and found no evidence of curvature of the characteristic lines of any of the funds. They concluded that over this period, the mutual fund managers could not outguess the market, that is, they had no ability to anticipate whether the general stock market is going to rise or fall and adjust the composition of their portfolios accordingly.

Sharpe (1966) evaluated the performance of thirty four mutual funds during the period from 1954 to 1963, and compared their performance with Dow Jones Industrial Average index. He found that the average reward to variability ratio for the funds was considerably smaller than that of Dow Jones Industrial Average index. He concluded that mutual funds, in his sample, underperformed the Dow Jones Industrial Average index during study period.

Jensen (1968) assessed the performance of one hundred fifteen mutual funds for the period between 1955 and 1964. He considered Standard and Poor Composite 500 price index as a market and found that the average of alpha measures was negative which indicated that, on
the average, the funds earned lesser than they should have earned given their level of systematic risk. He argued that the negative alphas imply that the funds, in his sample, were not able to forecast future security prices well enough to outperform a buy-the-market-and-hold policy and even to recover their brokerage expenses during the period of his study.

Carlson (1970) argued that the inferences drawn from calculations of return depend on the type of fund, the time period and the choice of benchmark. He examined the Sharpe and Jensen measures for different type of fund and time period, that is, for eighty two common stock funds during the period 1948-1967. He stated that his results were inconsistent with both Sharpe and Jensen. He showed that with the same benchmark in his time period, alpha was positive but in Jensen study which was conducted in different time period, alpha was negative. He highlighted that his results were in opposite direction from Sharpe’s results as his results were statistically significant in favour of funds outperforming the market.

McDonald (1974) evaluated the performance of one hundred twenty three American mutual funds in the period 1960-1969. He argued that the results of evaluating the performance of the mutual funds are consistent with some small degree of success in stock selectivity and market timing over his study period. He showed that in terms of Treynor and Jensen measures, approximately one-half of the funds in the sample outperformed the market but two-third of the funds had Sharpe ratios which were less than the market’s value. He concluded that for the mutual funds in the sample, the results implied neither significantly superior nor inferior performance during his study period.

Kon and Jen (1979) used the Quandt (1972) switching regression model, with a new identifiability condition and formulated an empirically tractable performance model in the context of a CAPM and Black (1972) equilibrium benchmark models to evaluate an investment manager ability to forecast the prices of individual securities and to forecast the future realizations on the market factors. They claimed that their investment performance model provided separable measures of timing and selectivity. Their sample consisted of forty nine mutual funds that reflected a wide range of investment objectives from January 1960 to December 1971. They found that many individual funds were able to generate significant superior selectivity performance. They concluded that, on the average, the mutual funds in the sample were able to predict security prices adequately to outperform the naïve policy (combinations of the riskless asset and market portfolio) given their selected levels of systematic risk and to recover all management charges and transaction costs. Their results were inconsistent with Jensen (1968) conclusion.
Henriksson (1984) attempted to find whether the excess returns achieved by active management are sufficient to offset the management charges and transaction costs. He evaluated the market-timing performance of one hundred sixteen mutual funds using Henriksson and Merton’s (1981) techniques to test the market-timing ability of investment managers from February 1968 to June 1980. He examined the performance of mutual funds in the sample by parametric test and his results showed little evidence of market-timing ability. He also applied non parametric test to examine whether active portfolio management can generate returns in excess of those earned by a feasible passive strategy. He found that, on the average, the funds in the sample did slightly worse than the passive strategy implying that no forecasting ability. He concluded that managers of mutual funds in the sample were not able to follow an investment strategy that successfully times the return on the market portfolio during his study period.

Grinblatt and Titman (1989) compared the abnormal returns of active and passive investment strategies with and without transaction costs. They employed the quarterly equity holdings of a large sample of mutual funds in the period 1975-1984. They categorised the sample of mutual funds according to different investment objectives and net asset values and examined the abnormal performance of these funds. They found that actual returns, on the average, did not exhibit positive abnormal performance for any category of funds, but the gross returns of both growth and aggressive growth funds were significantly positive on the average, even after adjusting for risk with a benchmark. They concluded that superior performance may exist, particularly among aggressive-growth and growth funds and those funds with the smallest net asset values, but because of highest expenses of these funds their actual returns, after deductions of all costs, do not show abnormal performance. They contended that, according to their results, the investors cannot take advantage of the superior abilities of these portfolio managers by purchasing shares in their mutual funds.

Ippolito (1993) reviewed several studies of mutual fund performance which were conducted from 1962 to 1991. He also reviewed his study (1989) that evaluated the performance of one hundred forty three mutual funds in the period 1965-1984. He applied the Jensen (1968) alpha performance measure for evaluating funds and found an average positive alpha which implied that mutual funds, on the average, were sufficiently successful in their trades to offset their expenses during his study period. He stated that according to his findings and previous research findings, large numbers of funds are sufficiently successful to generate an average industry experience that matches the returns available from index funds after subtracting expenses and adjusting for risk.
Gruber (1996) assessed the performance of two hundred seventy open-ended mutual funds during the period 1985-1994. He judged the performance of mutual funds by returns relative to the market and calculated risk-adjusted returns from a single index model and risk adjusted returns from a four index model and found that, in all cases, funds underperformed the benchmark; but his results indicated that the four index model did an excellent job of explaining mutual fund return behaviour as it explained 89 percent of the variability of return for the average fund in the sample. He concluded that the average actively managed funds had negative performance compared to appropriate passive market indices during his study period.

Ferson and Schadt (1996) evaluated the performance of sixty seven open-ended mutual funds from January 1968 to December 1990. They used unconditional performance evaluation models such as Jensen (1968) alpha measure, Treynor and Mazuy (1966) and Henriksson and Merton (1981) market timing models. They modified these models by incorporating lagged information variables such as dividend yield, term spread, short term interest rate, default spread and dummy variable for Januarys and called them conditional performance evaluation models. They used all these unconditional and conditional models to evaluate the performance of in sample mutual funds. They found very different results as in unconditional Jensen’s (1968) alpha model about two-thirds of the point estimates of the alphas were negative but in conditional Jensen’s alpha model about half (34 of 67) of the point estimates of the alphas were negative and half were positive. For unconditional Treynor and Mazuy (1966) model, 44 of the 67 estimates of the timing coefficients were negative whereas in conditional version of Treynor and Mazuy model, only 27 of the 67 estimates were negative. For unconditional Henriksson and Merton (1981) model, 46 of the 67 estimates of the timing coefficients were negative; however, in conditional Henriksson and Merton model, 25 out of 67 estimates were negative. They attributed the more pessimistic results of the unconditional models to the common variation in mutual fund betas and expected market returns and argued that the common variation is controlled using public information variables so the conditional models make the performance of the funds in the sample look better.

Wermers (2000) measured the performance of the mutual fund industry from 1975 to 1994. He found that funds hold stocks had gross returns more than the market but their net returns less than the market. He argued that about one third of the difference between gross returns and net returns was due to underperformance of nonstock holdings, whereas more than two third of this difference was due to expenses and transactions costs. He concluded that funds in the sample picked stocks well enough to cover their costs and also high-turnover funds beat
the passively managed counterpart such as Vanguard Index 500 fund on a net return basis over his study period. They stated that their evidence supported the value of active mutual fund management.

Otten and Bams (2002) investigated the performance of five hundred six European mutual funds from the five most important mutual fund countries -- France, Germany, Italy, Netherlands and UK from January 1991 to December 1998. They applied Carhart (1997) four-factor asset pricing model to evaluate performance of these mutual funds. They found positive alphas after deducting all the costs for countries in the sample except Germany. They concluded that European mutual funds, especially, small cap funds were able to add value during their study period. They contended that their findings differed from most US studies that argued mutual funds underperform the market by the amount of expenses and management fees. They claimed that European funds, in contrast to most US funds, were sufficiently successful in finding and implementing new information to offset their expenses and therefore, add value for the investor.

Bauer et al. (2006) investigated the performance of New Zealand mutual funds using a survivorship-bias controlled sample of one hundred forty three funds for the period of 1990-2003. They categorized these funds into equity funds and balanced funds based on investment objective. They also divided the equity funds into two groups of domestic and international equity. They applied traditional capital asset pricing model (single index model) and Carhart (1997) four-factor asset pricing model to evaluate performance of these mutual funds. They found that, by applying the single index model, the Jensen alphas were negative for all funds and highly significant for international equity funds and balanced funds. They applied Carhart (1997) four-factor asset pricing model to domestic and international equity funds and found that alphas were insignificantly different from zero. They employed multifactor model including bond index for evaluating balanced funds performance and found that balanced funds underperformed significantly. They observed no evidence of timing abilities by the fund managers and concluded that New Zealand mutual funds were not able to provide out-performance during their study period.

Baker et al. (2010) studied the nature of stock-picking ability of mutual fund managers to find how mutual fund managers selected stocks that outperformed the sold stocks. They addressed the question of how fund managers distinguished winners from losers in their trades by applying new methodology of identifying trading skill. They claimed that their method increases the power to detect skilled trading and shed light on its source. They constructed measures of trading skills based on how the stocks held and traded by fund managers perform
at subsequent corporate earnings announcements. They found that the stocks that US equity funds bought, outperformed the stocks that fund sold around the next earnings announcement and contended that the abnormal returns to trading around earnings announcements represented a disproportionate fraction of the total abnormal returns earned by stocks that funds traded. They argued that the abnormal returns to trading around earning announcement constituted between 18% and 51% of the total abnormal returns earned by stocks that fund traded. They found that a substantial fraction of the abnormal returns earned by fund trades derived from skill at forecasting the economic earnings fundamentals of firms. They concluded that mutual fund managers were able to trade profitably in part because they were able to forecast earnings-related fundamentals during their study period.

Bialkowski and Otten (2011) investigated the performance of one hundred forty Polish mutual funds during 2000-2008. They categorized funds in the sample into equity funds, bond funds and mixed funds based on investment objective and also divided them to domestic and international funds based on their regional focus. They applied Carhart (1997) four-factor asset pricing model to equity and mixed funds and one factor bond model to bond funds to measure their performance. They observed negative net alphas for all groups of funds and found that domestic funds outperformed international funds as domestic funds produced Carhart (1997) alpha that were indifferent from zero, whereas international funds underperformed significantly. They also found that adding back management fees to excess returns led to produce alphas that were significantly positive and indifferent from zero for domestic and international funds, respectively. They argued that domestic mutual funds were able to beat the local market but charged too much fees to deliver out-performance. They concluded that Polish mutual funds, on the average, were not able to add sufficient value to offset the management charges and transaction costs during their study period.

Kiymaz (2012) examined the performance of four hundred sixty three US based diversified emerging market funds and one hundred thirty eight emerging market bond funds during the period of January 2000 till November 2011. He found that diversified fund managers experienced limited success in their search for alphas and emerging market bond fund managers generally failed to realize positive alphas during his study period. He argued that twenty percent of the diversified equity funds and three percent of the emerging market bond funds provided statistically significant alphas to their investors. He also divided the entire study period into four sub-periods which involved two recessions and two expansions in the economy and covered significant ups and downs in the financial markets. These sub-periods included technology bubbles of US during 2003 till 2007 and financial crises during 2007 till
2009. He found emerging market equity funds underperformed the market during the two expansion periods and bond funds experienced significant negative returns during 2007 till 2009. He concluded from the analysis of sub-period performance that emerging market fund managers were not able to provide positive alphas to investors consistently.

Ferreira et al. (2013) conducted a comprehensive research on the performance of open-ended actively managed equity mutual funds by using worldwide sample of mutual funds. Their sample consisted of 16316 funds in 27 countries over 1997-2007. They used the Carhart (1997) four-factor model to measure risk-adjusted performance. They found that equity mutual funds around the world underperformed the market on the average by 20 basis points per quarter after fees and adjusting for the Carhart (1997) four factors during their study period.

The literature on whether active strategy has empirically outperformed passive strategy has in general been mixed in its conclusions. Many studies concluded that market returns cannot be surpassed consistently over time and passive portfolio management strategies provided the best returns. On the other hand, some studies provided a promising picture of active portfolio management strategies. These contradictory conclusions could be the results of different study periods, types of funds, methodologies used and authors’ biases. It remains still an open issue whether portfolio managers who actively transact stocks, add value.

**4.8 Review of Indian Studies**

Jayadev (1996) evaluated the performance of two growth oriented mutual funds compared to benchmark from June 1992 to March 1994. He considered The Economic Times Ordinary Share Price Index as market index or benchmark and used Treynor (1965), Sharpe (1966) and Jensen (1968) measures to find risk-adjusted performances of two funds. He showed that both funds did not perform better than the benchmark and did worse in terms of total risk. He found that both funds were poor to earn superior returns due to the lack of market timing and security selection ability. He concluded that the two growth oriented funds were not offering advantages of diversification and professionalism to the investors.

Chander (2000) investigated the performance of thirty four mutual fund schemes from January 1994 to December 1997. He considered S&P BSE SENSEX as a benchmark and found that most of the funds had higher returns and risks compared to benchmark. He showed that the funds in the sample earned superior returns due to diversification and stock selectivity but they had no market timing ability.
Irissappane et al. (2000) evaluated the performance of thirty-four close-ended mutual fund schemes for ten years period from June 1988 to June 1998. He used S&P BSE SENSEX and S&P BSE 100 (NATEX) as the surrogate for the market. He applied Treynor and Mazuy (1966) and Henriksson and Merton (1981) models to evaluate market timing ability of mutual funds. They found that only three out of thirty-four funds showed reasonable market timing ability. They concluded that in general mutual funds in the sample did not exhibit superior market timing ability.

Gupta and Gupta (2004) examined the investment performance of fifty-seven growth schemes from April 1999 to March 2003. They used CNX Nifty Index as a proxy for the market portfolio. They applied Treynor (1965), Sharpe (1966), Jensen (1968) measures and Fama (1972) components of investment performance to evaluate funds and found mixed performance of sample funds during the study period. They found no conclusive evidence about superiority of Indian mutual funds to the market.

Sondhi and Jain (2006) evaluated the stock selectivity skills of the fund managers of thirty-six equity mutual funds in India for nine years from 1993 to 2002. They used Jensen (1968) measure to evaluate stock selection abilities of in-sample fund managers. They found that twenty funds were able to generate positive alphas, and values of fifteen of them were statistically significant. They argued that fund managers added value to funds in the sample due to stock selection ability.

Subha and Bharathi (2007) examined the investment performance of fifty-one open-ended mutual fund schemes from October 2004 to September 2005. They used CNX Nifty as a benchmark portfolio to compare its performance with the performance of the sample schemes. They applied Treynor (1965), Sharpe (1966) and Jensen (1968) alpha measures to evaluate the performance of mutual funds. They found mixed performance of sample schemes as the results of Sharpe ratio indicated good performance by majority of the schemes, the results of Treynor ratio exhibited good performance by only few schemes. They observed that Jensen alpha measures were positive for 98% of the funds which indicated that the funds had superior performance relative to benchmark. They concluded that the performance of mutual funds in the sample was acceptable during study period.

Raju and Rao (2009) studied the performance of sixty Indian mutual fund schemes from April 2000 to March 2005. They used BSE Sensex and NSE Nifty as market proxies. They employed Treynor and Mazuy (1966) and Henriksson and Merton (1981) models to evaluate market timing ability of the fund managers. They found that as per Treynor and Mazuy model, more than 56% and 52% of selected schemes with BSE Sensex and NSE Nifty
respectively turned out to be negative performers and as per Henriksson and Merton model, more than 61% and 67% of the schemes with BSE Sensex and NSE Nifty respectively turned out to be negative performers. They concluded that a majority of the selected mutual fund scheme managers were not seriously engaged in any market timing activities and relied mainly on stock selection skills.

Duggimpudi et al. (2010) evaluated the performance of seventeen Indian equity diversified mutual funds from 2000 to 2009. They used BSE Sensex as a benchmark index and applied Treynor (1965), Sharpe (1966) and Jensen (1968) techniques. They found that funds in the sample performed better than the market according to Treynor and Sharpe techniques. They also found that Jensen alpha measures for all funds were positive. They concluded that all mutual funds in the sample outperformed the market during the study period.

Kaur (2011) evaluated the performance of ten Indian open-ended equity mutual funds for the period 2008-2010. He analysed the managerial performance on the parameters of diversification, market timing ability and stock selection skill. He used BSE Sensex index as a benchmark and applied Treynor (1965), Sharpe (1966) and Jensen (1958) measures. He employed Treynor and Mazuy (1966) model to test the market timing ability and Fama (1972) measure to test selectivity skills of mutual fund managers. He found that majority of funds had better performance than the market according to Treynor and Sharpe measures. His results exhibited significant positive alpha value for six out of ten mutual funds. He found that the mutual funds in the sample were not well diversified, and they had positive but low stock selection and market timing skills. Prasad and Srinivas (2012) examined the performance of seventeen equity mutual funds in India over the period of April 2000 to March 2010. They used BSE Sensex index as a benchmark and applied Treynor and Mazuy (1966) and Henriksson and Merton (1981) models to evaluate market timing ability of fund managers. They found that majority of fund managers were successful in timing the market and could earn returns in excess of the market. Dhar (2013) evaluated the investment performance of eighty Indian mutual fund schemes in terms of selectivity skills of fund managers from May 2000 to March 2012. He applied unconditional and conditional Jensen models. He incorporated three public variables to Jensen (1968) model for conditioning the alphas and betas of funds. Incorporated variables are dividend yield of market index, short term Treasury bills yield and growth rate of index of industrial production as a proxy for the performance of the real economy. He found fifty six schemes had positive alphas as per the unconditional Jensen (1968) model but among them, just twenty schemes were significant. According to conditional version of Jensen model he observed fifty five schemes had positive
alphas and among them just eighteen schemes were significant. He concluded that around twenty five percent of fund managers in the sample possessed superior selectivity skills based on both unconditional and conditional Jensen models.

Many Indian studies support the hypothesis of outperformance of actively managed funds. At the same time some studies showed that active fund managers underperformed the passive benchmarks. The academic studies in this area are extensive and in some cases the results are not entirely consistent and some ambivalence still persists.

4.9 Security Return Predictability

Numerous studies have demonstrated that there are economic state variables behind the time series behaviour of expected asset returns. Most of these variables can be interpreted theoretically as indicators of the underlying macro economy. Balvers et al. (1990) presented a general equilibrium model relating returns on financial assets to macroeconomic fluctuations in a context that is consistent with efficient markets. They showed that, within an efficient market framework, stock prices need not follow a random walk and that changes in the equilibrium return on stocks can be predicted to the extent that there is predictability in aggregate output. They argued that stock returns are a predictable function of aggregate output. Pesaran and Timmermann (1995) examined the robustness of various economic factors contributing to the predictability of US stock returns. They found that the predictive power of these economic factors over stock returns changed through time and tended to vary with the volatility of returns throughout the sample period 1960 to1992. Lettau and Ludvigson (2001) investigated the power of fluctuations in the aggregate consumption-wealth ratio for predicting stock returns. They found these fluctuations in the consumption-wealth ratio are strong predictors of both real stock returns and excess returns over Treasury bill rate. They argued that consumption-wealth ratio is a better predictor of future returns at short and intermediate horizons than the dividend yield and the dividend payout ratio; but these financial variables are more successful at predicting returns at long horizons. Santos and Veronesi (2005) proposed general equilibrium model that generates stock return predictability in both the time series and the cross section. They found that a regression of stock returns on lagged values of the labor income to consumption ratio produces statistically significant coefficients and large adjusted $R^2$, and claimed that this macroeconomic variable is a strong predictor of long horizon returns. Abugri (2008) investigated whether dynamics in key macroeconomic variables significantly explain market returns in four Latin American countries, namely, Argentina, Brazil, Chile, and Mexico. He used four domestic and two
international macroeconomic variables. He considered the nominal exchange rate, the money supply, industrial productivity, and nominal interest rate as domestic macroeconomic variables and US 3-month treasury bill yield and MSCI world index as international macroeconomic variables. He found that the global macroeconomic variables are consistently significant in explaining returns in all the markets; but there are differences across markets in terms of significance and magnitude of impact of domestic macroeconomic variables, and for the most part, such differences are consistent with the underlying economic environment, trade and financial links with the rest of the world. Singh et al. (2011) studied the relationship between stock returns and some macroeconomic variables for Taiwan. They used five crucial macroeconomic variables, namely, employment rate, exchange rate, GDP, inflation and money supply to test the effects of macroeconomic variables on portfolio returns during the period 2003-2008. They found that the exchange rate affected all portfolio returns in the sample positively and GDP had positive, positive and negative relationship with stock returns of big, medium and small companies, respectively. They also found that employment rate, inflation rate and money supply had negative relationship with all portfolio returns.

Various studies have shown that security returns can be predicted by expected inflation and dividend yield variables.

Fama and Schwert (1977) found that common stock returns are negatively related to the expected inflation rate during the period, 1953-1971. Blume (1980) analyzed the relationship between dividend policy and total returns on a risk-adjusted basis. He included anticipated dividend yield variable to Sharpe-Lintner-Mossin capital asset pricing model and found that over the 1936-1976 period, the cross-sectional regressions revealed a positive and significant relationship on the average between the quarterly realized rates of return, and both the beta coefficients and the anticipated quarterly dividend yields. He construed that the Sharpe-Lintner-Mossin capital asset pricing model is too restrictive and the dividend yield is acting a surrogate for some unspecified variables omitted from this model. Chen et al. (1986) showed that expected inflation has a predictability feature on returns of stocks. They found that the coefficient of the expected inflation was highly significant in explaining expected stock returns in the period 1968-1977. Fama and French (1989) found that dividend yield, the default spread and the term spread forecast stock and bond returns. They interpreted dividend yield and the default spread as reflecting long-term business conditions that forecast high returns when business conditions are persistently weak and low returns when conditions are strong. They argued that the term spread is related to shorter-term measured business cycles and it is low near business cycle peaks and high near troughs. Hodrick (1992) concluded that
changes in dividend yields forecast significant persistent changes in expected stock returns. Patelis (1997) showed the significant predictive power of the dividend yield. He argued that dividend yield is to be the dominant factor in the variance decomposition because the effect of the other variables (excess stock returns, real interest rate, term spread and federal fund rate growth) on future expected asset returns persists much less than that of the dividend yield. Engstrom (2003) argued that the dividend yield contains important information for measuring the conditional equity risk premium. He concluded that the dividend price ratio is an important tool which can be used to measure the conditional equity premium and forecast excess equity returns. Ang and Bekaert (2007) examined the predictive power of the dividend yield for forecasting excess returns. They found that the dividend yield variable with the short rate (T-bills rate) variable predict excess returns only at short horizon and do not have any long-horizon predictive power. They argued that a uni-variate predictive regression including dividend yield, captures a much smaller proportion of movement in log expected excess returns than a bivariate predictive regression including both risk-free rate and dividend yield. They concluded that the strongest predictability comes from the short rate rather than from the dividend yield. Schmeling and Schrimpf (2011) argued that expected inflation carries significant information for future stock returns over multiple horizons and significantly forecasts stock returns. They showed that the forecasting power of expected inflation does not vanish even after including other popular forecasting variables such as the dividend yield and the term spread in the predictive regression. They concluded that expected inflation is a significant and strong predictor of future stock returns.

Several studies have shown that monetary policy has the predictive power for stock returns and variables such as discount rates, term spreads, and default spreads hold predictive content for security returns. Waud (1970) found that discount rate changes affect market value of equity shares. He pointed out that discount rate decreases result in positive reaction of stock market and vice versa. Gupta (1974) analyzed money supply and stock price relationship. He quantitatively evaluated the ability of money supply to predict future movements of the stock market. He found that money supply predict accurately about 65 percent of the troughs and 59 percent of the peaks. He concluded that money supply could be considered as a predictor of future movements of the stock market. Gargett (1978) pointed out high significant correlation between the deflated monetary variable and stock prices. He found that the Dow Jones Industrial Average index followed changes in the liquidity supply with a lag of about three months during the period 1961-1976. He argued that liquidity changes move the market.
Lynge (1981) investigated the relationship between money supply announcements and stock prices. He examined the presence and the strength of money supply announcements effect on stock prices of Dow Jones Industrial Average index. He concluded that money supply announcements provide new information that cause stock prices significantly react to them. Chen et al. (1986) found that changes in the risk premium and twists in the yield curve were significant variables in explaining expected stock returns during the period 1958-1984. Bernanke (1990) found that the spread between the commercial paper rate and Treasury bill rate is the best predictor among alternative interest rate variables which have been predictors of the economy. He argued that the commercial paper- Treasury bill spread reflects default risk and measures the stance of monetary policy. He claimed that the commercial paper-Treasury bill spread more closely related to conventional indicators of monetary policy such as the federal funds rate than to alternative measures of default risk. He concluded that the spread between commercial paper and Treasury bill rates is a good predictor of the economy because it combines information about both monetary and nonmonetary factors affecting the economy. Estrella and Hardouvelis (1991) showed the term structure as an indicator of real economic activity is a significant predictor of asset returns and contended that it has extra predictive power over the real short term interest rates, lagged growth in economic activity, and lagged rates of inflation. Jensen and Johnson (1995) investigated the long term security market performance following discount rate changes. They found that in the period between 1962 and 1991, the stock market experienced higher returns and lower variability in periods following discount rate decreases than in periods following discount rate increases. They depicted that the stringency of Federal Reserve monetary policy affects stock and bond return patterns in a different way. Jensen, Mercer, and Johnson (1996) analyzed expected stock and bond returns by using predictive variables such as dividend yields, term spread, default spread in the presence of discount rate changes dummy variable for the period February 1954 through December 1992. They characterized these periods as either restrictive or expansive monetary environments according to increasing or decreasing discount rates, respectively. They found that the behaviour of dividend yield, term spread and default spread as predictive variables and their influences on expected security returns are significantly affected by the monetary environments. They showed that dividend yield and default spread play significantly different roles in explaining stock returns, depending on monetary stringency and these two predictive variables explain significant variation in expected stock returns only in expansive monetary environment. They also showed that dividend yield, term spread and default spread offer little explanatory contribution to the expected return variation for stocks
during restrictive monetary environment. They demonstrated that the term spread explains significant variation in expected bond returns only in restrictive policy, and just dividend yield is marginally significant for the expected bond returns during expansive periods. They found significant explanatory contribution by any of the predictive variables in explaining expected stock (bond) returns only during expansive (restrictive) monetary environment. Patelis (1997) found that monetary policy impacts on the behaviour of long horizon return. He concluded that monetary policy variables are significant predictors of future returns, although they cannot fully account for observed stock return predictability. Durham (2001) showed that movement in interest rates, reflecting monetary policy changes, may directly affect the equity cost of capital as well as the expectation of corporate profits hence causing fluctuations in stock prices. Avramov (2002) investigated the robustness of fourteen predictive variables to predict future stock returns. He found that the predict powers of the market premium and term premium which is difference between long-term government bond and Treasury bill rates are superior to that of other predictors. Bernanke and Kuttner (2005) analyzed the impact of changes in monetary policy on equity prices and found that the stock markets considerably response to the unexpected changes in the Federal funds rate. Campbell and Yogo (2006) developed efficient test of predictability in the sample period 1952-2002 and argued that stock returns can be predicted by short-term interest rate and long-short yield spread variables. They also claimed that by employing their methods earning-price and dividend-price ratios predict returns and can be considered as predictor variables. Hjalmarsson (2008) conducted a comprehensive study on stock return predictability and used sample of 40 international markets including 24 developed and 16 emerging economies. He analyzed the predictive abilities of four common forecasting variables, namely, dividend-price, earnings-price ratios, the short interest rate, and the term spread. He developed new methods for predictive regressions with panel data and showed that the short interest rate and the term spread are fairly robust predictors of stock returns in developed markets. Li et al. (2010) studied the impact of monetary policy shocks on stock prices for Canada and the United States. They applied structural VAR models and used the Federal fund rate and the overnight rate as the monetary policy instrument in the United States and Canada, respectively. They found monetary policy shocks affect stock prices in both countries. They observed that, in Canada, the immediate response of stock prices to a domestic contractionary monetary policy is small and the dynamic response is brief, whereas, in the United States, the immediate response of stock prices to a similar shock is relatively large and the dynamic response is relatively prolonged. Niu (2012) investigated the impact of monetary policy on
price of the Shanghai stock index by using the VAR model, Granger causality test, co-integration test and impulse response function. He used seven days interbank lending rate and money supply variables as proxies of monetary policy and studied the influence of these two variables on price of Shanghai stock index. He observed that seven days interbank lending rate is the Granger cause to Shanghai stock index. He found that the impulse response of Shanghai stock index to money supply is significant. He showed that there are co-integrating relationships between money supply, seven days interbank lending rate and Shanghai stock index. He concluded that monetary policy has lagging effect on the Shanghai stock index.

Maio (2013) analyzed the effect of monetary policy actions on the cross section of equity returns. He found that changes in monetary policy affect stock returns. He showed that the impact of monthly changes in the Federal funds rate is greater for the returns of small capitalization and value stocks than on returns of large capitalization and growth stocks.

4.10 Utilizing Security Return Predictability to Extract Excess Returns

While, numerous studies support the predictability of security returns by economic and monetary variables, a few researchers such as Brocato and Steed (1998), Jensen and Mercer (2003), Calamari (2007) and Chen and Chen (2009) demonstrated how investors can exploit such information to earn economically significant excess returns by employing tactical asset allocation strategies.

Brocato and Steed (1998) showed that asset allocation shifts based on turning points in the business cycle enhance portfolio performance over a long-term buy-and-hold approach. They showed that the portfolio rebalancing based on NBER (National Bureau of Economic Research) business cycle turning points considerably improves in-sample Markowitz efficiency versus a buy-and–hold strategy. They demonstrated how cyclical phases impact proportions of specific asset in the optimal portfolios. They depicted that the variance-covariance structure of nine asset classes included in their portfolio is influenced by phases of the business cycle. They emphasized that portfolio rebalancing based on business cycle turning points is impractical because the dating of turning points by the NBER is done ex-post and with substantial lag and NBER declarations are usually forthcoming 12 to 18 months after an official turning point date has been designated.

Jensen and Mercer (2003) investigated how alternative information about economic conditions can be used to time portfolio rebalancing. They performed tactical asset allocation based on turning points in the monetary cycle. They used the US Federal Reserve's discount rate changes to identify the monetary cycle turning points and explained that “turning points
occur when the discount rate is initially changed in the opposite direction from its prior change.” They found that the monetary cycle has a greater influence than the business cycle on the return structure of multiple asset classes. They argued that their indicator of monetary cycle turning points has a practical advantage over the NBER business cycle turning points because the former relies on ex-ante information while the latter relies on ex-post information. In addition, they showed that portfolio rebalancing based on the monetary cycle provides significantly higher risk-adjusted returns after transactions costs than both the Brocato and Steed’s business-cycle approach and a buy-and-hold strategy.

Calamari (2007) explored whether alternative information rather than the discount rate can be used to identify monetary cycle turning points in Jensen and Mercer’s (2003) time asset allocation approach. He used Federal funds futures contracts as an accurate predictor of monetary cycle turning points. He showed that an investor can earn superior portfolio returns after transaction costs through timing asset allocation based on monetary cycle turning points which are predicted by Federal funds futures market.

Chen and Chen (2009) investigated whether discount rate changes serve as a useful indicator for investors to form investment strategies. They implemented a market timing trading strategy based on discount rate changes. They used discount rate changes as an informative signal to enter or exit the stock market. They used two assets, a diversified portfolio consisting of common stocks and Treasury bills, in their investment structure. They proposed entering the stock market on an initial discount rate cut and staying fully invested through all subsequent rate cuts and exiting from the stock market on an initial discount rate increase and investing fully in Treasury bills during the rate increase sequence. They evaluated the performance of market timing strategy based on discount rate changes relative to the passive buy-and-hold strategy and found that the market timing strategy based on discount rate changes outperforms the passive buy-and-hold strategy.

By reviewing the literature, it can be found that no research studies have been carried out to investigate how investors can exploit monetary policy information to earn profits in excess of a passive buy-and-hold strategy through tactical asset allocation in the Indian context. Therefore, this study has the potential to make a meaningful contribution to the body of literature.