CHAPTER – I

INTRODUCTION AND DESIGN OF THE STUDY

Indian Stock market has witnessed considerable changes in late 1990s due to liberalization, privatization and globalization. As a result, the relative importance of the fundamental variables determining equity returns would have also undergone some changes. It is important to study the determinants of equity returns in India after introduction of reforms, which emphasized more towards openness to foreign trade and competition. Identifying the forces that drive stock returns is a major concern for practice and academic research.

Risk is the major determinant of the rates on financial assets. Financial theories stipulate that the expected return on any financial asset is derived by

\[ E(R_i) = R_f + \varnothing \]

Where \( E(R_i) \) is the expected return on the \( i^{th} \) asset, \( R_f \) is the risk free return and \( \varnothing \) is the risk premium applicable to the \( i^{th} \) financial asset.

Implicitly the above formulation argues that the difference between the returns on different financial assets arises only because of the differences in the risk premium as the risk free rate of return is constant for all financial assets. This argument is also synonymous with the theoretical construct that financial assets having identical risk characteristics must produce identical rates of returns, assuming conditions of equilibrium and efficient capital market. While in the short run the capital market may be imperfectly efficient, in the long run the capital market should be, at least, operationally efficient, if not perfect, because only then the capital market mechanism would allow free flow of funds to different investments.
The important purpose of this study is to examine the risk-return relationship as it applies to the equity shares. This purpose is achieved by a study of different concepts of risk through different definitions of risk; an investigation in to the interdependence structure of risk factors and finally the relationship between risk and return under the conditions of equilibrium. Under the circumstances, this study does not claim to have unraveled all the possible features of risk in equity shares. It has only looked at the different ways in which risk has been defined and discussed in finance theory and attempted to apply these risk theories to Indian conditions.

1.1 CONCEPT OF RISK IN FINANCE THEORY

The return from holding equity shares consists of dividend yield and capital gain components. Equity risk arises mainly on account of uncertainties in receiving dividends and a possible adverse change in prices leading to capital depreciation. The concept of risk underwent many changes in the last 50 years. In the earlier times it was associated with the probability of bankruptcy of the firm; subsequently it was associated with the departure of the market value of the firm from its intrinsic value\(^1\). At the same time, in more concrete terms, it was associated with the uncertainties faced by the firm in earning adequate post tax profits to pay reasonable dividends to the share holders. Ever since the theme ‘maximization of investor’s net wealth’ became the main plank for financial decision making, Business, leverage and liquidity risks assumed a lot of importance as descriptors of risk. To describe the total risk, which is a combination of business, leverage and liquidity risks, it became common to accept the variability in the returns distribution as a surrogate for the total risk. Statistical theory offers a number of measures of dispersion which could be used, alternatively, as measures of variance in the distribution of random variables.

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The modern theory of finance, especially, the work done by Markowitz and the subsequent development of the Modern Portfolio Theory (MPT) contributed to the understanding of risk in terms of its systematic (non-diversifiable) and the non-systematic (diversifiable) risk components.

There were also contributions by other financial theorists to describe equity risk in terms of a market wide risk (equivalent to the macro economic common risk) factor, extra-market risk factors and the firm specific risk factors. While the market risk factor is the same as the systematic risk factor used in MPT, the other two risk factors, viz., the extra-market level and firm specific factors, became quite popular in evaluating equity investments, especially drawing a lot of support from the protagonists of the fundamental analysis.

There were also many attempts by financial economists to integrate the different theories of risk by empirically demonstrating that most of the risk classifications are in reality only different components of the same risk, which should be the total risk.

1.2 SOURCES OF RISK

In the previous section (1.1) an overview of the historical evolution of risk were presented. In the present section a brief summary of the sources of risk is given. In the subsequent sections approaches to measure different aspects of risk would be shown.

A. Traditional Classification

1. inflation or purchasing power risk
2. business risk

\(^2\)H. Markowitz, “Portfolio Selection”, Journal of Finance, March 1952, pp77-91

\(^3\)Farrell uses the term ‘traditional view point’ to denote all the risks that come under this category. See James Farrell, “Modern Investments and Security Analysis”, NY, McGraw Hill, 1987, p.320
3. financial (or leverage) risk, and
4. liquidity risk.

B. Latent Structure Classification
1. the market related common risk
2. extra-market level risks, and
3. firm specific risks.

C. Classification according to MPT
1. systematic risk (or the non-diversifiable risk)
2. non-systematic risks (or the diversifiable risks)

Purchasing power or inflation risk is associated with decrease in purchasing power of money on account of inflation. High inflation will corrode the capital values of investments.

Business risk is associated with the fluctuations in a firm’s earnings. The more the variations in the earnings streams the greater the business risk faced by the firm. This risk is generally associated very closely with the investment decisions of the firm. Any less profitable investments yielding less than expected cash flows will enhance the business risk.

Financial risk is connected to the capital structure decision of the firm. The presence of fixed interest carrying debt can always take away on priority a part of the earnings of the company and leave behind no or less earnings for common share holders. If the earnings of the firm are not adequate to service its debt it may lead to liquidation. This is also a part of the financial risk.

Liquidity risk is not so sharply defined as business or financial risks. Liquidity has two connotations - it could mean the liquidity of the firm to meet its obligations or the liquidity of the investor which implies that he should receive periodically a
definite stream of cash flows to meet his requirements. Without any loss of generality it could be said that liquidity of the firm influences its interest and dividend payments and thus the liquidity requirements of the investors are met.

Market risk is the risk which is common to all the firms. Though the extent of market influence differs from firm to firm, there is enough evidence\(^4\) to suggest that this risk is very important in the valuation of equity stocks. The market risk is also known as systematic risk in portfolio theory. This risk reflects the covariance between any two stocks on account of their common variation with the market index.

Extra-market sources of risk include industry level risk factors and other non-market common factors which, along with the market factor, cause the equity stocks to covary. The industry level factors include such aspects as the licensing policies of the government, raw material support, competition, entry barriers, price controls and so on. Farrell\(^5\) defined the other non-market common factors as belonging to growth, stable and cyclical factors.

The firm specific factors include such factors as the size, dividend yield, corporate tax rate applicable to the firm, quality of the management and a host of other factors which differ from firm to firm. Some of the firm specific risk factors are quantifiable while some others are purely qualitative.

MPT has decomposed risk into two components – systematic and the non-systematic risks. While systematic risks are unavoidable and non-diversifiable, the non-systematic risks are most often diversifiable to a very large extent by the portfolio decisions of the investors.

\(^4\)see chapter II for related literature

Though, three broad classifications of risk factors have been given above, it should be emphasized here that the risks included therein are not mutually exclusive. In fact, there is a large body of empirical literature that shows all these risks are highly correlated and hence are synonymous. For instance, most of the firm specific factors and some of the extra-market factors are essentially diversifiable risks (i.e. Non-systematic risks), the Market factor is the same as the systematic factor which can not be diversified away. Inflation risk is also a systematic risk because if can not be avoided even when securities are grouped into portfolios. Recent theoretical developments show that business, leverage and liquidity risks are partly systematic and partly non-systematic in nature.

In the next section a brief presentation is made about the statistical and accounting measure of risk. The theoretical setting regarding the latent structure of equity returns and the asset pricing models follows thereafter.

1.3 STATISTICAL MEASURES OF RISK

Generally, risk is associated with variability and uncertainty. If the investors consider the returns stream to be highly fluctuating making prediction about the future outcomes difficult, it is reflected in the form of risk inherent in the returns stream. The oft quoted maxim in finance theory is, greater the variability of possible returns, the greater the risk. Thus any measure of variation of returns distribution should act as a reasonably adequate proxy for risk. However, it is necessary to note that finance theory stipulates the variability of return to be the total risk. Statistical theory offers several alternative measures of computing the variability of a distribution of random variables. These measures\(^6\) are Range, Inter Quartile Deviation, Standard Deviation, Semi variance, Mean Deviation, Skewness and Kurtosis. Presently, only their utilitarian aspects are being discussed.

\(^6\) the formulae for computing these are given in Chapter II
One frequently used measure of risk and one that is easy to compute and has a certain degree of statistical validity\(^7\) is the range. The range specifies the interval from the highest possible outcome to the lowest. One shortcoming of the range is the face that is affected by extremely high or low values. To preclude any bias that might be introduced by the extreme values, the Inter-quartile range could be employed. This has the advantage of considering only the middle 50 percent of the variables in the distribution and the extreme values are ignored. In other words, if the original distribution is non-normal, most of the non-normality would be on account of outliers. By ignoring the outliers the inter-quartile range becomes more stable than range. Another quartile based measure is the Quartile deviation or its coefficient. This measure also has the same advantages as the Inter-quartile range.

Both the measures are ideal when the distributions are significantly non-normal. However, the disadvantage is that both of them do not consider the individual items in the distribution.

A measure of risk, and one that is especially important in theoretical considerations, is the variance, or its square root, the standard deviation. Standard deviation (or alternatively, sometimes, variance) is the most commonly used measure of risk. This is obviously on account its statistical properties; in particular, it can be used to define a range within which the actual returns can be expected to fall with a certain probability. However, the utility of standard deviation to a large extent is dependent of the normality of the distribution. The variance is an appropriate measure of risk if the return distributions of the individual securities are stable with finite variance.

\(^7\)R.Johnson and B.Siskin, "Quantitative Techniques for Business Decisions, New Delhi, Prentice-Hall of India, 1977, p.244
Fama\textsuperscript{8} has shown that stock returns follow a stable paretion distribution. Ramachandran\textsuperscript{9} found a similar evidence for Indian Stock market. Fama\textsuperscript{10} has however shown that returns distributions are adequately characterized as symmetric and that at the portfolio level the variance is highly correlated with other popular dispersion measures such as the Mean deviation, the semi variance, the range, the inter-quartile range and higher central moments of the distribution.

When the distributions are markedly non-normal standard deviation may not be a representative statistic for measuring the volatility in the returns. In such conditions a measure which produces reasonable stability is Mean Absolute Deviation. When the shape of the distribution is unknown, the mean deviation could be computed by taking deviations from Median. It would also be a better measure of dispersion than the inter-quartile range or quartile deviation. When the distributions are near normal both standard deviation and mean deviation produce similar rankings of stocks.

While the variance of expected returns is the most commonly used risk proxy, there are other measures which are intuitively and theoretically more appealing. One such measure is the semi-variance. It is a measure of the down side risk in the sense that it measures the dispersion of only less than expected returns. Returns which are in excess of expected returns are treated as zeros because they are not strictly risky. (In a world dominated by risk-aversers semi-variance is an ideal measure of risk) When the returns distributions are perfectly symmetrical the semi-variance is exactly one-half of variance. Under conditions of normality both variance and semi-variance produce similar ranking of securities.

\textsuperscript{9}G.Ramachandran, “Portfolio Analysis in Stable Paretion market”, Paper Presented at the 26th Indian Econometric Conference, Bombay, Jan 1989
\textsuperscript{10}E. Fama, op.cit
Additional information about the variability of returns can be obtained by computing the skewness and the kurtosis of the distribution of possible returns. There are many financial theorists\textsuperscript{11} who has argued in favor of higher moments providing additional information for describing the equity returns generation. Generally, skewness and kurtosis are inversely related to the other risk measures such as standard deviation, range, mean deviation and so on. That is because, negative skewness is considered to be undesirable and positive skewness desirable by the risk averse investors. There is also ample empirical evidence in support of skewness preference.

However, the arguments in favor of kurtosis are fewer and are not well supported by the empirical evidence.

1.4 ACCOUNTING MEASURES OF RISK

The Accounting system generates information on several aspects of profitability and financial position of the business firm that are considered by many as measures of risk. A pioneering study made by Beaver, Kettler and Scholes\textsuperscript{12} showed that there are some important measures computed from the accounting data which have a very close association with the endogenously determined risk measures such as the systematic and non systematic risks. In particular, they identified 7 measures of risk which could be computed from the accounting data and further showed that these measures are significantly related to the market determined $\beta$. The accounting measures identified by them were dividend payout, growth, leverage, liquidity, asset size, variability of earnings and covariability of earnings. Subsequent empirical investigations by many others also indicated that broadly these 7 risk variables contained risk information useful to the investors and corporate managers. It should,

\textsuperscript{11}See chapter II for related literature
however, be noted here that each of these risk factors can be measured by alternative means. For example, growth as a risk factor can be represented by sales growth or earnings growth or growth in networth. Similarly size can be proxied by size of the assets or sales size or earnings size and so on. Keeping this in view\textsuperscript{13}, a brief explanation of each of the risk variable is presented hereunder.

a. **DIVIDEND PAYOUT** – It is often said that, ceteris paribus, firms with low dividend payout are highly risky and vice-versa. Two arguments can be made in this regard. First, most firms try to maintain a stable dividend, at least in the short run. In the long run, however, the earnings must be adequate to cover the dividends. Therefore, firms which expect a higher volatility of earnings tend to keep the dividend payout ratio at a lower level to stay out of trouble. Secondly, dividend payout ratios are kept lower by firms which have growth projects. Future growth may bring in capital appreciation but risk-averse investors would prefer current dividends and hence would view low payout ratio as a symbol of risk.

b. **GROWTH** – Myers\textsuperscript{14} distinguishes between growth as expansion and growth as defined as the opportunity to invest in projects which offer expected returns in excess of cost of capital. While the first interpretation of growth is easier to represent, the second interpretation is more difficult to measure accurately. His contention is that growth as defined as the opportunity to invest in new projects is risky because of future uncertainties.

\textsuperscript{13}accounting variables used in this study are defined in Chapter II

c. **LEVERAGE** – Finance theory stipulates that as debt is increased, the earnings stream of the common shareholders becomes more volatile and hence addition of debt is risky. In other words, high leverage ratio is an indicator of high risk. However, there is one point to be noted in this regard; if the addition of debt to the capital structure does not change the total risk, it is difficult to consider that additional debt is risky. In fact, in such cases, addition of debt would indeed be favored by the common shareholders because of the tax shield offered by the interest on debt.

d. **LIQUIDITY** – Generally, liquidity of the firm is associated with its solvency to meet its short term obligations. It indicates the efficiency of the management of working capital. Highly liquid firms are less risky.

e. **SIZE** – Investors widely believe that large firms are less risky. Large firms are generally more diversified and hence less affected by business and default risk. Further, size of the firm may also indicate greater liquidity to the investor because the shares of larger firms have a ready secondary market.

f. **EARNINGS VARIABILITY** – It is logical to expect that firms with highly volatile earnings will have highly volatile stock prices. This implies high total risk and not necessarily a high systematic risk. To a certain extent variability of earnings will depend on the leverage because large debt component in the capital structure may affect the earnings available to common shareholders. Further, a very highly volatile earnings will lead to a firm having a low dividend payout ratio.

g. **EARNINGS COVARIABILITY** – This is a measure of ‘cyclicality’ which measures the extent to which fluctuations in firm’s earnings are correlated with fluctuations in earnings of firms generally. This measure is popularly
known as the ‘earnings beta’ and it is more closely related to the systematic risk on account of its dependence on the business cycles. High earnings beta should imply high systematic risk.

Once again, it should be emphasized here that these classifications are not mutually exclusive. There is bound to be a certain degree of interdependence among the risk variables cited above.

1.5 LATENT FACTOR STRUCTURE OF EQUITY STOCK RETURNS

The Modern Portfolio Theory assumes that the returns of individual stocks are related to each other only through their common co-variation with the market. This postulate is the basis for the development of the Single Index Model (SIM) and its equilibrium version, the Capital Asset Pricing Model (CAPM). The SIM (or Market Model) is

\[
R_i = \alpha_i + \beta_i R_m + e_i \quad \text{(eqn.1)}
\]

Where \(R_i\) is the return on stock, \(\alpha_i\) is the intercept term which is that component of security’s return which is independent of the market’s performance, \(\beta_i\) is the beta coefficient that measures the change in \(R_i\) given a change in \(R_m\), \(R_m\) is the rate of return from the market index and \(e_i\) is the residual term.

The SIM or the Market Model holds good if the underlying assumption that the co-movement (correlation) between stocks is due to a single common influence is upheld. This model also stipulates that beta is the only measure of risk. How well the model performs depends on the behavior of the residuals. That the variable \(e_i\) is measured to be independent and unique to security ‘i’ implies that
COV (e\textsubscript{i}, e\textsubscript{j})=0, for all stocks i=1,2,\ldots, n and j=1,2,\ldots,n

and i \neq j.

If COV (e\textsubscript{i}, e\textsubscript{j}) \neq 0, it implies that that there are more than one common factor that cause the stocks to co-vary; market factor is not the only common factor and that there are extra-market factors that also account for the co-movement between stocks.

If it is hypothesized that macro-economic conditions prevailing in an economy will affect the operating conditions of its business firms, then it is logical to presume that a steady flow of information regarding such economic conditions will influence the investor expectations about the prices of the equity shares of the firms. For example, if there is some information regarding a change in the government’s corporate taxation policy, this news is bound to have a market-wide impact on securities’ prices. The magnitude of impact need not, however, be the same for all the stocks. Therefore, the market-wide simultaneous co-movement in share prices may be attributed to a common extraneous macro factor which may simply be called the ‘market factor’. The stock market is also subjected to an inflow of other types of information and much of it will also have an effect on the set of anticipations that determine the share prices. Such other types of information may affect only certain subgroups of stocks. For instance, a news of change in governments ‘textile policy’ will have an impact on the prices of textile stocks, and still other news, such as an announced ‘bonus issue’ may be unique to a particular share. It is possible, therefore, that the incoming stream of information is broken down in to meaningful pieces that can be classified according to their scope of impact. The stock market digests these pieces of information and translates them into changes in the set of anticipations that determine the share prices. The price change caused by the other type of information, which affects only a particular share and none other, may be said to be an account of ‘firm specific factors’.
To summarize, the price change of a security is a function of (i) a market-wide common factor, (ii) non-market factors common to a subgroup of shares, and (iii) company specific factors. Hence, in quantitative terms, the change in the price of a security ‘j’ at the close of time period ‘t’ is written as

\[ y_{it} = \lambda_{j1} f_{1t} + \lambda_{j2} f_{2t} + \ldots + \lambda_{jq} f_{qt} \]  

(Eqn. 2)

Where, \( y_{it} \) is the change in price of security ‘i’ at the close of time ‘t’, \( \lambda_{ji} \) \((i=1,2,\ldots,q)\) is the sensitivity of share price changes to a set of information affecting the shares, and \( f_{it} \) \((i=1,2\ldots q)\) is the set of information that cause the price changes.

Equation (2) merely states that a lump of information at time ‘t’ causes a change in anticipations that affects every security in the market to some degree. The change in anticipations is, hence, classified under impact class 1 and it is mapped into an element of price change by the function \( f_{1t} \). \( \lambda_{j1} \) expresses the degree to which the change function \( f_{1t} \) affects \( y_{it} \). Similarly, impact class 2 may be the class of changes that affects only a particular group of stocks, class 3, a different group of stocks and so on. The group of stocks may be those belonging to a particular industry classification or a group of stocks classified according to some other common characteristics.

There is a difficulty in empirically verifying the above theory.

Obviously, the theoretical model needs to be redefined in terms of a more utilitarian and a well testable form. The theoretical model assumes that the impact classes and the change function are known a-priori. In real world this information is seldom foreknown. It is, therefore, necessary that this information should be estimated and the best way to get the estimates of “\( \lambda_{ji} f_{it} \)” would be to examine the correlation.
structure of the stock returns and then decompose the correlations in to different components.

It is an implicit assumption in correlation theory that if two distinct variables are influenced by one or more common elements then the variables will exhibit a correlated behavior to some degree. Extending the same logic to correlations among stock returns, if the correlations are sufficiently large and significant, a decomposition of the correlation matrix should yield at least one or more common factors influencing the stock returns. A statistical technique best suited to achieve this would be the “Factor Analysis”. Factor Analysis extracts sequentially a number of factors ensuring that each factor extracted explains as much as possible of the co-variance in the returns structure that has not been explained by the previous factor, given that each factor extracted is uncorrelated with the factor previously extracted. To the extent that there is any real underlying structure in the original stock returns, most of the correlation matrix of stock returns should be explained by the first few factors. These factors would represent the market and the extra market factors that account for the co-variance among the equity shares returns. The extra-market factors may be the industry factors or some other non-market related common factors.

In the real world where expansion and product diversification are common corporate strategies for reducing the business risk, traditional industrial classification may be more anachronistic. In such cases most firms will not exhibit any tendency to form homogeneous stock groups. Firms belonging to a traditional industry may belong to different stock groups on the basis of some other common characteristics. For example, Tata Steels and Mukand Iron and Steel may both belong to the same industry but there are major differences in their performance and the risk to which they are subject. Given the problems with traditional industry classifications, it is useful to develop an alternative or group of alternative classifications. On the basis of
such classifications factors representing the extra-market forces can be constructed and used in a multi-index formulation to explain the stock returns.

1.6 EQUILIBRIUM ASSET PRICING THEORIES

Capital market theory deals with how capital asset prices are determined in the market place. The prices of a capital asset reflect the expected return and risk associated with that asset. Under equilibrium conditions there are two major asset pricing models. The Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT).

1.6.A. THE CAPITAL ASSETS PRICING MODEL (CAPM)

The CAPM is an equilibrium version of the Single Index Model (SIM) which assumes that the co-movement in equity share prices is the result of the influence of a single common factor, viz., the market factor, the CAPM is an extension of the portfolio theory of Markowitz\(^\text{15}\) and was developed by Sharpe\(^\text{16}\), Linter\(^\text{17}\) and Mossin.\(^\text{18}\) The CAPM provides explanation with regard to:

a. the relationship between expected return and risk for efficient portfolios
b. the appropriate measure of risk for inefficient portfolios and individual securities

c. the relationship between risk and return for inefficient portfolios and individual securities.

\(^\text{15}\) H. Markowitz. Portfolio Selection: Efficient Diversification of Investments, NY, John Wiley, 1959
The CAPM has a wide-ranging role to play in security valuation, risk analysis, cost of capital estimations and performance measurement. The CAPM is based on the following assumptions.

1. Investors are risk averse utility maximisers

2. Investors choose portfolios on the basis of their expected mean and standard deviation of returns.

3. Investors have a single period holding horizon.

4. Individuals have homogeneous expectations regarding the means, variances and co-variances of security returns i.e. the returns distribution is joint normal.

5. Individuals can borrow and lend freely at a riskless rate of interest

6. The market is perfect and frictionless, i.e. there are no taxes, no transaction costs and securities are perfectly divisible and

7. Quantities of securities are fixed and all securities are marketable

Many of these assumptions appear to be unrealistic, yet the model is quite robust with regard to the validity of its conclusions. The theory indicates that the appropriate measure of risk for efficient portfolios is the standard deviation of the returns and that there will be a linear relationship between the risk and the expected return for these efficient portfolios.

The risk in the inefficient portfolios and individual stocks consists of two components viz. the systematic risk and the unsystematic risk. The unsystematic risk
can be diversified away and hence such risk is not relevant either for determining the measure of risk or for indicating the risk-return relationship. Systematic risk, symbolically represented by Beta, is the measure of risk that applies to all the securities and portfolios (both efficient and inefficient). The Security Market Line (SML) developed by Sharpe helps in the identification of the risk-return relationship for all securities and portfolios.

If market equilibrium has to exist, the prices of all assets must adjust until all are held by investors and the excess demand for any asset is zero. In other words, the supply of all assets must equal the demand for holding them. The equilibrium price relationship will be:

\[ E(R_i) = R_f + \beta [E(R_m) - R_f] \] (eqn.3)

The above equation is the commonly used ex-ante CAPM. It is also known as the equation of the Security Market Line (SML). In the above equation, \( E(R_i) \) is the expected return on asset ‘i’, \( \beta \) is the quantity of risk, i.e. the degree of riskiness of asset ‘i’ and \( E(R_m) - R_f \) is the price of risk. Therefore, \( \beta [E(R_m) - R_f] \) is the risk premium.

It may be stated that the systematic risk in the CAPM is represented by ‘\( \beta \)’ which is the standardized covariance between the returns on asset ‘i’ and the market ‘m’. Symbolically,

\[ \beta = \frac{(COV_{i,m})}{(\sigma_m)^2} \]

Standard deviation is no longer the relevant measure of risk because the non-systematic risk can be diversified away. The intercept of the line is the risk free rate of
return which has a variance of zero. The market portfolio has always a beta equal to unity. In equilibrium, all securities and portfolios, both efficient and inefficient, will plot along the SML.

The CAPM is based on the assumption of efficient markets with a large number of risk-averse investors having homogeneous expectations about normally distributed asset returns. Given this assumption all relevant aspects of the investor’s asset portfolio are completely captured by the expected return and the corresponding standard deviation. There is sufficient empirical evidence to show that the empirical distributions of stock returns follow a stable paretian model with fat tails and infinite variance. However, Fama\textsuperscript{19} showed that the CAPM remains practically unaltered if the normal distributions are replaced by some other stable distribution. Therefore if the distributions are stable and fairly symmetric, the CAPM framework is still valid.

RELAXING THE ASSUMPTIONS OF THE CAPM

The CAPM has been developed on the basis of some very restricting and unrealistic assumptions. How well the model explains the real world risk-return relationships depends on the stability and robustness of the model when the initial assumptions are relaxed. It appears from the various extensions made to the CAPM, when the initial assumptions are relaxed, that it emerges as a fairly resilient model capable of empirical verification\textsuperscript{20}. This does not, however, mean that the CAPM is a perfect model because there are departures from the theoretical formulations which the CAPM has not been able to capture\textsuperscript{21}. Yet the CAPM has sufficient explanatory power in it notwithstanding the differences from reality.

\textsuperscript{19}E. Fama, op.cit
\textsuperscript{21}These studies are popularly known as the “Anomaly Studies”. See Chapter II for a review of related literature.
1.6.B ARBITRAGE PRICING THEORY (APT).

Capital market equilibrium requires that the market prices should be fixed by the interaction between the supply of securities and the demand for them. In the context of the State Preference framework, market equilibrium is possible only if the condition, that any two assets with the same risk characteristics must be priced identically, is satisfied. If this condition is met, every investor would want to buy the asset with lower price and sell the asset with the higher price. If both the assets are in positive supply their prices are not in equilibrium. This condition is often called the ‘Single Price Law of Markets.’

APT was first proposed by Ross\textsuperscript{22} as a testable alternative to the CAPM. Single Price Law of Markets is the basis on which the APT is built. While the CAPM uses the Mean – Variance Theory of pricing with all its restrictive assumptions, the APT is based on the State Preference Theory with much less restrictive and more realistic assumptions. Furthermore, the CAPM provides that the rates of return from securities will be linearly related to a single common factor Viz. the market, whereas, the APT provides that the rate of return on any asset is a linear function of multiple factors.

ASSUMPTIONS OF APT

i. The capital markets are perfectly competitive and frictionless

ii. Individual investors have homogeneous beliefs that the random returns for the set of assets being considered are a linear function of k. factors (i.e., multiple factors) and

iii. Individual investors are risk averse and prefer more wealth to less.

**APT VIS – A – VIS CAPM**

Supporters of APT argue that APT is superior to the CAPM because the unrealistic assumptions made by the CAPM are not required in the APT:

1. APT is not restricted to one period asset holding horizon,

2. APT does not assume that the stock returns follow joint normal distributions,

3. APT does not depend on any stronger assumptions about investors’ utility functions.

4. APT does not require a mean-variance efficient market portfolio for its formulations, and

5. APT is not based on any requirement for risk less borrowing and lending.

**ARBITRAGE PRICING MODEL**

The APT makes use of k-factor return generating model because the empirical evidence\(^2\) clearly provides for the existence of multiple factors in the generation of asset returns. The APT can be looked at as an equilibrium version of the Multi–Index Models. It is based on the theoretical formulation that in equilibrium conditions arbitraging opportunities do not exist.

\(^2\)See Chapter II for related literature
The APT assumes that the rate of return on any security is a linear function of \( k \) factors and thus the return generating model is:

\[
\bar{R}_i = E(R_i) + b_{i1}F_1 + \ldots + b_{ik}F_k + e_i \quad \text{(eqn.5)}
\]

Where, \( \bar{R}_i \) is the random rate of return on asset ‘\( i \)’, \( E(R_i) \) is the expected return on the \( i^{th} \) asset, \( b_{ik} \), is the sensitivity of the \( i^{th} \) asset to the \( k^{th} \) factor, \( F_k \) is the mean zero \( k^{th} \) factor common to the returns of all assets under consideration.

To derive the equilibrium asset pricing relationship it may be stated that the expected return vector, \( E(R) \), must be a linear combination of the constant vector and the co-efficient vectors. Hence, there exist \( (k+1) \) coefficients such that

\[
E(R_i) = b_0 + b_1b_{i1} + b_2b_{i2} + \ldots + b_kb_{ik} \quad \text{(eqn.6)}
\]

Where ‘\( b \)’ are the sensitivities or loadings of the returns on the security ‘\( i \)’ to the factor ‘\( k \)’. If there exists a riskless asset with a riskless rate of return, \( R_f \), then

\[
b_0 = R_f
\]

Thus, The equation (6) can be rearranged as follows:

\[
E(R_i) = R_f + b_1b_{i1} + b_2b_{i2} + \ldots + b_kb_{ik} \quad \text{(eqn.7)}
\]

Equation (7) is the APT model which indicates that the equilibrium asset pricing relationship is linear. The equation (7) is also called the “Arbitrage Pricing Line” (APL).

In the equation (7)
b stands for the risk premium and symbolically $b_k = (f_k - R_f)$ (for all k-factors) $f_k$ is the expected return on a portfolio with unit sensitivity to the $k^{th}$ factor and zero sensitivity to all other factors.

In equilibrium, all assets must fall on the Arbitrage Pricing Line. If some assets do not fall on the APL, then arbitraging opportunities exist and arbitraging process will go on till all the assets fall on the APL.

1.7. THE RISK FREE RATE OF RETURN

The nominal risk free rate of return, ‘$R_f$’ can be thought of consisting of the following two components:

1. a real rate of return that is free from the effects of any inflationary expectations, and

2. a premium that is equal to the effects of expected inflation. The inflation premium is normally equal to investors’ expectations about future purchasing power changes.

3. Hence, $R_f = \text{Real rate of return} + \text{inflation premium}.

1.8 STATEMENT OF THE RESEARCH PROBLEM

There is not much of empirical work done in the area of risk and return on equity shares with reference to the Indian Stock Market. A large part of the available literature in India is mainly on empirical tests of relevance of dividends in equity pricing, random walk tests and the influence of certain financial variables on equity share prices. There are hardly any major works which have gone into a study of risk as an important determinant of equity returns.
The concept of risk is very crucial and central to the study of finance literature. Most importantly, such an important concept is yet to be accurately measured because all the attempts made so far have only achieved success to a limited extent. In fact, it would not be an exaggeration to say that the present knowledge of risk, especially in the context of its measurement, is still not fully complete.

In view of the importance of risk and risk premium in determining the rates of returns from equity shares, this work proposes to, broadly, examine the risk-return relationship in equity shares. This would involve looking at the different facets of risk, different measures of risk and important models of risk-return relationships.

1.9 SIGNIFICANCE OF THE STUDY

Capital Market Theories assume the existence of free market mechanism. This condition may be largely satisfied in Western countries where state intervention in the capital market is very minimal. However, in India being a planned economy, state intervention in many economic activities is quite obvious. There is a great need for verifying the validity of the capital market theories for such less perfectly competitive markets.

Yet another important point is that Indian Capital Market is a developing one and has a tremendous potential to play a pivotal role in Indian economic development. It has been growing rapidly and rate of growth ever since 1979-80 has been phenomenal. Thus, it is all the more important that the capital market should be subjected to a more intensive investigation.

It is often said that investors are guided by market sentiment rather than hard headed rational decision making process. More often this is cited to be the main reason for the market to be irrational. However, there is an argument, supported by
growing evidence that over long periods of time the market is reasonably efficient. Markets are efficient only if they recognize and reward risk. Therefore, Risk-Return relationships are of paramount importance in understanding the behavior of the capital market. It is in this direction that this work is oriented and thus the results of this study may provide useful insights into the working of the Indian Stock Market.

1.10 SCOPE OF THE STUDY

Carrying out a research on Indian capital Market is a very tedious and daunting task for various reasons. There has not been much of work in this area which could give the much needed initial base on which one could depend. Further, most of the data needs to be manually collected and verified which is a very long drawn process, apart from being very expensive. These constraints automatically place limitations on the sample size and testing periods.

In view of the importance of the BSE in Indian Capital Market, it may be stated that this work proposes to limit the study to only BSE quoted equity shares which satisfy the data requirements.

The main emphasis of this study is on risk inherent in equity investments and more specifically to identify the risk measures, which are significantly associated with the rate of return on equity shares. Thus, broadly, the study limits itself to an examination of statistical risk measures, the accounting measures of risk, the presence and impact of market and extra market factors and the applicability of Equilibrium Asset Pricing Theories to Indian conditions using BSE quoted equity returns.
1.11 OBJECTIVES

This research work is primarily motivated towards investigating the Risk-Return relationship in the equity shares. Obviously, a work of this nature should be able to identify correctly the various risk variables and provide proper definitions for accurately measuring such risk variables so that a meaningful discussion on the risk-return relationship could be provided. Since risk by itself can not be directly measured, most often different measures are used to proxy for the risk. Since many of the risk measures are mere proxies, there is always a chance that such measures may not be efficient in describing the risk they are proxying for. If a particular risk measure fails to explain significantly the returns from equity shares, it would not mean that the risk is absent but only that a different measure may perhaps explain the risk factor more efficiently. Therefore, there is a need for identifying as many alternative measures of risk as are theoretically possible. This may give rise to an illusion of multiplicity of research objectives but in reality there is only one major objective, which is, to identify the real determinants of rates of return on equity shares.

Capital market efficiency is the most crucial theme in financial research. Directly or indirectly, every empirical attempt leads to the testing efficient market hypothesis. Efficient market hypothesis is not directly testable. It must be tested jointly with some model of equilibrium, an asset pricing model. The entire gamut of financial research undertaken so far, in areas such as event studies, return predictability studies, anomaly studies and so on, are essentially attempts to test risk-return relationships jointly with the efficient market hypothesis. Even in this study, though the explicit objective is not the testing of efficient market hypothesis, it is quite inevitable that implicitly some evidence may point towards the efficiency or otherwise of the Indian stock market.
The major purpose and focus of this study are towards an examination of the risk-return relationship in equity shares in India.

Risk measures used in this study\(^\text{24}\) are basically those commonly used in finance theory. The first set of risk measures are those computed from the returns distributions. These are endogenous risk measures which include standard deviation, mean absolute deviation, range, inter-quartile range, semi-variance, skewness, kurtosis and beta. While the first five variables are measures of total risk, beta is a measure of systematic risk. Skewness and kurtosis are inverse measures of risk. Since the first five risk variables are measures of total risk, there should be informational overlap among these variables. Besides, they should be related positively with the beta because total risk includes systematic risk. Further, the statistical risk measures, as these variables are known, could have utilitarian value only if they are intertemporally stable.

Therefore, one of the primary objectives of this study is to study the interdependence structure among the statistical risk measures, their intertemporal stability and their relationship with the rates of return from equity shares. The second set of risk measures used in this study is derived from the accounting data. These are exogenous variables which have been in use traditionally, both in theory and practice. These risk measures are computed from such data as sales, earnings, dividends, net worth and total assets of sample firms. For long, they have been associated with the

\(^{24}\text{See Chapter II for definitions and theoretical relationships}\)
traditional risk classes such as business, leverage, liquidity and growth. In the recent past, linkages between accounting measures of risk and systematic and unsystematic risks have been empirically established. Therefore, it is evident that any study of risk and return should necessarily consider risks as measured by accounting data based variables.

The next most important set of objectives of this study is to identify the accounting measures of business, leverage, growth and liquidity risks, to examine the interdependent structure of these risk measures, and to determine if these accounting measures of risk are associated with the measures of systematic and total risk.

An important development in finance theory is the recognition that firms tend to group into risk classes according to some well defined criteria. More specifically, the grouping behavior may be on account of industry level influences. However, there is enough empirical evidence to suggest that there may be other influences, which transcend the industry level forces, which may cause the firms to form risk classes. Equity price changes are dependent on the expectations formed by the investors.

Investor expectations, in turn, are formed by information available to them. Information available to investors may be macro level information or industry specific information or firm specific information. Whatever may be the information class, investor responses to such information will be reflected in equity share price charges and hence, in the rates of return on equity shares. The covariance among equity stocks is due to the existence of common driving risk factors such as the market factor and the extra-market factors. By decomposing the covariance (correlation) structure of the rates of returns on equity shares, the underlying common risk factors can be detected. The knowledge of latent risks can be of immense help in defining the equity returns generating models.
Another important purpose of this study, therefore, is the detection of the underlying forces that cause the correlations among equity stocks, more particularly, segregating the systematic and unsystematic risks in equity returns. Incidental to this objective is the analysis of the residual returns after the removal of the impact of the common market factor.

The advent of the Modern Portfolio Theory has shifted the emphasis from total risk to systematic risk in the pricing of the equity shares. Efficient diversification of a portfolio of risky assets implies that unsystematic risk (diversifiable risk) is immaterial for the valuation of risky assets; only the systematic risk is priced by the market. On the basis of this principle, two equilibrium asset pricing models such as the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Model (APM) have made enormous contribution to the understanding of the risk-return relationship in equity shares. The tests of the empirical validity of the asset pricing models are joint tests of capital market efficiency and the testable model. In view of the importance of the two asset pricing models in finance theory, this study set for itself other objectives, viz. to examine the relevance of the equilibrium asset valuation models such as the CAPM and the APM for Indian conditions and to compare the empirical performance of the two models. Incidental to the objective stated above is the empirical verification of the relevance of the Three Moment Capital Asset Pricing Model which is essentially an extension to the Standard CAPM.

In continuation of the aforesaid purpose and focus of this work, the major objectives of this study may be summarized as follows:
1. To identify the different statistical distributional risk variables and the degree of inter-relationships among them,

2. To examine the relationship between different statistical risk variables and the returns on equity shares,

3. To determine the sources of systematic risk in equity shares in the context of the association between the market determined and firm specific financial risk measures,

4. To discover and explain the extent of cross sectional interdependence displayed by the residual equity returns, after the removal of the impact of the common market factor,

5. To test for the validity of the different forms of Capital Asset Pricing Model (CAPM) and the multi-factor Arbitrage Pricing Model (APM) in Indian conditions,


1.12 RESEARCH DESIGN

Since the present study is interested in describing the risk-return relationship of equity shares in terms of firm specific and market risk factors, it is Descriptive in nature. In the following part of this chapter the details of data, sample, testing period and statistical techniques employed are discussed. Variable definitions, testable models and their implications are given in the next chapter.
1.12.A. DATA

The study is predominantly based on secondary data consisting of month end price quotations of BSE. The month end equity prices consist of the quotations of the last two trading days in the month. The returns computed from the last trading day’s prices have been the basis for all computations and analysis, whereas the returns computed from the penultimate trading day’s prices have been used for cross sectional analysis in testing the APM. Bombay Stock Exchange (BSE) is the premier stock exchange of India accounting for about 40 percent of the total number of equity shares listed in all the 21 stock exchanges of India. The turnover of the BSE is approximately 70 percent of the overall turnover of all the stock exchanges in the country. In view of this impressive position of the BSE in Indian Capital Market, the employment of BSE quoted stocks is quite justified.

However, primary data was collected using pre-structured interview schedule from the Finance Manager / Controller of the sample companies on bonus issues, dividends paid for all the sample stocks and financial data viz. annual sales, total assets, net worth, Earnings Per Share (EPS), debt to equity ratio etc. Accounting data was collected only for 101 firms due to non-availability of data. Analysis utilizing the accounting information is confined to 101 firms covering an analysis period of 10 years.

For computing the rates of returns on equity shares, appropriate adjustments have been made for bonus issues, dividends, stock splits and stock consolidations. The bonus share adjustment factor has been computed and used to multiply the ex-bonus month end price so as to determine the capital gain which is a part of the stock’s return. If a bonus issue is made, say, in n:q ratio, the adjustment factor would be equal to (n+q)/q.
While deciding the basic single period for which the return data is to be computed, daily and weekly returns were not considered because of the following reasons:

a. for many securities regular daily quotations are not available owing to infrequent trading.

b. Daily and weekly prices are subject to greater speculative pressures which would add noise to the returns distributions.

c. Collection of daily and weekly data manually would be highly expensive and time consuming

Quarterly, half yearly and annual returns were not considered because of the limited number of years which the present study covers. In view of the above reasons, it was decided that monthly returns would be used for analysis. Even in the USA, using of monthly data is a very common practice.

1.12.B. SAMPLE

The main sample consists of 112 companies for which monthly share price information is available. The sample was chosen purely on the ground of continuous data availability over the analysis period. The sample is, strictly speaking, not a random sample. Initially, more than 120 firms were identified but it was decided to drop those firms for which price data was not available continuously. It was decided that any security which was not traded for more than 2 months in each year would exclude itself from the sample. If the price data for any month is missing, the missing value was interpolated by taking the average of the preceding and succeeding month prices. Further, a stock would be excluded from the sample if the number of price interpolations in respect of that stock exceed 16 which is 10 percent of the number of months in the overall sample period. The sample data of 112 stocks belonged to 15 groups consisting of 13 industry groups, 1 diversified group and 1 miscellaneous group.
1.12.C. ANALYSIS PERIOD

The sample period of the study covers a time span of 159 months commencing from January 1997 and ending in March 2010. This constitutes a period of 13 years and 3 months. This is the main analysis period. Financial statement data was available for the entire period for only 76 of the 112 companies. For another 25 firms the financial data was available only for a period of 10 years ending with the financial year 2009-10. For the remaining 11 firms, financial data was not available and therefore they were dropped from the analysis whenever financial variables were used. Further, the more one goes into the past the lesser would be the number of stocks satisfying the selection criteria. It was decided to use the sample period of 159 months, i.e. 1/1997 - 3/2010.

1.12.D. SOURCES OF DATA

Information relating to the month end stock prices, dividends, bonus issues, stock splits and stock consolidations were manually collected for all the 112 sample firms from the BSE Daily official lists (records are regularly published by the Bombay Stock Exchange) and the financial statement data was collected from the finance manager / controller of the companies using pre-structured interview schedule.

1.12.E. STATISTICAL METHODOLOGY

The accuracy and interpretability of the results of any research, more specifically research in Finance and Investment depend on the statistical methodology applied. Very often the empirical model and the statistical methodology are jointly tested for their relevance. While it is the job of the Financial Theory to formulate a theoretical model, the testability of a model is dependent on the formulation of an
equivalent empirical model. To elaborate on this point, the testing of CAPM can be cited. While the theoretical CAPM is an ‘ex-ante’ model, the empirical testability of CAPM is possible only in its ‘ex-post’ form. The ‘ex-post’ form of CAPM can be, with some assumptions, approximated to the Linear Regression Model.

In the case of APT it is possible to specify the theoretical model as a multi-factor model which again is very close to a multi-index model. It is that much easier if all the priced factors or indices can be specified a-priori. This would then conform to a Multiple Regression model. However, it is not very often known a-priori what macro factors enter into pricing equation. Obviously the methodology appropriate under such circumstances would be to first extract by ‘Factor Analysis’ the statistically significant common factors from the stock returns’ co-variance or correlation matrix and subsequently identify such common factors with theoretically plausible economic forces. Thus, APT is best verified when Factor Analytic techniques are employed. In APT tests, Maximum Likelihood Factor Analysis technique was employed for the estimation of factor loadings and subsequently multiple regressions were run for detecting the priced factors.

The extent of cross sectional interdependence displayed by the stock returns has been examined with the help of Pearsonian Co-efficients of correlation computed from the Stock returns. The overall communality i.e., variance due to common factors was determined as equal to the co-efficient of multiple determination (R²) between each stock return and the other stocks returns. R² in this context is interpreted as indicative of the degree of association between a security and the rest of the market. The common variance due to the market factor has been estimated with the help of the first principal factor by subjecting the returns correlations matrix to a principal factor analysis.
Cluster Analysis was used on the residual correlation matrix to detect the existence of any homogeneous stock groupings such as Industry wise clusters. This process of factor analysis identifies if the residual stock returns have any other macro level extra market factors latent in them.

Thus in this study statistical techniques such as Factor Analysis (Maximum Likelihood Estimator and Principal Factor Analysis Techniques), Principal Components Analysis, Linear Multiple Regressions, Cluster Analysis, Correlation Co-efficients etc. were used. The usual F tests and ‘t’ tests were performed wherever and whenever found necessary.

1.13 CHAPTER SCHEME

The report consists of six chapters. The first chapter provides a brief theoretical background to the study. This chapter also presents the statement of research problem, scope, significance of the study, principal objectives of the study and the details of the research design employed.

The second chapter summarizes main findings of some very important earlier research studies undertaken in India and outside India. Definitions of key variables are given. The testable models are specified and their implications are discussed.

The third chapter consists of three sections. In the first section, the interdependence structure among different statistical risk measures is examined and discussed. The second section identifies certain accounting. (i.e. financial) measures as possible risk surrogates and discuss their inter-relationships and the association between such measures of risk and the rates of return on equity shares. The last section in this chapter provides a discussion of the evidence relating to the association between the market determined and firm specific accounting risk measures.
The fourth chapter discusses the evidence of the Market and Extra-Market factors latent in the stock returns. The question of homogeneous stock classifications are analyzed and presented in this chapter.

Empirical testing of the different forms of CAPM and APM, the results thereof along with a discussion on the results and a comparative study of the empirical performance of APM and CAPM constitute the contents of the fifth chapter.

Sixth chapter summarizes the report and provides conclusions about the study. Limitations of the study are listed and the areas for further research have been identified on the basis of the results obtained in this work.