Indian Sensitive Index (Sensex) and Assets Pricing Literature in Financial Economics

A Peer Mohamed*

Capital Asset Pricing Model (CAPM) relies heavily on the stock market index as it is practically impossible to collect the entire data from the complex stock market. Though beta value is derived by applying such indices, empirical findings and conclusions vary from one finding to another. This paper briefly presents such findings under four broad headings. The first one gives a concise view of early development of CAPM when beta is considered—before 1980s—the messiah to pricing of an asset. In the 1980s and 1990s, some researchers concluded that many other variables also influence the asset pricing model and declared beta dead. The second heading presents the anomalies or puzzles in CAPM. After the 1990s, some researchers asserted that asset pricing is primarily based on behavioral attitude of investors. This is dealt with under the third heading CAPM, the sui generis. The collaged Indian empirical findings on CAPM are presented under the last part.

1. Introduction

Sensex is regarded to be the pulse of the Indian stock market. History is created at the fag end of the session at around 3:12 pm on February 6, 2006 when Sensex crossed the 10,000 level and reached 10,002.83, the day's high, before closing at 9,980.42. This is a milestone for the Indian capital markets. It reflects the underlying strength of the economy and the leap of faith that global and local investors have taken on India.

Sensex depicts market index. For asset pricing, market index is the base to create E When market index moves, the value of a stock also moves in tandem with the market index. Increase in market price leads to increase in share price and ultimately increase in market capitalization. The Capital Asset Pricing Model (CAPM) theoretically depends on whole market such as share market, money market, antique/painting market, human capital market, etc. As practically it is not worth to collect data for the whole market, CAPM relies heavily on stock market index. Our market index (Sensex) is robust now. We are, therefore, forced to know the literature on CAPM. This paper surveys and reviews the field of assets pricing literature and the emphasis is on the interplay between theory and empirical work.

* Senior Lecturer, School of Accounting and Finance, Binary University College, Bandar Puchong Jaya, 47100 Selangor, West Malaysia. E-mail: dsapmohamed@gmail.com

The rest of the paper is organized as follows:

- Early Development of the Capital Asset Pricing Model (a concise view is given);
- Anomalies in the CAPM (theorists develop models with testable predictions, but there are stylized facts that fail to fit established theories, called "puzzles", these puzzles are surveyed here);
- The *sui generis*CAPM (a brief view of application of behavioral science on the CAPM);
- Indian Empirical Findings on the CAPM; and
- Conclusion.

2. Early Developments of CAPM

The first shareholder-owned business might be the Dutch East India Company, with an object of trading with India, was founded by Dutch Merchants in 1602 and issued negotiable share certificates that were readily traded in Amsterdam until the company failed almost two centuries later. By the 17th Century, traders in London coffee houses earned their living dealing in the shares of joint-stock companies. But it was not until the industrial revolution made it necessary to raise large amount of capital to build factories and canals that share trading became widespread. In the 20th century, the world stock market moved towards its zenith. The gigantic growth of stock market results into the capitalization of world's stock markets in 2005 as $39 tn. CAPM becomes workable horse for stock market.

The Three Ps

There are three Ps that are directly related to share prices and their behavior, namely, "Preferences, Probability and Price"[1]. Formal models of asset prices and financial markets, such as those of Merton (1973), Lucas (1978), Breeden (1979) and Cox, Ingersoll, and Ross (1985), show precisely how the three Ps simultaneously determine an "equilibrium" in which demand equals supply across all markets in an uncertain world. For example, given an equilibrium in which preferences and probabilities are specified, prices are determined exactly (this is the central focus of the asset pricing literature in economics).

Preferences

Preference of an asset can be directly expressed in terms of utility. In the framework proposed by Von Neumann and Morganstern and Savage, any individual's preferences can be represented numerically by a utility function U (X) under certain axioms.[2] In other words, if an individual's preferences satisfy these axioms then a utility function U (X) can be constructed in such a way that the individual's choices among various alternatives will coincide with the choices that maximize the individual's expected utility, E[U(X)]. This utility function can be traced back to St. Petersburg Paradox.

An individual is offered this gamble: "A fair coin is tossed until it comes up heads, at which point the individual is paid a prize of $\$2^k$, where k is the number of times the coin is tossed." How much should an individual pay for such a gamble?

The expected value of this gamble is infinite, yet individuals are typically willing to pay only between $2 and $4 to play. And this is the St. Petersburg's Paradox. Why are they willing to pay only between $2 and $4?

Daniel Bernoulli (1738) resolves the Paradox by asserting that gamblers do not focus on the expected gain of a wager but, rather, they focus on the expected logarithm of the gain, in which case, the "value in use" of St. Petersburg gamble is:

$$\sum_{1}^{f} 2 \quad \log(2\ ) \quad 2\log 2 \quad 4 \qquad \cdots(1)$$

Although Bernoulli does not present his resolution of the St. Petersburg Paradox in terms of utility, the essence of his proposal is to replace expected value as a gambler's objective with expected utility, where utility is defined to be the logarithm of gain. This approach to decision-making under uncertainty is remarkably prescient;

The price, P_t, of any financial security that pays a stream of dividends D_{t+1}, D_{t+2},... must satisfy the following relationship:

$$\sum_{W}^{f} \frac{W \quad W}{C} \qquad \cdots(2)$$

where, $U_t(C_t)$ and $U_{t+W}(C_{t+W})$ are marginal utilities of consumption at dates t and $t+W$ respectively. This "maximizing the expected utility E[U(X)]" is a powerful representation. It lies at the heart of virtually every modern approach to pricing financial assets, including modern portfolio theory, mean-variance optimization, the Capital Asset Pricing Model, the Inter-temporal CAPM, and the Cox-Ingersoll-Ross (1985) term-structure model.

Probability

Objective (or statistical/aleatory) probabilities are based on the notion of relative frequencies in repeated experiments. On the other hand, subjective (or personal/epistemic) probabilities measure "degree of belief", which is not based on statistical phenomena. The link between subjective probabilities and risk management becomes even stronger when considered in light of the foundations on which subjective probabilities are built. The three main architects of this theory—Ramsey (1926), De Finetti (1937), and Savage (1954)—argue that, despite the individualistic nature of subjective probabilities, they must still satisfy the same mathematical laws as objective probabilities; otherwise, objective probabilities will arise. Subjective probabilities behave like objective probabilities in every respect. This principle is often called "Dutch book theorem."[3]

Price

Equilibrium is a function of price. Price, probability and preferences or utility are interlaced with each other. One of the great successes of modern economics is the sub-field known as asset pricing; within asset pricing, surely the crowning achievement is the development of precise mathematical models for pricing and hedging derivative securities. The basic equation of asset pricing can be written as follows:[4]

$$P_{it} = E_t\,[M_{t+1}\ X_{i,\ t+1}] \qquad \cdots(3)$$

where, P_{it} is the price of an asset I at time t ("today"), E_t is the conditional expectations operator conditioning on today's information, $X_{i,\ t+1}$ is the random payoff on asset I at time t + 1 ("tomorrow") and M_{t+1} is the Stochastic Discount Factor (SDF). The SDF is a random variable whose realizations are always positive. According to the standard present value relationship, the fundamental real price of an asset at time t is[5]:

$$P_t^f = E_t\left[\sum_{j=1}^{\infty}\left(\prod_{i=1}^{j}\gamma_{t+i}\right)D_{t+j}\right] \qquad \cdots(4)$$

where, E_t [.] denotes the mathematical expectation conditional on all information available at time t, and T refers to the accumulated real dividend or other payoff on the asset from time t–1 through t. Finally the discount factor is $\gamma_t =$ exp (–r_t), where r_t is a continuously compounded required rate of return.

The Beginning of Investment Theory

The vertex of the study of capital assets starts earlier exactly 105 years from now by a French mathematician Louis Bachelier (1990) in his Ph.D thesis about 'random walk' hypothesis. He uses Brownian motion as a model for stock exchange performance. He is the first to apply the trajectories of Brownian motion, and his theories prefigure modern mathematical finance. Constructs developed by Kenneth Arrow and Gerard Debreu provided a similar foundation for financial economics. Their approach represents securities and other types of financial instruments in terms of their most elemental components.

Markowitz's Efficient Frontier

Statistical analysis is made on stock prices. John Burr Williams (1938) is the first man to observe that subjective probabilities should be assigned to various possible values of security and the mean of these values is used as the value of security. "In the end all prices depend on someone's estimate of future income". This statement, taken from John Burr Williams' 1938 text, pierces the very heart of the subject of finance. Yet his stance is atypical, and in general the economic-theory-based approach he adopts was remarkably modern. He further observes that by investing in sufficiently many securities, risk could be virtually eliminated. Leavens (1945) further suggest diversification among industries is needed to protect against unfavorable factors.

These publications, unfortunately, lack risk-return trade-off, correlation of securities' weights, covariance between securities and utility theory. Preference or utility is the motive behind consumption and investment. Markowitz (1952) synthesized all the parameters and geometrically developed Investment Theory, based on the probabilistic notion of expected return and risk.

His work is based on the idea that stock returns are normally distributed and that people like returns and do not like risk. Thus they want high mean, low standard deviation portfolio. The portfolios that have the highest return for a given level of risk are called the Mean-Variance Efficient frontier (MVE). When we graph the efficient portfolios in risk-return space the concave line is the 'efficient frontier'.

Risk can be broken into market (systematic/undiversifiable) risk and unique (firm-specific/ diversifiable/unsystematic/idiosyncratic) risk. Diversified investors are concerned with market risk. Beta is an asset's contribution to the risk of a fully diversified portfolio. Beta is calculated by regressing the asset's return against the market portfolio. Thus the beta of Treasury Bills is zero and the beta of the market portfolio is 1.00.

The Capital Asset Pricing Model

A homogeneous expectation is an assumption in the Capital Asset Pricing Model (CAPM) that states that all investors see the same risk-return profile for assets. Investor's risk tolerance interactions for risky alternatives, in competitive markets, provide signals to the economy in the form of asset prices. This valuation of risky assets results in an efficient allocation of resources in the economy over time.

The CAPM shows that the equilibrium rate of return on a risky asset is a linear function of its covariance with the market portfolio; it can be expressed in terms of a simple linear model that captures the trade-off between the firm's expected returns and expected systematic (non-diversifiable) risk. In its ex ante form it can be represented by:

$$E\ (R_t) = R_{ft} + \beta_i (R_{mt} - R_{ft}) \quad \cdots (5)$$

where, $E\ (R_t)$ is the ex ante expected returns of a firm, R_{ft} is the contemporaneous risk-free rate, β_i is the systematic risk of a firm and R_{mt} is the return on the market portfolio.

The Empirical CAPM

The CAPM is an equilibrium model and the relationship between beta and expected return is explicitly specified, but it does not mention the empirical way of testing the CAPM. Expected return rests on the expectations of the investors, which is ex ante and it cannot be ascertained so easily. Hence, a researcher is left with the only chance of testing the CAPM with ex post returns data. We need to transform the CAPM from an ex ante form of equation 5 into a form that uses observed data. Assuming that the rate of return on an asset is fair game,[6] on average, the realized rate of return on this asset is equal to the expected rate of return. The CAPM model can be expressed in ex post form as:

$$R = \gamma_0 + \gamma_1 \beta_p + \varepsilon_{pt} \quad \cdots (6)$$

where, R = The excess return on a portfolio over the risk free rate ($R_t - R_{ft}$)

γ_0 = The intercept term,

γ_1 = The risk premium ($R_{mt} - R_{ft}$),

β_p = The covariance between the portfolio's return and the market portfolio return divided by the variance of the market portfolio's return,

ε_{pt} = A random error term.

The testable implications of the CAPM can be summarized as follows:

- The intercept term, γ_0 should not be significantly different from zero (otherwise, there may be something captured by the empirically estimated intercept),
- The beta should be the only factor that explains the rate of return on a risky asset,

- The relationship should be linear in beta,
- The coefficient of beta, γ_1 equals to the difference between the market portfolio return and the rate of return on the risk free rate,
- Because the market portfolio is riskier, on average, it should have a higher rate of return than the risk-free rate.

The time-series regression of empirical CAPM can be expressed as:

$$R_{it} - R_{ft} = \alpha_i + \underbrace{\beta_i (R_{mt} - R_{ft})}_{\text{Nondiversificable or Systematic Risk}} + \underbrace{\varepsilon_{it}}_{\text{Diversificable, Nonsystematic or Idiosyncratic Risk}} \qquad \cdots(7)$$

(If the CAPM is an accurate representation of the asset pricing in stock markets, then other factors or measures, once included in the empirically estimated model, like residual variance, P/E ratios, dividend yield, firm size (ME), book-to-market equity (BEME), beta squared etc., should have no explanatory power).

3. Anomalies of the CAPM

The CAPM is taken to numerous empirical tests. The results reported by empirical studies show mixed indications to the empirical performance of the CAPM. Using cross-sectional regressions, studies before 1980s demonstrate that expected returns are linearly related to their CAPM's betas. Using multivariate regression framework, studies after 1980s show that the CAPM is not supported by data; a wide variety of anomalous variables begins to appear in the literature. β is still found to be positively related to the returns, but it could not explain away the impact of some stylized facts, as the case of size, price-earning ratio (P/E) etc. These anomalies can be described parsimoniously using multifactor models in which the factors are chosen a theoretically to fit the empirical evidence.[7]

By using such models, however, it is well known among financial economists that they are testing two joint hypotheses. That is, the efficiency of price mechanism and the validity of the models used in the empirical studies cannot be disentangled from each other. On this background, three schools of thought try to explain about these anomalies[8] by giving due interpretations on their findings of empirical studies.

The first school of thought attributes error of measurement of beta or market portfolio as a reason for anomalies. They argue that since beta and market portfolio are unobservable, improper measurements may be taken leading to Errors In Variable (EIV) problem. The stationarity of beta is also questionable.

The second school of thought thinks on the line of market efficiency. They interpret that market is inefficient and they assume that investors always behave irrationally by overreaching to new information, which leads to abnormal returns achieved due to the possession of portfolios that mimic size, book-to-market equity, EPS etc., The last school of thought specifies that market is efficient but CAPM is misspecified. Each school of thought has their own way of empirically testing their hypotheses and finally makes interpretations about the anomalies.

The First School of Thought: Errors in Measurement and the CAPM

CAPM theory did not mention the empirical way of testing the CAPM. The expected return rests on the expectations of the investors, which is ex ante and it cannot be ascertained so easily. Hence, a researcher is left with the only chance of testing the CAPM with ex post returns data. Further, the measuring of beta and market portfolio entirely depends on how they are measured. An error in measurement ultimately creates an anomaly. There are many aspects associated with the measurement of systematic risk. The empirical tests along this line are given below.

Bias Due to Infrequent or Non-synchronous Trading

Error or bias may be upward or downward while estimating average returns or systematic risk (βs), if the frequencies of trading days are different. Roll (1981) points out that infrequent trading cause downward bias in the estimate of systematic risk and upward bias in the estimate of "risk adjusted" average returns. Roll's findings are given in Table 1.

Table 1: The Bias of Beta Measurement Due to Infrequent Trading (1962-1977)

Holding Period in Trading Days	Sample Size	β (E/S)[a] (Std. Error)	σ^2_H / σ^2_S[b]
1 (Daily)	3881	0.879 (.00859)	1.050
2 (Weekly)	776	1.06 (.0235)	1.555
10 (Bi-weekly)	388	1.16 (.0375)	1.896
21 (Monthly)	184	1.25 (.0570)	2.159
42 (Bi-monthly)	92	1.36 (.0983)	2.730
63 (Quarterly)	61	1.39 (.116)	2.727
126 (Semi-annual)	30	1.48 (.186)	3.166

[a] Ordinary Least Square β of equal weighted market portfolio on value weighted market portfolio.

[b] Variance of equal weighted market portfolio over variance of value weighted market portfolio.

Source: This table is condensed from Roll (1981), Table 1, Page 880.

As the investment horizon lengthens (i.e., more frequent tradings), beta increases uniformly. Later Reinganum (1982) and Roll (1981) test Roll's conjecture about the size effect due to the biasedness of beta measurement. They apply Dimson's Aggregated Coefficient (AC) method in estimating and correcting systematic risk. They use leading, lagging and current market proxy to obtain betas, instead of using only the contemporaneous market proxy as the independent variable. The equation is:

$$R_{p,t} = a_p + \sum_{k=-n}^{T} \beta_{pk} R_{m,t+k} + e_{it} \qquad t = 1, 2, ..., T \qquad \cdots(8)$$

where, a_p is an excess return; n = lead and lag period; R_{pt} = return of the p[th] portfolio at time t; $R_{m,t+k}$ = Return of the market at t+k time; β_{pk} = beta of the p[th] portfolio at k[th] time and e_{it} = error terms of its portfolio at time t.

The following regression is run to test firm size effect along with beta risk.

$$r_{p,t} = \gamma_{0,} + \gamma_{1,} \beta_{p,} + \gamma_{2,} \ _{p,} + \varepsilon_{p,} \qquad \cdots(9)$$

where, $r_{p,t}$ = Return in month t on market value portfolio p;

$E_{p,y}$ = Estimated Dimson beta for portfolio p during year y;

$S_{p,y}$ = Logarithm of median firm size in portfolio p at the end of the year y-1;

and $0_{p,t}$ = Disturbance terms.

Table 2 reveals the overall results of cross-sectional regressions of 30 market value portfolios.

Table 2: Pooled Cross-sectional Regression Estimates Using Dimson Betas and Logarithms of Market Capitalizations

Period	Months	$J_{0,t}$ (Std. Error)	$J_{1,t}$ (Std. Error)	$J_{2,t}$ (Std. Error)
1/64–12/78	180	8.502 (2.04)	0.039 (0.36)	–0.911 (0.22)
1/64–12/68	60	13.322 (2.74)	0.118 (0.41)	–1.420 (0.30)
1/69–12/73	60	0.902 (3.38)	–0.940 (0.60)	0.024 (0.35)
1/74–12/78	60	11.283 (4.16)	0.941 (0.77)	–1.337 (0.433)

Note: Hundred multiply monthly portfolio returns before regressions are run.

Source: This table is reproduced from Reinganum (1982), Table 3, and Page 33.

It indicates that, even after correcting for the downward bias in beta, size is still negatively statistically significant. Beta is statistically significant in the overall as well as 4/5-year sub-periods, but size is four standard errors away from zero. It means that bias in beta due to infrequent trading cannot solely explain size effect.

Return Measurement Interval and Beta

The longer time interval of return measurement leads to greater sampling error due to the availability of fewer observations. It further leads to arriving at larger standard errors of testing the significance of beta and introduces bias toward observing the size effect. Studies like Levhari and Levy (1977) and Handa, Kothari and Wasley (HKW, 1989) show that the true betas are non-linear due to the infrequent returns intervals. Moreover the covariance of the portfolio with the market and the variance of the market do not change proportionately. HKW proves that greater error in the estimations of beta further biases the coefficient of size variable away from zero in a multiple regressions of returns on beta and firm size. In the following regressions monthly and annual beta is obtained by regressing annual portfolio returns on annual market returns, after ranking the portfolios by size:

$$r_{p,t} = J_{0,t} + J_{1,t}\, b_{mpt-1} + J_{2,t}\, b_{apt-1} + J_{3,t}\, MV_{pt-1} + H_{pt}$$
$$p = 1, \ldots, P \qquad t = 1, \ldots, T. \qquad \cdots(10)$$

where, $r_{p,t}$ = Monthly or annual market value portfolio returns

b_{mpt-1} = Monthly beta

$_{a\ t\ 1}$ = Annual beta and

MV_{pt-1} = Natural logarithm of market value of the MV portfolio's equity in millions of dollars.

The results are reproduced in Table 3.

Table 3: Time-series Means of the OLS Second-pass Regression Co-efficient Using Monthly and Annual Betas and Market Values: Dependent Variable Annual Returns

$$r_{p,t} = J_{0,t} + 1, J_{1,t} b_{mpt} + J_{2,t} b_{apt} + J_{3,t} MV_{pt-1} + H_{pt}$$

Period	$J_{0,t}$ (t-value)	J (t-value)	J (t-value)	J (t-value)	Adj. R^2 %
1941-82	0.0182 (2.08)	–0.0061 (–1.19)	0.0096 (3.69)	–0.0007 (–1.54)	43.90
1941-54	–0.0126 (–0.85)	0.0160 (2.06)	0.0065 (1.55)	0.0065 (0.98)	41.75
1955-68	0.0227 (1.97)	–0.0091 (–1.14)	0.0112 (2.59)	–0.0010 (–1.78)	37.90
1969-82	0.0445 (2.47)	–0.0251 (–2.42)	0.0111 (2.23)	0.0018 (–1.82)	52.06
Panel B: Annual Portfolio Returns					
1941-82	0.2675 (2.05)	–0.0630 (–0.84)	0.1177 (2.34)	–0.0120 (–1.79)	50.37
1941-54	–0.0977 (–0.50)	0.2069 (1.81)	0.0666 (1.24)	0.0054 (0.56)	49.74
1955-68	0.4065 (2.18)	–0.2125 (–1.62)	0.2161 (1.57)	–0.0197 (–2.08)	36.23
1969-82	0.4933 (1.84)	–0.1835 (–1.52)	0.0705 (2.25)	–0.0217 (–1.51)	65.15

Source: This table is reproduced from Handa, Kothari and Wasley (1989), Table 3, Page 91.

It shows that annual beta is the only statistically significant variable. It supports that beta is sensitive to return interval and it also supports both the CAPM and market efficiency and that the size effect may be due to the poor measurement of true beta. Later the study of HKW is refuted by Kothari, Shanken and Sloan (KSS, 1955).

Non-stationarity and Beta

The sample observations of a variable (i.e., returns) $Y = r_1, r_2, ..., r_T$ is a time series. Subscripts denote the time points on which the observations are taken. Each observation in the sample is a realization of different random variables. In other words, it is assumed that each value $r_1, r_2, ..., r_T$ in the series is drawn randomly from a probability distribution, and that the set of data points $r_1, r_2, ..., r_T$ represents a particular outcome of the joint probability distribution function. In order that a forecast must involve minimum error, it is important to make sure that no fundamental changes occur in the characteristic or structure of the stochastic process during the time period for which time series is referred to. Generally it is accepted that stock returns follow Gaussian distribution. Thus there are some important doubts and the crucial question is: Can the assumption of normally distributed returns be employed as a working hypothesis? Most authorities would seem to accept that it could. (Allen, 1983).

However, the researchers of 1980s are worried about what happens to beta in case of non-stationarity of stock-returns because betas may affect size.

Some authors see these non-stationarity deviations as evidence of market inefficiency as the prices deviate irrationally from the fundamental value. Others see that non-stationarity is attributed to the systematic changes in equilibrium in response of variation in beta risk. They argue that the failure to capture in beta risk may induce size and other effect.

Ball and Kothari (1989) design a methodology of incorporating variation in beta risk to test the hypothesis that there is inverse relationship between abnormal returns and the size of the firm. Twenty equally weighted portfolios, by their market value at the beginning of each calendar year, are made from 1930 to 1981 from CRSP stocks. The following market model regression is used to find the return data for the years 1930 to 1981 by estimating abnormal returns and beta of each of the 20 portfolios:

$$r_{pt}(\tau) - r_{ft} = \alpha_p(\tau) + \beta_p(\tau)[r_{mt} - r_f] + \varepsilon_{pt}(\tau) \qquad \cdots(11)$$

where $r_{pt}(\tau)$ = Annual buy-and-hold return on portfolio p for calendar year t and event year;

r_{ft} = Risk-free rate of return in calendar year t;

Table 4: Average Total Returns, Beta Risk, and Abnormal Returns Over Five-year Ranking (RP) and Post-ranking Periods (PP) from 1930 to 1981: Portfolios Formed by Ranking Stocks on Firm Size

Portfolio	(1) Average Annual Total Return		(2) Average Relative Risk (Beta)		(3) Average Annual Abnormal Return	
	RP (%)	PP (%)	RP (%)	PP (%)	RP (%)	PP (%)
1	9.2	28.8	1.29	1.52	–10.9	4.2
2	13.3	23.1	1.23	1.31	–6.1	1.4
3	13.7	21.9	1.14	1.26	–4.5	1.0
4	14.1	21.0	1.11	1.18	–3.6	1.1
5	15.4	20.7	1.13	1.14	–2.7	1.4
16	18.4	14.2	0.96	0.83	2.9	0.8
17	16.8	14.0	0.86	0.80	2.4	–0.6
18	15.8	12.4	0.73	0.69	3.2	–0.7
19	16.6	11.0	0.70	0.61	4.4	–1.0
20	15.4	11.5	0.65	0.65	3.9	–1.0
Market	16.3	17.4	1.00	1.00	0.0	0.0

Correlation between Ranking and Post-ranking Period	Rank (p-value)	Product-Moment (p-value)
Total Returns	–0.456 (0.05)	–0.721 (0.001)
Beta	–0.974 (0.001)	0.966 (0.001)
Abnormal Returns	–0.802 (0.001)	–0.938 (0.001

Source: This table is reproduced from Ball and Kothari (1989), Table 2, Page 62.

r_{mt} = Return on the market portfolio in calendar year t;

$D_p(\,)W$ = Abnormal return in event year for portfolio p; and

$E_p(\,)W$ = Systematic risk in event year for portfolio p.

The results are given in Table 4.

For small portfolios, post-ranking returns are largely higher than the ranking period returns. Variations in the betas seem to account for a substantial amount of abnormal returns of firm size.

The Second School of Thought: Misspecification of Capital Market

In an efficient capital market, securities fully reflect available information instantaneously or very quickly and provide unbiased estimates of the values of the underlying assets. When the intrinsic values are not reflected in prices, the predictability of stock returns is impaired. Logically, researchers conclude that market is inefficient both in the weak form and the semi strong form.

Brokerage, overreaction and misassessment of fundamentals are the main causes that make a capital market inefficient. The three sources of market inefficiency that may be consistent with the size and book to market equity effects are described below.

Transaction Cost and Information Cost

The cost of broker's commission, information-gathering cost, the cost of monitoring the firm's activities and the bid ask spread, in an imperfect market are the sources of market inefficiency. Black (1974) explains that transaction costs may hinder the market from quickly adjusting to earning announcements. Jones and Litzerberger (1970) argue that private costs of processing and gathering earnings information are compensated by the excess returns. Price adjustments due to the arrival of new information would be gradual (rather than instantaneous) because it takes time to disseminate the changes in fundamental values to the general investing public. This allows the market professionals to make abnormal profit during the decay of information transfer. This is only presumption. No professionals out beat the market.

Overreaction Hypothesis

Smidt (1968) notes that inappropriate responses to information costs by over-reaction of investors about growth in earnings are other potential sources of market inefficiency. Basu calls this 'over-reaction hypothesis', 'the price ratio hypothesis'.

DeBondt and Thalar (1985) provide a highly influential paper presenting the evidence of substantial weak form of market inefficiency. They provide that there is negative correlation between systematic overreaction to new market information by the investors and the future price movements. The overreaction and future price movements are called price movement and price adjustment. The greater the initial price movement, the larger will be the subsequent price adjustment. The empirical question is whether such stock price reversals are predictive. Analytically,

$$_{jt} \quad (r_{jt} \quad _{1} \quad _{1} \quad (u_{jt} \quad _{1} \quad 0 \qquad \text{...(12)}$$

where, ϕ_{t-1} = The complete set of information at time t–1

r_{jt} = The return on security j at t

Em (r_{jt} | ϕ_{t-1}^{m}) = The expectation of r_{jt}, assessed by the market on the basis of the information set ϕ_{t-1}^{m}

Market efficiency implies (E_m (u_{wt}| ϕ_{t-1}^{m}) = (E_m (u_{lt}| ϕ_{t-1}^{m}) = 0, while overreaction implies (E_m (u_{wt}| ϕ_{t-1}^{m}) < 0 and (E_m (u_{lt}| ϕ_{t-1}^{m}) > 0

DeBondt and Thaler's findings are counter argued by Zerowin (1990), who finds that it is possible that overreaction hypothesis is largely driven by the January effect. Furthermore, the reversals of long-term returns documented by DeBondt and Thaler can also be explained by Fama and French's Three-Factor model (market, size and book-to-market equity ratio).

Systematic Misassessment in the Fundamentals

The third way of explaining anomalies in stock returns is simply blaming investors for irrational expectation and behavior. Dreman (1978) postulates that the mispricing of securities is due to bias in market expectations regarding earnings and earnings growth of low and high E/P firms. Earnings and growth of high E/P firms are systematically underestimated and those of the low E/P firms are systematically overestimated. Klein and Rosenfeld (1991) also attribute partially to security analyst's consistent underestimation of reported earnings of firms with the highest earnings yields.

The more important thing to find is that those who favor rational pricing theory have not yet derived a pricing model that can explain the empirical findings. Why are the abnormal returns not arbitraged away by relatively more informed investors? Compared to naive investors "experts" manage mutual funds and they must arrive at significant excess returns because their strategies are superior. So far, most of the fund managers have not been able to beat the market in the last several years.

These unanswered questions may make a person wonder if the evidence of the study reviewed is just another example of statistical artefacts or perhaps there are missing fundamentals that researchers have yet to discover. This makes us lead to another approach of solving the puzzles by keeping the market efficient but the CAPM is misspecified.

Misspecification of the CAPM

These researchers say that CAP Model is misspecified. What is a good model? Harvey (1981) lists the following criteria or guidelines by which one can judge a model chosen in empirical analysis to be good/appropriate/right model:

- **Parsimony:** A model must be kept as simple as possible. The model can never completely capture the reality; some amount of abstraction or simplification is inevitable;
- **Identifiability:** For a given set of data, there is only one estimate per parameter;
- **Goodness of fit:** The adjusted R^2 ($\bar{R}^2$) is as high as possible;
- **Theoretical consistency:** In constructing a model, we should have some theoretical underpinning to it; measurement without theory often can lead to very disappointing

results. No matter how high the goodness of fit measures, a model may not be judged good if one or more coefficients have a wrong signs; and

- **Predictive power:** One would choose a model whose theoretical predictions are borne out by actual experience.

Therefore, a model should be parsimonious in that it should include key variable suggested by theory and relegate minor influences to the error term u. There are several ways in which a model can be deficient, called 'specification errors'. The specification errors are:

- Omitting the relevant variable or under-fitting the model,
- Inclusion of irrelevant variables or over-fitting a model, and
- Incorrect functional form.

Fama and French (1995), consistent with rational pricing, report that the market portfolio, firm size and BEME factors in earnings explain the earnings of firms in the same way as those corresponding factors in returns explain stock returns. This suggests that market, size and BEME factors in earnings are the source of corresponding factors in returns. In CAPM these variables are not included. Hence, they argue, CAPM is misspecified. Ross (1976) proposes another model which can accommodate any number of variables so as to explain fully the variations in expected stock returns. The new model is called Arbitrage Pricing Theory.

Arbitrage Pricing Theory and Its Empirical Tests

Ross (1976) develops the equilibrium returns of securities that are functions of a number of factors. Arbitrage Pricing Theory (APT) is more general and allows for the incorporation of the fundamental economic factors that can cause uncertainty in the market. The APT starts with the assumption that the stocks' returns can be generated via the following factor model:

$$R_i = D + E_{1i} + E_{2i} + \ldots + E_{ni} + H \qquad \cdots(13)$$

where, n = Number of factors

E_{1i} = The sensitivity of stock i to the first factor

E_{2i} = The sensitivity of stock i to the second factor

E_{ni} = The sensitivity of stock i to the n^{th} factor

F_1 = The magnitude of the first factor

F_2 = The magnitude of the second factor.

F_n = The magnitude of the n^{th} factor

r_i = The rate of return of i^{th} asset

a_i = The stocks expected return assuming the market is flat

e_i = A random amount that also does not depend on what happens in the rest of the market.

Basically, the APT is breaking down the market returns into its generation via fundamental economic factors that are themselves uncertain and therefore are the root cause of the uncertainty of stock's return. A given stock's non-diversifiable risk is thus a multi-factor concept, given by the stocks sensitivities (or betas) with respect to individual economic factors. Unfortunately, the APT, in itself, does not specify exactly what these factors are. It is up to economists and analysts to determine how many factors drive non-diversifiable market risk and what these factors are. The APT equation for determining a stocks required rate of return as a function of risk is in general:

$$E(R_i) = r_f + \beta_{i1} RP_1 + \beta_{i2} RP_2 + \ldots + \beta_{in} RP_n \quad \ldots(14)$$

where RP_i = The risk premium associated with factor i.

This equation (14) is the multifactor APT counterpart to the CAPM equation. It makes no assumption about the probability distribution of risky assets, the market portfolio concept, the mean variance efficient portfolio or the single period model constraint. It basically relies on the-law-of-one-price to drive the model. That is, two securities with the same βs are forced to offer the same expected return. The central tenet of the model is that prices will adjust until portfolios cannot be formed to achieve any arbitrage profit.

However, APT is less applicable and less practical than the CAPM, because the model does not specify how many factors are needed and what these relevant factors are. The academicians and practitioners are left to explore these factors on their own. Therefore, there is a possibility that each one can hypothesize his or her own set of factors that are different from others. Moreover, due to the limitations and indeterminancies of factor analysis, it is not possible to test the significance as individual risk premia coefficients. Rather only asymptotic Chi-square tests on the significance of the overall risk premia can be carried out. Thus, whether each factor is individually and significantly priced is also unknown. Dhrymes, Friend and Gultekin

Table 5: Chi-square Test of the Hypothesis that k Factors Generate Daily Security Returns Using Varying Group Sizes

Number of Factors (k)	Number of Securities in a Group (Statistical Significance)			
	15	30	45	60
1	132.6 (0.0023)	572.4 (0.001)	1246.4 (0.001)	2318.7 (0.0001)
2	78.0 (0.4140)	435.4 (0.0189)	1065.1 (0.0001)	2057.9 (0.0001)
3	54.5 (0.7676)	372.6 (0.1742)	958.41 (0.0094)	1845.6 (0.0001)
4	37.7 (0.9165)	318.4 (0.5309)	858.6 (0.1461)	1697.4 (0.0023)
5	28.5 (0.9132)	269.4 (0.6554)	776.5 (0.4785)	1603.3 (0.0133)
6	—	230.3 (0.9617)	711.2 (0.7290)	1502.1 (0.0762)
7	—	199.3 (0.9869)	658.9 (0.8403)	1409.4 (0.2301)

Source: This table is partially reproduced from Dhrymes, Friend and Gultekin (1984), Table 3, Page 339.

(1984) and Dhrymes, Friend, Gultekin and Gultekin (1985) further report that the number of factors concluded by Ross are not robust to the number of securities in a group. They demonstrate that the number of factors found is proportional to the number of securities added to a group. This proof is given in Table 5.

We can find that the significance level on each number of securities varies. At 5% significance level, for the 15 securities group, only one or two factors can be found. For 30 securities group two or three can be found. The trend continues as securities in a group increases. The empirical research further questions how many factors are appropriate and sufficient for a multifactor model. The two-stage factor analysis for APT does not fare better than the CAPM against anomalies.

Macroeconomic Factors

The following are the major approaches to macroeconometric modeling:

- The traditional Cowles Commission structural equation approach,
- Unrestricted and Bayesian VaRs,
- Linear rational expectations models and
- The calibration approach associated with real business cycle theories.

In all these approaches, the main area of disagreement is over the relative roles of economics and statistics: Should one aim to estimate a model derived from formal economic theory, or is it sufficient to find a model that accords well with the data.

Compared with natural sciences, where applied work has a profound influence in setting the theoretical agenda by uncovering empirical puzzles that require a new theoretical tools to deal with them, in economics, notwithstanding data problems, applied research does not receive the attention that it deserves. The lack of widely accepted methodological framework for applied economics is a major reason for this. The variation in stock return can be associated with macroeconomic approach, where variations in risk premiums are due to macroeconomic conditions. Chan, Roll and Ross (1986) argue that macroeconomic variable should affect stock prices through changes in the discount rate and expected cash flow. They identify four factors that might affect the discount rate:

1. The level of rates;
2. Term spread (spreads across different maturities);
3. Default spread (risk premium); and
4. Real consumption charges.

As for expected cash flow, changes in the expected level of real production should all influence current real value of cash flows. The following cross-sectional regression is run:

$$R = a + b_{mp}\, MP + b_{dei}\, DEI + b_{ui}\, UI + b_{upr}\, UPR + b_{uts}\, UTS + e \qquad \cdots(15)$$

where, R = Monthly returns on portfolios which are formed by size

MP = Monthly growth of industrial production

DEI = Change in expected inflation

UI = Unexpected inflation

UPR = Risk premium or term spread

UTS = Term structure or default spread

Flannery and Protopapadakis (2002) argue that stock market returns are significant correlated with inflation and money growth. The impact of real macroeconomic variables on aggregate equity returns is difficult to establish, perhaps because their effects are neither linear nor time invariant. They estimate a GARCH model of daily equity returns, where realized returns and their conditional volatility depend on 17 macro series' announcements. They find six candidates for priced factors: three nominal (CPI, PPI and a Monetary Aggregate) and three real (Balance of Trade, Employment Report and Housing starts). Popular measures of overall economic activity, such as Industrial production or GNP are not represented.

In multifactor asset pricing models, any variable that effects the future investment opportunity set or the level of consumption (given wealth) could be priced factor in equilibrium [Merton 1973), Breeden (1979)]. Macroeconomic variables are excellent candidates for the extra market risk factors. However, the hypothesis that macroeconomic developments exert important effects on equity returns has strong intuitive appeal but little empirical support.

Microeconomic Factors

This kind of research with microeconomic factors may depend on the right explanatory variables, but the ex ante explanation is proven to be much more difficult. What is needed is a theoretical basis (similar to the CAPM) that can underlay what these fundamental factors are in explaining stock returns. It's just like sermon in a crowded church where the room becomes stuffy. In this context, a window is drawn open to breath in fresh air, the CAPM is viewed from another angle which is of its own peculiar kind; in a class by itself: sui generic CAPM. The CAPM through behavioral finance (CAPM sui generis).

4. The Sui Generic CAPM

In his classic 1980 paper, Eugene Fama writes:

> "[Efficient markets and asset pricing] research...did not begin with the development of a theory of price formation which was then subjected to empirical tests... Faced with the evidence, economists felt compelled to offer some rationalization... In short, there existed a large body by empirical results in search of a rigorous theory"

After nearly 40 years of exploration of the CAPM, DeBondt (2001) remarks:

> " Today, three decades later, the search for rigorous theory continues".[9]

As before, stylized empirical facts constrain the various modeling effects. What is different nowadays is that behavioral finance determines much of the empirical and theoretical agenda.

Behavioral finance is new. It studies how financial decisions in households, organizations and markets are truly made. Decision processes are often crucial to decision outcomes. That is the main reason why behavioral finance borrows ideas from psychology. In contrast, modern finance is based on the classical notation of ‘homo economics’, that is, the normative axioms that underlie expected utility theory, risk aversion, rational expectations etc. However, in experiments, decision-makers systematically and often willingly violate the axioms of rationality. In practice, when financial or other problem arises, there is often no unitary model of truth, even through there are degrees of knowledge. The tacit models, that people are fluid, can be misleading and they are not internally consistent. Even when there is consistency, the inner logic is not Aristotelian logic of the type that says “one plus one is two”. Rather the logic is psychological.[10]

Psychologists’ experiments show that human beings are not 100% rational decision makers. Shefrin and Statman (1984) use some of the psychologists’ results to argue that investors may have an irrational preference for cash dividends.

Daniel, Hirshleifer and Subramanyam (1998) attempt to account for short-run momentum and long-run reversals in stock returns on two classical psychological biases in judgement: overconfidence and “biased self attribution”.

DeBondt (2001) finds in surveys, investors who tilt their portfolios toward equity are more likely to see themselves as “leaders”, they “worry” less about the future, and they believe more firmly that “entrepreneurial values benefit society”.

Nelson (2002) models rational herd behavior when the underlying value changes over time, with payoffs that are either dependent or independent of the stock’s underlying value. He shows that herding does not last forever and is not monotone in single quality. High correlation among agent’s actions does not necessarily imply herding.

Since the application of behavioral sciences including psychology to asset pricing is very latest in financial economics, these may be well documented in future.

5. Empirical Researches on the CAPM in India

Empirical research on the CAPM in India is few, as compared to the most developed countries’ research on the CAPM. The main reason may be due to India’s percentage of equity market capitalization compared to world’s equity market capitalization is a meagre 0.69% (whereas, it is for USA 49.67%, Japan 13.04% and UK 9.67%).[11] The other reasons are non-existence of cohesiveness of research and publication and non-synchronization of doctoral research between Indian universities. The total number of research publication on the CAPM comes below 50. These Indian research publications are subdivided into these categories: (1) Random Walk Hypothesis (RWH), (2) Indian Capital Market (ICM)’s Efficiency, (3) The Capital Asset Pricing Model in Indian context and Offshoots of the CAPM inclusive of Market Microstructure and Anomalies. These are analyzed and discussed in the following.

Random Walk Hypothesis (RWH)

Krishna Rao (1971) tests RWH on Indian Aluminium weekly average share price data for a period of 16 years (1955-1970), collected from Calcutta Stock Exchange. Spectral analysis of the data indicates that RWH holds for Indian Aluminium. Sharma and Kennedy (1977) take the last Friday share price data of each month for 132 observations each from India, UK and USA for RWH. Spectral density confirms randomness of securities and the existence of RWH in ICM.

Indian Capital Market's (ICM) Efficiency

Barua (1981) uses runs test and serial correlation test on 20 securities and on market index. He concludes that ICM is efficient. Sharma (1983) tests market efficiency with just 23 stocks during the period 1973-1978 and concludes that ICM is fit for RWH only.

Krishna Rao's (1988) sample is ten blue-chip companies for a period between 1982 and 1987. He supports the hypothesis that ICM is weekly efficient. Maheswari and Vanjara (1989) take 142 securities for a period between 1980-1986 and conclude that market is not very efficient. Pande and Ramesh Bhat (1989) collect and data from 600 users of accounting information about their perception about ICM, and he concludes in a nut shall that ICM is perceived to be inefficient. Obaidullah (1991) reports that risk-return parity does not exist in Bombay Stock Exchange (BSE) and the market is efficient.

The Capital Asset Pricing Model (CAPM) in Indian Context

Gupta (1981) takes data, from Bombay, Calcutta and Madras Stock Exchanges, of 606 equity shares (from 1960-1976) with each year's high and low prices of the stocks. He finds that Investment in equity shares is not a hedge against inflation and he doubts the applicability of the CAPM in ICM. Yalawar (1985) takes a sample of 122 actively traded scrips in BSE and shows that equity returns are high and consistent with market risk premium. He supports the CAPM that it is a good descriptor of ICM.

Varma (1988) studies capital asset pricing in India and he does not reject CAPM. Srinivasan (1988) takes quarterly annual data of 85 securities for a period of three years. He concludes that the CAPM does not exactly hold equilibrium theory in India. Obaidullah (1991a) finds the abnormal returns are observed to persist and concludes that the CAPM equilibrium is never reached in ICM. Obaidullah (1991b) tests the normality of stock returns in India. He finds that daily returns are significantly different from normal distribution, yet they are positively skewed and leptokurtic.

Sehgal (1993) takes the average prices of monthly low and high prices of 30 scrips of Sensex index over a period of ten years (1979-1989). The Sensex is also used a proxy for the market. He concludes that the CAPM in India is a good indicator of asset pricing in all years except during recession. A die-hard CAPM fan.

Ray (1994) conducts a test of the CAPM using 170 actively traded scrip of BSE for a period of 11 years (1980-1991) and uses Fama-MacBeth methodology. He finds that the CAPM does not hold good for ICM. Obaidullah (1994) uses monthly stock price data of 30 scrips for a period of 16 years (1976-1991). He finds that the results are contradictory. The coefficients of É are generally not statistically significant, but É are statistically significant in multiple regressions. He concludes that the CAPM does not rest solidly in Indian stock market.

Gali (1995) tests for normality of returns of Sensex, The Economic Times index and Natex from 1987 till 1994 and concludes that the returns are normal for all the indices. Sehgal (1997) takes the three-moment model of the CAPM and his sample is 100 actively traded shares in BSE over a period of nine years (1984-1993) and finds that the average return on Indian stocks is 31.44% annualized (i.e., one can double the money in 2 ¼ years), yet his empirical findings do not support the CAPM in ICM.

Badhani (1997) attempts to analyze the effects of financial leverage on cost and value of equity using the CAPM. His results do not confirm the consistency between Modigliani-Miller hypothesis and the CAPM. Rao, Nath and Malhotra (1998) take 50 stocks of five year time interval and they conclude that their market proxy is an efficient portfolio and industry betas bear a linear relationship with mean quarterly returns, but it cannot be treated as a proof of validity of the CAPM in India.

Vipul (1998) tests CAPM's return generation process in ICM compared to native rules. His data is on 114 securities for seven years (1986-1993) in BSE. He finds that Market Model holds good for ICM, two-factor CAPM does a better job of explaining return generation process and zero-beta return (R_z) is time variant in ICM.

Ansari (2000) takes 96 stocks from BSE over a period of seven years and finds that his study casts a doubt on the validity of the CAPM as an asset-pricing model in India. However, he concludes that the game is not lost for the CAPM. Parchure and Uma (2000) formulate Markowitz-model for solving portfolios that are efficient in a return-risk-liquidity sense in their first part of the paper. These portfolios are more liquid and more diverse than standard Markowitz portfolios. It is shown that the "potable" portfolios sometimes dominate the Markowitz portfolios in terms of return and risk. The second part of the paper derives a general version of the CAPM, which is consistent with the empirical findings of an intercept greater than risk-free interest rate and a slope lesser than the market excess return.

Chaturvedi (2001) investigates parameter shift on earning announcements during 1990-1998 and finds that the traditional market model parameters do not measure event period abnormal returns accurately and he suggests using Bayesian procedure to reflect the shifts. Marisetty and Alayar (2002) test normality of Indian stock returns and find a significant positive skewness and asymmetry in all the years between 1991 and 2001.

Offshoots of the CAPM Inclusive of Market Microstructure and Anomalies

In single-factor and two-factor model of the CAPM, E is assumed to capture the average return of stocks in the CAPM. In the 1980s and 1990s, various anomalous variables are taken atheoretically, resulting into the offshoots of the CAPM. In this section, we view the various atheoretical effects tested in India.

Barua and Raghunathan (1986) study the efficiency of ICM and show that an investor operating in the forward market can earn abnormal return, compared to an investor operating in the cash market. Vasal (1988) studies on the effect of corporate financial decisions and share price behavior in ICM and the results indicate that ICM is reasonably efficient in valuing a firm.

Barua and Raghunathan (1990) calculate P/E ratio based on fundamental analysis of 23 stocks and compare them with actual P/E ratio. The results indicate that, on an average, shares are overvalued in BSE. Agarwal (1991) looks into dividend and stock prices in commercial vehicle sector in India for a period of 20 years (1966-1986). The adaptive expectation hypothesis supports his findings that current net profit and two past dividends explain current dividend behavior.

Vaidyanathan and Gali (1993) find that the average return on the first trading day is usually higher than that on the last trading day and intermediate days of settlement period. Madhusoodanan (1993) finds the extent of mean reversion of Indian stocks and concludes that most of the Indian stocks are mean reverting, though overall market shows a persistent behavior. Madhusoodanan (1995) establishes that ICM also overreacts and hence the contrarian strategy of selling past winners and buying past losers could produce excellent results. Daterao and Madhusoodanan (1996) apply the theory of chaos and fractals to ICM and conclude that ICM shows chaotic behavior.

Poshakwale (1996) provides empirical evidence on weak-form efficiency and day-of-the-week effect in BSE over a period of seven years (1987-1994). He concludes that BSE is efficient and day-of-the-weak effect persists in BSE. Mishra (1999) also finds that returns on Fridays are the highest.

Madhusoodanan (1997) attempts to find out the relationship between risk and expected return and tests it to find if it is really positive or not, for 120 scrips in BSE for a period of eight years (1987-1995). He finds that there is no positive relationship between beta and the expected return. Karmakar (1997) tests hypothesis of volatility of share prices and explanation of volatility by fundamental economic factors. He concludes that noise-traders destabilize the markets resulting “fads” or “bubbles”. Nageswara Rao (1997) examines the responses of stock prices to fiscal and monetary policy pronouncements, changes in industrial policy and changes in exchange rate policy, amendments to Foreign Exchange Regulation Act (FERA) and regulatory action by Monopolies and Restrictive Trade Practices Commission (MRTPC). It is found that changes in administered prices seem to have the maximum impact on the market.

Mohanty (1998) takes a smaller sample of 112 scrips and a larger sample of 2135 scrips to find out the impact of P/E effect, the book-to-market effect and size effect in ICM. He finds that only book-to-market effect and P/E effect are more dominant and indexed stocks are not representative of non-indexed stocks. Madhusoodanan (1998) applies the variance ratio tests under the null hypothesis of homoscedasticity as well as heterocedasticity. He concludes that RWH cannot be accepted in ICM and heterocedasticity does not play a major role in the Indian market. Sanyal and Sen (1998) attempts to examine how risk is diversified in India. Malhotra (1998) hypothesizes that the systematic risk of a company increases as the leverage is increased, and, a sample of ten companies from BSE for a period of four years (1993-1996) is taken. The closing prices of first four days of each month are observed, along with that Debt/Equity ratio and returns of Sensex are taken. It is concluded that the hypothesis of a positive correlation between E and debt-equity ratio is rejected.

Burman (1998) analyzes the stock prices data to find out if fundamentals or bubbles determine the changes in stock prices. He finds that the fundamentals are more important than bubbles.

Mathew (1999) finds that the industry and firm level results support the information content of dividend hypothesis. Chaturvedi (2000) analyzes the evidence of P/E effect in pre- and post-ranking announcement periods of 90 scrips in six years period (1990-1996). He concludes that significant P/E ratio effect exists in the market during the study period.

Shanmugham (2000) studies information sourcing by investors, their perception of various investment strategy dimensions and the factors motivating share investment decisions. He finds that psychological and sociological factors dominate the economic factors in share investment decisions. Anshuman and Goswami (2000) examines day-of-the-week effects on BSE, during the period 1991-1996 and finds evidence of heterocedasticity adjusted excess positive returns of Fridays and excess negative returns on Tuesdays and the presence of badla does not have any special influence on the day-of-the-week effect. Waghmare (2000) finds that, though the ban on short sales does result in reducing 'noise' volatility, the same is not true in badla. There is also evidence of leverage effect in stock returns and its reversal during the period of ban. Karmakar and Chakraborthy's (2000) results show that the average pre-holiday returns are significantly higher than the mean returns of other days. Fridays exhibit significantly positive returns.

Jha and Nagarajan (2002) examine market structure and efficiency of price transmittals in BSE and National stock Exchange using Johnson-Juselius multivariate cointegration technique, and they find that some short run price movements stabilize and BSE and NSE appear to be reasonably efficient markets. They take 120 scrips for a period between July 1, 1996 and July 30, 1997.

6. Conclusion

The asset pricing founder Markowitz (1959) provides the genuine economic model within the framework of general equilibrium. Expectation of investors cannot be arrived at ex ante data (also called opportunity cost in the parlance of Economics) and the researcher has to depend on ex post data with strong reference to market index for the calculation of beta. Empirical research after 1980s shows that Ealone is not the main price factor, other anomalous variables are empirically tested by three school of thoughts in atheoretical models, but with contradictory results. Going further on this track, asset pricing are under pinned on psychological factors in sui generic CAPM. A brief review of Indian research on CAPM is given. All these researches are underpinned on market index. Since Indian barometer Sensex crosses historical 10,000 marks, a passing remark of asset pricing literature with reference to market index is discussed.Y

Reference 42J-2006-06-01-01

End Notes

1 An excellent article is given on the "The Three P's of Total Risk Management" by Andrew W Lo (1999), *Financial Analysts Journal*, January-February 1999, pp. 13-26.

2 The fundamental axioms are on the basis of five assumptions: (1) Transitivity, (2) Continuity of preference, (3) Independence, (4) High probability of success and (5) Compound probabilities. See *Finance—A Theoretical Introduction* by David E Allen, (1983), Martin Robertson, Oxford, pp. 60-2.

3 Andrew Lo, *op.cit*,

4 John Y Campbell, (2000), "Asset Pricing at the Millennium", *The Journal of Finance*, Vol. LV. No. 4, pp. 1516-67.

5 Bollerlev, Tin and Robert J Jodrick (1999). "Financial Market Efficiency Tests", *Handbook of Applied Economics, Vol. I Macroeconomics*, eds. M Hashem Pesaran and Michael R Wickens, Blackwell Publishers, 1999, UK.

6 Fair Game Model says that, on average, across a large number of observations, the expected return on an asset, given information set, Info, will equal its actual return. The appropriate mathematical expression is:

$$H_{j,t+1} = \frac{P_{j,t+1} - P_{j,t}}{P_{j,t}} - \frac{E(P_{j,t+1} \mid Info_t) - P_{j,t}}{P_{j,t}} \qquad \cdots(1)$$

where, $P_{j,t+1}$ = The actual price of security j next period

$P_{j,t}$ = The price of security j this period

$E(P_{j,t+1)} \mid Info_t)$ = The predicted (or expected) security price next period, given a current amount of information, $info_t$

$H_{j,\,t+1}$ = The difference between actual and predicted returns.

Fair Game Model (1) is really written in returns form. Let one period return be defined as

$$r_{ij,i+1} = \frac{P_{j,t+1} - P_{j,t}}{P_{j,t}} \qquad \cdots(2)$$

then (1) can be written as

$$H_{j,\,t+1} = r_{j,t+1} - E(r_{j,\,t+1} \mid Info_t) \qquad \cdots(3)$$

If we take the expectation of (3), the price pattern will be a fair game if the expected difference between the actual and the predicted return is equal to zero.

$$E(H_{j,\,t+1}) = E(r_{j,\,t+1} - E(r_{j,\,t+1} \mid Info_t)) = 0$$

Let the value of a portfolio be x_t i.e., $x_t = h_t P_t$ where h_t = number of shares at the beginning of the period t and P_t = price at t. The expected future value of x_t is $E_t(x_{t+1})$ and it is equal to $(1+r) h_t P_t$ or $(1+r) x_t$, x_t is a martingale (r=0). If $r > 0$, x_t is a submartingale or if $r < 0$, x_t is a supermartingale.

[7] John Y Campbell (2000), op cit.,

[8] Courtesy:

- Lin, Chien-Jung and R Stephen Sears Misspecification of CAPM: Implication for Size and Book-to-Market Effect, February 2001; on-line, Internet, January 14, 2002, Available FTP: bs. ac. cowan.edu/au/fbe/wps/working paper / pdffiles/wp0102el.pdf.
- Brealey, Richard A, and Stewart C Myres. Principles of Corporate Finance , Tata, McGraw-Hill, 1997, pp. 224-30.
- Chien-Ting Lin, "Misspecification of Capital Asset Pricing Model (CAPM): Implication for Size and Book-to-market Effects", Unpublished Doctoral Dissertation, Texas Tech University, May, 1999.

[9] DeBondt, W.F.M., (2001), "Cultural Factors in Investment Decision Making", Working Paper, University of Wisconsin-Madison.

[10] See 8 above.

[11] Comparative size of World Equity Markets in USD (for Morgan Stanley Capital International: Methodology and Index Policy, 1998), quoted by Andor, György, Mihály Ormos and Balázs Szabó, "Empirical Tests of Capital Asset Pricing Model (CAPM) in the Hungarian Capital Market", Periodica Polytechnica Ser.Soc.Man.Sci., Vol. 7, p. 62.

References

1. Agarwal R N (1991), "Dividends and Stock Prices: A Case Study of Commercial Vehicle Sector in India 1966-67 to 1986-87", Indian Journal of Finance and Research, Vol. 1, pp. 61-7.

2. Allen, David E (1983), Finance-A Theoretical Introduction, Mertin Robertson, Oxford.

3. Ansari, Valeed A (2000), "Capital Asset Pricing Model: Should We Shop Using it?" Vikalpa, Vol. 25, No. 1, pp. 55-64.

4. Anshuman, Ravi V, and Ranadev Goswami, (2000), "Day-of-the-Week Effects on the Bombay Stock Exchange", The IUP Journal of Applied Finance, Vol. 6, No. 4, pp. 31-46.

5. Bachelier, Louis (1900), "Théorie de la Spéculation", Annales Scientifiques de l'Ecole Normale Supérieure 17 (3rd Series 1900), pp. 21-88; Translated from French into English by A J Boness, "The Theory of Speculation" in The Random Character of Stock Market Prices, edited by P H Cootner (Risk Publications 2000), pp. 18-91.

6. Badhani, K N (1997), "Effects of Financial Leverage on Systematic Risk, Cost and Value of Equity under Capital Asset Pricing Model", Finance India, Vol. XI, No. 2, pp. 343-352.

7. Ball R and S P Kothari (1989), "Nonstationary Expected Returns: Implications for Tests of Market Efficiency and Serial Correlation in Returns," Journal of Financial Economics, Vol. 25, pp. 51-74.

8. Barua S K (1981), "The Short-run Price Behavior of Securities: Some Evidence on Efficiency of Indian Capital Market", Vikalpa, Vol. 6, pp. 93-100.

9. Barua S K and Raghunathan V (1986), "Inefficiency of the Indian Capital Market", Vikalpa, July-September, Vol. 11, No. 3, pp. 225-229.

10. Barua S K and Raghunathan V (1990), "Soaring Stock Prices: Defying Fundamentals". Economic and Political Weekly, November 17, Vol. 25, No. 46, pp. 2559-61.

11. Bernoulli, Daniel (1738), "Specimen Theoriae Novae de Mensura Sortis" in Commentarii Academiae Scientiarium Imperialis Petropolitannae ; translated from Latin into English by L Sommer, "Exposition of a New Theory on the Measurement of Risk", Econometrica 22, No. 1, (January 1954), pp. 23-36.

12. Black F (1974), "Can Portfolio Managers Outrun the Random Walkers?" Journal of Portfolio Management, Vol. 1, pp. 32-36.

13. Breeden D (1979), "An Intertemporal Capital Pricing Model with Stochastic Investment Opportunities", Journal of Financial Economics, Vol. 7, No. 3, pp. 265-96.

14. Breeden D (1979), "An Intertemporal Capital Pricing Model with Stochastic Investment Opportunities", Journal of Financial Economics, Vol. 7, No. 3, pp. 265-96.

15. Burman R B (1998), "What Determine the Prices of Indian Stocks: Fundamentals or Bubbles? **The IUP Journal of** Applied Finance, pp. 245-254.

16. Campbell J, Lo A and MacKinlay A C (1997), The Econometrics of Financial Markets, Princeton University Press.

17. Chan, Roll N R and Ross S (1986) "Economics Forces and the Stock Market," Journal of Business, Vol. 56, pp. 83-403.

18. Chaturvedi, Hari Om (2000), "Anomalies Based on P/E Ratios: Empirical Evidence from the Indian Stock Market," IUP Journal of Applied Finance, Vol. 6, No. 3, pp. 1-13.

19. Chaturvedi, Hari Om (2001), "Parameter Shift in Event Studies: The Case of Earnings Announcements," Prajnan, Vol. XXIX, No. 1, pp. 303-314.

20. Cox J, Ingersoll J and Ross S (1985), "An Intertemporal General Equilibrium Model of Asset Prices", Econometrica, Vol. 53, No. 2, pp. 363-84.

21. Daniel K, Hirshleifer D and Subramanyam A (1998), "Investor Psychology and Security Market under and Observations," Journal of Finance, 53, pp. 1839-86.

22. Daterao M and T P Madhusoodanan, (1996), "Fractals and Chaos: Application to the Indian Stock Market", Working paper No. 7, UTI Institute of Capital Markets.

23. De Finetti B (1937), La Prevision: Ses Lois Loguiques, Ses Sources Subjectives Translated into English by H Kyburg and H Smoklerm eds. 1964. Studies in Subjective Probability, New York: John Wiley & Sons.

24. De Finetti B (1937), "La Prévision: Ses Lois Logiques, Ses Sources Subjectives". Annales de l'Institut Henri Poincaré, Vol. 7, pp. 1-68. Translated into English in H Kyburg and H Smokler, eds. 1964. Studies in Subjective Probabilitiy. New York: John Wiley & Sons.

25. DeBondt W F M (2001), "Cultural Factors in Investment Decision Making", Working Paper, University of Wisconsin-Madison.

26. DeBondt W F M and R Thaler (1985), "Does the Stock Market Overreact?" Journal of Finance, Vol. 40, pp. 557-581.

27. Debreu, Gerard (1959), Theory of Value, The Cowles Foundation Monograph 17, 1959.

28. Dhrymes P, I Friend, and N B Gultekin (1984), "A Critical Reexamination of the Empirical Evidence on the Arbitrage Pricing Theory," Journal of Finance, Vol. 39, pp. 323-346.

29. Dhrymes P, I Friend, M N Gultekin, and N B Gultekin (1985), "New Tests of the APT and Their Implications," Journal of Finance, Vol. 40, pp. 659-674.

30. Dimson, E (1979), "Risk Measurement when Shares are Subject to Infrequent Trading," Journal of Financial Economics, Vol. 7, pp. 197-226.

31. Fama, E F (1976), Foundations of Finance, New York: Basic Books.

32. Fama E F (1980), "Efficient Capital Markets: A Review of Theory and Empirical Work", Journal of Finance, XXV, pp. 383-417.

33. Fama E F, and K R French (1995), "Size and Book-to-market Factors in Earnings and Returns", Journal of Finance, Vol. 50, pp. 131-55.

34. Flannery, Mark J, and A Protopapadakis Aris (2002), "Macroeconomic Factors Do Influence Aggregate Stock Returns", The Review of Financial Studies, Summer, Vol. 15, No. 3, pp. 751-82.

35. Handa, Puneet, S P Kothari and Charles Wasley (1989), "The Relation Between Return Interval and Betas: Implication for the Size Effect", Journal of Financial Economics, 23, pp. 79-100.

36. Jones C P, and R H Litzenberger (1970), "Quarterly Earnings Reports and Intermediate Stock Price Trends," Journal of Finance, Vol. 25, pp. 14-148.

37. Karmakar M (1997), "Share Price Volatility and Efficient Market Hypothesis—An Analysis of Indian Experiences," Finance India, Vol. XI, No. 3, pp. 685-688.

38. Karmakar M and M Chakraborty (2000), "Holiday Effect in the Indian Stock Market," Finance India, Vol. XIV, No. 1, pp. 165-172.

39. Karmakar, M and M Chakraborty (2000), "Holiday Effect in the Indian Stock Market," Finance India, Vol. XIV, No. 1, pp. 165-172.

40. Klein A and J Rosenfeld (1991), "PE Ratios, Earnings, Expectations, and Abnormal Returns", Journal of Financial Research , Vol. 14, pp. 51-64.

41. Kothari S P, J Shanken and R Sloan (1995), "Another Look at the Cross-section of Expected Stock Returns", Journal of Finance , Vol. 50, pp. 185-224.

42. Levhari D and H Levy (1977), "The Capital Asset Pricing Model and the Investment Horizon," Review of Economics and Statistics, Vol. 59, pp. 92-104.

43. Lucas R (1978), "Asset Prices in an Exchange Economy", Econometrica, Vol. 46, No. 6, pp. 1429-46.

44. Madhusoodanan T P (1995), "Optimal Portfolio Selection: A Performance Analysis with Indian Stock Market Returns", Working Paper No. 2, UTI Institute of Capital Markets.

45. Madhusoodanan T P (1997), "Risk and Return: A New Look at the Indian Stock Market", Finance India , Vol. XI, No. 2, pp. 285-304.

46. Madhusoodanan T P (1998), "Persistence in the Indian Stock Market Returns: An Application of Variance Ratio Test", Vikalpa, Vol. 23, No. 4, pp. 61-73.

47. Maheswari G C and K R Vanjara (1989), Risk Return Relationship: A Survey of Selected Equity Shares, in Stock Market Efficiency and the Price Behavior (The Indian Experience), ed. by O P Gupta, First Edition, Anmol Publication, New Delhi, pp. 335-52.

48. Malhotra, Minakshi (1998), "Capital Structure and Systematic Risk—An Interrelationship in Indian Industries", Journal of Accounting and Finance , Vol. 12, No. 1, pp. 87-94.

49. Malhotra, Minakshi (1998), "Capital Structure and Systematic Risk—An Interrelationship in Indian Industries", Journal of Accounting and Finance , Vol. 12, No. 1, pp. 87-94.

50. Marisetty, Vijaya B and Vedpuriswar Alayar (2002), "Asymmetry in Indian Stock Returns—An Empirical Investigation," **The IUP Journal of** Applied Finance, Vol. 8, No. 2, pp. 14-20.

51. Markowitz H M (1952), "Portfolio Selection and Foundation of Portfolio Theory", Journal of Finance , pp. 469-477.

52. Mathew P A (1999), "Indian Stock Markets: Empirical Evidence on the Information Content of Dividend Hypothesis", Journal of Accounting and Finance , Vol. 13, No. 2, pp. 51-65.

53. Merton R (1973), "An Intertemporal Capital Asset Pricing Model", Econometrica, Vol. 41, No. 5, pp. 867-87.

54. Mishra, Bishnupriya (1999), "Presense of Friday Effect in the Indian Stock Market", Paradigm , Vol. 3, No. 2, pp. 57-64.

55. Mohanty Pitabas (1998), "On the Cross Section of Stock Returns: The Effect of Sample Size on the Research Findings", **The IUP Journal of** Applied Finance, pp. 306-18.

56. Nageswara Rao S V D (1997), "Response of Stock Prices to Macroeconomic Events", Finance India, Vol. XI, No. 4, pp. 881-918.

57. Nelson Lee (2002), "Persistence and Reversal in Herd Behavior: Theory and Application to the Decision to Go Public", The Review of Financial Studies, Spring, pp. 65-95.

58. Obaidullah M (1991a), "Earnings, Stock Prices and Market Efficiency: Indian Evidence, Securities Industry Review", Journal of the Singapore Securities Research Institute, October.

59. Obaidullah M (1991b), "The Price-Earnings Ratio-anomaly in Indian Stock Markets", Decision, July-September.

60. Obaidullah M (1991), "The Distribution of Stock Returns", Charted Financial Analyst, pp. 17-31.

61. Pandey I M and Ramesh Bhat, (1989), Efficient Market Hypothesis: Understanding and Acceptance in India, in Stock Market Efficiency and the Price Behavior (the Indian Experience), Edited by O P Gupta, First Edition, Anmol Publication, New Delhi, pp. 279-93.

62. Parchure Rajas and S Uma (2000), Potable Portfolios, Indian Capital Markets—Trends and Dimensions, Eds. Uma Shashikant and S Arumugam, Tata MacGraw-Hill Publishing Company Ltd., Delhi.

63. Poshakwale Sunil (1996), "Evidence on Weak form Efficiency and Day of the Week Effect in the Indian Stock Market", Finance India, Vol. X, No. 3, pp. 605-616.

64. Ramsey F (1926), "Truth and Probability", Foundations of Mathematics and Other Logical Essays, R Braithwaite (Ed), New York: Harcourt Brace.

65. Ramsey F (1926), Foundations of Mathematics and Other Logical Essays. R Braithwaite (Ed). New York: Harcourt Brace.

66. Rao C V, Golaka C Nath and Manish Malhotra (1998), "Capital Asset Pricing Model and Indian Stocks". The IUP Journal of Applied Finance, reprinted in Research Papers in Applied Finance .

67. Rao N Krishna (1988), "Stock Market Efficiency: The Indian Experience", Paper Presented at 'National Seminar or Indian Securities Markets: Thrusts and Challengers', Organized by the Department of Commerce, University of Delhi, South Campus, March 24-26, 1988. Reproduced in Stock Market Efficiency and the Price Behavior (The Indian Experience), Edited by O P Gupta, First Edition, 1989, Anmol Publication, New Delhi, pp. 203-18.

68. Rao, N Krishna and K Mukherjee (1971), "Random Walk Hypothesis: An Empirical Study", Arthaniti, Vol. 14, Nos. 1 and 2, pp. 53-58, Reproduced in Stock Market Efficiency and the Price Behavior (the Indian Experience), Edited by O P Gupta, First Edition, 1989, Anmol Publication, New Delhi, pp. 99-105.

69. Ray, Subrata, "Capital Asset Pricing Model—The Indian Context", Unpublished Doctoral Dissertation, Indian Institute of Management, Bangalore, 1994.

70. Reinganum, M R (1982), "A Direct Test of Roll's Conjecture on the Firm Size Effect," *Journal of Finance*, Vol. 37, pp. 27-35.

71. Roll R (1981), "A Possible Explanation of the Small Firm Effect, "*Journal of Finance*, pp. 879-888.

72. Ross S A (1976), "The Arbitrage Theory of Capital Asset Pricing", *Journal of Economic Theory*, Vol. 13, pp. 3341-60.

73. Sanyal G and S Sen (1998), "Portfolio Diversification and Risk Redmetion in India—An Empirical Analysis", *Finance India*, Vol. XII, No. 2, pp. 375-383.

74. Savage L (1954), *Foundations of Statistics*, New York: John Wiley & Sons.

75. Savage L (1954), *Foundations of Statistics*, New York: John Wiley & Sons.

76. Sehgal Sanjay (1993), "The Distribution of Stock Market Returns: Tests of Normality", *Indian Journal of Finance and Research*, Vol. V, No. 2, July.

77. Sehgal Sanjay (1997), "An Empirical Testing of Three-Parameter Capital Asset Pricing Model in India", *Finance India*, Vol. XI, No. 4, pp. 919-40.

78. Shanmugam, R (2000), *Factors Influencing Investment Decisions in Indian Capital Market—Trends and Dimensions*, Tata MacGraw-Hill Company Ltd. New Delhi.

79. Sharma J L (1983), "Efficient Capital Markets and Random Character of Stock Price Behavior in a Developing Economy", *Indian Economic Journal*, October-December, Vol. 31, No. 2, pp. 53-70, Reproduced in *Stock Market Efficiency and the Price Behaviour (The Indian Experience)*, Edited by O P Gupta, First Edition, 1989, Anmol Publication, New Delhi, pp. 219-43.

80. Sharma J L and Robert E Kennedy (1977), "Comparative Analysis of Stock Price Behavior on the Bombay, London, and New York Stock Exchanges", *Journal of Financial and Quantitative Analysis*, September, Vol. 12, No. 3, pp. 391-413.

81. Sharpe W F (1963), "A Simplified Model for Portfolio Analysis", *Management Science*, January, pp. 277-293.

82. Shefrin H and M Statman (1984), "Explaining Investor Preference for Cash Dividends", *Journal of Financial Economics*, 13, pp. 253-82.

83. Smidt S (1968), "A New Look at the Random Walk Hypothesis", *Journal of Financial and Quantitative Analysis*, pp. 235-262.

84. Srinivasan N P and M S Narasimhan (1988), "Testing Stock Market Efficiency Using Risk-Return Parity Rule", *Vikalpa*, April-June, Vol. 13, No. 2, pp. 61-66.

85. Vaidyanathan R and Kanti Kumar Gali (1993), "Stock Market Returns and "Vallan" (Settlement Period) Effect", Chartered Financial Analyst , December, Vol. 8, No. 12, pp. 5-10.

86. Varma Jayant Rama (1988), Asset Pricing under Parameter Non-stationarity , FPM Thesis, Indian Institute of Management, Ahmedabad.

87. Vasal V K (1988), "Corporate Financial Decisions and Share Price Behavior in India", Paper presented at 'National Seminar on Indian Securities Markets: Thrusts and Challenges', organized by the Department of Commerce, University of Delhi, South Campus, March 24-26, 1988. Reproduced in Stock Market Efficiency and the Price Behaviour (The Indian Experience), Edited by O P Gupta, First Edition, Anmol Publication, New Delhi, pp. 245-53.

88. Vipul (1998), "CAPM: Does it Help in Indian Capital Market?," Finance India , Vol. XII, No. 1, pp. 1-19.

89. von Neumann J and O Morganstern, (1944), Theories of Games and Economic Behvior, Princeton University Press.

90. Waghmare, Tushar (2000), "Volitility in India Stock Markets: A Study of Badla and Short Sales Restrictions" in Indian Capital Market—Trends and Dimensions, Tata MacGraw-Hill Company Ltd. New Delhi.

91. Williams, John Burr (1938), The Theory of Investment Value, North-Holland, Amsterdam, 1964.

92. Yalawar Y B (1985), "Bombay Stock Exchange: Rates of Return and Efficiency", Paper published by Indian Institute of Management, Bangalore.

93. Zarowin P (1990), "Size, Seasonality, and Stock Market Overreaction," Journal of Financial and Quantitative Analysis , Vol. 25, pp. 113-125.