Chapter 3

A Debate On Efficient Market Hypothesis – Foreign

This chapter is devoted to a discussion on the efficient market hypothesis (EMH) and the review of empirical studies conducted around the world on different forms of efficient market hypothesis i.e. weak form, semi strong form and strong form. As Fama (1991) asserted the literature is so large that a full review is impossible, and is not attempted here. We made a modest attempt to discuss and review the studies that we found interesting and significant from the point view of our study.

The efficient market hypothesis (EMH) states that current stock prices fully reflect all the available price sensitive information. It holds that the security prices reflect certain information instantaneously and in unbiased fashion and thus leaves no scope for investors to plan investment opportunities and beat the market consistently except by chance. Efficient market hypothesis (EMH) assumes that the security markets are efficient. Fama (1965) defined an efficient market as:

“A market where there are large number of rational, profit maximisers actively competing, with each trying to predict future market values of individual security, and where important current information is almost freely available to all participants” (p 56)

Samuelson (1965) provided a rigorous proof that if all the price sensitive information is provided to all market participants freely who have identical investment horizon and expectations regarding prices, then changes in stock prices will be random and stock market will be efficient. However, these conditions are so stringent that even developed stock market will not satisfy these conditions. That is why Fama (1970) asserted, “these conditions are sufficient for market efficiency, but not necessary” (p 387). This implies that stock market may be efficient with somewhat flexible conditions.

3.1 Forms of Efficiency

The studies on efficient market hypothesis have been concerned with whether stock prices “fully reflect” relevant information “instantaneously”. Stock prices reflecting all available information instantaneously are an extremely stringent requirement. Even Fama (1970) the proponent of efficient market hypothesis stated
that "the security market prices, at any point in time "fully reflecting,” all available information, is an extreme null hypothesis and it is not expected to be literally true" (p 388) Therefore, testing of efficient market hypothesis is difficult, but not impossible.

Studies on EMH in the initial stage were concentrated on studying whether past information reflected in the current stock prices i.e., testing of weak form efficiency and majority of the studies supported efficiency market hypothesis at this level. Later attention was focused on testing speed and accuracy of stock price responses to publicly available information i.e., semi strong form of market efficiency. Some of the studies supported and some studies rejected semi strong of EMH. This created confusion and controversy among the researchers that resulted in flood of research on semi strong form of EMH. Finally, some researchers started investigating whether private or inside information reflects in the stock prices i.e., strong form of efficiency. Fama (1970) suggested these three forms of market efficiency. Classification of efficient market hypothesis into three forms enables us to understand which level the stock market is efficient or inefficient.

3.2 Weak Form Efficiency – Model

Weak form of efficient market hypothesis states that investors cannot use past stock price information to consistently outperform the market. In other words, the stock prices reflect all historical information and changes randomly. Much of the research on weak form of the EMH has centered on the question whether security prices follow a random walk? Random walk requires independence of successive price changes. Fama (1965) asserted:

“The theory of random walk implies that a series of stock price changes has no memory—the past history of the series cannot be used to predict the future in any meaningful way. The future path of the price level of a security is no more predictable than the path of a series of accumulated random numbers” (p 56).

The best predictor of tomorrow’s prices is today’s price. According to Fisher Black (1971) “The past history of stock price movements, and the history of stock trading volume, do not contain any information that will allow the investor to do consistently better than a buy-and-hold strategy in managing a portfolio” (p.18).

Dyckman, Downes and Magee (1975) stated:
"The weak form of market efficiency, however, does not require all that is implied by a random walk. Rather the weak form of the EMH require only that the expected value (or average) of today's price changes is completely independent of all prior prices. Therefore, evidence, which supports the random walk behaviour of security prices, supports the EMH. However, evidence which contradicts the random walk does not necessarily contradict the EMH" (p 17)

Random Walk Model in terms of returns mathematically stated by Fama (1970) as:
\[ f(r_{t+1} / \Phi_t) = f(r_{t+1}) \]  \hspace{1cm} (1)

In the random walk model, the information set \( \Phi_t \) in model (1) is usually assumed to include only the past return history, \( r_{j, t}, r_{j, t-1}, \) So, the model (1) can also be expressed as:
\[ f(r_{j, t+1} / r_{j, t}, r_{j, t-1}, r_{j, t-2}, \ldots) = f(r_{j, t+1}) \]  \hspace{1cm} (2)

Where \( f(r_{j, t+1}) \) denotes the probability distribution of returns for security \( j \) at period \( t+1 \). The above expression implies that the conditional and marginal probability distributions of independent random variables are identical. This implies that the entire distributions of returns are independent of the preceding sequence of returns.

The review of studies concerning weak form of efficient market hypothesis has been classified on the basis of methodology used. The methodology used for the study consisted of either the use of some statistical tool to discover dependencies in stock price movement or testing the efficacy of some mechanical trading rules based on past price changes in outperforming the market.

3.2.1 Weak Form Efficiency Early Studies

The random walk model dates back to the year 1900. In that year Bachelier (1900) not only developed the theory for the behaviour of commodity prices but also found that commodity price changes on the French Bourse followed a random walk. Bachelier in his Ph.D. thesis in mathematics observed, "past, present and even discounted future events are reflected in the market price changes" This showed that he recognised informational efficiency of the market. Bachelier presented evidence that the current price of the commodities was an unbiased estimate of its future price and past data were not useful for predicting future price changes. Unfortunately Bachelier's work had little impact at that time and was forgotten. In a research article
Slutsky (1927) found that randomly generated price changes look like stock price changes and that they appear to exhibit cycles and other patterns and it does not violate random walk.

Later empirical studies by Cowles (1933), Working (1934) and Cowles and Jones (1937) in the United States and Kendall (1953) in the UK found evidence that changes in market prices were random. Although, these researchers did not call their models as “random walk model” but the results of the studies provided evidence to the random walk hypothesis.

Cowles (1933) and Cowles and Jones (1937) investigated whether stock market prices could be predictable. They found no evidence on predictability of stock prices and concluded that outguessing of stock market was not possible. Even these works did not receive much attention from contemporary researchers.

Working (1934) empirically tested commodity prices and found that speculative price patterns might be shown to be random by demonstrating that even artificially generated series of price changes form trends and patterns. Thus, the existence of trends and patterns does not violate random walk.

Working (1934)'s study also did not receive much attention from other contemporary researchers. After these studies, researchers did not pay much interest on the study of share price behaviour. By 1940s, there was scattered evidence in favour of the weak and strong form of efficient market hypothesis, though these terms were not known at that time.

Kendall (1953) conducted a study to analyse the behaviour of stock prices. He used serial correlation. He analysed the behaviour of weekly changes in 19 indices of British industrial share prices and two commodity spot price series using serial correlations and found that stock price changes are statistically independent of past prices and correlations coefficient was insignificant for 18 out of 19 index series considered for the study. He found the mean value of serial correlation coefficient to be 0.131 for a time interval of one week, with the lowest and the highest values being 0.006 and 0.156 respectively. These values were insignificant and no profitable strategy could be developed on the basis of values.

Modern research on random walk hypothesis began in 1959 with the publication of two papers by Roberts (1959) and Osborne (1959). In one paper, Roberts (1959) conducted simulation tests by comparing the levels of Dow Jones Industrial Average (DJIA) for 52 weeks during December 30, 1955 to December 28,
1956 with a series of numbers created by cumulating random numbers. He found a close resemblance between the patterns produced by the two series. Roberts further showed that the first differences of the artificially generated series also resembled the first difference of stock prices. Thus, Roberts (1959) was the first modern researcher to show that "probably all the classical patterns of technical analysis can be generated artificially by a suitable roulette wheel or random number table" (p. 10).

The second major work published in the same year was by Osborne (1959), an eminent physicist. He examined stock prices to see whether these numbers confirmed to certain laws governing the motion of physical objects. In particular, he examined whether stock price movements were similar to the movements of very small particles suspended in solution—the "Brownian motion." There was evidence of a very high degree of conformity between the stock price movements and the law governing Brownian motion. The variance of price changes over successive longer intervals of time was found to increase as the square of the length of time. This implied that the logarithms of price changes were independent of each other.

The two studies published in 1959 and development of computerised databank of security prices generated considerable controversy and induced interest among researchers to test whether stock prices follow a random walk. Subsequently, a number of studies empirically tested random walk hypothesis and published in the journals. The studies covered different sets of data, time period and a wider variety of statistical tools such as serial correlation, runs tests and spectral analysis. In addition, studies were also conducted to examine various mechanical trading rules used by the technical analysts in buying and selling stocks.

The review of studies conducted by Working (1934), Kendall (1953) and Roberts (1959) revealed that these researchers made significant contributions to the development of the random walk theory. However, Gupta (1989) stated thus: "While these researchers made significant contributions to the development of the random walk theory, they were more concerned with analysing the statistical properties of stock price series rather than suggesting an economical rationale for the model which was provided much later by other researchers." (p. 38)
3.2.2 Serial Correlation Tests

One of the popular methods of testing for randomness in stock price changes is to measure their serial correlations (or synonymously autocorrelations). Serial correlation indicates whether the price changes in time 't' (denoted $r_t$) is influenced by the price changes occurring in 'kth' period earlier (denoted $r_{t+k}$), 'k' is the number of periods of lag. The correlation coefficient from regression equation below measures the serial correlation coefficient for asset 'i' with lag of 'k' periods

$$r_{t+k} = C_{0i} + C_{1i} r_{t-k} + e_{it}$$

E($e_{it}$)=0

Where,

- $C_{0i}$ and $C_{1i}$ are the regression intercept and slope statistics, respectively.
- $e_{it}$ is the unexplained residual.

Serial correlations can take on a value ranging from -1 to +1. A positive correlation indicates direct relationship, a negative correlation indicates reverse relationship, and a correlation near to zero implies that stock price changes are independent.

Kendall (1953) examined 19 indices of the UK stock prices and 2 indices of commodity prices. He found the mean value of serial correlation coefficient to be 0.131 for a time interval of one week, with the lowest and the highest values being 0.006 and 0.156 respectively. These values were insignificant and led him to conclude that, "there is no hope of being able to predict movement on the exchange for a week ahead without extraneous information" (p 11).

Cootner (1962) used weekly price data on 45 stocks from New York Stock Exchange (NYSE) and tested randomness by using mean-square-successive-differences test. Basically, the test is a comparison of the variance of the difference between successive one-week price changes and the variance of the price changes themselves. He found evidence that stock prices followed a random walk when examined for a shorter interval, i.e., one week. At the longer interval, i.e., 14 week interval, the situation was almost reversed. Nine out of 45 stocks showed a significant tendency for price changes to follow one another at 5% level, and 35 out of the 45 stocks showed tendency toward positive autocorrelation. Further, the shift from an excessive tendency for reversals to an excessive tendency for trends takes place relatively uniformly as the interval increases.

Moore (1964) studied serial correlation of weekly prices of 30 stocks for the period 1951 to 1958. Moore measured the correlation of one week's price change with
the next week's price change. He found an average serial correlation of -0.06, which indicated that data on weekly price changes were not useful in predicting future price changes.

In 1965 Fama published one of the widely quoted studies on random walk hypothesis. He investigated the daily proportionate price changes of the 30 industrial stocks in the Dow Jones Industrial Average (DJIA) for approximately five years, ending in 1962. Fama calculated the correlation coefficient for different lags and for price changes across longer differencing intervals of four, nine, and sixteen days and found an average coefficients of -0.039, -0.057 and -0.009 respectively. These values were not significantly differing from zero. The evidence, thus, supported the random walk hypothesis. He concluded, "the evidence produced by the serial-correlation model seems to indicate that dependence in successive price changes is either extremely slight or completely non-existent." Since serial correlation coefficients have the limitation of being affected by a few extreme and unusual observations, Fama employed a non-parametric runs test also. He considered the signs rather than the size of successive changes to see if runs tended to persist. In general, the actual number of runs closely conformed to the expected number of runs. The departure from randomness was negligible, although, there appeared to be some tendency for runs in daily changes to persist. Thus, he produced impressive evidence in favour of the random walk hypothesis.

King (1966) examined the monthly price changes of 63 stocks for the period from 1927 to 1960. He used serial correlation test and found that average correlation coefficient being +0.02, which was insignificant. He also estimated serial correlation coefficients for each of four sub periods and average correlation coefficient were 0.102, -0.110, -0.047 and -0.053 respectively. The overall results of the study suggested that stock prices followed random walk.

Conard and Juttner (1973) empirically tested the behaviour of daily prices of 51 stocks in German stock market during January 1968 to April 1971 by using both parametric and non-parametric tests. They found significant serial correlation coefficient and highly dependence of stock prices changes. Thus, they concluded that random walk model was not applicable to German stock market and it was weak form inefficient market.

Fama and French (1988) investigated the autocorrelations of returns on diversified portfolios of NYSE stocks for the period from 1926 to 1985. They found
that the autocorrelations were close to zero in the short period, but negative in the longer period 1 e 3 to 5 years. They concluded that the pattern of autocorrelation was stable for a long period of time. If the period from 1926 to 1940 was ignored from the study period, the negative autocorrelation in the long period 1 e 3 to 5 years disappeared. This is an interesting and significant observation of the study and suggests that stock returns distribution pattern has been changed since 1940s.

Frennberg and Hanson (1993) tested the random walk hypothesis on the monthly returns of value-weighted Swedish stock index from 1919 to 1990. They used both the variance ratio test and the test of auto regressions of multi period returns. They found that Swedish stock returns were positively auto correlated over shorter period 1 e 1 to 12 months, and negatively auto correlated over longer period 1 e 5 or more than 5 years. Therefore, random walk hypothesis, interpreted as independence of stock price changes, is rejected in the Swedish stock market.

3.2.3 Runs Tests

It is possible that security prices might fluctuate randomly but sometimes follow trends different to detect under the filter rules and serial correlation. It implies that price changes may be random most of the time but occasionally become serially correlated for different periods. To examine this possibility, runs tests are useful. One of the limitations of autocorrelation test is that correlation coefficients can be dominated by extreme values and this will affect results of the study. To overcome this possible limitation, many researchers are using runs tests. Runs test is a non-parametric statistical test that involves using of the signs of stock price changes rather than their absolute values. In case of stock prices, a run consists of a succession of price changes of the same sign followed or preceded by price changes of different signs. In simple terms, a run is said to have occurred when signs of price changes are same, when the sign of price changes differs, and a new run begins; for example, if stock prices have following sequence of price changes + + + - - + + + + - - - +. The stock prices have experienced six runs. Comparing observed number of runs in the series with their expected number in a purely random series of the same size, randomness of stock prices are tested. A statistically significant difference between observed and actual number of runs indicate dependence in successive price changes.

In the initial stages of the development of random walk hypothesis, Roberts (1959) and Fama (1970) used runs test. Roberts (1959) found that weekly stock price
changes follow random walk. Fama (1970) found dependence in weekly stock price changes but it was insignificant from investment and statistical point of view. Thus, in general, the results of both the studies supported random walk hypothesis. Conard and Juttner (1973) investigated random walk hypothesis in the German stock market by selecting a sample of 54 stocks during the period from January 1968 to April 1971. They found significant difference between actual and expected number of runs in respect of 48 out of 54 stocks. They concluded that stock prices in the German stock market had not supported random walk theory.

3.2.4 Relative Strength Analysis

Relative strength and filter rule are the two most widely used mechanical trading rules. The relative strength theory holds that the stock which had performed out the market in the past will continue to outperform the market in future, and the stock that have done poorly will continue to perform poorly. If the relative strength is correct, it is possible to get useful information from past prices for predicting future prices.

Levy (1967) used the following relative strength:

$$RSI_t = \frac{P_t}{P_{rt}}$$

Where,

- $RSI_t$ = Relative strength index for security j at time t.
- $P_t$ = Price of security j at time t.
- $P_{rt}$ = Average price of security j based on the last 27 week’s prices.

Empirical studies based on Relative Strength Analysis are reviewed and discussed in the chapter 1.

3.2.5 Filter Rules Analysis:

It is any trading rule under which decisions are based on price movements. An x percent filter is, defined by Fama (1965a) as follows:

“If the daily closing price of a particular security moves up at least x percent, buy and hold the security until its price moves down at least x percent from a subsequent high, at which time simultaneously sell and go short. The short position is maintained until the daily closing price raises at least x percent above a subsequent low at which time one covers and buys. Moves less than x percent in either direction are ignored” (p 81)
Alexander formulated the filter techniques to test the belief, which was widely held among market professionals that prices adjust gradually to new information. The empirical studies based on filter rules are reviewed and discussed in chapter 1.

3.2.6 CRISMA Trading System

Empirical studies based on the CRISMA Trading System are reviewed and discussed in chapter 1.

3.2.7 Return Reversal Effect

Many studies suggested that in the long run extreme market performance tends to reverse itself. That is, the stocks which have performed best in the recent past seem to perform under the rest of the stocks in the following periods, while the worst past performers tend to show better performance in future. This suggests that the stock market overreacts to relevant price sensitive information. Once the overreaction is recognised, extreme investment performance is reversed. This phenomenon would imply that a contrarian investment strategy, i.e., investing in recent losers and avoiding recent winners, should be profitable, which is inconsistent with the efficient market hypothesis.

DeBondt and Thaler (1985) reported the predictability of stock returns on the basis of past returns. Research in psychology suggested that most of the people tend to ‘overreact’ to unexpected and dramatic new information. So, DeBondt and Thaler (1985) investigated whether such behaviour of people affects stock prices and market efficiency. They used monthly return data for NYSE common stocks during the period January 1926 to December 1982. An equally weighted arithmetic average rate of returns on all CRSP listed securities taken as market index. On the basis of the performance of the stocks over a five-year period, they constructed two portfolios consisted of 35 best-performed and 35 worst performed stocks respectively. DeBondt and Thaler found that loser portfolio, i.e., portfolio with 35 worst performed stocks in the initial stage outperformed winner portfolio, i.e., portfolio with 35 best-performed stocks in the initial stage by 25 percent on an average in the following three-year period. They also observed that the large positive excess returns earned by the loser portfolio in the month of January and its effect continued even after 5 years of portfolio formation.

In the follow-up study, DeBondt and Thaler (1987) re-evaluated the overreaction hypothesis to investigate winner-loser, size, and January effects along
with time varying risk premium and market efficiency. They used monthly returns from 1926 to 1982 for stocks listed on NYSE as compiled CRSP. On the basis of cumulative excess returns over a five-year period, they formed a portfolio of 50 most extreme winners and 50 most extreme losers. The results of the study revealed that during the period of the study, the portfolio of extreme losers outperformed the portfolio of extreme winners by an average of 31.9 percent. They also found that winner-loser effect could not be attributed to changes in risk as measured by beta and size effect. Moreover, the earnings of winning and losing firms showed reversal patterns that are consistent with overreaction hypothesis. Thus, the overall results of the study were inconsistent with weak form of efficient market hypothesis.

The results of the studies conducted by DeBondt and Thaler (1985, 1987) have generated tremendous interest and debate among the researchers. Replicating DeBondt and Thaler's study, with the inclusion of risk adjustment, Chan (1988) produced a slightly negative return. He argued that loser stocks have more fundamental risk, and beta changes too much to be captured by the long-term averaging method used by DeBondt and Thaler (1985). Consequently, the higher return to loser stocks would only be a compensation for risk.

Different researchers have advanced different opinions about the reasons for return predictability. DeBondt and Thaler (1985, 1987) argued that it was because of irrational behavior of investors, which resulted in overreaction by them. Zarowin (1989) argued that long-run overreaction phenomenon reported by DeBondt and Thaler (1985, 1987) was a manifestation of the January effect and/or size effect and was not indicative of a price pattern, as stocks with superior performance tend to be smaller sized firms. Jagadeesh and Titman (1993) argued that most of the abnormal return of loser stocks was due to the January effect. Ball et al. (1995) claimed that long positions in low-priced stocks occurred disproportionately after bear markets, and that the effects were particularly strong in January. They found that the contrarian strategy was sensitive to the choice of ranking period.

Chopra, Lakonishok and Ritter (1992) used a multiple regression equation with size, prior returns and betas as variables. The multiple regression equation was as follows:

\[ r_p - r_f = a_0 + a_1 \text{SIZE}_p + a_2 \text{RETURN}_p + a_3 \beta_p + e_p \]

The study was based on monthly returns from 1926-1986. They found significant overreaction even after adjusting for size and beta. The analysis of the
results revealed that extreme prior losers outperformed extreme prior winners by 5 to 10 percent in the subsequent 5 years. This effect was stronger for smaller firms, which were held by individuals, and overreaction was not observed in the large firms that were predominantly held by institutional investors. This indicates that return reversals closely associated with the individual investor's behaviour. Moreover, most of the overreaction was restricted to January.

The results of DeBondt and Thaler (1985, 1987), Chopra et al. (1992) were re-examined by Chen and Sauer (1997). They used monthly returns from 1926 through 1992. They formed 20 portfolios based upon the criteria used by Chopra, Lakonishok and Ritter (1992) in order to be consistent with their work. They found that the arbitrage portfolio did not earn abnormal returns after the risk differential between the loser and winner portfolios was taken into the analysis. They suggested that if consistent performance is a requisite for a contrarian strategy to show better performance then, this strategy failed because returns generated from the contrarian investment strategy utilising the overreaction of the investors were not time stationary. The results showed that for some period contrarian strategy earned excess profits, for some period contrarian strategy earned negative profit and for some period contrarian does not earn excess profits at all. The analysis of the study revealed that the overreaction phenomenon was not consistent for the entire study period. Therefore development of trading strategy based on volatile overreaction hypothesis is questionable.

Dissanaike (1997) investigated the overreaction hypothesis in the U.K. Stock Market. The study covered the period from January 1, 1975 to January 1, 1991. The selected companies were ranked on the basis of the rank period returns. Companies having the highest rank period return were assigned to winner portfolio, and those with the lowest rank period returns were assigned to loser portfolio. The results of the study supported overreaction hypothesis i.e. if investors overreact to news, past market losers should become winners and past winners should become losers. Thus, he concluded, “the evidence would seem to suggest a stock market anomaly, if not an inefficiency” (p.45).

3.2.8 Market Anomalies

There are many empirical studies that demonstrated the possible trading strategies yielding abnormal rates of return by using historical and publicly available
information and questioning the efficiency of the markets. The studies supporting market anomalies are broadly related to the following areas:

### 3.2.8.1 Size Effect

One of the most frequently cited anomalies with respect to the efficient market hypothesis is the size or small firm effect. Several researchers have examined the impact of size of the firm on stock returns. Size of the firm in this context refers to the market capitalisation of a company or total market value of all the outstanding stocks of the firm. The size effect can be described as a tendency of small market capitalisation of the firm to outperform the large market capitalisation of the firm over a period of time.

Banz (1981) examined the relationship between the return and market value of common stocks from 1931 to 1975. The empirical tests are based on a generalised asset pricing model which allows the expected return of a common stock to be a function of risk $\beta$ and an additional factor $\Phi$, the market value of the equity. Banz presented mean monthly returns on arbitrage portfolios constructed to be long in small firms and short in large firms with the nine non-overlapping five-years sub-periods. He found that both risk-adjusted and total adjusted rate of return tend to fall with increase in the relative size of the firm, as measured by the market value of the firms’ outstanding equity. He divided all NYSE stocks into portfolios according to firm size. Banz (1981) found that the average annual return of firms in the smallest size portfolio was 19.8 percent greater than the average return of firms in the largest size portfolio. He concluded that small firms were better performers than large size firms.

Remganum (1981) explored the size effect further by classifying the entire sample of 566 firms from NYSE and AMEX into 10 portfolios based on their market capitalisation. He found that the portfolio consisted of the smallest firms with beta risk equal to those of large firms experienced an excess return of approximately 18 percent per year and the excess returns persisted for at least two years. The results of the study supported size effect and it was inconsistent with efficient market hypothesis. Remganum concluded:

"That alternative models of capital market equilibrium ought to be seriously considered and tested. For evidence, this study clearly demonstrates that, at least for portfolios based on firm size or E/P ratios, the simple one period..."
capital asset pricing model is an inadequate empirical representation of capital
market equilibrium” (p 45)

Brown, Kleidon, and Marsh (1983) examined the variability of the size effect
with a sample of 566 firms during the period from 1963 to 1979. The results of the
empirical study suggested that small firms earned excess return over large firms. They
reported that the size effect was not stable for the entire study period. However, they
identified two different sub periods when the relation between size and abnormal
return is relatively stable. There was a stable positive relation between size and
abnormal return from January 1969 to December 1973 and a negative relation from
January 1974 to June 1979. The small firms had ex ante positive excess returns of
more than 25% per annum from January 1974 to June 1979 and ex ante negative
excess returns of about 25% per annum from January 1969 to December 1973. The
results of the study supported size effect, and it is inconsistent with semi strong form
of EMH.

Keim (1983) examined the empirical relation between abnormal returns and
market value of NYSE and AMEX common stocks during 17 years period from 1963
to 1979. The number of sample firms in a given year ranges from approximately
1,500 in the mid 1960’s to 2,400 in the late 1970’s. Keim (1983) ranked firms in the
order of increasing size as measured by the market value of equity and then divided
them into 10 portfolios grouped by the size of each firm. The results indicated that the
average return of the portfolio of the smallest firms is about 20.7 percent per year
higher than the return implied by its beta. On the other hand, the portfolio of the
largest firms earned a return of 9.6% per year less than that implied by its beta. He
also provided evidence that daily abnormal return distributions in January have large
means relative to the remaining eleven months, and that the relation between
abnormal returns and size is always negative and more pronounced in January than in
any other months. Approximately 50% of the average magnitude of size anomaly over
the period 1963 to 1979 was due to January abnormal returns. Further, more than 50% of
the January premium was attributable to large abnormal returns during the first
week of trading in the year, particularly on the first trading day. The overall results of
the study-supported size related anomalies and stock return seasonality.

Carleton and Lakonshok (1986) attempted to explain the small size effect in
terms of industry effect. There are industries dominated by several small firms and
there are other industries that include only small number of large firms. Industries
dominated by small firms may outperform industries dominated by large firms, which may appear to be size effect. However, Carleton and Lakonishok reported the existence of small firm effect even after removal of the possible industry effect.

Fama (1991) reported January effect for the period 1941 to 1981 and 1982 to January 1991. The results for the period from 1941 to 1981 revealed an average 8.06% return for small firms in January and large stocks had a return of 1.342%. In both the cases (small and large stocks) return in the month of January was higher than the average return in other months of the year. During the period from January 1982 to January 1991 the small stocks had a return of 5.32% and large stocks 3.2% in the month of January.

In a study Bajaj and Vyh (1995) also examined the market reaction to dividend announcements with regard to the firm size and stock price and reported that average excess return to all dividend announcements increased as the firm size and stock price decreased. The sample consisted of 67,592 dividend announcements by NYSE listed firms over the period from July 1962 to June 1987. Bajaj and Vyh found 0.21 percent average excess return over the three-days after the announcement period. For the portfolio of small firm size the average abnormal return was 0.67 percent while in the case of the largest firm size was 0.07 percent. The overall results indicated that small firms performed better than large firms.

There has been extensive research to provide explanations for size effect. According to Elton and Gruber (1996), "One research avenue has been to hypothesised that the CAPM was inappropriately measured causing apparent excess returns. The argument is that the betas estimated for small firms were too low. If beta is too low, then the estimate of expected return using the CAPM is too low and the difference between actual return and expected return would be positive even if it was zero when expected return was correctly estimated" (p.425).

Roll (1981) and Reinganum (1981) offered reasons why estimated beta is too low for small firms. According to them, the beta for small firms will be biased downward because they trade infrequently compared to large firms and infrequent trading leads to an underestimate of beta.

Amihud and Mendelson (1991) investigated the effect of liquidity on stock returns related to small firm and neglected firm effect. They argued that investors will demand a higher premium to invest in less liquid stocks that necessitate higher trading.
In accordance with their hypothesis, they showed that stocks of small firms showed a strong tendency to exhibit abnormally high risk-adjusted rates of returns. Small and less analysed stocks are less liquid; the liquidity effect might be a partial explanation of their abnormal returns. However, this theory does not explain why the abnormal returns of small firms should be concentrated in January. But exploiting these effects can be more difficult because the high trading costs on small stocks wipe out abnormal profit opportunity.

Another approach to explain the small firm effect is that the expected return was miscalculated because the CAPM is an inappropriate model for measuring the expected return. A multifactor model explains expected returns in a better way and when these models are used to measure expected return, the size effect disappears. Chan, Chen and Hsieh (1985) supported this argument. They used the Arbitrage Pricing Theory (APT) model to measure expected return on 20 portfolios formed on the basis of size. They found that the difference in the returns between the smallest portfolios and the largest portfolios was 1.5% per year. In contrast, using the CAPM resulted in a difference in return of 11.5% per year. Thus, they concluded that the size effect disappears when a more appropriate model of expected returns is used for the empirical study.

### 3.2.8.2 Calendar Anomaly

There have been many studies investigating possible calendar anomalies. These tests consider whether there are regularities in the rates of returns on stocks during specific time periods, e.g., month-of-the-year, day-of-the-week, holidays and hour-of-the-day. These returns are not explained by considerations of risk. Many researchers attempted to explain some of these anomalies in terms of tax loss selling at year-end, cash flows at month end, and negative news releases over weekends, and human psychology.

### 3.2.8.3 Month-of-the-Year Effect

The month-of-the-year is a special month for tax paying individuals, for a majority of firms that close their books of accounts and for investment managers whose performance would be evaluated. The month-of-the-year is January for the USA, the UK, and other developed stock markets and a large number of studies have documented higher stock returns during this time and termed it as the ‘January effect.’ Different explanations have been given for this effect. The first one is the
implementation of purchase decisions with the beginning of the New Year. Secondly, taxable investors dump losers in December to reduce tax liabilities and subsequent decrease in selling pressure in January results in the higher returns.

Rozeff and Kinney (1976) presented evidence on the existence of seasonality in monthly rates of return on the NYSE from January 1904 to December 1974. They analysed the time series over four sub periods and found seasonality in stock returns and higher mean rate of return in the month of January compared with other months. Other important findings were mean return in July, November, and December, and relatively high and low mean returns in February and June. The seasonality effect on the NYSE was weaker than those found in Australian stock market. Seasonality is also a prominent feature of 'risk premiums' estimated by using CAPM. In January risk premium was relatively higher and it differs noticeably from other months.

Keim (1983) examined the empirical relation between abnormal returns and market value of NYSE and AMEX common stocks during 17 years period from 1963 to 1979. The number of sample firms in a given year ranges from approximately 1,500 in the mid 1960's to 2,400 in the late 1970's. Keim (1983) ranked firms in the order of increasing size as measured by the market value of equity and then divided them into 10 portfolios grouped by the size of each firm. The results indicated that the average return of the portfolio of smallest firms is about 20.7 percent per year (0.082 percent per day x 252 trading days per year) greater than the return implied by its beta risk. On the other hand, the portfolio of the largest firms earned a return of 9.6 percent per year (-0.032 percent x 252 trading days) less than that implied by its beta risk. He also provided evidence that daily abnormal return distributions in January have large means relative to the remaining eleven months, and that the relation between abnormal returns and size is always negative and more pronounced in January than in any other months. Approximately 50% of the average magnitude of size anomaly over the period 1963 to 1979 was due to January abnormal returns. Further, more than 50% of the January premium was attributable to large abnormal returns during the first week of trading in the year, particularly on the first trading day. The overall results of the study, supported size related anomalies and stock return seasonality.

Gultekin and Gultekin (1983) studied January return patterns in 17 countries including the U.S. They found much higher returns in January than other months for
all the countries they studied. Their study showed that for the period they studied the January effect was stronger in the 16 countries compared to the U.S. stock markets.

Similarly, Kato and Shallheim (1985) examined excess returns in January and the relationship between size and January effect for the Tokyo stock exchange in Japan. They found no relationship between size and return for all the months except January. However, they found abnormal returns in January and a strong relationship between return and size. The smallest firms earned 8% return and the largest firms less than 3%.

Fama (1991) reported January effect for the period 1941 to 1981 and 1982 to January 1991. The results for the period from 1941 to 1981 revealed an average 8.06% return for small firms in January and large stocks had a return of 1.342%. In both the cases (small and large stocks) return in the month of January was higher than the average return in other months of the year. During the period from January 1982 to January 1991 the small stocks had a return of 5.32% and large stocks 3.2% in the month of January.

Pandey (2002) empirically investigated the existence of seasonality in the Malaysian stock market. He used the monthly return data of the Kuala Lumpur Stock Exchange’s EMAS Index for the period from January 1992 to June 2002 for the study, which resulted in 126 monthly observations. He used a combined time series and regression model to find out the monthly effect in stock returns. The analysis of the results revealed that the maximum average (positive) return occurred in the month of February and the lowest (negative) in the month of March. The average returns were positive for five months (February, April, September, October, and December) and negative for the remaining seven months (January, March, May, June, July, August, and November). For seven months the skewness of returns was negative and kurtosis was in excess of three for three months. The regression results confirmed the seasonal effect in stock returns. The returns were statistically different in the months of February and December. The December returns were positive and the highest as compared to all other months. Pandey concluded that “these findings cannot be explained by the tax loss selling hypothesis, rather it may be attributed to the informational inefficiency” (p. 43). This implies that Malaysian stock market is informationally inefficient and this provides an opportunity to investors to earn excess returns by timing their investment decision.
3.2.8.4 The Day-of-the-Week Effect

Another thoroughly studied calendar anomaly is the weekend effect or day-of-the-week effect. These studies examine the stock return from Friday to Monday. The stock market is observed to have a tendency to end each week on a strong note on Friday and to decline on Monday. This is known as the ‘week-end’ effect or day-of-the-week effect. The day-of-the-week effect anomalies were documented in the U.S., the U.K., and the Japanese, Canadian, Australian and Indian Stock Market. In these studies, Monday returns were observed to be consistently and significantly negative while the returns on the last trading days of the week, Friday, tend to be higher than that of the other days of the week.

Lakonishok and Levi (1982) examined stock prices and weekend effect for the period from 1962 to 1979. They found that the daily stock returns depend on the day of the week and that this will affect the return for each of the weekdays as well as the weekend. This is because there is a certain amount of days from the trade date to the settlement date, and that the rates of interest for this period will affect the prices for each day. This rate of interest approach will cause a difference between stock prices immediately before the Friday close and the corresponding prices just after the Monday open.

In another study, Rogalski (1984) studied day-of-the-week returns for both trading periods and non-trading periods. The study covered a period from October 1, 1974 to April 30, 1984. He like Lakonishok and Levi (1982) decomposed the period from the Friday close to the Monday open in two parts. He found that the Monday and non-trading weekend effects are directly related to the January effect. He showed that Monday average returns in January were positive and related to firm size but during the other months of the year the same is negative. The results suggested that a large portion of the magnitude of the day-of-the-week / January / size effect occurred during the first 5 days of January. Thus, the January and turn-of-year effect dominated the Monday effect.

Tang (1993) investigated weekend effect on daily and weekly returns during the period January 1980 to December 1989 by using closing price of the Dow Jones Industrial average (DJIA). The empirical results showed that the day-of-week-effect existed on weekly data. He found that stocks’ returns on Monday and Tuesday were negatively skewed and had the largest value of kurtosis. The stock returns were non-normally distributed and standard deviations cannot fully describe the investment risk.
Chen and Singal (2003) empirically examined whether speculative short sales affect stock prices and focused on weekend effect. The daily returns for stocks listed on the NYSE were collected for the period from July 1962 to December 1999. They found evidence consistent with the hypothesis that short sellers systematically influence stock prices. Short sellers buy stocks to cover on Fridays and reopen their positions on Monday, causing Friday returns to be larger than Monday returns. Moreover, the more volatile stocks have a greater weekend effect than less volatile stocks because short sellers are more likely to close open positions for more volatile stocks than for less volatile stocks over the weekend.

3.3 Semi-Strong Form of Efficient Market Hypothesis

The semi-strong form of efficient market hypothesis (EMH) asserts that stock prices adjust rapidly to the release of all publicly available information. Hence, current stock prices fully reflect all public information. If semi-strong form of efficient market hypothesis holds, this implies that all types of fundamental analysis would be useless. Fama (1991) referred to tests concerning this form as “event studies.” There have been several studies examining the validity of the semi-strong form efficient market hypothesis. Most of these studies were examining the adjustment of stock prices to public announcements. If it is possible to use these information to earn abnormal returns, the semi-strong form of efficient market hypothesis will not be valid and vice versa.

We discuss empirical studies conducted abroad to test semi-strong form of efficient market hypothesis. The types of research undertaken around the world differ widely. American researchers took the initiative and inspired researchers in other countries of the world to do research on semi-strong form of efficient market hypothesis. Researchers in the USA empirically tested semi-strong form of the market efficiency by covering almost all the price sensitive information. For facilitating smooth discussion and review, the studies are classified under different heads. In order to provide a theoretical framework within which empirical studies are undertaken, Capital Asset Pricing Model (CAPM), Arbitrage Pricing Theory (APT) and the Market Model, which describe the process that generates security prices, and beta (β) which is the sole measure of risk according to CAPM will be discussed briefly.
3.3.1 Capital Asset Pricing Model (CAPM)

A substantial portion of research in investment management is devoted to understanding how investors evaluate the riskiness of securities and return associated to the risk. Though it is commonly said that higher the risk higher would be the returns, the questions that remain are, what type of risks are awarded and what is risk premium per unit of risk. A few equilibrium asset-pricing models attempted to answer these questions. Out of these, Capital Asset Pricing Model (CAPM) is the most popular and widely used model. It was independently developed by Sharpe (1964), Lintner (1965), and Mossin (1966) Fama (1968), Black, Jensen and Scholes (1972), Fama and MacBeth (1973), and Fama and French (1992) and others proposed further refinements. The CAPM provides a precise prediction of the relationship between the risk of an asset and its expected return. According to CAPM all investments carry two types of risks. First is the market risk, denoted by “beta”. This is also called “systematic risk”, cannot be diversified away. The second is unsystematic risk, which is related to the company and can be diversified away. Since unsystematic risk can be mitigated through appropriate diversification, Sharpe (1964) stated that a portfolio’s expected return solely depend on its systematic risk or beta. The CAPM helps us to measure portfolio’s risk and the return an investor can expect for taking that risk. It is the first model to present a testable hypothesis regarding risk - return relationship.

The CAPM relies on theoretical market portfolio, which includes all assets such as real estate, foreign stocks, etc. The identification of the true market portfolio is very difficult. Therefore in practice, the CAPM is analysed and tested by using some stock market index, which represents the market portfolio. The CAPM can be mathematically expressed as:

\[ E(R_{jt}) = R_{ft} + \beta_j (R_{mt} - R_{ft}) \]

Where,
- \( E(R_j) \) = the expected return of security ‘j’ during time period ‘t’.
- \( R_{ft} \) = the risk free rate during time period ‘t’.
- \( \beta_j \) = the beta of security ‘j’.
- \( R_{mt} \) = the expected return on the market portfolio or expected return on index during time period ‘t’.

There is a linear relationship between risk and return. The risk premium on the stock or portfolio of stocks is a function of the risk premium on the market and varies...
directly with the level of beta or systematic risk. The expression $R_{mt} - R_{f}$ denotes premium per unit of risk. Thus, the investors holding risky security or portfolio is expected to receive risk-free rate of return plus premium or compensation for each unit of risk taken by them. Therefore,

$$E(R_m) = R_f + \text{Risk premium}$$

A number of simplifying assumptions lead to the basic version of the CAPM. Sharpe's CAPM is based on the following assumptions:

1. The market for capital assets is composed of risk-averting investors, all of whom are one period expected utility of terminal wealth maximisers and find it possible to make optimal portfolio decisions solely on the basis of the means and standard deviations of the probability distributions of terminal wealth associated with the various available portfolios.

2. All investors have the same decision horizon, and over this common horizon period the means and variances of the distributions of one period returns on assets and portfolios exist.

3. Capital markets are perfect in the sense that all assets are infinitely divisible, there are transactions costs or taxes, information is costless and available to everybody, and borrowing and lending rates are equal to each other and the same for all investors.

4. Expectations and portfolio opportunities are "homogeneous" throughout the market. That is, all investors have the same set of portfolio opportunities, and view the expected returns and standard deviations of return provided by the various portfolios in the same way.

Many of these assumptions are unrealistic. The empirical studies revealed that all these assumptions are not necessary for the derivation of the model. The model can be derived even when investors have heterogeneous expectations regarding the distribution of stock returns (Lintner, 1969), there are personal income taxes in particular, differential rates on capital gains and dividends (Brennan, 1970), existence of transactions costs and considering a world without a risk-free asset (Black, Jensen and Scholes, 1972), and non-divisibility of assets (Mayshar, 1983). These modifications in the model are made to reflect the real world situations. But the linear relationship between risk and expected return hold good even today.

Many researchers investigated CAPM in its traditional form and they found mixed results. The empirical studies of Sharpe and Cooper (1972), Fama and
MacBeth (1973), Foster (1978), Sauer and Murphy (1992), and others supported the CAPM as a valid asset-pricing model. However, there is a growing body of empirical research, which showed that CAPM is not able to explain the relationship between risk and return. The studies of Black, Jensen and Scholes (1972), Yosef and Kolodny (1976), Tinic and West (1984), Green (1990) and Hawawini (1993) questioned the validity of CAPM. Banz (1981), Reinganum (1981), Chan, Chen and Hsueh (1985) and Elton and Gruber (1996) empirically showed that small firms in terms of market capitalization could earn more returns than what is prescribed by CAPM. Ball (1992) said that CAPM is a pure exchange model, ignoring properties of the supply of securities.

In the Indian stock market the empirical studies on CAPM showed mixed results. Yalawar (1988), Srinivasan (1988), Verma (1988), Dhankar (1996), Amanulla and Kamaiah (1998), Thirpalraju and Amanulla (2002) and others found support in favour of CAPM. On the other hand, Gupta (1981), Gupta and Sehgal (1993), Ray (1994) and others found that CAPM has failed to explain the risk-return relationship. Sehgal (2003) found that there are market size and book-to-market equity factors in stock returns. Therefore, he concluded that the three-factor asset-pricing model provides better description of average stock returns for the Indian stock market as compared to one factor CAPM.

While, all these accumulated evidence against CAPM remained largely within the academicians, Roll's (1977) article entitled "A Critique of the Asset Pricing Theory's Tests" shook the investors and analysts' world also. Roll (1977) argued that since the true market portfolio can never be observed, the CAPM is necessarily not testable. Roll (1977) concluded:

"The two-parameter asset pricing theory is testable in principle; but arguments are given here that: (a) No correct and unambiguous test of the theory has appeared in the literature, and (b) there is practically no possibility that such a test can be accomplished in the future" (p 129-130)

Roll's critique has attracted attention of many researchers and resulted in popular articles such as "Is Beta Dead?" "Is Beta Dead or Alive?" "Are Reports of Beta's Death Premature?" "Is Beta Dead Again?" that effectively reduced the popularity of CAPM in the world of finance. In 1992 Fama and French published an article that criticised CAPM in a harsh way. They claimed that once you control a set of widely followed characteristics of the firm, such as the size of the firm and its ratio...
of market value to book value, the firm's beta (\( \beta \)) is its systematic risk does not contribute anything to the prediction of future returns.

Fama and French (1993, 1995 and 1996) and several other researchers have published many follow-up studies on CAPM. These studies made it clear that beta does give full information related to risk. There seems to be risk factors that affect stock returns beyond beta’s one-factor measurement of market sensitivity. Fama (1991) rightly said that despite the anomalies, criticisms, and limitations (discussed above), the CAPM still remains the most popular asset-pricing model among the researchers as well as practitioners. This is mainly because of simplicity and the absence of better alternative models.

### 3.3.2 Beta (\( \beta \))

Shareholders are bearing two types of risks - systematic or market risk, and unsystematic or unique risk. Risk in holding securities refers to the possibility that the realised returns will be less than the returns that were expected. The unsystematic risk (\( \text{unique to a firm or industry} \)), the portion of total risk that is unique to a firm or industry, can be eliminated by diversification and it is unlikely that bearing unsystematic risk will be rewarded. Returns on securities are related to the systematic risk (\( \text{portion of total risk that is not possible to diversify} \)), the portion of total risk that is not possible to diversify. The systematic risk is denoted by beta \( (\beta) \).

Most of the researchers and practitioners accepted beta as a measure of systematic risk. There is a linear relationship between risk and return. According to Grnold (1993),

"Beta splits a security’s return into a part that is perfectly correlated with a market portfolio and a residual that is uncorrelated with the market. Beta is used to analyse performance, control risk, make conditional forecasts and set expected returns” (p 28).

It has wide-ranging applications in financial economics including testing of asset pricing theories, estimation of the cost of capital, evaluation of portfolio performance and calculation of hedge ratios for index derivatives. Beta is the heart and soul of CAPM. In the CAPM beta says expected residual returns should be zero, which makes beta controversial.

During 1990s, the debate about “whether beta is dead or alive” has heated up once again. One school of thought led by Fama and French (1992, 1993, 1995 and 1996), Roll and Ross (1996), and others demonstrated that beta is dead, or if it is not dead it is at least seriously ill, because beta fails to explain the behaviour of stock.
returns. Another school of thought led by Black (1993), Sharpe (1998), Kothari, Shanken and Sloan (1995), Kandel and Stambaugh (1995), Hsia, Fuller and Chen (2000) and others showed that beta is alive if annual returns instead of monthly or daily returns are used. There are a few researchers [Chan and Lakonishok (1993), Grinold (1993), Ashton and Tippett, (1998)] who are in a confused mind. The statement “beta is dead” created confusion among the academicians, practitioners, analysts and students of finance. However, the debate is still continuing.

In India Vipul (1999) examined the effect of size of the company (as measured by capitalisation of equity shares of respective companies), industry and liquidity of the stock on the beta. He selected a sample of 114 companies listed on the BSE during July 1986 to June 1993. He found that the size of the company affects beta value. Medium sized companies have lowest beta, which increases with increase or decrease in the size of the company. Chawla (2001) examined the stability of beta in the Indian stock market. He used monthly data on 36 stocks for the period from March 1996 to March 2000. The results of the study rejected the hypothesis of stability of beta in majority of the cases. Therefore, he concluded that the instability of beta has its implications on investment decisions.

### 3.3.3 Arbitrage Pricing Theory (APT)

It is generally accepted that the capital asset pricing model (CAPM) is not truly testable in a strict sense (Shanken, 1982, p 1137). Much of this acceptance can be attributed to the analysis of Roll (1977), who argued that the CAPM is not testable unless the market portfolio of all assets is used in the empirical test. Therefore, at the end of 1970s efforts of researchers directed towards developing alternative models of ascertaining expected returns of the securities. In 1976 Ross proposed Arbitrage Pricing Theory (APT) as a testable alternative to the CAPM, which attracted considerable attention of researchers.

The Arbitrage Pricing Theory (APT) recognises several systematic factors that affects security’s returns instead of a security’s beta against the market as asserted by CAPM. Though, both the APT and CAPM based upon similar assumptions related to perfect capital market and common investment horizons, APT has less restrictive assumptions regarding the existence of market portfolio, risk free borrowing and lending rates. Like CAPM, a linear relationship between the systematic risk and the related return is assumed in the APT. However, the difference between the APT and
CAPM lies in the definition and measurement of the systematic risk. Under APT, the total systematic risk of a security depends on its sensitivity to movement in several common factors. Thus, each security has a set of beta coefficients each measuring its sensitivity to one of the common factors. The expected return is the risk-free rate plus a risk premium for each of the common factors. The risk-return relationship under APT is shown (Fuller and Farrell, 1987) below:

$$E(r_i) = r_z + b_{11} [E(r_1) - r_z] + b_{12} [E(r_2) - r_z] +$$

The APT risk-return relationship is linear. Since the APT does not assume an ability to borrow and lend freely at the risk-free rate, the $r_z$ that is directly derived from this model could represent either a risk-free return (if available) or the zero beta return that was derived by Black for the amended version of the CAPM. The term $[E(r_i) - r_z]$ represents the risk premium that is associated with the factor, and is alternatively represented by the symbol $\lambda$. The $b$ coefficient measures the responsiveness of the stock to changes in the factor. If we assume that there is only a single factor determining security returns, the basic APT return equation is similar to the security market line:

$$E(r_i) = r_z + b_1 \lambda$$

In contrast to CAPM, APT does not require identification of a market portfolio, which may or may not be one of the factors influencing security returns. As a result, APT does not create any problems in testing that were pointed out by Roll (1977) in CAPM. However, APT presents other problems such as specifying the number of factors appropriate to determine the security return, their identification and separating unanticipated from anticipated factor movements in the measurement of sensitivities. But APT does not indicate any number or process of identification. This requires the use of statistical technique called factor analysis. Chen, Roll and Ross (1986), on the basis of their research, identified four relevant economic factors, which affect the stock market and stock returns. Those factors are: (i) unanticipated changes in inflation, (ii) unanticipated changes in expected level of industrial production, (iii) unanticipated shifts in interest premiums, and (iv) unanticipated movements in the shape of the term structure of interest rates.

Many researchers conducted comparative studies on CAPM and APT. The results were mixed. Roll and Ross (1983) compared APT with CAPM and argued that APT is a superior model, from both theoretical and practical point of view. They demonstrated APT’s application by using it in an empirical study and found better
results than those produced by CAPM. However, Shanken (1982) had cast doubts on testability of APT. According to Shanken, factor models can be manipulated by repackaging a given set of security. The debate regarding superiority between CAPM and APT is continuing. Many researchers found that both the models have their own strengths as well as weaknesses. An acceptable and possible solution would be to use a combined model that incorporates the strength of both the models. The empirical testing of APT is still in its early stage and concrete results in favour of APT or against CAPM do not exist. Till then, CAPM is expected to dominate the capital market as a measure to ascertain expected returns of risky securities.

3.3.4 Stock Price Response: The Measurement

To examine stock price responses to announcements of earnings, dividend, stock split, bonus issue, rights issue, mergers and acquisitions, buyback, etc., expected returns, abnormal returns and cumulative average abnormal returns are to be computed. To measure whether the security prices have reacted to these events, it is necessary to isolate the returns of each security into two parts. These are, those returns that can be attributed to market movement and those which cannot be attributed to market movement but to the events mentioned above. The market model is used to measure the expected returns of the stock that is related to market movement.

The market model was developed and suggested by Sharpe (1963). This model has been extensively used by the academicians to determine the expected return on a specific asset, given the return on market portfolio and beta of the asset. Market model is based on the fact that the most important factor affecting stock returns is market factor and it is captured in the market model in the form of beta ($\beta$). It is a simple model to analyse the riskiness of stocks in terms of systematic and unsystematic components. Thus, the market model relates the return on any stock or portfolio of stocks to the return on the ‘market portfolio’ in a linear fashion.

Mathematically, market model can be expressed as:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + e_{jt}$$

Where,

- $R_{jt} =$ The rate of return of security j at time t
- $\alpha_j$ and $\beta_j =$ The regression coefficients for security j
- $R_{mt} =$ The rate of return on market portfolio at time t
- $e_{jt} =$ The residual return for security j at time t that cannot be explained by the
market factor

The above empirical model divides security returns into two components, a systematic component ($\beta_j R_{m,t}$) and an unsystematic component ($e_{j,t}$). The systematic component measures the impact of general market movement, and unsystematic component, also called the error term, measures the impact of micro event on the rate of return of individual security. Thus, the error term is a firm specific component. The market model is not as sophisticated conceptually as the CAPM. But it is consistent with CAPM because market model also assumes a linear relationship between return and risk of a security, which is measured by beta coefficient. Market model does so without incorporating unrealistic assumptions of the CAPM.

The behaviour of error term creates some problems while using market model. Because of this, the error term is found to have a specific pattern other than simple random variations, which interfere in the process of parameter estimation and forecasting. Robin (1993) found that exclusion of high trading volume periods improves the applicability of market model to the U.S. stock market. Karathanassis and Philippas (1993) found presence of significant heteroscedasticity while applying market model to Athens Stock Exchange. Xiang (1993) found that two factors CAPM with generalised least squares method is better for estimation and inferences than the market model for the U.S. capital market. Vipul (1997) found that market model with generalised least squares (GLS) techniques are useful to estimate parameters as well as for forecasting purposes without much loss in accuracy in the Indian capital market.

To know the existence of semi-strong form of market efficiency, abnormal returns should be calculated. Abnormal returns are defined as the excess of actual returns of a security over the expected returns. The expected returns are related to the market movement. The error term $e_{j,t}$ in the market model represents the residual, or abnormal returns, for the security $j$ at time $t$, which is equal to the actual returns $R_{j,t}$ minus expected returns:

$$AR_{j,t} = e_{j,t} = R_{j,t} - (\alpha_j + \beta_j R_{m,t})$$

This method of estimating abnormal returns is referred to as "residual analysis", since the regression equation represents a normal return and the residuals $e_{j,t}$ in the equation represent the abnormal returns (Fuller and Farrell, Jr., 1987). Existence of abnormal returns indicates market inefficiency. To measure the security's overall reaction to the event, cumulative average abnormal returns...
(CARRs) are calculated over some period before and some period after the occurrence of the event.

The cumulative average abnormal return is computed by adding the average abnormal returns (AARs) for each time period several days before the event and several days after the event. Thus, the cumulative average abnormal return provides information about the average price behaviour of securities overtime. If markets are efficient, the cumulative average abnormal returns should be close to zero. Although a number of refinements have been made since the Fama, Fischer, Jensen and Roll (1969) study by different authors [Yosef and Brown (1977), Charest (1978), Brown and Warner (1980)], their general procedure for calculating and analysing abnormal returns centred on the date of particular event is still widely used.

An empirical study to test the semi-strong form of efficient market hypothesis examines the speed and accuracy of adjustment of stock prices to release of certain new relevant information. Security prices are expected to respond to the relevant new information as and when it reaches the market. In an efficient market, stock prices reflect available information fully and instantaneously. In other words, efficiency of stock market is reflected in two ways, i.e., speed and accuracy. Speed refers to the time taken by the stock to respond to new publicly available relevant information. Speed of stock price response is important because if response is slow, the informed and alert investors would exploit it to earn abnormal returns by outperforming the market. This implies that market is inefficient in the semi-strong form. Woodruff and Senchack (1988) asserted that the adjustment process is assumed to be over when the likelihood of continuation (reversal) comes back to the level expected in non-announcement period.

A semi-strong form of efficient market is a market in which adjustment of stock prices to new publicly available information is not only rapid, but also accurate, i.e., in the right direction and of right magnitude. There should not be any bias in the adjustment of stock prices to new information and if there is no systematic bias in the adjustments of stock prices to new information, the average price movement will be zero. Keane (1983) asserted:

"It would clearly be an odd interpretation of efficiency if a doubling in the price of a share were regarded as an efficient reaction to new information, simply because the movement was instantaneous, if the information in fact warranted a substantial reduction in the price" (p 9)
Therefore, speed and accuracy of stock price adjustment is important to consider any stock market as an efficient market. Both underreaction and overreaction to new price sensitive information would offer an opportunity to investors to systematically beat the market and earn abnormal returns, which is inconsistent with semi-strong form of efficient market hypothesis.

For facilitating smooth discussion and review, we can classify and review the empirical studies on semi-strong form of efficient market hypothesis under different events:

### 3.3.5 Earnings Announcements

In this section, we review the studies, which examined stock price responses to earnings announcements. If it is possible to use information of earnings announcements to earn abnormal returns, then the semi-strong form of efficient market hypothesis will not be valid.

#### 3.3.5.1 Studies Supporting Semi-strong Form

Jordan (1973) examined the adjustment of stock prices to quarterly earning information. He used a sample of 45 firms chosen randomly during the period April 1, 1963 to December 31, 1968. He used the market model and residual analysis method. Jordan selected 50 days surrounding the earnings announcement i.e., 25 days before and 24 days after the quarterly earnings announcement. The results of the study indicated that the market evaluated the third quarter and annual earnings reports differently from the first and second quarter reports. This might be because the annual report was audited and it contains year-ending adjustments. The results also indicated that the share prices of higher growth companies adjusted to earning information differently compared to the shares of medium and low growth firms. He concluded, "in total our results seem to be consistent with the "loose" form of efficient market hypothesis. This is because of the difficulty in predicting the signs of the mean residuals. Or alternatively, while we could observe significant changes in the absolute means, it was considerably more difficult to predict the direction of these changes as seen in the mean residuals" (p. 619).

Reinganum (1981) examined whether portfolio selection strategy based on unexpected earnings systematically earn abnormal returns. He defined expected earnings with respect to a time series-forecasting model used by Latane, Jones and
Reike (1974), and Latane and Jones (1977) He used the following model to calculate standardised unexpected earnings (SUE):

\[
SUE = \frac{\text{Reported Earnings per share} - \text{Estimated Earnings per share}}{\text{Standard Error of Estimate for the Estimated Regression Equation}}
\]

Reinganum formed two portfolios to have an estimated beta equal to one. First one containing 20 stocks with the highest SUE and second containing 20 stocks with lowest SUE. The results of the study showed that no abnormal returns could be earned even if one acts immediately after the close of fiscal quarter. This showed that the mean differences of daily returns for high and low SUE portfolios were not statistically different from zero. For the overall study period the difference in daily means for the two portfolios was only 0.000280 and its standard error 0.000295. Similar results were reported for the portfolio positions taken at the end of +2, +3, and +4 months from the end of the fiscal quarter. Thus, the results of the study were against the findings of Latane and Jones (1977). However, Randleman, Jones and Latane (1982) re-examined Reinganum's results. They questioned the portfolio selection procedure devised by the Reinganum (1981). According to them the high and low SUE Reinganum identified stocks from a small sample. They also suggested that Reinganum has chosen for his analysis the one sub-period out of almost an entire decade that would lead him to the conclusion that SUE cannot be an effective discriminator between over and under performing stocks. Re-examination of Reinganum's study by Randleman et al. (1982) supported persistence of post earnings announcement drift.

Patell and Wolfson (1984) investigated the intra-day speed of adjustment of stock prices to earnings and dividend announcement. They selected a sample of 571 earnings and 96 dividend announcements during 1976 to 1977. Patell and Wolfson (1984) measured effects of earnings and dividend announcements on intra-day stock price behaviour with regard to mean returns, return variance, and serial correlation in consecutive price changes. The analysis of the results suggested that price reaction to earnings and dividend announcements begins very quickly, i.e., within a few minutes after the announcement. The returns earned by simple trading rules disappeared within 5 to 10 minutes, although significant returns were detected in the overnight period and at the opening of trading on the next day. Disturbances in the variance and
serial correlation persisted for several hours and extended into the following trading
day. The overall results of the study suggest that the stock market responds very
quickly to publicly available information.

Woodruff and Senchack (1988) too investigated intra-day price adjustment of
stock prices to unexpected earnings in NYSE. The results of the empirical study
revealed that stock prices adjusted to new earnings information within a few hours of
earning announcement. The reaction started approximately 15 minutes after the
earnings announcement. The adjustment of stock prices to favourable or unfavourable
earnings was very quick and rapid. According to them unexpected earnings refer to
difference between the actual earnings and expected earnings based on the forecasting
model used. For the most favourable positive earnings 69% of the adjustment was
over in half an hour and 91% in three hours, and was completed by the end of next
day's trading. The adjustment of stock prices to extreme unfavourable negative
earnings was slow. However, the slower adjustment process for negative earnings
could not provide any opportunity to earn abnormal returns. The volume of trading
and frequency of transactions was very high in the first half an hour and declined
rapidly thereafter, but it was above average. Further, a high degree of positive
correlation was found between the trading volume and degree of surprise earnings.
Frequency of transactions during announcement period was high compared to non-
announcement period. Therefore, the results of the study were consistent with the
market efficiency.

3.3.5.2 Studies that Contradicts Semi-strong Form

There are many studies, which support the view that stock market is semi-
strong form of efficient marked hypothesis. However, there are many empirical
studies that questioned the semi-strong of efficient market hypothesis. In efficient
market hypothesis literature these studies are commonly called ‘anomalies’. Accord-
ing to Ball (1992) “the anomaly is that estimated future abnormal returns are
predicted by public information about future earnings, contained in (i) current
earnings and (ii) current financial statement ratios” (p.319). There is a consistent
anomaly in the behaviour of security prices after the announcement of earnings,
dividends, merger and acquisition, stock split, bonus issue, rights issue etc.

Bernard and Thomas (1989) stated that there are three explanations for post
earnings announcement drift. One explanation suggested that at least a portion of the
price response to new information is delayed. The delay in stock price response is due to traders' failure to assimilate available information, or because of transaction costs or opportunity costs of implementing and monitoring a trading strategy that exceeds gains from immediate exploitation of information. A second explanation is because of the limitations of CAPM that is used to calculate abnormal returns. A third explanation is of the bias resulting from research design problems other than CAPM misspecification. The post earnings announcement drift could represent delayed response to new information. However, it is difficult to explain why the market would not respond immediately to earnings announcement.

The drift in the market response was, first observed by Ball and Brown (1968), using annual earnings. They are also the first to investigate the behaviour of stock prices around earnings announcements. The study was conducted with the objective of studying the relationship between stock prices and accounting income numbers. Using a sample of 261 firms listed on the NYSE over the period 1946 to 1966, they classified firms into good or bad earnings groups. The earnings of a firm were classified good or bad in relation to the earnings that was expected. Ball and Brown used the market model to measure the unexpected change in the stock prices of the firms. They found that throughout the preceding 12 months, cumulative average abnormal returns (CAARs) moved in the same direction as defined by increased or decreased earnings. The analysis of the results revealed that more than 85 percent of the stock price change associated with unexpected earnings took place before the month of announcement and only about 10-15 percent of stock price adjustment took place on or after earnings announcements, which is not significant to trade profitably. In the post earnings announcement period, the abnormal returns were randomly distributed around zero. Therefore, Ball and Brown (1968) were the first to note that even after earnings are announced, estimated cumulative abnormal returns continue to drift up for "good news" firms and down for "bad news" firms.

Jones and Litzenberger (1970) investigated stock price responses to quarterly earnings announcements during the period 1962 to 1967 with a sample of 500 companies. They used two alternative but similar methods of measuring return per unit of risk. 1 the reward to variability ratio developed by Sharpe, referred to as the Sharpe's ratio, and 2 the reward to volatility ratio developed by Treynor, referred to as the Treynor ratio. The Sharpe ratio is simply the ratio of the reward, defined as the realised portfolio return $r_p$, in excess of the risk-free rate, to the variability of return as
measured by the standard deviation of return ($\sigma_p$). The Treynor ratio is the ratio of the reward, also defined as the realised portfolio return $r_p$ in excess of the risk free rate $r_f$, to the volatility of return as measured instead by the portfolio beta ($\beta_p$). The two performance ratios thus differ only in that one considers only market risk as measured by standard deviation, while the other considers only market risk as measured by beta. Using Treynor's excess return measure, found excess returns of $+7.1\%$, $+13.6\%$, $+12.9\%$, $+7.9\%$, $+12.1\%$, $+0.7\%$, $+16.4\%$, $+20.0\%$, $+25.0\%$ and $+16.4\%$ during 10 overlapping time periods in the 3 years and 6 months i.e. from May 1964 to November 1967. Sharpe's reward to variability index also revealed similar results, inspite of poor diversification of the sample compared to Standard and Poor's Industrial Index. However, there are several biases in the Jones and Litzenberger (1970) tests. They did not examine the pattern of price adjustment for the period surrounding a quarterly announcement. They did not provide tests of statistical significance and moreover, they offered unconvincing argument that bad news disseminated more rapidly because its dissemination is not slowed down by intervening brokers and advisory services.

Joy, Litzenberger and McEnally (1977) investigated the adjustment of stock prices to announcement of unanticipated changes in quarterly earnings. The sample consisted of 96 companies that were continuously listed on the NYSE over the period 1963 through 1968. To examine the adjustment of common stock prices to informational content of quarterly earnings results, the Ball and Brown (1968) and Fama, Fisher, Jensen and Roll (1969) method of residual analysis was used. They used naive earnings expectation model to categorise observed earnings announcements as favourable, neutral, or unfavorable. For each earnings observation, weekly rates of return are observed over the period 13 weeks prior to and 26 weeks subsequent to the announcement week. Employing a conditional expectations model based upon the security market line, authors then used residual weekly rates of return to calculate an index of price adjustment for the favourable, unfavourable and neutral categories of earnings announcements. The results of study suggested that stock price adjustments to the information contained in unexpected highly favourable quarterly earnings reports are gradual, rather than instantaneous which is inconsistent with semi-strong form of efficient market hypothesis.

Watts (1978) empirically tested whether significant abnormal returns are observed after the announcement of quarterly earnings and whether those abnormal
returns are more consistent with market efficiency or with the existence of deficiencies in the asset pricing model after taking all the steps suggested by Ball (1978). He selected a sample of 73 firms with announcement of earnings for 75 quarters from January 1950 through September 1968. Black and Scholes (1973) technique was used to calculate abnormal returns and total firms were divided into two portfolios: the firms with positive forecast errors and the firms with negative forecast error for the quarter. He applied weights to the securities within each portfolio to make $\beta$ of each portfolio equal to unity. The analysis of the results revealed that significant abnormal returns exist after the earnings announcement and it is because of stock market inefficiency and cannot be attributed to deficiencies in the capital asset pricing model. Moreover, the abnormal returns were substantial during 1962 to 1965 and other periods only those who can avoid transaction costs can earn abnormal profits after the announcement of quarterly earnings.

Ball (1978) surveyed twenty studies, as a whole and that revealed consistent abnormal returns after the announcement of firms' earnings. However, Ball cautions that on a study-by-study basis, the significance of the result is difficult to measure because many studies did not use significant tests and even those who used significant tests were based on questionable assumptions. Ball suggested that the abnormal returns reported in the study were due to deficiencies in the asset-pricing model used in the studies and not due to market inefficiencies. He hypothesised that the earnings information used in the studies act as proxies for variables that determine equilibrium expected returns and which are not included in the asset-pricing model and for errors in measurement of the market portfolio.

Further, Ball (1978) also suggested steps that can be taken to reduce the bias regarding overstating of abnormal returns and rejecting market efficiency. According to him the researchers have to take the following steps to completely avoid the proxy effect.

1. That the experiment should be predictive, in the sense that the yield surrogate is observed prior to the market yield, thus avoiding any contemporaneous price adjustment to the information in the variable being investigated,

2. That excess market yield, not simply market yield, be the dependent variable (in the case of the two parameter model, this would be the risk adjusted excess return), and
3 That the estimated excess yield, conditional upon the yield surrogate, be an unbiased estimator for the true excess yield, presumably derived from the true model of variation in securities' expected returns.

The third condition seems unlikely to be met in earnings or dividend yield experiments, because it requires any omitted variables or other specification errors to be independent of the earnings or dividend variable. Securities' earnings and/or dividend yields seem likely to be independent of the (unknown) factors which determine securities' market yields. If it is desirable to minimize the bias, it seems wise to avoid experiments in which the variable on which ranking occurs is highly autocorrelated across time or is highly correlated with the determinants of securities' expected returns (p 115). Therefore, Ball supports efficient market hypothesis and according to him methodological deficiency made market inefficient.

Brown (1979) examined the adjustment of stock prices to earning per share (EPS) information. The study covered a period from 1963 to 1971 with a sample of 158 firms. He used residual analysis method previously used by Ball and Brown (1968), Brown and Kennelly (1972), Fama et al. (1969), Kaplan and Roll (1970) and Pettit (1972). The analysis of the results suggested that statistically significant cumulative abnormal returns appeared from day 15 to day 45. This indicated that the market failed to adjust instantaneously to the new EPS information and provided an opportunity to earn excess returns on the EPS information after 45 days of announcement. Moreover, the excess returns from purchasing the qualifying security at the time of publication of the EPS information substantially higher than transaction costs.

Rendleman, Jones and Latane (1982) examined stock price responses to unexpected quarterly earnings. This study is considered better because it introduced several refinements over the earlier studies. For instance, Latane and Jones (1977, 1979) measured stock price response beginning either two or three months after the end of the fiscal quarter, thus mixing the performance of the companies that reported earning sooner with performance of those companies that reported later. Rendleman et al. examined their performance separately. In contrast to relatively small sample of companies (e.g., 102 by Joy, Litzenberger and McEnally (1977) and 73 by Watts (1978), the sample size of Rendleman et al. (1982) study ranged from 618 companies in the third quarter of 1971 to a maximum of 1,496 companies in the first quarter of 1980. In addition, to assess the importance of risk adjustment in SUE analysis, they
used ordinary least square (OLS) and Scholes and Williams (1977) technique and constructed portfolios to have beta of 1.0. They also recalculated the results of the SUE analysis without making any adjustment for risk. Rendleman et al. found significant abnormal returns during the post announcement period. They found that mean abnormal returns are quite large and almost all are statistically significant. They concluded the mean abnormal return for the holding period of 3 months are quite large, ranging from almost 6% for the first portfolio starting position one month (+1) to about 3.4% for the position starting five months (+5) after the close of the fiscal quarter.

Foster, Olsen and Shevlin (1984) examined whether systematic post-announcement drifts in security returns are associated with the sign or magnitude of unexpected earnings changes. The study was based on the sample of over 56,000 observations of 2,053 companies during the period from 1974 to 1981. The cumulative abnormal returns (CAR) are calculated for three periods: -1 to 0 day (CAR for the trading day preceding and the trading day of the earnings announcement), -60 to 0 day (CAR from 60 trading days before and including the day of the earnings announcement) and +1 to +60 day (CAR for the 60 trading days period subsequent to the earnings announcement date). Foster et al. used earnings based model and security return model approach to analyse the post announcement behaviour of stock returns. The analysis of the results indicated that the systematic post announcement drifts in security returns are found for only a subset of earnings expectations models. Portfolios based on two price based expectations models exhibited no systematic post announcement drifts in the +1, +60 trading day period (60 days after the announcement of earnings). The second important set of results are related to the class of earnings expectations models showed systematic drifts in security returns in the +1, +60 period. These drifts persisted throughout the entire 1974 to 1981 period. The overall results suggested an annualised abnormal return of about 25 percent before transactions costs.

In another study Jones, Rendleman and Latane (1985) investigated earnings announcement and its pre and post responses. They examined standardised unexpected earnings announcements of 1,503 companies for the period from 1971 to 1980 and concluded that although market could anticipate changes in earnings, a substantial price adjustment occurred after the earnings announcements.
Bernard and Thomas (1989) examined post-earnings announcement drift to ascertain whether it is delayed stock price response or premium for the risk undertaken by the investors. The sample consisted of 84,792 quarterly announcements for stocks listed on NYSE and American Stock Exchange (AMEX) for the period 1974 to 1986. Bernard and Thomas put all stocks into one of the ten standardised unexpected earnings (SUE) decile portfolios on the basis of their respective categories. In a portfolio that every calendar quarter takes equal weighted long positions in the top decile of earnings performers, and short positions in the bottom decile, earned +4.19 percent average abnormal return over the 60 trading days following the earnings announcements. The estimated post-announcement abnormal return was positive for 46 out of the 50 calendar quarters studied. Over the first 5 trading days, i.e., approximately one week, the portfolio earned +0.70 percent, i.e., one sixth of the estimated 60 days abnormal returns. The trading days 61 to 80 exhibited additional abnormal returns of approximately the same magnitude as those in days 1 to 60. By day 180, i.e., approximately three quarters the estimated abnormal return was +7.74 percent and very small or no further drift occurs after day 180. On the basis of the results of the study, they concluded that post-earnings announcement abnormal returns are not premium for the risk but it was consistent with delayed response by the stock prices. This indicated the persistence of post-earnings announcement drift.

Bernard and Thomas (1990) tested the possibility of current earnings information having implications for future earnings that may not be reflected in stock prices immediately. Bernard and Thomas examined hypothesis that stock prices reflect earnings expectations based on a naive seasonal random walk model rather than more sophisticated statistical forecasting models. Under seasonal random walk model, the expected earnings in the current quarter are simply earnings for the corresponding quarter from the previous year. They found that investment in the stocks of the firms with extreme good news produced abnormal returns of +1.32%, +0.70%, +0.04% and -0.66% respectively for the four quarters earnings announcements and t-statistics were +14.63, +8.46, +0.45 and -7.86 respectively. The significance of the results is that the pattern of the estimated abnormal returns are +, +, 0, - pattern of autocorrelation. This indicates the persistence of positive autocorrelation for the first three lags that decline over the period, and it is negative at the fourth lag. The pattern of autocorrelation remained consistent from the beginning of the period. Bernard and Thomas (1990) concluded that "the stock prices partially
reflect a naive earnings expectation that future earnings will be equal to earnings for the comparable quarter of the previous year" (p.338) They considered different alternative explanations for the results, including risk adjustment problems and impact of transactions costs However, they failed to support any of them.

Ball and Bartov (1996) re-examined Rendleman, Jones, and Latane (1987) and Bernard and Thomas (1990) hypothesis and reported that investors use a naive seasonal random walk model for quarterly earnings The sample comprises of 70,728 quarterly earnings announcements made by the NYSE and AMEX firms during 1974 to 1986. The analysis of the results revealed that the four lagged standardized unexpected earnings (SUE) variables have the predicted reversed (−, −, −, +) signs and each is significant at the 1% level of t-statistics. This indicates that the investors are being aware of the signs of serial correlation in seasonally differenced earnings. The magnitudes of the coefficients supported that market systematically underestimating serial correlation in SUEs. The overall results of the study supported the predictability of estimated abnormal returns at future earnings announcements.

### 3.3.6 Dividend changes

Dividend payments may have an impact on stock prices. Hence, the empirical study on stock price responses to dividend announcement is important. It may be a possible source of market anomaly. Asquith and Mullins (1983) examined the impact of initiating dividend payments on shareholders' wealth. They have taken into consideration both the initial decision of paying dividends, as well as changes in an already existing dividend. The results of the empirical study suggested that both the situations would increase shareholders' wealth. Thus, the information concerning dividends would therefore, be valuable to investors. Compared to other publicly available information, dividend payments are unique, because they have to be backed up with actual cash payments. Thus, this is a signal from the company that they are capable of paying cash dividend and also future cash payments could be interpreted as a sign of better future performance.

Bajaj and Vjih (1995) examined the trading behaviour and the market reaction to dividend announcements. The sample consisted of 67,592 dividend announcements during the period from July 1962 to June 1987. They found that all dividend announcements resulted in positive average excess return. In addition, they found higher excess returns for small firms and low-priced stocks and lower average excess.
returns for larger firms and high priced stocks. The study suggested a 0.21 percent average excess return over the three-day after the announcement period. For the lowest decile of firm size, the average excess return was 0.67 percent and corresponding average for the highest decile of firm size was 0.07 percent. Further, they found evidence of increased information production around dividend announcement days, resulting in greater trading volume and increased price volatility. The excess return, price volatility, and trading volume are all positively correlated.

Firth (1996) suggested that unexpected dividend changes would lead to abnormal returns. He focused on whether the dividend changes of one company would affect the valuations and earning forecasts of other companies in the same industry group. He found positive correlation between abnormal returns of the firms reporting dividend changes. Moreover, returns were correlated with future dividend and earnings performance of non-reporting firms within the same industry groups. The results supported the hypothesis that changes in dividends have informational value for other firms in the same industry group.

### 3.3.7 Stock Splits

The announcement of stock splits is one of the most tested events in the event study literature. Fama, Fisher, Jensen, and Roll (1969) examined 940 stock splits on the New York Stock Exchange (NYSE) from 1927 to 1959 for which the split ratio was 5.4 or more. The stock price behaviour was examined for a period of 29 months before and 29 months after the split. The split itself is not an event that affects the wealth of the shareholders. It increases the number of shares that an investor possesses without affecting his proportionate holding in the company. The calculated CAAR was flat from the date of the split. This supported the view that the act of stock split does not create value. The CAARs increased in the 29 months before the split and stock price adjustment was completed on the month of announcement for the entire sample. Fama et al. hypothesised that the reason for positive abnormal returns before the split was that investors anticipated higher earnings and dividends not the stock split itself. To test this, Fama et al. divided their sample into stocks that provided increased cash dividends after the split and those which actually decreased their cash dividends. The CAARs for those stocks that increased their cash dividends was flat after the stock split, which indicated that the investor correctly anticipated the increased dividends. However, CAARs was declined for those stocks that decreased
cash dividends. The overall results when all stock splits taken together indicated that the abnormal returns randomly distributed around '0' during the post split year. These results were consistent with an efficient market that reacts rapidly and in an unbiased manner to the announcement of stock split.

Charest (1978) studied stock price responses to stock splits during the period from 1947 to 1967. He has selected 606 split proposal announcements, 435 approval announcements and 1,252 realisations. He examined variety of methodological issues associated with the techniques of estimating abnormal returns. He applied these methods to the proposals, approvals, and realisations of stock splits. The evidence from the stock split study showed some indication of non-zero abnormal returns, but they are sensitive to the precise estimation techniques used and the particular time intervals covered. Charest concluded that the evidence on stock price response to stock splits is generally consistent with market efficiency.

**3.3.7.1 Studies that Contradicts Semi-strong Form**

Nichols (1978) examined the adjustment of stock prices to the announcement of stock dividends and stock splits for the years 1960 to 1975. The sample selected for the study included 494 stocks splits, which had a complete data set on the CRSP tape for 96 months before and 18 months after the split announcement month. He used a cross sectional methodology similar to Charest (1978) to generate expected returns. The results of the study indicated that substantial excess returns were associated with securities issuing stock dividends equal to or greater than 25 percent of the shares previously outstanding. The results were inconsistent with market efficiency.

Ikenberry, Rankine and Stice (1996) examined 1,275 two-for-one stock splits that took place from 1975 to 1990 in the U.S. stock market. They found an excess return after the announcement of stock split. For the first year abnormal return was 7.93 percent and the three years following the stock split was 12.15 percent. These results were based on buy-and-hold strategy and both book-to-market equity and size were taken into consideration. This is inconsistent with EMH.

Desai and Jain (1997) examined long run common stock returns following stock splits and reverse splits during the period 1976 to 1991. The sample consisted of 5,596 stock splits, out of which 3,457 stocks listed on the NYSE and AMEX, and the remaining 2,139 on the Nasdaq. Out of 76 reverse splits, 30 were traded on the NYSE and AMEX and the remaining 46 were on the Nasdaq. The analysis of the results...
revealed that in the announcement month, abnormal returns were 7.11 percent. The market does not incorporate the full effect of the announcement. The average 1 year and 3 year's abnormal returns after the announcement month were 7.05 percent and 11.87 percent, respectively. For a sample of 76 reverse split announcements, the announcement period abnormal returns of -4.59%, and are followed a drift of -10.76% in 1 year and -33.90% in 3 years. The positive abnormal returns following stock split and a negative abnormal return following reverse split supported the notion that the market underreacts to firm specific news. The overall result of the study was inconsistent with the EMH.

3.3.8 Other Information

Keown and Pinkerton (1981) examined unannounced merger plans, and the impact of trading on inside information in advance of planned takeover announcements by focusing on the daily stock price movements of 194 successfully acquired firms during 1975 to 1978 prior to the first public announcement of their proposed mergers. Out of 194 sample stocks, 101 stocks listed on the NYSE and AMEX and 93 traded on over-the-counter market. Using residual analysis method, abnormal returns were calculated for 126 trading days before and 31 trading days on and after the announcement date. The results revealed that price adjustment started before the announcement date. The results of the study suggested that while 43.3 percent of the total price adjustment for the listed securities occurred before the announcement date, and 56.3 percent for unlisted securities. The overall results revealed that market reaction to the new public information was completed by the day after the announcement and supported the semi-strong form EMH.

Barnes and Ma (2002) empirically tested the behaviour of China's stock prices in response to the proposal and approval of bonus issues during the period from 1994 to 1998. The total bonus proposals for A-shares were 196 divided into three portfolios. The small bonus portfolio included 103 proposals, middle bonus portfolio included 37 proposals, and large bonus portfolio included 56 proposals. For B-shares only, 56 bonus proposals were selected. Among 56 bonus proposals, 34 belong to the small bonus portfolio and 22 belong to the middle and large bonus portfolio. Barnes and Ma used event study methodology earlier used by Fama, Fisher, Jensen and Roll (1969) and Brown and Warner (1980, 1985). They studied stock price behaviour 20 days before and 20 days after the proposal and approval of bonus issue. They concluded
that the A-share market reacts more strongly than the B-share market to the announcements of bonus proposals and approvals, suggesting that the A-share market is not as efficient as the B-share market. The hypothesis of semi-strong form market efficiency was rejected only for small bonus issues traded on the A-share market. The A-share market can be deemed to be semi-strong form efficient for middle and large bonus issue proposals and approvals and the B-share market was for small, middle and large bonus proposals and approvals.

Ekanayake (2004) examined the information signaling of and market reaction to common stock on market buyback announcement in the Australian stock market. He selected 127 buyback announcements during the period from January 1, 2000 to March 10, 2003. Ekanayake calculated daily abnormal returns and cumulative abnormal returns during the event period. The results of the study suggested that on buyback announcements share prices increased significantly in the short run. During the event window cumulative abnormal return was 3.31% and on the event day 1.24%. The abnormal returns for three days surrounding the event date was 3.72%. He concluded that the market considered share buyback announcements as a positive signal. The results of the study also supported the hypothesis that higher the proportion of the shares that is sought to be bought back, the stronger the positive signal of the announcement. The signal is stronger when the information asymmetry between the management and the investors is high and when the proportion of shares to be bought is between 7.5% and 10% of the total number of outstanding shares. The Australian stock market considered stock buyback announcement as insider information that shares are currently under priced.

3.4 Strong Form of Efficient Market Hypothesis

Strong form of efficient market hypothesis assumes that all available public and private information is fully reflected in a stock price. The strong form, in terms of market participants, also assumes that no individual can have higher expected profits than others because of monopolistic access to information. It is an extreme hypothesis. One possible test of strong form is to determine whether insiders earn superior returns than market returns. Testing of strong form of efficiency is often based on different investment groups that possibly have access to important private information. If one or more of these groups earns excess returns, then strong form of EMH will not be valid. Although, the developed stock markets in the world including
India have exhaustive regulatory framework to curb such ‘insider trading’, studies have reported that ‘insider’ do earn excess returns.

Fuller and Farrell, Jr (1987) have divided strong form of EMH into two groups: First, “super strong form”, which includes insiders and exchange specialists who have true monopolistic information, and secondly, “near strong form”, which includes private estimates developed from public information (p 116)

3.4.1 Corporate Insiders

According to Jaffe (1974) trading by corporate officers, directors, and large stockholders is called insider trading. Because of their position in the organisation they have access to price sensitive information on corporate investment and financing plans, future policies and strategies, etc. This monopolistic information is not available to public and it can be used to devise profitable trading strategies. Researchers and academicians are interested to know the type of special information insider's posses and how that special information is exploited to earn excess returns.

Much of the research on monopolistic information and insider trading have been undertaken in the U.S.A., where there is prohibition on the use of private information by the insider to earn abnormal profits. In the U.S.A in case insider trading has been proved, then the regulatory authorities are imposing severe penalties and profits earned by the insider by selling or buying the stocks on the basis of monopolistic information should be returned. However, Jaffe (1974) stated that investors in the U.S.A violates provisions of Securities and Exchange Act, 1934 by doing the transactions in the names of the friends, relatives or even insiders of other firms.

Jaffe (1974) suggested another way in which insiders can gain without private or inside information about the firms. The trading of an insider i.e. either buying or selling of stock without monopolistic information may trigger flood of transactions in the same direction by the outsiders. It may generate abnormal returns to insiders during the period subsequent to the period in which they trade. Grivoly and Palmon (1985) have expressed similar opinion. Jaffe stated that the failure of stock market to distinguish between insider transactions with information or without information provides opportunity to beat the market, which Jaffe called ‘gamesmanship’. Further, he observed that large transactions by insiders were not found to contain more information than small transactions and the cumulative average abnormal returns
(CAARs) were almost identical to both large and small transactions. Jaffe (1974) concluded,

"The findings indicate successful trading by insiders. However, the results do not suggest that profit to insiders is an increasing function of the intensity of the trading. One might speculate that, as the number of insider traders increases, the nature of their information becomes increasingly similar to that of outsiders, either through leaks or from a common assessment of generally available information." (p 423)

Jaffe examined special information and insider trading. He selected a sample of 200 large firms during the period 1962 to 1968. His study revealed that insiders earned positive abnormal returns by using private information. The results suggested that the CAAR increased approximately 1% in each of the first 2 months following the date of the insider trade and reached a level of approximately 5% after 8 months. Even though the abnormal profit is without considering transaction cost, 5% abnormal return is certainly more than the transaction cost. He also calculated cumulative average abnormal returns from the month information became publicly available. He found abnormal return of 4% for 8 months holding period without transaction cost and after considering transaction costs, the abnormal profits is significant.

Scholes (1972) investigated secondary offerings, many of which were issued by insiders, and found that the abnormal returns of securities declined an average of 1 percent on the days of these offerings. He concluded that the drops in the abnormal returns are due to the market's belief that the issuers possess inside information of an adverse nature and rejected the hypothesis that selling pressure reduces abnormal returns.

Finnerty (1976) examined insider trades for the New York Stock Exchange (NYSE) firms during January 1969 to December 1972 with a sample of 9,602 buy transactions and 21,487 sell transactions. Based on a methodology developed by Jensen (1968), which described the risk premium of an individual security above the market return, Finnerty evaluated both buy and sell portfolios. For the buy portfolios, results were evaluated for up to 12 months after the trade. The returns were consistently positive and significantly different than zero at the 10% level except the returns for the 5th and 7th months. For sell portfolios also, results were similar, indicating that the prices of the securities sold by the insiders fell more than the market in the months following the trade. When comparing the post-trade months, the
first month showed the highest abnormal return. This might have been caused by the fact that the insiders’ trades became public information soon after the trade. He concluded that insiders were able to identify profitable or unprofitable situations in their own company in the short run. Although his methodology was different, Finnerty’s results were similar to results of Jaffe (1974), and both the studies refuted the strong form of efficient market hypothesis.

Givoly and Palmon (1985) have attempted to find out the extent to which abnormal profits earned by the insiders can be attributed to possession and use of superior information during the period from 1973 to 1976. They found that abnormal returns associated with large transactions were not significantly different from the abnormal returns associated with the small transactions. They found that the superior performance of insiders was due to better assessment of the transactions of their firms and insider trading followed by outsiders. The insiders earned abnormal returns by exploiting private information and not because of the knowledge of forthcoming disclosures.

Rozefeld and Zaman (1988) examined the potential abnormal returns for corporate insiders as well as the possibilities for outsiders to earn abnormal returns based on publicly available information considering insider trades. They also investigated whether positive abnormal returns linked to insider trading could be explained by other factors such as size or P/E ratios for the period from 1973 to 1982. They found that insiders earned abnormal returns by using inside information. The abnormal returns for the shorter periods disappeared after considering transactions cost of 2% but the returns for the longer period i.e., 12 months was significantly higher than the market return. When they adjusted the market model for the size and P/E ratio effects, the abnormal return for 12 months horizon became insignificant. These results suggested that the abnormal returns earned by outside investors, on the basis of the trades of corporate insiders, were mainly caused by size and P/E effects and supported the results of Banz (1981) and Basu (1983). For the insider trades, an average abnormal return was between 3.12% to 5% per year after adjusting transaction costs, size and P/E effects.

Bushman and Indjejikian (1995) examined voluntary disclosures and trading behaviour of corporate insiders. They found that an insider’s trading profits could increase due to a public disclosure even though such a disclosure reduces his private information advantage at the time of trade. This result was contrary to the usual
argument that insiders have an incentive to disclose information only after trading. The results also highlighted that incentives for voluntary disclosures are influenced by the nature of the market for the firm's shares in any given period or across time. These incentives arise because a public disclosure changes the trading behaviour of all traders in a way that allows an insider to increase his profits at the expense of other informed and uninformed traders.

Park, Jang and Loeb (1995) examined the insider trading activity surrounding annual earnings announcements during January 1, 1986 to December 31, 1987. The sample consisted of 1,328 firms listed on NYSE and AMEX. They used event study methodology and calculated cumulative abnormal returns for 50 days before and 20 days after the annual earnings announcements. The cumulative average abnormal return was 5.8%. They also compared insider trading by position holders and major shareholders, large firm and small firms. They found that corporate position holders such as officers and directors are more active in using inside earnings information than major shareholders. The insiders of large firms are more active in their trading around earnings announcements and insiders of small firms, holding a larger portion of outstanding shares than insiders of large firms, are not used inside earnings information in trading as often as the insiders of larger firms.

### 3.4.2 Performance of Professionally Managed Funds

Professionally managed funds include mutual funds, pension funds, etc. Performance of mutual funds and other professionally managed funds is an indirect test of strong form of efficient market hypothesis. The managers of mutual funds would like to have access to inside or private information than ordinary investors. In such a situation, the inside information can be used to earn abnormal profits. Then mutual funds would expect to earn consistently higher returns than the average market return. If this expectation is realised, it is an indication of market inefficiency in its strong form. Further, if the market is efficient, the performance of mutual funds could be expected to be in accordance with the market, and in the worst situation to fall short of it by the amount of management's expenses.

The evaluation of performance of mutual fund managers is an indirect way of testing strong form of EMH. However, the fund managers use all the major techniques of security analysis like technical analysis, fundamental analysis, and also
have access to inside information. Hence, in a way it is a joint test of all the three forms of market efficiency i.e., weak, semi strong and strong form of EMH.

Sharpe (1966) examined the performance of 34 open-ended mutual funds from 1954 to 1963 using the criteria developed by him and the criteria suggested by Treynor (1965). Sharpe found that mutual funds have not consistently outperformed the market. His results supported the view that the stock market is efficient and good fund managers concentrate more on evaluating risk and providing diversification, rather than spending much effort and money on the search for incorrectly priced securities. In another study, Treynor and Mazuy (1966) investigated whether mutual funds outguess the market. The sample selected for the study consisted of 57 open-end mutual funds during a 10-year period from 1953 to 1962. They found that only one out of 57 mutual funds outguessed the market and the results of the study are consistent with the strong form of EMH.

Jensen (1968) examined the performance of mutual funds during the period 1945 to 1964. The sample consisted of 115 mutual funds. He found that the mutual funds selected for the study earned approximately 11% less per year than they should have given their level of systematic risk. He concluded that mutual fund managers do not have access to inside information and consistently they will not beat the market.

Bogle and Twardowski (1980) examined comparative performance of institutional investments of commercial banks, insurance companies, investment counselors, and mutual funds over the period from December 31, 1967, to December 31, 1977. The results of the study revealed that among all the institutional investments, mutual funds performed better, followed by investment counselors, insurance companies, and commercial banks. Further, the results suggested that none of these professionally managed portfolios could beat the stock market consistently. Hence, the result is consistent with the strong form of efficient market hypothesis.

Shawky (1982) empirically tested the performance of mutual funds. The sample selected for the study consisted of 255 mutual funds over the period 1973 to 1977. He used Treynor, Sharpe, and Jensen measures to analyze the performance of mutual funds. The results suggested that the performance of the mutual funds during the 1970s proved better than what was reported earlier during the 1950s and 1960s. He found that the rate of return earned by the mutual funds was proportionate to their systematic risk.
Chang and Lewellen (1984) have examined the performance of 67 mutual funds with different investment objectives such as growth, income, stability of capital and maximum capital gain during the period from 1971 to 1979. They used statistical techniques to test jointly the presence of either superior market timing or security selection skills. They concluded that the mutual fund managers do possess neither superior market timing nor superior security selection skills. The results of the study supported strong form of efficient market hypothesis.

Ippolito (1989) evaluated the performance of 143 mutual funds using information from 1965 to 1984. The results revealed that the expenses associated with mutual funds were offset by their superior results. He also found that mutual funds having higher turnover and more expenses (i.e., more actively traded) funds seemed to compensate these costs with superior performance. He suggested that, on average, the mutual funds justify their costs.

Elton, Gruber and Blake (1996) pointed out that earlier studies might be suffered from survivorship bias. Some companies regularly close down their worst performing mutual funds. If empirical studies include only mutual funds for which returns are available during an entire sample period, the average returns of the funds that included in the sample will be reflective of the performance of long-term survivors only. With the failed funds excluded from the sample, the average measured performance of mutual fund managers will be better than one could reasonably expect from the full sample. This is called ‘Survivorship Bias’. The source of this bias could be attributed to the fact that mutual funds that disappeared tend to do so due to poor performance. They concluded that almost all prior studies were affected by this bias, and they probably overstated true performance of mutual funds. The authors found that for a 10 years study the bias will be 0.396% and for a 20 years study the bias will be 0.966%.

3.4.3 Security Analysts Recommendations

Security analysts are not in possession of inside or private information but they have experience in finding undervalued stocks. The studies of security analysts will therefore give a more meaningful approach to strong form of efficient market hypothesis testing. Many studies supported the view that security analysts possess inside information. Recently, there have been many studies evaluating the well known Value Line Investment Survey in the USA. Value Line Investment Survey is an
advisory services with financial information on approximately 1,700 stocks from 1 (best) to 5 (worst) for the next 12 months on the basis of stock's expected performance. Many researchers have tested performance of stocks recommended by Value Line Investment Survey, and the findings have been mixed.

Copeland and Mayers (1982) examined the performance of Value Line Investment Survey recommendations made during the period from November 26, 1965 to February 3, 1978. They used market model and future benchmark technique to evaluate the recommendations of Value Line Investment Survey. Results suggested statistically significant abnormal performance when future benchmarks were computed using market model. The gross abnormal performance measured through the future benchmark technique was lower than that found by Black (1971) using Jensen methodology. Black (1971) reported approximately 20% per year abnormal return without transaction costs for an investor who was long in portfolio 1 and short in portfolio 5. However, Copeland and Mayers (1982) have found annual rate of return of about 6.8% for a similar strategy. Bjerring, Lakonishok and Vermaelen (1983) examined the recommendations of a Canadian brokerage house. The data used for the study consisted of all the recommended, speculative, and representative lists from September 1977 to February 1981. They selected a total of 221 companies out of which 71% of the companies were from Toronto Stock Exchange, 23% from the NYSE and the remaining 6% from the Vancouver Stock Exchange, AMEX, and OTC. The analysis was conducted for Canadian and U.S. securities separately as well as for all the securities together. The results revealed that an investor following the recommendations would have achieved significant positive abnormal returns, even after allowing transactions costs. The result of the study is similar to Copeland and Mayer (1982) who demonstrated that customers of financial analysts could have achieved abnormal returns by following their recommendations.

Dimson and Marsh (1984) examined 4,000 return forecasts made by 35 different firms of analysts in the U.K. They correlated actual return with forecasted returns and found an average correlation coefficient of 0.08. Despite the small amount of information contained in the forecasts, as indicated by the correlation coefficient, the performance of the fund outperformed the market by 2.2%. The results also showed that more than 50% of the information contained in the forecasts was reflected in share price in the first month following the forecast. Thus, a rapid reaction to analysts' forecasts was necessary to outperform the market. Further, they
concluded that, "these benefits are not, of course, freely available to all, they may be available to the largest institution in exchange for acceptable volume of fixed commission business" (p 1288).

Elton, Gruber and Grossman (1986) examined the data consisted of more than 10,000 recommendations per month made by more than 720 analysts at 34 brokerage houses, spread over a period of 33 months in the U.K. They found that a change in recommendation and the recommendation itself contained information. Abnormal risk adjusted returns could be earned by buying upgraded stocks or stocks that were in a better grade, and selling downgraded stocks or stocks that were in a lower grade. They concluded that abnormal returns were found in the recommended month and persisted two months after the recommendation or after change in the recommendation. These results are inconsistent with strong form of efficient market hypothesis in the U.K. stock market.

Liu, Smith and Syed (1990) analysed the impact of stock recommendations in the Wall Street Journal’s Heard on the Street (HTS) column on stock prices. They found average price changes of about 1.7% on the day of the announcement. Their conclusion was similar to Stuckel (1985) and Peterson (1987) on the effect of changes in Value Line ranks.

Bauman, Datta and Datta (1995) empirically tested the economic value of Heard on the Street (HTS) column recommendations for short and long-term investors. The sample consisted of 168 buy and 92 sell recommendations of stocks listed on the NYSE during 1987. The results revealed that on an average, the portfolio comprising stocks of the buy recommendations earned a cumulative abnormal return of 25% while the sell recommendations had negative CAR of -4.38% before the publication period. However, after the publication period the buy portfolio experienced a negative CAR of -1.29% for days +1 to +8 and the sell portfolio experienced a gain of 2.16% over +1 to +19 days and 3.44% gain over +1 to +30 days. The results are consistent with the overreaction hypothesis supported by DeBondt and Thaler (1985, 1987). However, the contrarian investor, who followed the policy of buying the sell portfolio at the close of the column’s publication day, could earn 3.44% abnormal returns without considering transaction costs. If transaction costs are taken into consideration, the abnormal returns to contrarian investors are insignificant. The results revealed that for long-term investors HTS recommendations are more valuable compared to short-term investors. The overall
results indicated that over 6 months holding period, buy portfolio outperformed the market by 4.61%, while for 12 months holding periods by 6.5%. The sell portfolio outperformed the market for 6 months by 2.57% and for 12 months holding period by 7.53%. Thus, the results supported the view that analysts' forecasts are useful for long-term investors. However, Bauman, Datta and Datta (1995) concluded, “the six month returns had a standard deviation of 39.28% for the buy portfolio and 37.00% for the sell portfolio. This indicated that an investor should engage in time diversification and portfolio diversification in order to experience the gains inferred in this study” (p 668-669).

This chapter aimed at, besides discussing the concept of efficient market hypothesis, throwing some light on the empirical studies conducted on the foreign markets. Three forms of efficient market hypothesis have been extensively tested in the developed countries like the U.S.A, and the U.K. The review of literature revealed that since the beginning of the 19th century till the 1960s and 1970s, majority of the empirical studies in the foreign stock markets have supported the view that stock markets are efficient in the weak form and stock prices fluctuated randomly. Studies on semi strong form of efficiency examined the speed and accuracy of stock price responses to announcement of new information to the public. The results of the studies supported the argument that the stock price responses are quick, although there is a controversy over the issue that stock price adjustments are accurate. There is very less research on strong form of market efficiency. Since the 1980s, there has been a shift in the nature of problems addressed by the researchers on EMH. There exists a considerable amount of evidence in support of and against the three forms of efficient market hypothesis. This created an impression that all issues related to efficient market hypothesis are not closed and the controversy is still continuing not only in India but also in the foreign markets.