Chapter 1

Introduction to Efficient Markets Theory and Anomalies

1.1 Introduction to Market Efficiency

Financial markets, particularly the stock markets attract investors as well as academicians. Investors want to predict the market to earn more returns on their investments. Academicians want to predict it in order to test the effectiveness of their predictive models. In fact, financial markets put a great challenge before the researchers interested in the development of predictive models. Not only financial economists, but researchers from other streams including statistics, mathematics, physics, psychology and social sciences, leveraged with the expertise of their respective domains, have attempted to build predictive models for stock prices. But all of these efforts seem to yield little success. Why are the prices of financial assets unpredictable?, the efficient market hypothesis provides the answer to this question.

The financial market has direct influence of the money along with information there in. The prices of financial assets at a point of time reflect the expectations of investors which are shaped mainly by the available information. Accuracy and the quickness in which market translated the expectation into prices are termed as market efficiency. Fama (1970) stated, ‘A market in which prices always fully reflect available information is called efficient.’ In an efficient market price rapidly translate in to the available information.

Here the term market efficiency is used in context to the ‘informational efficiency’ rather than the ‘operational efficiency' and the ‘allocative efficiency’. The concept of operational efficiency is basically related to the efficiency of the market microstructure and is influenced by the factors as time taken to execute the order and the number of bad deliveries. The operationally efficient market keeps the transaction costs at minimum. On the other hand, the concept of ‘allocative efficiency’ refers to the application of basic concept of ‘Pareto-efficiency’ of economics in the field of financial markets. Financial markets are efficient in Pareto sense if they allocate the
capital to different products in an efficient way and any further reallocation of capital cannot increase the national output.

1.2 Efficient Market Hypothesis

The efficient market hypothesis (EMH) deal with informational efficiency and strongly based on the idea that the stock market prices or returns are unpredictable and do not follows any regular pattern so it is impossible to “beat the market”. According to the EMH theory security prices immediately and fully reflect all available relevant information.

The EMH theory suggests that the asset prices are determined by the demand and supply in the competitive market with rational investors. Rational investors gather information very rapidly and immediately incorporate this information into stock prices. Only new information, i.e. news, cause change in prices but the news, by definition, is unpredictable; therefore stock market which is immediately influenced by the news is also unpredictable. James Lorie has defined the efficient market as follow-

“(Efficient markets) ... means the ability of the capital market to function efficiently, so that prices of securities react rapidly to new information. Such efficiency will produce prices that are appropriate in term of current knowledge and investors will be less likely to make unwise investments.”

According to EMH theory neither technical (study of past stock prices in an attempt to predict future prices) nor fundamental analysis (financial analysis such as industry analysis, company analysis, asset valuation etc.) can help the investor to select “under-valued stock”. Past price contain no useful information and cannot predict the future change, today’s price is totally independent from past price so it is waste of time to analyze past return and on the basis of result attempt or expect to make profit from market.

If we discuss about historical background of EMH theory, efficient market is as old as stock market itself but the hypothesis was first expressed by Louis Bachelier, a French mathematician in 1900. In his dissertation, “The Theory of speculation” he has suggested that price fluctuation are random and do not follow any regular pattern. In
Cowles, an American economist and businessman attempted to investigate the predictability of stock price, he analyzed the performance of market professionals and suggested that stock market is unforecastable even professional investors are unable to outperform in the market. Further in 1934, Holbrook Working supported the EMH theory by showing his empirical result that in ideal market, prices follow random differences and it is impossible to predict price changes successfully.

In 1956, Bachelier’s name reappeared in finance, Paul Samuelsson took interest in Bachelier’s work and he circulated this among economists. Samuelsson was the first who provided the formal economic argument for efficient market; his contribution was summarized by the title of his article “Proof that Properly Anticipated Prices Fluctuate Randomly”. Prior to Samuelsson’s work it was believed that random fluctuation of asset prices is a reflection of market inefficiency. Economists used to look at such observations at great disbelief (See Kendall 1953). According to them, if prices are determined by the "forces of supply and demand", then price changes should move in particular direction towards market clearing and not randomly. Samuelsson argued that the random nature of changes in asset prices is not a reflection of inefficient functioning of financial markets rather it is a reflection of their efficiency. In an efficient market, prices reflect all the available information at a particular point of time; prices change only when new information (news) arrives in the market. Since, news by definition is unpredictable and random in nature; hence, it causes random changes in price. Mandelbrot (1966) also supported this view. He argued that if markets are working properly, then all public (and, in some versions, private) information regarding an asset will be channeled immediately into its price. If price changes seem random and thus unforecastable it is because investors are doing their jobs: all arbitrage opportunities have already been exploited to the extent to which they can be.

In 1965, the term “Efficient Market” was defined by Fama at first time, Fama explained how the theory of EMH challenges to both technical and financial analysts. Some important definitions related to efficient market hypothesis are as follow:

Fama (1965) defines EMH theory “...an “efficient” market for securities, that is, a market where, given the available information, actual prices at every point in time represent very good estimates of intrinsic values.”
Jensen (1978) defines “A market is efficient with respect to information set $\theta$ if it is impossible to make economic profits by trading on the basis of information set $\theta$”.

Malkiel (1992) provides a closely related definition of efficient market hypothesis as “A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set, $\varphi$, if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to information set, $\varphi$, implies that it is impossible to make economic profits by trading on the basis of $\varphi$”.

Fama (1998): “…market efficiency (the hypothesis that prices fully reflect available information)… “…the simple market efficiency story, that is, the expected value of abnormal returns is zero, but chance generates deviations from zero (anomalies) in both directions.”

Timmermann and Granger (2004): “A market is efficient with respect to the information set, $\Omega_t$, search technologies, $S_t$, and forecasting models, $M_t$, if it is impossible to make economic profits by trading on the basis of signals produced from a forecasting model in $M_t$ defined over predictor variables in the information set $\Omega_t$ and selected using a search technology in $S_t$."

Implications of EMH theory may be pointed out as follows:

- In efficient market stock price is always at the “fair” level, a stock price change only when its fair value changes.
- The market is efficient if the reaction of market prices to new information is immediate and unbiased.
- Stock prices immediately react on the news.
- Stock price changes are unpredictable because no one knows tomorrow’s news.
- Stock prices follow random walk, if price of today goes up nobody can tell what would be the price of tomorrow.
- It is impossible for investors to consistently outperform in the market.
1.3 **Forms of Efficient Market Hypothesis:**

In 1970, Fama classified efficient market hypothesis in three categories according to the level of information reflected in market prices – weak form, semi-strong form and strong form; a summarized description of these different forms of market efficiency is presented below:

1.3.1 **Weak form:**

The weak form efficiency is also popularly known as ‘random-walk’. In weak form of market efficiency stock prices reflect by all available trading information which can be derived from the market data such as past price, trading volume etc, so nobody can use information related to past price to identify the undervalued security and make a big profit by them, It implies that no one should be able to outperform the market using something that "everybody else knows". If the markets are efficient in weak from, technical trading rules cannot be used to make profit on a consistent basis. This form of market efficiency is called weak-efficiency because the security prices are the most publicly and easily accessible pieces of information. Although number of empirical studies support weak form of efficient market but there are still numbers of financial researchers are studying the past stock price series and trading volume data in attempt to generate profit. In short weak form of efficient market implies that:

- Stock prices quickly incorporate all past price information which can be derived by trading data (i.e. past prices, volume, short interest).
- Everyone knows the past price movement of market, therefore nobody can outperform the market on a consistent basis using some trading strategy based on past price trends (as done by technical analysts).
- Prices follow a “random walk” or more precisely an ‘exponential random walk’.
1.3.2 Semi-Strong Form:

In semi-strong form all publicly available information are incorporated into current stock prices. Publicly available information includes past price information plus company’s annual reports (such as financial reports, balance sheet and profit and loss account), company's announcement, macro economic factors such as (inflation, unemployment etc) and others. Some information (to the extent anticipated in advance) is discounted even before the event is announced and some before the event took place. Such matters like earnings reports, bonus, and rights affect the market even in anticipation before the formal announcements. Semi-strong form implied that share prices adjust to publicly available new information very rapidly and in an unbiased fashion, such that no one should be able to outperform the market using something that "everybody else knows". This indicates that a company's financial statements are of no help in forecasting future price movements and securing high investment returns. Evidences of empirical studies (most of them are based on event-study methodology) broadly support this form of efficiency.

Implications of Semi-Strong form are as follow:

- Market prices incorporate all publicly available information.
- Publicly available information is easily reachable for everybody so no investor can use it to device the strategy which could outperform the market on a consistent basis.
- Share prices adjust to publicly available new information very rapidly and in an unbiased fashion, such that no excess returns can be earned by trading on that information.
- Neither technical analyst nor fundamental analyst will be able to help the investors to outperform in the market
However, the following factors can impede the market-efficiency in its strong form:

- Information may be relatively difficult and costly to obtain.
- Information may be asymmetrically distributed; some investors may have access to information but others may not have.
- It may be difficult to segregate the information from noise.
- It may be difficult to interpret and to understand the exact implication of information.

### 1.3.3 Strong Form:

In strong form of efficiency stock prices quickly reflect all types of information which include public information plus companies inside or private information. Thus, it is the combination of public and private information that is incorporated into current prices. This form implies that even companies management can not make profit from inside information; they cannot take advantage of inside affairs or important decision or strategies to beat the market. According to strong-form market efficiency, inside information is also already incorporated into stock prices, the common rational behind this is unbiased market anticipation that already react in to market before companies strategic decision. Strong form of efficiency is hard to believe in practice except where rules and regulations of law are fully ignored. Studies (Reilly & Brown, 2008) that examined the result of the corporate insiders and stock exchange specialists do not support the strong form of efficient market hypothesis. Empirical evidence has been mixed, but has generally not supported strong forms of the efficient-market hypothesis

Implications of strong form of efficiency is-

- Market prices incorporate all public and private information.
- Nobody can gain abnormal return even those who have inside information.
- This type of market is very hard to believe.
1.4 Evidence in Favor of EMH:

From past studies by researchers following evidences come out in favor of EMH:

- In general, prices appear to react quickly to new information.
- Fama (1965) found no serial correlation in stock returns (price changes are random).
- Most money managers do not outperform in the market, and those that do outperform in one period do not appear consistently to do so in the next period.
- Most of anomalies disappear quickly.
- Even the strongest anomalies do not produce dependable returns over all time periods.

EMH remained a prominent theory until 90’s. By the start of the twenty first century, the monopoly of EMH among other market theories had became far less universal, a number of empirical argument started to attack EMH theory. EMH has been a hot topic for argument among financial researchers. Empirical analysts have consistently found problem with the efficient market hypothesis. Many financial economists and statistician began to believe that stock prices are at least partially predictable because many researchers found in their studies that psychological and behavioral (sentiments and expectations) elements play an important role in determining price of stock in market rather than fundamental factors.

Some empirical evidences which are against the EMH are as follows:

- If the markets are efficient and prices reflect the fundamental value of assets, the prices should not follow the volatile moves as they generally follow. Assets bubbles are crises are difficult to explain in an efficient market. Sudden market crashes as happened on 1992, Black Monday in 1987 are unsolved for the supporters of EMH.
- Researchers have observed statistically significant (although economically quite low) autocorrelations in stock returns. These correlations are mostly positive in short run and negative in long run.
There are certain systematic patterns (called anomalies) observed by the researchers; which are inconsistent to the EMH.

Grossman and Stiglitz (1980) suggested that Information are costly, prices cannot perfectly translate into available information so it is very hard for a market to be perfectly efficient, if so investors who have spent resources on obtaining and analyzing they would receive no compensation. LeRoy and Porter in 1981 found that stock markets exhibit ‘excess volatility’ and they rejected market efficiency. However there are a number of empirical evidences by researchers that show market inefficiency and reject random walk of security prices i.e. (Laffont and Maskin 1990, Lehmann 1990, Jegadeesh 1990), Shiller 2000 etc.).

1.5 Anomalies to EMH

Consistent abnormal patterns in asset return in the market are called anomalies. In other world, anomalies are empirically observed consistent patterns in the asset prices and returns which are inconsistent with EMH. Researchers (see Bowman and Buchanan, 1995) believe that anomalies are the result of the shortfalls in the models applied for testing market efficiency, rather than of inefficiency of market.

Anomalies have always been a challenge for efficient market hypothesis. EMH theory says that nobody can make excess profit or outperform in market whereas anomalies are all about ‘How to make profit in the market’. These indicate market inefficiency (profit opportunities) or in another words inadequacies in the underlying asset-pricing model. After its documentation and analysis in the academic literature, anomalies often seem to disappear, reverse, or soothe. It raises a question, whether profit opportunities existed in the past, but have since been arbitraged away, or whether the anomalies were simply statistical peculiarity that engrossed the attention of academics and practitioners.

There are a large numbers of anomalies documented by researchers and still continues to grow. In which some important or famous market anomalies are:
1.5.1 Size Effect (Small Firm Effect):

Researchers such as Banz, (1981), Reinganum (1981) etc. found that the stock of small firms (small capitalized firm) provide higher return than the stocks of the large firms. Banz (1981) examined 10 small and 10 large companies of New York stock exchange for the period of 1931 to 1975 and he found that returns are highly correlated with size of firms. Fama and Frence (1992, 1993) in their famous studies, confirmed that the small capitalization firms provide higher returns than large capitalization firms.

1.5.2 The Value Effect:

Stocks with a low valuation and low price-to-book ratio earn on average higher returns than growth stocks with a high valuation and high price-to-book ratios. Fama and French (1992) analyzed data for the period 1963-1990 from a cross-section of companies and found that the premium for investing in value stocks instead of growth stocks was about three and half to four percent.

1.5.3 The Momentum Effect (Past price movement Effect):

It consists of two kinds of effects:

**Contrarian Effect:** De Bondt and Thaler (1985) and Guin (2005) observed in their empirical results that past loser (stock which has low return in past 3 - 5 years) overtake winners (stock with high return of the past 3 - 5 years). This suggests that in long run market tends to over-react to information which is subsequently corrected producing the reversal effect.

**Continuation Effect:** Jegadeesh and Titman, (1993) found high returns are obtained by recent past winner than past losers. This effect is found highly effective for short term winners in several studies even Fama and French (1996) could not explain the short term momentum effect. Guin, (2005) comments - “Stocks that have outperformed the market usually continue to do so for an intermediate period of time, three to five years on average”. This effect suggests that the market under-react to information in short run. The information gets reflected in price gradually (not instantaneously as claimed.
by the supporters of EMH) producing returns which are positively auto-correlated in the short run.

1.5.4 **Low Beta Firm Effect:**

Low beta stocks outperform high beta stocks on average over time on a risk-adjusted basis.

1.5.5 **Neglected Firm Effect:**

Stocks with a relatively small analyst following have higher risk-adjusted returns on average than stocks with many analysts.

1.5.6 **Liquidity Effect:**

According to Amihud and Mendelson (1986), higher returns compensate for low liquidity of small firm stocks than high liquidity stock.

1.5.7 **Speculative Economic Bubbles Effect:**

Economic bubbles are typically followed by an overreaction of hysterical selling, allowing shrewd (wise) investors to buy stocks at bargain prices.

1.5.8 **Buyback of Shares:**

Studies have found that after announcement of stock repurchases, stock outperform in the market in competition to the stocks of the companies who have come with their new issues. This evidence seems to confirm the theory that managers tend to have inside information regarding the value of their company's stock and their decisions whether to issue or buyback their stock may signal over or undervaluation.

1.5.9 **Announcement Effect:**

Ball (1978) discovered in his empirical study that announcement related to financial health, made by the company reflects on the movement of the stock of the related company. Stocks with positive surprises tend to go upward; those with negative surprises tend to go downward. Some refer to the likelihood (possibility) of positive earnings surprises to be followed by several
more earnings as the "cockroach" theory which says when you find one, there are likely to be more in hiding.

1.5.10 Low P/E Ratio:

Basu (1977) documented the use of price/earnings ratios (P/E) to forecast stock returns. In a study of 1400 firms over the period 1956-71, he observed that low P/E securities outperforming their high P/E counterparts by more than seven percent per year. Basu regards his results as indicative of market inefficiency:

1.5.11 Calendar Anomalies

Calendar effect is most common anomaly among all. The abnormal returns of stock in a particular time /season (hours of the day, day of the week, week of the month, month of the year etc.) are called calendar anomalies. In this study we will explore these anomalies in detail.

1.6 Seasonal Anomalies or Seasonality or Calendar Anomalies

Abnormal returns of stock in some particular time or period are called calendar anomalies. This time may be an hour of the day, or a day of the week or a week of the month or a month of the year etc. In this time stock market have statistically very high tendency of either to move up or to fall. As these effects are related to calendar (as day of the week, month of the year etc), they are called calendar anomalies. Calendar anomalies are also known as seasonality or seasonal anomalies.

Interestingly, calendar anomalies are not only observed in stock returns, but also in various financial markets such as money, derivative and commodities markets etc. Seasonal anomalies seem to conflict with the standard theories of asset pricing. They indicate either market inefficiency (profit opportunities) or inadequacies in the underlying asset-pricing model.

An interesting observation seen about calendar anomalies is that, after they are documented and analyzed in the academic literature, they often seem to disappear, reverse, or attenuate. These findings imply that investors may exploit the patterns of previous anomalies in trading behaviors which gradually cause disappearance of
documented anomalies. Thus, there are growing skepticisms on the study providing the evidence of calendar anomalies.

Calendar effects in stock markets have always been a challenge for finance economists; as these are difficult to explain with in standard framework of financial economics. Predictable patterns in stock prices are inconsistent with the efficient market hypothesis. Therefore, researchers have shown great interest in the study of Calendar anomalies – finding them and trying to understand them in light of the market frictions and behavioral imperfections.

There are a number of calendar anomalies discovered by the researchers, we have taken four most arguable anomalies for our empirical study which are (i) Day-of-the-Week Effect, (ii) Turn of the Month Effect, (iii) Month-of-the-year Effect, (iv) Holiday Effect.

1.6.1 Day-of-the-Week Effect:
The most common calendar anomaly is day-of-the-week effect. This anomaly states that expected returns are not same for all the week days. It is well noticed that the average return on Monday is significantly negative and is lower than average returns of other week days. On the other hand, Friday returns are found abnormally high. The returns on Mondays are found to be negative in many studies, which are commonly referred to as the weekend effect. There are variations in some countries as in Australia and Japan negative Tuesday effect, instead of Monday-effect, is observed. The use of daily data makes it possible to examine the relationship between the changes that occur in stock prices from one trading day to the next and over weekends or, in other words, to study the weekend effect. In particular, it is possible to test whether the rapidity of the process whereby stock prices are formed changes when the market is closed, i.e. whether the process is defined in terms of market time or real time.

1.6.2 Turn-of-the-Month Effect:
The turn-of-the-month effect could not gain as much popularity in the literature as other calendar anomalies such as the day-of-the-week effect and the month-of-the-year effect. It has been observed that a positive rate of return occurs only in the first half of the month beginning from the last few days of
the previous month. This implies that average daily returns of stocks on turn of
the month are different from the average daily returns in rest of the month.

1.6.3 Month-of-the-Year Effect:

This effect states that return on common stock is not the same for all the
months of the year. Empirical studies conducted in various countries have
found that the statistically significant positive returns to common stocks occur
in January. Month-of-the-year effect is not same for all countries e.g. for USA
returns are obtained high in December while the strongest month in the UK
and Tokyo stock market is January. However in most countries returns are
found significantly higher in month of January than rest of the months of the
year that’s why this effect is also called ‘January effect’. In India empirical
research found high return in month of March. So we will use the term
“month-of-the-year” instead of January effect further for our empirical
research to check whether this effect is found in the month of March or in
other month in India.

1.6.4 Holiday Effect:

Another important seasonal anomaly commonly found in the markets is
‘holiday effect’. This effect is related to the behavior of stock prices around a
public holiday. Higher returns are observed around holidays, mainly in the
pre-holiday period as compared to returns of the normal trading days.

Holiday effect is segmented in to pre-holiday and post-holiday effects. Pre-
holiday refers days before holidays and post-holiday refers days pertaining
immediately after holidays. Returns are found higher in pre holiday in
comparison to post holiday when market goes comparatively down. Some
researchers think that the day-of-the-week effect is a special case of the
holiday-effect.

In this study we will examine the existence of these calendar anomalies in
Indian stock market; and try to link them with market micro-structure and
behavioral factors. In the next chapter a detailed survey of existing literature is
conducted. The chapter explains the observed calendar anomalies and different
explanations extended by the researchers for them.