Chapter 4

A Debate On Efficient Market Hypothesis – India

In the previous chapter we discussed and reviewed empirical studies conducted on the foreign markets on all the three forms of efficient market hypothesis. This chapter is devoted to a detailed discussion on findings of studies conducted on the Indian stock market on all the three forms of the efficient market hypothesis.

4.1 Weak Form of EMH

Efficient market hypothesis (EMH) has been extensively tested in the developed countries like the U.S., the U.K., Australia, and Germany. However, Indian stock markets have been less subject to efficient market hypothesis research than their counterparts elsewhere. Majority of Indian studies on efficient market hypothesis related to weak form. The researchers have, generally, followed two approaches to test weak form of efficient market hypothesis. The first is based on statistical testing of independence of price changes, using statistical techniques such as serial correlation, runs tests, spectral analysis, integrated moving average, rank correlation, Kruskal-Wallis test, ARIMA, Kolmogrov Smirnov goodness of fit test, regression, skewness, and variance ratio. The second approach is to test independence of stock price changes by directly testing various mechanical trading rules such as filter rules, relative strength of prices to examine whether trading profits based on them are greater than it would be under a buy-and-hold policy. Using different samples over different time periods and methodology, majority of studies in the 1970s and 1980s found that the Indian stock market is weak form efficient. However, recent studies questioned weak form efficiency of the Indian stock market.

4.1.1 Studies Accepting Weak Form of EMH

Krishna Rao and Mukherjee in 1971 for the first time examined independence of stock prices in India. They examined the validity of the random walk hypothesis for the Indian Aluminum Company’s weekly average prices for the 16 years period from 1955-1970. By using spectral analysis, they showed that there is no dependency among the share prices, which is consistent with the random walk hypothesis.
However, conclusion of this study, which was based on only one company, need not be regarded as the representative of the share price movement of the entire market.

Sharma and Kennedy (1977) conducted study by taking the behaviour of three leading indices of Bombay, New York and London Stock Exchanges during 1963-1973 covering 132 monthly observations for each index. They selected Bombay Variable Dividend Industrial Share Index (BVDISI or Bombay Stock Index), London Financial Times Actuaries 500 Stock index of London Stock Exchange, and New York Standard and Poor’s 425 Stock Index (S&P 425) of the New York Stock Exchange. They used runs tests and spectral analysis. No significant difference was observed between the indices and they concluded that stock prices on the Bombay Stock Exchange obey random walk and are similar to the behaviour of stock prices in the markets of developed countries like the USA and the UK.

Sharma (1983) studied the stock price behaviour in Indian stock market and tested whether random walk model was applicable. The study covered a sample of 23 actively traded equity shares on the Bombay stock exchange, for six years from 1973-1978. He used Integrated Moving Average (IMA) form of the random walk model to test randomness of the share prices. Except two shares, all the share prices were adjusted for rights and bonus. He found that the stock price changes confirmed randomness in Indian stock market.

Gupta (1985) tested random walk hypothesis by employing two sets of data during the period 1971 to 1976. He used serial correlation and runs analysis. The first data set consisted of two commonly used series of index numbers of share prices, viz. a) Economic Times Index of Ordinary Share Prices and b) Financial Express Index Numbers of equity Shares. The second data set included weekly closing prices of 39 equity shares. The observed serial correlation coefficients for various lags were not statistically different from zero for a majority of share prices analysed and thus, suggested that successive price changes are serially independent of each other. The analysis of runs test results also confirmed that difference between the observed and expected number of runs of all signs was not significantly different from zero in respect of majority of the series studied. On the basis of these results, Gupta concluded that Indian stock market is weak form of efficient.

Krishna Rao (1988) investigated weak form efficiency of Indian stock market on weekend price data over the period from July 1982 to June 1987 for 10 blue-chip companies by using serial correlation analysis, runs tests and filter rules of 3 percent,
5 percent and 10 percent. He reported that 80 out of 100 serial correlation coefficients were within twice of their corresponding standard errors, 16 coefficients were more than twice (but less than thrice) of their corresponding standard errors, only 4 coefficients were more than thrice of their standard errors. These results confirmed the existence of weak form of market efficiency. However, these results cannot be generalised because the study was based on only 10 blue-chip companies.

Yalawar (1988) observed that the majority of earlier studies were based on stock market index and less importance was given to individual share prices and the periods covered by the earlier studies were short. In order to overcome these limitations of earlier studies, he examined equity share returns and stock market efficiency by selecting 122 equity shares listed and actively traded on BSE for the period 1963-1982, almost 20 years. To test random walk hypothesis, rank correlation and runs test were applied. The correlations reported in the study were so small that it was unlikely to profit from that by using some trading strategy. He concluded that Indian stock market is efficient in the weak form at least in pricing actively traded shares.

Dhankar (1991) studied weak form efficiency of the market by taking weekend stock prices of 43 companies listed on the major stock exchanges like Bombay, Calcutta, Madras, and Ahmedabad and Economic Times All India Index of Ordinary Share covering a period from July 1989 to June 1990. Both parametric test (serial correlation) and non-parametric test (runs analysis) were conducted. Both the tests generally supported independent assumption of random walk model and Indian stock market is competitive and weakly efficient in pricing shares.

Ranganatham and Subramanian (1993) used Rescaled Range (R/S) analysis to test long-term dependence in stock prices and random walk in Indian stock market. The analysis has been done on the Bombay Stock Exchange National Index covering a period from 1984 to 1990. The results showed that the behaviour of share prices follow random walk and any attempt of predicting future prices on the basis of past prices would be waste.

Belgaum (1995) tested market efficiency by using Economic Times All India Index and 70 selected companies' individual weekly share prices. He selected only those companies that were included in the 'A' list, and are traded in the Bombay, Calcutta, Madras, and Ahmedabad Stock Exchanges during the period from April...
1991 to March 1992. He employed serial correlation and runs analysis and found that Indian stock market is weak form efficient.

Mittal (1995) examined weak form of efficient market hypothesis in the Bombay, Calcutta, Madras, Ahmedabad and Delhi stock exchanges. He employed serial correlation and runs tests on monthly, weekly and daily share prices for two years, i.e., 1991 and 1992. The results of the study revealed that out of a total of 240 coefficients, only 19 coefficients are significant, thereby indicating serial independence in the behaviour of stock prices. The analysis showed that the magnitude of the first order correlation coefficients varies between 0.016 and 0.561. The results of the runs test showed that out of seven industries that revealed the tendency of rejecting random walk hypothesis to some extent under serial correlation test, only in the case of two industries the standardized variable Z is found significant at 5 percent and 1 percent levels respectively. Therefore, the Z value of all industrial indices is also insignificant and confirmed the results of serial correlation and showed that Indian stock market is weak form efficient.

Amanulla and Kamaiah (1998) examined weak form of efficiency of Indian stock market. He employed random walk tests on monthly stock prices of 53 stocks traded on the Bombay Stock Exchange (BSE) and two indices - BSE sensitive index and BSE national index during the period from January 1987 to June 1996. The results of the study revealed that Indian stock market supports weak form of efficient market hypothesis.


Debasish and Mishra (2003) examined the existence of random walk hypothesis in the Indian stock market by using adjusted daily, weekly, and monthly returns of six stock indices of BSE and NSE for the period January 1, 1998 to December 31, 2002. Out of six, three indices of BSE are BSE sensex, BSE-100, and BSE-200 and three indices of NSE are NSE Nifty, NSE Junior and NSE Defy. They employed two non-parametric tests - runs test and Spearman's rank correlation. The results of the study supported weak form of efficient market hypothesis.
4.1.2 Studies Rejecting Weak Form of EMH

The above studies supported weak form of efficiency the Indian stock market. This indicates that market participants due to unpredictable behaviour of stock prices cannot consistently earn abnormal returns, i.e., past price will not be of any use in predicting future price. However, majority of the recent studies questioned weak form efficiency of Indian stock market and indicated certain anomalies. An anomaly provides an opportunity to the rational investors to earn abnormal return by developing appropriate investment strategies. Some of the important variables that are responsible for stock return anomalies in Indian stock market are day-of-the-week effect, small firm effect, holiday effect, monthly effect and turn-of-the-month effect. The studies that questioned weak form of efficient market hypothesis in Indian stock market are reviewed below.

Kulkarni (1978) examined the behaviour of weekly RBI stock price indices for five stock exchanges. Bombay, Calcutta, Delhi, Madras and Ahmedabad stock exchanges and monthly indices of six different industries by using spectral analysis. The period of study varied from 1946-47 to 1972-73 for different stock exchanges and industries. On the basis of the results he concluded that there is a repeated cycle of four weeks for weekly prices and seasonality in monthly prices. Thus, the results of the study rejected random walk hypothesis in the Indian stock market.

Barua and Raghunathan (1986) evaluated Reliance case and showed that an investor can earn returns inconsistent with the risk assumed by operating on right issues of shares and convertible debentures simultaneously in forward and cash markets. They calculated reward in the form of return for risk taken by two investors C and D with varying assumptions regarding (i) the issue price of convertible debentures, (ii) the market price of reliance shares, (iii) the carry forward rate. The government policy of granting a low premium on right shares and convertible debentures supported inefficiency, and the market slowly adjusted the prices of the securities and violated risk-return party. By considering the facts given by Barua and Raghunathan (1986), Ramesh Gupta (1987) asserted that Indian stock market is excessively speculative rather than inefficient. He argued that low margin on carry forward transaction is responsible for speculation and increasing margin money and efficient administration of stock market would minimise the excessive speculation, which is responsible for the violation of risk-return party. In reply to this Barua and Raghunathan (1987) asserted that they re-examined their hypothesis using real data on
the Reliance case and held that their earlier conclusion (i.e., stock market violated risk-return parity) remained valid. They also argued that the peculiarities of Indian stock market pointed out by Ramesh Gupta (1987) did not affect their conclusion.

Srinivasan and Narasimhan (1988) questioned the methodology used by Barua and Ragunathan (1986 and 1987) in their article. They argued that Barua and Raghunathan misunderstood the concept of market efficiency and risk-return parity. They examined the concepts of risk-return parity and market efficiency and differentiated between market efficiency and informational efficiency. According to them, testing market efficiency by taking single security is totally inappropriate and it should be evaluated on the basis of large number of securities and for a long period of time. They neither argued that market is efficient nor supported the view that it is inefficient.

Chaudhuri (1991a) analysed short-term industrial share price movements based on the time series of weekend price indices published by the Reserve Bank of India (RBI). The study covered a period of 5 years from 1986 to 1990 and 13 industry groups as classified by the RBI. By using serial correlation analysis and runs test, he concluded that Indian stock market was weak form inefficient.

Barman and Madhusoodanan (1993) examined market efficiency on the basis of RBI Ordinary Share Price Index as well as share prices of 35 companies during 1984-1992. They employed variance ratio as suggested by Cochrane (1988) and unit root test and concluded that Indian stock market is not weak form efficient.

Gupta and Gupta (1997) examined weak form of efficiency of Indian stock market. The data used for the study consisted of daily closing prices of 50 actively traded equity shares for the period from July 1988 to January 1996. Though the beginning data varies in respect of some companies, the ending data was the same for most of the sample shares. The random walk model has been tested, by computing autocorrelation coefficients for lags 1-20 in respect of both simple price changes and log price changes. Using runs test, randomness of successive price changes has been tested. The results of the study showed that Indian stock market is not weak form efficient and the random walk model is rejected.

Madhusoodanan (1998) examined the acceptability of random walk hypothesis in the Indian stock market. The data consisted of weekly prices of 120 shares traded on Bombay Stock Exchange (BSE) and two-market indices- BSE Sensitive Index and BSE National Index for the period from January 1987 to December 1995. He used the
methodology that was suggested by Lo and MacKinlay (1988). He analysed mean reverting tendencies of Indian stock market under the null hypothesis of homoscedasticity as well as heteroscedasticity. He applied variance ratio test to find the mean reversion behaviour of stock prices. The results of the study indicated that only 16 out of 120 stocks showed random behaviour and hence, random walk hypothesis cannot be accepted for the Indian market.

Mitra (2000) investigated profitable trading opportunities in the Indian stock market during the period from January 1991 through December 1999. He used two indices - BSE Sensex and NSE Nifty. He tested long moving averages of 50, 150 and 200 days with short moving averages of 1, 2, and 5 days. He found that both long and short moving average provides profitable trading opportunities in the absence of transaction costs. Returns are higher in short moving average compared to long-term moving average. The results of the study questioned the applicability of EMH in the Indian stock market.

Barman and Samanta (2001) tested validity of efficient market hypothesis in the Indian stock market using monthly data of stock price index and dividend from April 1984 to March 1997. They used RBI Index of Ordinary Share Prices to represent stock price index. The data on dividend are not directly available and therefore, are proxies by a derived series based on price index and yield on ordinary shares published by the RBI. They applied two martingale tests using spectral shape, volatility test and co-integration between real price index and real dividend. On the basis of the results of the study they concluded that Indian stock market is not weak form of efficient.

Karmakar (2003) examined random walk and predictability of stock returns in the Indian stock market for the period January 1991 to October 2002. The data used for the study consisted of S&P CNX Nifty, constructed by the NSE on daily basis and daily closing prices of 50 individual companies included in the Nifty. Karmakar used Box-Jenkins Auto Regressive Integrated moving Average (ARIMA) model and found dependency of the aggregate market series and possible to predict future stock returns, which contradicts random walk hypothesis.

4.1.2.1 Size Effect

Mansetty and Vedpuriswar (2002) tested small firm effect in the Indian stock market by using 273 continuously trading stocks that are included in the BSE 500
index from January 1991 to January 2002. To test small firm effect, they created two portfolios by including 25 smallest companies in one portfolio and 25 largest companies in another portfolio. They used total assets as the measure of size. They calculated mean, standard deviation, skewness and kurtosis and concluded that small firms performed better than large firms and infrequent trading does not have any impact on small firms. The results of study supported size effect in the Indian stock market.

Mohanty (2002) by using Fama and McBeth (1973) methodology investigated whether size, market leverage, price-to-book-value, book leverage, price-to-sales, price-to-cash flow and earnings-to-price were related to the cross-section of stock returns. The study covered a period from September 1991 to March 2000. The sample varies from 762 companies in 1991 to 1,971 companies in 1999 and 3,270 companies in 1997. The analysis of the results showed that size, price-to-book value, market leverage, and earnings-to-price ratio were related to stock returns. Size of the firm and price-to-book value were negatively correlated but stock returns, earnings-to-price ratio and market leverage are found positively correlated to stock returns. They also found a flat relationship between returns and beta. The above effects are predominant during post 1995-sub period compared to the pre 1995 period. The overall results showed that small firms earned annualised 70 percent excess return over the large firms and supported size effect in the Indian stock market.

4.1.2.2 Calendar Anomaly

There have been many studies investigating possible calendar anomalies. These studies consider whether there are regularities in the rates of returns on stocks during the specific time periods, i.e., month-of-the-year effect, holiday effect, and day-of-the-week effect. Like other developed markets in the world, in India also many researchers attempted to investigate some of these anomalies.

4.1.2.2.1 Month-of-the-Year Effect

Karmakar and Chakraborty (2000) examined the monthly effect and the turn-of-the-month effect in the Indian stock market by adopting calendar day approach and trading day approach. The data used for the study consisted of daily closing prices of Economic Times Index Number of Ordinary Share Prices for the period from January 1981 to December 1995, compiled and published by Economic Times on a daily basis. Mean, standard deviation and t-statistics of calendar day and trading day
revealed significantly higher return at the first half of the month than that of the second half and abnormal returns at the turn-of-the-month supported seasonality in the Indian stock market

Pandey (2002) empirically tested the existence of seasonality in monthly stock returns in India. The study used monthly returns of BSE Sensex for the period from April 1991 to March 2002 and employed a mixed ARMA-(G)-ARCH-in-Mean model. The analysis of the results showed wide variations of returns across months. Returns for the months of January, February, August, and December are higher than returns for other months. The maximum average returns occur in the month of February. Returns in the months of March, April, May, September, October, and November are negative and it is positive in the months of January, February, June, July, August, and December. Stock returns showed negative skewness for six months and positive for other six months. This supports the view that Indian stock market is informationally not efficient and investors can earn abnormal returns by utilising monthly effects.

4.1.2.2.2 Holidays Effect

Karmakar and Chakraborty (2000a) studied holiday effect in the Indian stock market for a period of 15 years from January 1981 to December 1995. The study was based on daily closing prices of Economic Times Index Numbers of Ordinary Share Prices. The 15 years period divided into three non-overlapping sub periods of 1981-85, 1986-90, and 1991-95. To ascertain holiday effect, they classified trading days into four categories such as weekdays, pre-holidays, intra-holidays, and post-holidays and the four sub-sets contained 1,728, 753, 121, and 757 daily returns respectively. To measure pre-holiday return, Karmakar and Chakraborty have chosen 9 public holidays in each year when the stock market remains closed and which resulted in 135 pre-holiday returns for 15 years period. They used mean, standard deviation, and t-test and found that average pre-holiday return is significantly higher than the mean return of post-holiday and weekday. This indicated that holiday effect prevails in the Indian stock market, which contradicts weak form of market efficiency.

4.1.2.2.3 Day-of-the-Week Effect

Broca (1992) investigated the adequacy of the randomness assumption for stock returns in Indian stock market. He used daily stock prices of Bombay Stock Exchange (BSE) National Index of Equity Prices from April 1, 1984, to December 31,
1989 published by Bombay Stock Exchange By using Kruskal-Wallis test he concluded that share returns in the India stock market showed statistically significant difference across day of the week. Wednesday returns were consistently low and Friday returns were high which contradicts the random walk hypothesis.

Poshakwale (1996) examined weak form of EMH and day-of-the-week effect in the Indian stock market. The study was based on daily stock prices of the Bombay Stock Exchange National Index (BSENI) from January 2, 1987 through October 31, 1994. He employed Kolmogorov Smirnov Goodness of Fit Test, runs test and serial correlation coefficient test and concluded that the Indian stock market was not weak form efficient. The day-of-the-week effect prevails in the Indian stock market, which was evident as the returns achieved on Fridays were significantly higher compared to those of rest of the days of the week.

Arumugam (1999) investigated day-of-the-week effect on stock returns in the Indian stock market. The study was based on BSE Sensitive Index during the period from April 4, 1979 to March 31, 1997. The study covered a period of 18 years, which is sub divided into non-overlapping 3 sub-periods i.e., 1979-85, 1985-91 and 1991-97. The methodology adopted for the study is similar to the model applied in day-of-the-week effect by French (1980), Gibbons and Hess (1981) and Jaffe and Westerfield (1985). The results of the study indicated that Friday returns are significantly positive except for the sub period 1979-85 under both bull and bear phases. Monday returns are significantly negative in the bull phase and positive in the bear phase and insignificant in the other periods. Thursday returns are significant only for 1985-91. The overall results supported the presence of day-of-the-week effect in the Indian stock market.

Anshuman and Goswami (2000) investigated day-of-the-week effects in the Bombay Stock Exchange (BSE) by selecting daily closing prices of 70 stocks listed on the BSE for a period from April 1991 to March 1996. They selected a set of actively traded stocks in order to eliminate the effects of infrequent trading. They extended their investigation to examine the effect of badla trading, which was the special feature of the settlement process on the BSE before March 1994. They used the Gibbons and Hess (1981) methodology to examine the day-of-the-week effect. They used the following regression:

\[ R_{j,t} = a_{1,j} D_{1,t} + a_{2,j} D_{2,t} + a_{3,j} D_{3,t} + a_{4,j} D_{4,t} + a_{5,j} D_{5,t} + \varepsilon_{j,t} \]
Where \( R_{j,t} \) denotes the return on the \( j \)th security at time \( t \) and \( e_{j,t} \) is the corresponding error term. \( D_{i,t} \)'s (for \( i = 1 \) to 5) represent dummy variables that take a value of 1 or 0 depending on the day-of-the-week. For instance, \( D_{1,t} = 1 \) for Mondays and 0 otherwise. Similarly, \( D_{2,t} = 1 \) for Tuesdays and 0 otherwise. The coefficients capture the mean returns for Monday through Friday. They tested multivariate hypothesis \( a_{1,j} = a_{2,j} = a_{3,j} = a_{4,j} = a_{5,j} \) using daily returns data.

The analysis of the results for the entire period suggested that Fridays and Tuesdays experienced significantly above average and below average returns, respectively. The largest portfolio on the basis of market capitalisation has the minimum returns on Fridays. The results also revealed that settlement procedures do not have a significant impact on day-of-the-week effects. They found similar day-of-the-week effects for a subset of stocks with the badla trading facility and for a subset of stocks without the badla trading facility. The results showed that the badla trading facility does not influence day-of-the-week effects.

Amanulla and Thirupalraju (2001) empirically tested whether the carry-forward transaction in different periods have any impact on weekend effect in the Indian stock market during the 10 years period from January 1990 to December 1999. The data selected for the study consisted of 82 individual stocks traded on the BSE and returns on seven portfolios i.e., four beta portfolios and three stock index portfolios. Three indices, viz. BSE Sensex, BSE National Index and S&P CNX Nifty, were used for the study. By using regression and t-test, they found that the results of the study strongly supported the existence of weekend effect during the period of ban on badla transactions. The results of the study also supported reversals in the weekend effect i.e., positive Monday return and negative Friday return. The results of the study showed that there was consistent positive return on Wednesday and negative return on Tuesday due to possible impact of National Stock Exchange (NSE) and Bombay Stock Exchange (BSE)'s different trading operations and settlement period.

Sarma (2004) investigated stock market seasonality in Indian stock market. He used daily returns generated by the BSE sensex, BSE 100 and BSE 200 during the period from January 1, 1996 to August 10, 2002 comprising of 1,667 observations for each of the indices. In this study, he used daily mean index value for generating daily returns instead of closing values of the indices. He used non-parametric Kruskal Wallis test using 'H' statistic. The null hypothesis tested there are no differences in the mean daily returns across the weekdays. The results of the study revealed that the
Monday-Tuesday, Monday-Friday, and Wednesday-Friday sets returns have positive deviations from mean returns for all indices. The Monday-Friday set for all the indices has the highest positive deviation and provides an opportunity to earn abnormal returns consistently through the strategy of buying stocks on Mondays and selling on Fridays. Thus, the study showed the existence of seasonality in the Indian stock market and questioned weak form efficiency.

Karmakar and Chakraborty (2004) investigated day-of-the-week effect, monthly effect, turn-of-the-month effect, holiday effect, month-of-the-year effect, and Friday-the-thirteenth effect. The study was based on 3,072 daily returns for the day-of-the-week effect, the monthly effect, and the turn-of-the-month effect. They used 3,359 daily returns to test the holiday effect. The study covered a period from 1981 to 1995. The results of the study suggested that on Friday the returns were significantly positive, the average returns on Monday, Tuesday, and Wednesday were negative and supported Friday effect in the Indian stock market. They concluded that there is no support for monthly patterns in the Indian stock market. They also examined superstitious notion in the Indian stock market where irrational belief influences the mass mind of the investors. They investigated whether the average returns on Friday is larger than other days of the week and whether return on Friday-the-Thirteenth is lower than that on other Fridays. The results revealed that there was no evidence to show that the average returns being lower on Friday-the-thirteenth than on other Fridays for the entire study period. Hence, there is no Friday-the-thirteenth effect and ruled out the view that market may be affected by superstitious belief. The overall results suggested the presence of monthly effect, turn-of-the-month effect, holiday effect and Friday effect in the Indian stock market.

4.1.3 Mixed Conclusion

Barua (1981) examined serial independence of short run price behaviour of securities and stock market index to ascertain weak form efficiency of the Indian stock market. The data consisted of daily closing prices of 20 stocks and the market index for the period from July 1977 to June 1979. Runs test and autocorrelation were employed. The results of the study supported the null hypothesis of serial independence of stock price changes and suggested an efficient pricing process appears to be present in the Indian stock market. The market index suggested non-random behaviour in both the tests of randomness, i.e., runs test and autocorrelation.
test and rejected null hypothesis of independence of stock price changes. This may be because of changes in the overall economy or leader follower relationship among the stocks that determine the market index.

Mahapatra (1995) investigated whether a measure of relative strength for major stocks traded in the Indian stock market can provide information useful for predicting future price performance. He applied rank correlation on 26 major stocks traded in the BSE for the period from January 1989 to December 1992. The study was based on 48 monthly price data within 4 years of study period without adjusting for dividends, bonus issue or right issue. The results of the study supported the theory of relative strength and suggested that Indian stock market was not efficient in the short period of one month but efficient in the long run i.e., one year or more.

The above studies provided mixed evidence on the weak form efficiency of Indian stock market. However, the results of both the studies provided an opportunity for closer examination with longer time period and larger sample to arrive at a definite conclusion.

4.2 Semi-strong Form of EMH

An empirical study to test semi-strong form of efficient market hypothesis (EMH) examines the speed and accuracy of adjustment of stock prices to release of new information to the public. The impact of release of information on a wide variety of 'events' on stock prices was investigated under semi-strong form of efficient market hypothesis.

Indian stock market has been subject to considerably less empirical research in semi-strong form of EMH compared to the stock markets of the developed countries. The reasons could be difficulties in collecting the share prices and price sensitive information such as the earning announcements in comparable form and determination of its exact time of release. However, Securities and Exchange Board of India (SEBI) made it mandatory for the companies listed on the stock exchanges to announce half yearly results from October 1987 and quarterly results from 1998 and publish in the newspapers. The data relating to stock prices and financial results are also now available in selected websites and software developed by some agencies. This, to certain extent helped the researcher to do research on semi-strong form of efficient market hypothesis on Indian stock market.
4.2.1 Studies Accepting Semi-strong Form of EMH

Narayan Rao (1994) examined stock price adjustment to corporate financial policy announcements such as increase in dividend, bonus issue, and equity rights issue. The study covered different periods for different events. Dividend increase announcement covered a period from 1987 to 1988, bonus and rights issue announcement from 1988 to 1989. The sample consisted of 65 firms for dividend increase announcement, 42 firms for bonus issue announcement and 40 firms for equity rights issue announcements. He used event study methodology, originally suggested by Fama et al. (1969) and extensively used by others. He calculated daily abnormal returns for 10 days before and 10 days after (including announcement day) the announcement of dividend increase, bonus issue and equity rights issue respectively. The analysis of the results of the study indicated that the market witnessed large abnormal returns of 1.99, 2.06 and 1.44 percent on trading days -3, -2 and -1 respectively with respect to dividend increase. It can also be observed that the market experienced 5.38 percent abnormal returns on the bonus issue announcement day. In the case of rights issue, market witnessed abnormal returns of 1.74 and 1.20 percent on +1 and +2 days respectively. This indicates that market was not quick in responding to the equity rights issues. The abnormal returns in all the three cases (i.e., dividend increase, bonus issue and equity rights issue) are significantly greater than zero at 0.025, 0.0005, and 0.005 levels of significance respectively. The analysis of the results of the study indicated that Indian stock market responded in an expected direction to dividend increase, bonus issue and equity rights issue. But, the timing and speed of adjustment depends on the types of the announcement — it responded in advance to dividend increase, rapidly to bonus issue and slowly to rights issue. The overall results of the study revealed that India stock market was semi-strong form efficient.

Srinivasan (1997) examined security price behaviour associated with rights issue related events. The research consisted of two issues: event studies to determine abnormal performance and supplementary studies to explain abnormal performance. The study covered rights issues of equity and fully convertible debentures (FCD) between 1985 and 1991. The sample was restricted to issues made by companies actively traded on Ahmedabad, Bombay, Calcutta, Delhi, or Madras stock exchanges, which were also listed on either the Ahmedabad or Bombay stock exchanges. Accordingly, the sample consisted of 31 equity and 27 FCD issues made by 50...
companies. The study was based on daily prices and he used 100 trading days prices for estimating normal returns. Test period were 30 days before and 11 days after the announcement of Board meeting to consider rights issue and to adopt resolution, 10 days before and 10 days after ex-rights date, record date, issue opens, last date for obtaining split forms, issue closure, listing of securities, first conversion of convertible debentures. Five variants of event studies are used, i.e., comparison period method, the market model with Sensex, and market model with Natex with simple price series adjustment procedures, comparison period method, and the market model with Sensex with complex price series adjustment procedures. The supplementary studies used regressions and non-parametric tests. On the basis of analysis of the results he concluded that a rights issue of equity is seen as ‘bad’ news by investors, and a rights issue of fully convertible debentures (FCD) is seen as ‘neutral’ news. The pricing of rights issues is not very important, as price reaction to right issues do not seem to be related to the discount and that investment signals do not appear to be accepted by investors. He found that the choice of methodology does not make much difference in event studies. He concluded that Indian stock market was semi-strong form efficient with the exception of ex-rights abnormality.

**4.2.2 Studies Rejecting Semi-strong Form of EMH**

Obaidullah (1990) empirically tested stock price adjustment to announcement of half yearly earnings. He used weekly returns for a sample of 33 companies that announced their half-yearly earnings for the period ending September 1989. He calculated weekly cumulative abnormal returns for 9 weeks prior to and 7 weeks after the announcement of half yearly earnings in three situations: 1) without adjusting for the market factor, 2) with adjusting to changes in market index and 3) using the residual analysis method. The analysis of the results revealed that market reaction to half yearly earnings announcement continued after the announcement week, which confirmed the presence of learning lags. This indicated that stock prices do not immediately reflect all available information, and semi-strong form of EMH cannot be accepted for the Indian stock market.

Obaidullah (1991) examined investment performance of securities related to their price/earnings ratios. He has selected a sample of 118 companies for the period from January 1986 to September 1990. For most of the sample companies year ends on 31st March and almost all of them announced their annual results within a
maximum period of three and half months. He constructed portfolios of ten lowest price/earnings and ten highest price/earnings stocks. The analysis of the results revealed that during the first year of the study the ten lowest price/earnings stocks, on an average, earned about 63 percent higher than the ten highest price/earnings stocks. For the three subsequent periods also, the average return of the ten lowest price/earnings stock was much higher than that of the ten highest price/earnings stocks and the difference was 34.1 percent and 25.1 percent respectively. The results of the study thus, suggested that stock prices adjustment to earnings information was biased and inaccurate which contradicts semi-strong form of efficient market hypothesis.

Obadullah (1992a) examined whether price/earnings ratios are indicators of future investment performance. He selected a sample of 120 large and actively traded companies. The study covered a period from January 1986 to September 1990. He constructed two portfolios consisted of 10 lowest price/earnings stocks and the 10 highest price/earnings stocks. He used residual analysis method and found that during the first year of the study the ten lowest price/earnings stocks, on an average, earned about 63 percent higher than the ten highest price/earnings stocks. For the subsequent periods also the difference was 34.1 percent, 43.9 percent, and 25.1 percent for raw returns, and 34.4 percent, 65 percent, and 24.4 percent for market-adjusted returns respectively. Hence, the results of the study indicated inappropriate response of stock prices, which was against semi-strong form of EMH.

Chaturvedi (2000a) attempted to determine the existence of post-earnings announcement drift using unexpected half-yearly earnings information. The sample used for the study consisted of 90 companies listed on BSE and fulfilled the criteria determined by Chaturvedi. He divided sample companies into four portfolios, i.e., portfolio with positive unexpected earnings and high β values, portfolio with positive unexpected earnings and low β values, portfolio with negative unexpected earnings and high β values and portfolio with negative unexpected earnings and low β values. He used naive seasonal random walk model to forecast earnings. Abnormal returns were calculated for 20 days before and 40 days after the announcement of half yearly earnings. The results suggested the occurrence of abnormal returns during pre-and post-announcement periods. The difference in the mean cumulative abnormal returns between the positive and negative unexpected earnings portfolio for the event window of 20 days prior to and 40 days after the earnings announcements was found to be more than 28 percent and significant at 0.01 level. Further, he found that pre
announcement cumulative abnormal returns of 10.10 percent are also significant at 0.01 levels. During the study period, cumulative abnormal return of 10.61 percent could have been earned even by delaying the investment decision by 20 trading days, which on an average amounts to one calendar month. Even after considering transactions costs, the post-announcement period abnormal returns were significant and it cannot be attributed to inappropriate significance test. Thus, he found that it is possible to outperform the market and to earn abnormal returns on the basis of earnings information.

Chaturvedi (2000b) examined effect of price/earnings ratio in both pre- and post-earnings announcement periods. The sample consisted of 90 companies, which fulfilled certain criteria, and the study covered a period from January 1990 to March 1996. On the basis of price/earnings ratio, the sample was divided into five portfolios. He constructed the lowest and the highest portfolios to have estimated beta equal to one as suggested by Watts (1978). BSE-100 index of stock prices was used to proxy the market rate of return. Abnormal returns were calculated 20 trading days prior to and 40 trading days after the earnings announcement. The analysis of the results revealed that the cumulative abnormal returns (CAR) for the lowest price/earnings portfolio were 18.53 percent out of which only 2.66 percent occurred prior to the earnings announcement and 15.87 percent occurred in the post-announcement period. Further, abnormal return persisted during the control period +21 to +40 days. Only 14.38 percent of the total cumulative abnormal returns for the low price/earnings portfolio occurred in the pre-announcement period, while for the highest portfolio, the corresponding percentage was 43.49 percent. For the post-announcement period, only 12.87 percent of the total cumulative abnormal returns occurred during the control period +21 to +40 days for the highest price/earnings category stocks compared to 36.88 percent for the lowest price/earnings stocks. This indicated that low price/earnings stocks reacted slowly compared to high price/earnings stocks both for pre and post-announcement period. The overall results suggested that the stock prices do not reflect price/earning ratio quickly which was against the semi-strong form of efficient market hypothesis.

Chaturvedi (2001a) investigated three issues: (i) whether the parameters in the market model have a tendency to shift temporarily at the time of half yearly earnings announcements, (ii) whether the shift in the market model parameters are related positively to earnings as hypothesised by Ball, Kothari and Watts (1993), and (iii)
whether the post earnings announcement drift observed in the Indian stock market persist after the parameters in the market model are amended to incorporate their shifts. To test these issues, Chaturvedi selected a sample of 120 companies listed on BSE. The study covered a period of 9 years from January 1990 to December 1998. Using ordinary least square (OLS) and Bayesian Estimators for Random Alpha and Beta (BERAB), calculated abnormal returns for 20 days prior to and 40 days after the half yearly earnings announcement. The analysis of the results of study revealed that market risk for the positive unexpected earnings portfolio increases while for the negative unexpected earnings portfolio decreases at the time of earnings announcements. The results of the study also supported Ball, Kothari and Watts (1993) argument that beta shifts are related positively to the unexpected earnings through changes in investment policies. Even after incorporating parameter shifts in the market model, results of the study suggested that abnormal returns in relation to earnings announcements persisted both pre- and post-announcement periods, which was inconsistent with the semi-strong form of EMH.

Chaturvedi (2001b) examined the relationship between the standardised unexpected earnings (SUE), return generating models, and the role of transactions and search costs by taking a sample of 120 companies listed on BSE for the period January 1990 through June 1998. He used four variants of residual analysis methodology for the study. He calculated abnormal returns for 20 days prior to and 40 days after the announcement of half yearly results. The results of the study revealed that abnormal returns occurred even in the control period +20 to +40 days for four return generating models, and these are not only significant at 0.05 level, but also substantial. It was also observed that for the three models, i.e., market model, CAPM, and the market adjusted model, more than one-third of the total abnormal returns occurred in the pre-announcement period, for the industry adjusted model approximately 48 percent of the total abnormal returns occurred in the pre-announcement period. For industry adjusted model post earnings announcement abnormal returns in the control period 0 to +20 days was 29.43 percent, which was larger compared to other three models i.e., 22.62 percent, 23.59 percent, and 24.29 percent respectively. This showed that market was inefficient processor of the earnings information.

Out of the total post-earnings announcement abnormal returns, a larger portion occurred in the control period 0 to 20 days in the second half of the sample period for
all the four return generating models. Thus, while in the first-half only 10.57 percent, 14.05 percent, 12.23 percent and 25.41 percent of abnormal returns for the event window respectively for the four return generating models occurred in the control period 0 to +20 days, corresponding figure for the second half were 58.94 percent, 53.19 percent, 55.60 percent and 43.59 percent respectively. He found that none of the abnormal returns for the control period +21 to +40 days in the second half of the sample period were significant at 0.05 level. These results of the study collectively suggested that information contained in the half yearly earnings announcements was not quickly reflected in the stock prices. On the whole, the results of the study contradicted semi-strong form of efficient market hypothesis.

Kakati (2001) examined performance of bonus issues by taking 115 bonus issues made by the companies from January 1995 to March 1999. He calculated abnormal returns for 30 days prior to the announcement of bonus issues and 15 days immediately following it, and again for 15 days before and 15 days after the ex-date. For each bonus stocks, he calculated two types of returns i.e., raw returns and abnormal returns. The results of the study suggested that much of the impact of bonus issue on the stock prices occurs before the announcement date. He reported 15.4 percent average gain before the announcement and 3.53 percent loss after the announcement date and 6.53 percent gains on the ex-bonus date. It can also be observed from the results of the study that price performances on bonus issues were not uniform across the companies. He also tried to identify the factors influencing performance of bonus issue. The results of the study indicated that only small equity base and sales performance were the two factors influencing bonus performance. The industry performance, floating stock level, current EPS, P/E ratio, dividend, net-profit and book value had least influence on the bonus performance. The overall results of the study were inconsistent with semi-strong form of EMH.

Lukose and Narayan Rao (2002) examined stock price reaction to stock splits. The study covered a period from January 1992 to June 2001. The data consisted of 30 stock splits and in the case of ex-split date abnormal return calculation, the sample size was 27 stock splits due to infrequent trading problem. They used event study methodology and calculated abnormal returns for 10 days before the announcement of stock split and 10 days after the announcement. The authors also used two statistical tests i.e., t-test and nonparametric statistic proposed by Ohlson and Penman (1985) to measure changes in volatility after stock splits. The results of the study revealed...
statistically significant abnormal returns of 7.69 percent on the event-day and one day after the event day and 90 of the sample showed positive excess returns on the date of announcement. It was also observed that at 0.01 statistically significant levels, abnormal returns of 5.72 percent on the ex-split date and one day after and they found that nearly 55 percent of the sample showed an increase in post-split volatility.

They also measured volume changes around stock split based on a sample of 22 companies, which have gone for stock splits after January 1996. They calculated volume changes 15 trading days prior to and 15 trading days after the ex-split date. It was found that though average volume for the sample was increased after split, but in case of 45 percent of the cases it was declined. The number of small trades increased following stock split suggesting that small investors might have become more active in the market after split. However, the authors ignored market wide changes in volume during the period. On the whole, the results of the study were inconsistent with semi-strong form of EMH.

Mohanty (2002) investigated who gains in share buy back by taking 12 buy back announcements in India. He used event study methodology. The analysis of the results showed that the stocks yielded excess return compared to market portfolio during the period buy-back was announced. However, he observed that after third month, the stock prices falls back to the original level. This indicated that buy-back of shares does not result in permanent increase in the stock value. This was because of high premium offered by the companies, rather than due to any fundamental reasons related to the companies and economy. The share prices rose 15 days before the buy-back announcement and in the process insiders on an average gained 24 percent and ordinary investors only 4 percent. The results of study questioned semi-strong form of efficiency of Indian stock market.

Mallikaqunappa and Iqbal (2003) investigated stock price reactions to quarterly earnings announcement for the quarter ended June 30, 2001. We selected a sample of 30 companies, which are listed on BSE and included in the BSE Sensitive index. We used daily stock prices, BSE 100 index and the event study methodology of residual analysis. To examine stock price reaction to quarterly earnings announcements we calculated expected returns, abnormal returns, average abnormal returns and cumulative average abnormal returns for 21 days before the quarterly earnings announcement and 22 days after the announcement (including the day of announcement). The analysis of the results indicated that average abnormal returns...
are positive for 10 days and negative for 11 days before the event day. It is positive for 11 days and negative for 11 days after and on the event day. Cumulative average abnormal returns are positive for 3 days and negative for 18 days prior to the event day. It is positive for 16 days (including announcement day) and negative for 6 days after the event day. Thus, the results of the study indicated that abnormal returns occur throughout the sample period and the stock price adjustment to quarterly earnings announcement is delayed. This contradicts semi-strong form of efficient market hypothesis.

Malikarjunappa (2004a) investigated stock price reaction to quarterly earnings announcements. The study was based on 30 companies, which were included in the BSE Sensex and covered the period from January 1, 2000 to May 16, 2003. He took June 2003 quarterly earnings announcements date as the event day and calculated abnormal returns, average abnormal returns and cumulative average abnormal returns 30 days before and 30 days after the event date using single index model. The analysis of the results revealed that average abnormal returns persisted and cumulative abnormal returns were significantly greater than zero after the announcement of quarterly earnings. The average abnormal returns were negative for 16 days and positive for 14 days before the event day and negative for 13 days and positive for 18 days after the event day. The cumulative average abnormal returns were negative for 7 days and positive for 23 days before the event day and negative for 4 days and positive for 27 days after the event day. Therefore, he concluded, there is no statistical evidence to show that the Indian stock market is efficient in the semi-strong form.

Malikarjunappa (2004b) examined the efficiency of Indian stock market in the semi-strong form on the basis of quarterly results of September 2003. He selected 30 companies that are included in the BSE sensitive index. He calculated average abnormal returns and cumulative average abnormal returns for 30 days before and 30 days after the quarterly announcement based on single index model. He used parametric t test to know whether someone who trade on day-to-day basis could have earned abnormal profits or incur loss. He found that the AARs were approximate to zero for 96.72% of the days and therefore concluded that no trader could earn abnormal profits on a daily basis. By using runs test he found that there was no trend in the returns. Based on the results he concluded that India stock market is not semi-strong form efficient.
4.2.3 Mixed Results

Subramanian (1989) investigated the impact of political and economic events on share prices. The data for the study consisted of daily closing prices of 45 stocks and the Financial Express Index of Share Prices for the period 1979 to 1986. He analysed 15 major political and macroeconomic events such as credit policy, announcements of M1, M3, Wholesale Price Index (WPI), etc. The speed of reaction of the stock prices to political and economic events and market index was examined using the following methodology: For the market index, the mean and variance of returns outside the period of study were used to draw upper and lower bounds. If market returns exceed the bound around the event date, it implies a significant impact of the event. For individual stocks, similar upper and lower bounds were drawn on the basis of market model residual returns. A higher volatility of the market index and stock prices was observed around the dates of release of information than on other days for all the events except for the release of Wholesale Price Index (WPI). The results of the study provided mixed evidence for the semi-strong form of EMH. For some events, the stock price adjustment was not rapid and it is possible to earn abnormal returns even after considering transactions costs.

Obaidullah (1992) investigated stock price reactions to bonus issues. The data consisted of 75 bonus issues announced during 1987 to 1989. The cumulative average abnormal returns (CAAR) were calculated for six months before the event date and six months after the event date. A significant upward drift was found much before the announcement of bonus issues, i.e., four months before the event date. This indicates that the market was efficient, and the drift subsequent to the announcement period was insignificant. He also examined magnitude of stock price adjustment to bonus issue ratio. He found that there was no direct relationship between bonus issue ratio and the magnitude of stock price adjustment and concluded that stock price adjustment to bonus issue announcement was not accurate. Thus, the results of the study are mixed because the study neither out rightly rejected the market efficiency hypothesis, nor supported it.

Nageswara Rao (1997) examined the stock price responses to fiscal and monetary policy announcements, changes in industrial policy, changes in exchange rate, amendments to Foreign Exchange Regulation Act (FERA), regulatory action by Monopolies and Restrictive Trade Practice Commission (MRTPC) during the period January 1, 1991 to December 31, 1994. He used the event study methodology.
developed by Fama, Fischer, Jensen and Roll (1969) to examine the impact of industry specific announcements on the stock prices of relevant industry. He also used mean adjusted and market adjusted – two returns generating models as suggested by Brown and Warner (1985) to obtain announcement period abnormal returns. He calculated abnormal returns for 10 days before and 10 days after the event day. He found that of all the events, changes in administrated prices had the maximum impact on the market and stock prices adjustment completed on the day following the announcement. In the case of devaluation of rupee, exporting firms experienced 27 percent positive abnormal returns and companies with net import expenditure experienced – 8.2 percent (negative) abnormal returns. Delicensing and changes in FERA did not affect stock prices and investigation by MRTPC resulted in negative abnormal returns to shareholders. Non Banking Financial Corporations (NBFCs) gained significant positive cumulative abnormal returns because of deregulation of lending rates by the RBI. The analysis of the results of study suggested that the evidence regarding semi-strong form efficiency of Indian stock market was mixed and inconclusive.

4.3 Strong Form of Efficient Market Hypothesis

Strong form of EMH is an extreme hypothesis and very difficult to test because it requires private and inside information. There is a dearth of research on strong form of efficient market hypothesis in India. The published study so far, is Barua and Varma (1991). Barua and Varma (1991) examined the performance of master shares (the first all-equity; closed-end growth fund launched by the Unit Trust of India in 1986) from the point of view of funds management, large investors and small investors. The study covered a period from July 1987 to September 1990. They used capital asset pricing model (CAPM), Sharpe (1964), Treynor (1965), Jensen (1968), Fama (1972), to assess, the performance of master shares. A commonly used measure of risk is the volatility or standard deviation of returns. Therefore, annualised standard deviation of returns for mastershares is calculated. The analysis of the results indicated that the annualised standard deviation of returns for mastershares was 41.31 percent as compared to 19.44 percent for the market index. Therefore, the higher return on mastershares is accompanied by a substantial higher risk. To know whether investors have received a fair compensation for the additional risk, they examined the risk-return relationship that prevails in the stock market. The results showed that for a
risk of 41.31 percent mastershares provided a risk premium of only 58.60 percent implying a premium of 1.418 percent per unit of risk. This is lower than the compensation of 1.512 percent provided by the market. This indicates that from the point of view of investors, the returns earned on mastershares have not been adequate when risk is taken into account.

They also analysed the performance of mastershares from the point of view of large investors for whom mastershares is like other security to be held as a part of well-diversified portfolio. The security market line is determined by risk-free asset, which earns the return of 12 percent for a beta of 0, and the market portfolio, which earns the return of 41.4 percent for a beta of unity. The reward per unit of risk as measured by beta is, therefore 29.4 percent. Since mastershares has a beta of 1.121, the risk premium would be 1.121 times of 29.4 percent and returns should be 44.95 percent (32.95 + 12). The actual return of 70.60 percent is in excess of the required rate of return. This indicates that from the point of view of large investors, the returns on mastershares are exceptionally high compared to its systematic risk. Thus, the results of the study contradicts strong form of efficient market hypothesis.

The review of literature related to Indian stock market revealed that it is only in the late 1970s some researchers initiated studies on weak form of efficient market hypothesis. Till late 1980s, empirical studies provided evidence in support of weak form of EMH. However, recent years many studies questioned weak form of efficiency. As far as strong form is concerned empirical studies are in its infant stage in India. A very few studies were conducted on semi-strong form of efficiency and majority of the studies showed that Indian stock market is not efficient in the semi-strong form.