CHAPTER I

INTRODUCTION

In the past four decades many finance theorists have tried to explain whether there is a relationship between risk and return on equity shares and what factors dominate the valuations of stock returns. The Capital Asset Pricing Model (CAPM) of Sharpe (1964),Lintner (1965) and Mossin (1966), Zero Beta Model of Black (1972), Intertemporal Capital Asset Pricing Model (ICAPM) of Le Roy (1973), the Arbitrage Pricing Model of Ross (1974), and Merton (1973) Consumption - oriented CAPM (CCAPM) of Breeden (1979) and other theories have been developed to explain the behaviour of stock returns.

Finance researchers have used predominantly US, Japanese and other developed country stock markets as major sources to examine their hypothesis. The rapid and large increase in investments over the past 10 years in developing south Asian countries, especially India, have prompted the researcher to do research on Indian Capital Market (hereafter, ICM). In addition to this, the S&P Emerging Stock Markets Factbook 2002 depicts that India follows closely with 5,795 listed companies as of end-2001 on the Bombay Stock Exchange and India is in the second place among the world stock markets in terms of listed companies. However it is also stated that the average company size is just $19m, next only to countries like Kenya and Namibia; India is in the 85th place when it comes to average company size (source: The Economic Times dt.29th November 2002). Therefore this research is designed to know what factors price stocks of ICM.
1.1 STATEMENT OF THE PROBLEM

Can stock returns be predicted by variables such as firm Size or Book-to-Market ratio in addition to beta?

This is the main research question to be studied. The objective of this study is to examine the relationship between Indian stock returns and firm size, book-to-market ratio and beta. The CAPM predicts that beta is the only measure of risk needed to explain the cross-section of stock returns. Suppose certain variable(s) (other than beta) can predict stock returns, it is direct evidence against the validity of the joint hypothesis of the CAPM. This study further sheds light on those factors, which are the most important variables, in explaining the stock returns.

The research problems addressed are:

1. Is the theoretical CAPM (single factor model or two factor model) valid in Indian stock market?

2. Are there variables, other than beta, that can predict stock returns?

3. Which model, the CAPM or Fama-French Three Factor Model is more relevant to Indian Capital Market?

Consequently, the result will compare the relationship of CAPM and Fama-French Three Factor Model (hereafter, TFM) and assume that TFM capture much of the stock returns than those captured by β of the CAPM. While addressing this problem, this study also attempts to further examine stock descriptive statistics of the sample firms.
1.2 BACKGROUND OF THE PROBLEM

The Capital Asset Pricing Model (CAPM), originally developed by Sharpe (1963, 1964) and Treynor (1961) and further developed by Lintner (1965), Black (1972) and Merton (1973), shows that the equilibrium rate of return on a risky asset is a linear function of its covariance with the market portfolio.

The Capital Asset Pricing Model (CAPM) has been the model of choice, over the last 30 years, shaping the way the risk-return relationship is viewed. Asset pricing is arguably the most critical area of finance. Measuring and deciding how best to maximise value lies at the root of every issue within the field. We cannot determine value without considering risk due to the presence of uncertainty. In order to derive the expected return on an asset, we must distinguish between risk factors, for systematic risk investors are willing to pay (priced) and those unsystematic risk, which can be controlled through diversification. Researchers are dependent on pricing models when performing a wide range of empirical research including tests of market efficiency and event studies.

The expected return of CAPM is:

\[ E(R_i) = R_f + \beta_i [E(R_m - R_f)] \]  \hspace{1cm} (1)

where, \( E(R_i) = \) Expected return of the \( i^{th} \) scrip
\( R_f = \) Risk-free rate of return which has zero variance with the efficient portfolio
\( R_f = \) The calculated yield of Treasury Bill
\( R_m = \) Market or efficient portfolio returns
\( \beta_i = \) The linear relationship with the market (i.e. efficient portfolio)
\[ \rightarrow \frac{\text{Cov}(R_i, R_m)}{\text{Variance of } R_m} \]
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The amount by which the expected return on asset $i$ ($E(R_i)$) exceeds the return on a risk-free asset ($R_f$) is determined by the market risk premium ($R_m - R_f$) and the amount of non-diversifiable risk associated with the asset $\beta$, is defined as the covariance between assets and the market portfolios return divided by the variance of the market return.

The assumptions necessary to derive the above model are stringent. 1) There are no taxes or transaction costs; 2) All investors have homogeneous expectations and joint normal distributions; 3) Investors are risk averse and wealth maximising, and 4) Investors can take unlimited long or short positions in any asset and can borrow and lend at the risk-free rate of interest.

The theoretical CAPM (the single-factor model) is in its ex ante form. Since $\beta$ and market returns are unknown we transfer the CAPM from an ex ante form into a form that uses observed data (i.e., ex post form). In the ex post form, some market index is used in the place of the market and $\beta$ is regressionally estimated.

In the CAPM, $\beta$ is the only factor that explains the rate of return on a risky asset. Using cross-sectional regressions, studies before 1980s demonstrate that expected returns are linearly related to their betas. Using multivariate regression framework, studies after 1980's show that the CAPM is not supported by data.

Fama and French (1992) conclude that $\beta$ alone does not explain cross-sectional average stock returns, hence, they proclaim the death of beta and it further creates a heated debate over the fate of beta.

Beginning in the late 1980s a wide variety of anomalous variables begins to appear in literature. $\beta$ could not explain away the impact of some stylised facts such as Size, P/E (Price Earnings ratio) and so on. Several deviations from the CAPM are 'anomalies'. These
anomalies can be described parsimoniously using multifactor models in which the factors are chosen atheoretically to fit the empirical evidence.

These are Three Schools of Thought about these anomalies. The First School of Thought attributes Error of Measurement of Beta or Market Portfolio as a reason for anomalies.

The Second School of Thought thinks that market is efficient but the investors always behave irrationally by overreacting to new information which leads to abnormal returns by the strategy of buying losers and selling winners.

The Third School of Thought specifies that the market is efficient but the CAPM is misspecified, called as "Misspecification of the CAPM". Misspecification of the CAPM is further subdivided into: (a) Arbitrage Pricing Theory and its empirical tests, (b) Macroeconomic factors, and (c) Microeconomic factors.

The CAPM is viewed from another angle of behavioural finance, which is of its own peculiar kind, in a class by itself: The CAPM *sui generis*.

The majority of researchers on ICM India are related to Random Walk Hypothesis and Efficient Market Hypothesis. Only a few researches are related to the CAPM. Almost all the researches conclude that the CAPM is not applicable to ICM due to various reasons.

It is felt, therefore, that Fama and French's Three Factor Model to explain stock returns, suits best to ICM environment. This research is a newly tested empirical research on Three Factor Model on ICM, and it is hoped that it may cater to the need of professional and academic community on relevance of Fama-French TFM on ICM.
Besides the above, the following are the main reasons for choosing the Three Factor Model:

(1) Betas of the CAPM are demonstrated to be linearly related to the expected returns through various studies before 1980s. Using multivariate regression framework, the studies after 1980s show that the CAPM is not supported by the data. In India, some studies confirm that the CAPM is not applicable to the Indian Stock Market.

(2) In the year 1977, a negative correlation between E/P and returns is found. The subsequent researches on the relationship between E/P and returns have mixed answers. Biases in betas are assumed to influence stock returns. Bias may arise due to Infrequent or Nonsynchronous Trading, Return Measurement Interval or Nonstationarity of Beta. Later, it is proved that while assessing the return generation process, beta is not so important than other variables such as Size and Book-to-Market effects.

(3) In the same way, Transaction and Information Cost, Investor's Overreaction Hypothesis or Systematic Misassessment of the Fundamentals do not prove that they are the only causes of anomalies. Finally, misspecification of the CAPM is proved by Fama and French (1992, 1994, 1996 and 2000 with Davis) by showing that Size and Book-to-Market effects capture much of the returns than the returns captured by the beta of the CAPM.
(4) Though Fama, French or Davis does not provide theoretical foundation of the Three Factor Model, their parsimonious model is only atheoretically proved. However, still the Three Factor Model is found to explain average stock returns and the Size and Book-to-Market equity absorb other anomalies such as earnings yield and leverage.

(5) The Three Factor Model is empirically proved to operate at global level and the Three Factor Model is better than the CAPM in explaining stock returns.

1.3 OBJECTIVES OF THE STUDY

The objectives of the study are the following:

1) To find out the risk-return trade-off between beta and stock returns, and to find out whether the beta serves its purpose of proper measure of risk.

2) To empirically test whether the CAPM is adequate to describe Indian stock returns.

3) To understand any variables beyond $\beta$ whose coefficients yield a better view of return generating process.

4) To know the relevance and implications of other model(s) such as Fama-French Three Factor Model which may capture Indian stock returns better than the CAPM.
1.4 RESEARCH OUTLINE

This research paper tries to shed further light by finding more empirical evidence for
the application of Fama-French TFM. Fama and French (1992) claim that the CAPM is
misspecified because:

a) beta does not explain the cross-section of expected returns, but

b) a combination of size and book-to-market seems to absorb leverage and B/P
ratios in explaining average returns.

Fama and French (1992) suggest a Three Factor Model to explain the expected return on a
portfolio as under:

\[ E(R_i) - R_f = b_1[E(R_m) - R_f] + s_1E(SMB) + h_1E(HML) \]  \hspace{1cm} (1.2)

where \( E(R_m) - R_f \) is the expected premium on the excess return of a broad market portfolio,
\( E(SMB) \) is the expected premium on the difference between returns on a portfolio of small
stocks and the return on a portfolio of large stocks (SMB, small minus big), and \( E(HML) \) is
the expected premium on the portfolio of high book-to-market stocks and the return on a
portfolio of low book-to-market stocks (HML, high minus low); and \( b_1, s_1, \) and \( h_1 \) are the
slopes in a time series regression of

\[ R_i - R_f = \alpha_i + b_1(R_m - R_f) + s_1SMB + h_1HML + \epsilon_i \]  \hspace{1cm} (1.3)

Fama and French (1996) acknowledge that it may not be surprising that portfolios
like SMB and HML formed on size and BEME (Book Equity-to-Market Equity) can explain
the returns on other portfolios formed on size and BEME (although with a finer grid).
In Fama and French (1996) they test whether the Three-Factor Model can explain other prominent CAPM anomalies, and claim it can.

$R_M$, $SMB$ and $HML$ are formed in our research as follows:

1. **In June each year**, stocks are allocated into Small (S) or Big (B) groups according to whether their June Market Equity ($ME$) is above or below median.

2. **Stocks are then allocated in an independent sort to three book-to-market equity (BEME) groups** (Low, Medium or High) based on breakpoints for bottom 30%, middle 40%, top 30% of values for BEME stocks.

3. **Six size-BEME portfolios are formed**, namely, Small Low (SL), Small Medium (SM), Small High (SH), Big Low (BL), Big Medium (BM) and Big High (BH). They are defined as intersections of two $ME$ and three BEME groups. **Monthly returns on each portfolio are calculated from April to following March.**

4. **SMB** is the difference each month between the average return on the three small stock portfolios (SL, SM, SH) and the average returns on the three big-stock portfolios (BL, BM, BH).

5. **HML** is the difference between the average of the returns on the two high BEME portfolios and the average returns on the two low-BEME portfolios.
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We further test to find whether these “three factors” of Fama and French (1992) can explain the cross-sectional differences in the portfolios formed on size and B/E/M. We interpret the average HML return as a proxy for financial distress. Low B/E/M is typical of firms with strong earnings, while high B/E/M is associated with persistently low earnings.

The research outline is briefly stated as follows:

First, in order to avoid the possible size effects, this research deals only randomly selected 200 stocks of BSE in terms of market capitalisation and the number of days traded by the firm that achieved a benchmark of 65% of total number of trading days of BSE.

Second, the stock returns, book-to-market value, leverage etc. are taken from the dataset of Prowess provided by the Centre for Monitoring Indian Economy (hereafter CMIE).

Third, this study adopts the Annual Buy-and-Hold Strategy. Based on the select firms and Prowess database, this study regroups the equally weighted stocks by each year from 1990 till 2002.

Fourth, based on Prowess dataset from January of 1990 till March of 2002, this study calculates the monthly compounded rates of return for each security.

Fifth, this study applies the CAPM to each of the security individually or as a member of a portfolio.

Sixth, revising the portfolios each year our study uses Fama-French TFM.
1.5 SOURCES OF DATA

Though there are 22 stock exchanges in India, The Bombay stock Exchange (BSE) is one of the oldest and largest organised exchanges in the world, established in 1875, and it is the apex body of all exchanges in India. The data on listed companies of BSE are taken from CMIE database. Stock returns, Size, Book-to-Market ratios et al., are taken from CMIE database Prowess on the following conditions:

(i) The shares of a company must have been traded on BSE for a period of more than 12 years (from January 1990 till March 2002).

(ii) As the BSE has 2764 trading days between 01/1990 and 03/2002, the selected company's shares are traded on BSE at least for more than 65% of the trading days.

(iii) Month-end data are taken, irrespective of the fact that the select company may belong to "A Group", "B1 Group", "B2 Group" or "Z Group". A company is classified to adhere to any one of these "Groups" by the Board of the BSE, generally on the basis of how actively the shares of such company are traded on the floor of the BSE. The most actively traded shares of a company is treated as belonging to "A Group" and rarely-traded shares of a company is brought under "Z Group".

(iv) As CAPM is an equilibrium model, related to the entire market, we can not include every conceivable variable into the ambit of "market", such as Money Market Instruments, Fixed Income Capital Market and so on. Hence it is assumed that the data on randomly selected 200 companies represent the data of the entire market. The select 200 companies belong to a wide spectrum of industries.
We conditionally take our sample of firms’ returns as given above to avoid survivorship bias in ICM. The reason is that Kothari, Shanken and Sloan (1995) find that betas estimated from annual rather than monthly returns in NYSE, NASDAQ produce a stronger positive relation between average returns and beta. They also argue that there is a severe survivorship bias in the Compustat sample used in U.S.A. In our sample there are no survivorship bias.

1.5.1 Market indices

It is not possible to include the data of the entire market for our research purpose. We take an index as a proxy of the market. This surrogate index is Bombay Stock Exchange Sensitive Index (or Sensex). The main reason of choosing Sensex is:

- It is the most widely followed stock market index in India
- Sensex is used for Sensex options also.
- In the year 2001, Dollex-30 is launched by BSE. It reflects the changes in both the stock prices and the foreign exchange variation. Dollex-30 is the dollar version of Sensex. The Sensex is the benchmark index of equity markets in India.
- The Performance of Benchmark of Emerging Market Country Indices issued by BSE shows that the percentage increase in local currency since 1989 of Sensex is 668%, as compared to Indonesia (417%), Korea (50%), Malaysia (110%) and Thailand (17%).

Hence, Sensex returns are taken as a proxy of the market returns.
1.5.2 Risk-free rate of return

The implied yield, on the month-end auction of 91 days Treasury Bill (T-Bill) issued by the Reserve Bank of India, is used as a proxy of risk-free rate (R_f). The data are collected from The Handbook of Statistics on Indian Economy-2002 and RBI Bulletins, both issued by the Reserve Bank of India. Till 8th January 1993, T-Bills are regulated in India with a constant yield of 4.6% per annum. Since 8th January 1993, the 91-days T-Bill yield is exogenously determined on an auction basis. The month-wise data on 91-days T-Bill are taken over a period of more than 12 years (January 1990 – March 2002).

1.6 DETAILS OF ANALYSIS

There are 147 month-end data on each of the 200 scrips. The main statistical package used is SPSS. While calculating beta values, some scrip has negative βs, and some script data excludes Book-to-Market, Size (price times number of shares outstanding) and so on. Such scrip in total is 15 and hence these 15 are excluded from the select 200 scrip and many analyses are based on 185 scrip.

Betas are estimated using SPSS and Three Factor Model is tested using Multivariate Regression Analysis of SPSS. To find the stability of beta, autocorrelation of 16 lags are used. We also find Q statistic and Third and Fourth Momentum with their Z values.

1.7 CHAPTERISATION

Chapter I deals with Introduction [purpose of this dissertation, objectives of the study, problem statement, significance and contributions].

Chapter II deals with Literature Review – [Early Developments, The Capital Asset Pricing Model, Anomalies of CAPM (Errors Haunting the CAPM, Inefficiency Affecting
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Chapter III explains the Methodology of Empirical Testing of Three Factor Model [Research Design, Basic Data Sources and Instruments]. The model estimates the following: (i) Estimating the expected returns, (ii) Beta and Market Portfolio Proxy Measurement and (iii) Size and Book-to-Market Equity Measurement.

Chapter IV deals with Empirical Results and Analysis on testing the CAPM under Fama-MacBeth (1973) methodology of second-pass regression, two variants of Fama-MacBeth (1973) methodology and the Three Factor Model of Fama-French (1992) on Indian stocks.

Chapter V summarises the results and gives conclusions, limitations of the present study and suggests scopes for further research on the Three-Factor Model.