CHAPTER II

LITERATURE REVIEW

1. Introduction

The literature on the subject can be classified into two categories:

1) Theoretical Literature, and

2) Literature on empirical investigations carried out so far to test the theoretical models.

The theoretical literature discusses the basic theory of efficient market hypothesis (EMH). The empirical investigation carried out both in developed and undeveloped markets to test the EMH are discussed in the second part.

2. Efficient Market Hypothesis (EMH)

According to the efficient market hypothesis, in an informationally efficient capital market stock prices fully and instantaneously reflect all available relevant information. This means that the prices of publicly traded stocks are accurate signals for capital allocation.

In an efficient market, relevant information regarding the securities is rapidly reflected in the price of those securities. In such an efficient market, market price is a good estimate of the intrinsic value of a security. Professional or detailed security analysis should not produce any excess returns over a buy and hold strategy after adjusting the information costs. Other than by the laws of chances, investors are not expected to continuously over or under-perform the market on a risk adjusted basis.
The Efficient Market Hypothesis (EMH) maintains that the total market is quite sophisticated in the way in which it digests financial statement data and arrives at equilibrium security prices. Furthermore, equilibrium occurs in spite of the unsophisticated (or native) nature of many, if not most, of the individuals who, collectively make up the market. A securities market is generally defined as efficient if (1) the prices of the securities traded in the market act as though they fully reflect all available information and (2) these prices react instantaneously, or nearly so, and in an unbiased fashion to new information.

The ability of the market price to adjust quickly and accurately to the information derives from the existence of a group of professional investors who are capable of gathering, analyzing, and interpreting all types of information of the companies whose securities are being traded. Through constant and careful attention to the market and because of the large volume and frequency with which they trade, these professionals ensure that prices are set competitively, and the prices quickly (if not instantaneously) acquire new information. In this type of market, investors who misinterpret information have little, if any, influence on prices. It is Fama (1970)\(^{28}\) who coined the phrase “efficient market” to describe a market with prices that reflect information completely.

Fama (1970)\(^{28}\) categorized different levels of market efficiency the weak, semi strong, and strong forms based on the type of information involved. Weak-form market efficiency occurs when time related stock prices are independent and unpredictable as they are not repetitive of the past price movements. Markets are efficient in the Semi Strong form when prices reflect all publicly available information. Strong-Form market efficiency occurs when prices reflect public and
private information completely. While Semi Strong Form efficiency also implies Weak Form efficiency, Strong Form efficiency also implies both Semi strong & Weak Form efficiency.

2-1. Weak Form Market Efficiency

Studies of weak-form market efficiency began long before market efficiency was defined. Louis Bachelier (1900)\textsuperscript{13} is the pioneer in the studies of the ability of past prices to predict future prices began with. The commodity prices in France were studied by him and he concluded that the current price of a commodity was an unbiased estimate of its future price. This is consistent with the statistical definition of a random walk as applied to the series of commodity prices, although Bachelier did not use that term. It was another 60 years, before further research on security prices again suggested the hypothesis that stock prices followed a random walk. Two studies were published in 1959, which suggested that price changes were independent of each other. A paper by Roberts (1959)\textsuperscript{80} simply showed that a series of numbers following a random walk look very much like a series of stock prices. A study by Osborne (1959)\textsuperscript{77} found that the movement of stock prices is similar to that of the movement of small particles suspended in a chemical solution. These studies resulted in a boom of research interest on this topic. Study by Fama (1965)\textsuperscript{27}, substantiated the tentative findings of Roberts and Osborne. Collectively, this work served to convince many academicians and even a few practitioners, that the security prices did indeed follow a random walk. The argument that stock price changes are random does not mean that such changes take place without cause or reason. On the
contrary, prices change because of changes in the perceived earning potential of the issuing firm or changes in the returns expected from alternative investments. In other words, the set of knowledge of a specific security is frequently revised and updated, leading to changes in its price. The random walk hypothesis simply highlights that at a given point in time, the size and direction of the next price change is random with respect to the knowledge available at that point in time. The finding that the investors are unable to forecast future prices by studying the series of past prices is evidence enough to support the weak form of efficient market hypothesis. This result suggests that charting and other forms of technical analysis practiced by investors, amateurs and professionals alike are of questionable value.

2-2. Semi Strong Form Market Efficiency

To assert that the markets are efficient in the ‘semi strong form’ sense, the researcher must demonstrate that the current prices are independent of the sequence of past prices, but also reflect the publicly available information of the firm whose securities are being traded. It implies that the market prices of securities adjust rapidly and in an unbiased manner, to facilities of public information announcements such as newspaper articles, corporate forecasts, and annual reports. Semi strong form market efficiency is particularly relevant to the accounting profession because accounting information is generally available to public and provides primary data source for security analysis. If stock markets are efficient in the semi strong form, then no amount of security analysis can consistently achieve above-normal returns. This hypothesis is disconcerting,
given the large number of people involved in producing, interpreting and analyzing the accounting information. Indeed, it may be the competitive effect of all these individuals attempting to profit from processing information that causes markets to be efficient. Testing of ‘semi strong form market efficiency’ is commonly performed by examining stock returns following certain kinds of public information announcements. If investors can consistently obtain above-normal returns by trading at the time of a public announcement, then the stock market would be inefficient with respect to that information. For example, if above-normal returns can be made by buying stocks following announcements of increases in dividends, the stock market would not be ‘semi strong form market efficient’ with respect to announcements of dividend.

2-3. Strong-Form Market Efficiency

The ‘strong form of market efficiency’ is the most comprehensive. As per this hypothesis both public and private information are quickly impounded in the security price. Holders of private information, including managers and their associates, would not be able to make consistently above-normal returns using their private information. Although this is an extreme form of market efficiency that is more difficult to accept, even by adamant and stubborn believers of market efficiency, there are other mechanisms that could lead to ‘strong-form market efficiency’. The competition among the privately informed investors might be sufficient to produce prices that reflect private information. Further, there may be characteristics of securities markets that cause private information rapidly to become public. One example would be the uninformed investors using the stock
price as an information source. If uninformed investors observe rising prices, they may infer that this is caused by good news available to privately informed investors. Testing ‘strong form market efficiency’ is difficult because the existence of private information in the market cannot be directly observed. The most common tests of ‘strong form market efficiency’ have involved the examination of the profitability of a trading strategy using the *Official Summary of Insider Trading*, which is released monthly by the Security and Exchange Commission, U.S.A. This document is a record of transactions pertaining to a security made by the officers, directors, and major stockholders of that firm. If these insiders are able to make above-normal returns, the market is not strong-form efficient.

3. Reasons for Market Inefficiency

There are several reasons why stock markets may be inefficient. Even a cursory glance at the statistics of the number of copies of annual reports distributed by various corporations and the hours expended by internal accountants, independent public accountants, security analysts and investors in preparing and analyzing these reports, would indicate and lead us to conclude that the published statements play an important role in the dissemination of corporate information. Further, several studies have found that the annual report is found to be the most useful source of information about a company to available the investors and analysts. However, many observers believe that although the market pays attention to these financial statements, investors respond naively to the information contained in them. This view is based on the presumption that the
market is composed of a great number of individual investors, most of whom are relatively unsophisticated with limited ability to understand and interpret financial statements. It is argued that these naive investors are unable to detect subtleties in accounting the reporting procedures. Thus, they often make incorrect decisions based on perceived situations that are illusory rather than being substantive. Based on this view of individual investors’ behavior, it is argued that the market collectively reflects this inability of investors to process information. The resultant is that many securities are inappropriately priced.

4. Random Walk Hypothesis

The random walk model is very popular in the literature. The starting point of our analysis is the hypothesis of an efficient market, hence randomness of returns can be assumed. Theory of random walk in stock prices involves two hypotheses: (1) the successive price changes are independent (2) the price changes conform to some probability distribution (Fama 1965). The simplest and the strongest version of the random walk hypothesis are based on independently and identically distributed (IID) increments where the dynamics of stock prices are given by the following equation:

$$P_t = P_{t-1} + \mu + \varepsilon_t, \quad \varepsilon_t \sim \text{IID } N(0, \sigma^2)$$

where $P_t$ is price of the financial asset observed at time $t$, $\mu$ is the expected price change or a random walk with drift, and $\text{IID } N(0, \sigma^2)$ denotes that $\varepsilon_t$ (error term) is independently and identically distributed with mean 0 and variance $\sigma^2$. The independence of the increments $\{\varepsilon_t\}$ implies that the random walk is not only a fair game, but also in a much stronger sense than the martingale. Independence
implies not only that the increments are uncorrelated, but any nonlinear functions of the increments are also uncorrelated. The distributional assumption suffers from violations of limited liability. The random walk theory emerges from the early tests of weak form efficiency.

It is related to the efficiency theory because if price changes from one day to the next exhibit some regular patterns, investors can learn the regularities and use them to make speculative profits. Indeed, if today’s price had good forecasting power that would be evidence against the efficient-market hypothesis, because it would mean that current prices do not incorporate all relevant information. The early studies found that price movements have no predictive patterns. Instead, they are similar to a series of numbers drawn at random.

5. Review of Literature on Empirical Studies of Weak Form Market Efficiency

As already stated, most of the empirical investigations are concerned with evaluation of weak form efficiency of stock markets. It is weak form efficiency that can be examined by econometric and statistical models. Such investigations have been carried out both in respect of advanced stock markets and the markets in under-developed and developing economies. The following is an exhaustive list of such investigations.

Laurence (1986)\textsuperscript{56} applies both the runs and autocorrelation test on the Kuala Lumpur Stock Exchange (KLSE) and the Stock Exchange of Singapore (SES). He uses price observations of the individual stock from the period 1973 to 1978.
for both KLSE and the SES. The results of both tests suggest that both markets are not weak form efficient. Contrary to his results, Barnes (1986) finds KLSE to be weak form efficient. He conducted a similar method of testing applied to 30 companies and six sector indexes for the six years period ended 1980. Barnes (1986) concludes that the results of both tests show that the KLSE exhibit a high degree of efficiency in the weak-form.

Choudhry (1994) investigate the stochastic structure of individual stock indices in seven countries: the United States, the United Kingdom, Canada, France, Germany, Japan and Italy. The Augmented Dickey-Fuller and KPSS unit root tests, and Joansen’s co integration tests was used to test the log of monthly stock indices from the period 1953 to 1989. He concludes that stock markets in seven countries are efficient during the sample period. Their result from both unit root tests show that all seven series seem to contain a stochastic trend (Unit root) and they are non-stationary in levels. The result of Johansen’s Cointegration test shows no support for a stationary long-run relationship between the seven stock series. Absence of long-run multivariate relationships also provides evidence of efficient markets.

Huang (1995) examine efficiency of nine Asian stock markets: Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan by using the variance ratio statistic with both assumptions homoscedastic and heteroskedastic. His data consist of weekly stock returns of nine stock market indexes from the period 1988 to 1992. Excluding the market in Indonesia, Japan
and Taiwan, the random walk hypothesis for the remaining markets is rejected. The result of variance ratio exceeds one in the markets of Korea, Malaysia is rejected for all holding periods, whereas the hypothesis for the Hong Kong, Singapore, and Thailand markets is also rejected but in using the heteroskedasticity-consistent variance ratio estimator.

Urrutia (1995)\textsuperscript{94} employs both variance ratio of Lo and Mackinlay (1988) and runs test to investigate random walk for the four Latin American emerging markets. He uses monthly data of index price in local currency from the period December 1975 to March 1991 for Argentina, Brazil, Chile, and Mexico. The variance ratio test rejects the random walk hypothesis for all the four markets, while runs test does not. Based on results from the runs test, he concludes that the four Latin American emerging stock markets are weak-form efficient.

Susan Thomas (1995)\textsuperscript{88} has studied conditional heteroskedasticity in a market index on the Bombay Stock Exchange, from April 1979 to March 1995. She found strong evidence of heteroskedasticity in daily, weekly and monthly returns. The conditional variance of all three data series seems best approximated by a Generalized Auto Regression Conditional Heteroscedasticity (GARCH) (1, 1) model. The GARCH parameter estimates at all data frequencies exhibit strong persistence in variance.

In the case of monthly returns, she found that there is seasonality in the volatility and there is one regime shift in the level of unconditional variance of the data. Remarkably enough, after controlling for these, monthly returns are
homoscedasticity, and there is no persistence. Both, the regime shift and the seasonality, have clear economic interpretations. The regime shift appears in March 1985 and is associated with a sharp turn towards market-oriented economic policies – among other things; this led to an enormous expansion of the domestic market and secondary market trading volumes. The seasonality in the post-March 1985 period is characterized by the enhanced volatility associated with each federal budget announcement in end-of-February. The results with weekly and daily data are not as drastic – while strong evidence of the regime shift and of seasonality is found in daily and weekly data, even after controlling these, returns are still Auto Regression Conditional Heteroscedasticity (ARCH) and still exhibit a fair degree of persistence. Finally, she uses our volatility models to test whether the market prices observed heteroskedasticity using GARCH-in-mean models. They are unable to reject the null that higher risk is not priced. She offered qualitative argument suggesting reasons for this behavior and conjecture that this may change in the near future.

Al-Loughani and Chappel (1997) examine the validity of the weak –form of efficient market hypothesis for the United Kingdom stock market using the Lagrange multiplier (LM) serial correlation, Dickey-Fuller unit root and Brock, Dechert and Scheinkman (BDS) non-linear tests. Their data include daily observations of Financial Times Stock Exchange (FTSE) 30-share index from the period June 30, 1983 to November 16, 1989, a period that they describe as free of changing government economic policy toward financial markets. The result of Dickey Fuller tests show that series are non-stationary in levels and are
stationary in first difference, which are consistent with random walk hypothesis. However, based on the BDS and serial correlation tests, they reject the random walk hypothesis finding autocorrelation and conditional heteroskedasticity in the FTSE 30 returns. Therefore, according to their results the series of FTSE 30-share index does not follow a random walk during the sample period.

**Martin Laurence, Francis Cai and Sun Qian (1997)** experimented in China which has two major stock exchanges, the Shanghai and the Shenzhen exchanges. Each of these exchanges trades two types of shares, type “A” and type “B” shares. Type “A” shares are available to domestic investors only and type “B” shares are available to foreign investors. This article tests for the weak-form efficiency in these markets and explores the statistical relationships and causality among these Chinese stock markets with each other and with the U.S. and Hong Kong stock markets. The results indicate the existence of (1) a weak-form efficiency in the market for “A” shares but not “B” shares, (2) statistically weak linkages between the Chinese markets, (3) a weak causal effect from the Hong Kong to the four Chinese markets, and (4) a strong casual effect from U.S. stock market to all four Chinese stock markets and the Hong Kong Stock market, particularly during the second period of the sample. These results support the assertion that the Chinese stock markets are becoming more integrated to the global economy.

**Ojah and Karemera (1999)** tested random walk for the same four Latin American markets as Urrutia (1995) did. They apply single variance ration of Lo
and Mackinlay (1988), multiple variance ratio of Chow and Denning (1993), and runs testes to monthly national stock price indexes in U.S. dollar terms for the period December 1987 to May 1997. Under the single variance ration test, except Argentina, rest of the three markets including Brazil, Chile and Mexico do not follow a random walk. However, the result of multiple variance ratios indicates that all the four market follow a random walk, whereas the runs tests reject the random walk hypothesis for Chile, but not Argentina, Brazil and Mexico. Similar to Urrutia (1995), Ojah and Karemera (1999) conclude that four Latin American emerging markets are weak-form efficient.

Mauro Mecagni and Maged Shawky Sourial (1999)\(^6\) examine in their paper the behavior of stock returns in the Egyptian stock exchange, the efficiency of the market in pricing securities and the relationship between returns and conditional volatility. GARCH \((p, q)\)-\(M\) models estimated for the four best known daily indices indicate significant departures from the efficient market hypothesis, the tendency for returns to exhibit volatility clustering; and a significant positive link between risk and returns, which was significantly affected during the market downturn that followed the introduction of circuit breakers in the form of symmetric price limits on individual shares.

Kwong C. Cheung and J. Andrew Coutts (2001)\(^3\) in their paper employ variance ratio tests with both homoscedasticity and heteroscedasticity error variances to examine the random walk hypothesis for the Hang Seng Index on the Hong Kong Stock Exchange. The empirical investigation leads us to suggest
that the Hang Seng follows a random walk model and consequently that the index is weak form efficient. This conclusion offers both confirmatory and conflicting support for the conclusions of previous research, which investigated for the presence of random walks in the indices of both developed and emerging markets.

**Xiaoming Li and Jian Xu (2001)** in their short paper studied the efficient market hypothesis using four New Zealand Stock Exchange indexes (NZSE 10, NZSE 30, NZSE 40 and NZSE SC) within the random walk, Cointegration and Granger causality test framework. The test results have shown that the small-firm stock market is semi-strong form efficient to a certain degree. However, results concerning large firms are sensitive to the choice of index. The share market of the top 10 companies only is not even weak-form efficient; while the share markets covering the top 30 and 40 large companies are weak-form efficient but not semi-strong form efficient.

**Timur Mihailov and Dirk Linowski (2002)** have highlighted that due to the recent foundation of the Latvian stock market; sufficient analysis of its efficiency has not yet been performed. Moreover, Latvia’s supposed entrance in to the European Union and the Euro zone in the following decade made this research particularly interesting. The paper reviews the paradigm of technical analysis as an alternative to the weak-form Efficient Market Hypothesis from an evolutionary perspective. It is shown that in the light of investors’ bounded rationality technical analysis may have a valid theoretical framework. A test of the Latvian stock
market weak-form efficiency by means of technical trading simulation is performed. Using Genetic Algorithms a problem of subjective selection and interpretation of technical indicator parameters is partially resolved. The test results indicate that the Latvian stock market might be inefficient and set up a ground for further research.

Jose Carlos Dias, Luis Lopes, Vitor Martins and Jose Manuel Benzinho (2002) have investigated in their paper, the efficiency of the two major stock indices of the Iberian Peninsula, the Portuguese Stock Index (PSI-20) and the Spanish Stock Index (IBEX-35). They used daily data from January 1993 to September 2001 for the Portuguese stock index and daily data from October 1990 to September 2001 for the Spanish stock index.

Serial correlations, unit root tests and variance ratio tests are used to test the efficiency of these two stock indices. Although complementary of these tests, they used all of them to get a higher robustness of the conclusions. They examined serial correlation coefficients for successive stock index changes to test whether they are statistically equal to zero to establish the random walk nature of stock indexes. The augmented Dickey-Fuller (ADF) test are used to test the null hypothesis that the series has a unit root and the variance ratio tests are used to examine the random walk hypothesis for the series of these two stock indexes. The results of the serial correlations, unit root tests and variance ratio tests provide ambiguous evidence for the random walk hypothesis. The empirical evidence from the unit root tests do not reject the efficient market hypothesis for
the two stock indexes, while the results from the variance ratio tests and serial correlations do.

**Fred P.Wheeler, Bill Neale, Tadeusz Kowalski and Steve R.Letza (2002)**

presented a paper that reports a test of the changing pricing efficiency of the first stage of development of the Warsaw Stock Exchange (WSE). Emerging stock markets are unlikely to be fully information-efficient; partly due to institutional rigidities which restrict information flows to the market and partly for lack of experienced market participants to impound new information of security prices. Tests for runs and autocorrelation were conducted for the 1991-1996 trading history of the WSE and also segmented sub-periods during which different institutional arrangements applied. As the number of trading days per week increased, the general level of efficiency, although low, steadily improved (except for the “bubble” period of 1993-1994). Inefficiencies persisted in some stocks, possibly explained by opportunities to conduct off-market, out-of-hours transactions in specific stocks, and the stock exchange authorities’ continuing power to suspend trading.

**Abraham Abraham, Fazal J. Seyyed and Sulaiman A. Alsakran (2002)**

drew inferences from tests of market efficiency that were rendered imprecise in the presence of infrequent trading. As the observed index in thinly traded markets may not represent the true underlying index value, there is a systematic bias toward rejecting the efficient market hypothesis. For the three emerging Gulf markets examined in this paper, correction for infrequent trading significantly
alters the results of market efficiency and random walk tests. The Beveridge-Nelson (1981) decomposition of index returns is done to estimate the underlying index. They used weekly index values for three major Gulf stock markets of Kuwait, Saudi Arabia and Bahrain from October 1992 to December 1998. They examined data of the hypotheses for ADF area by three methods that consist of variance ratio test, runs test and estimating the true index-correcting for infrequent trading. The results presented that they cannot reject the RWH for the Saudi and Bahrain markets. The Kuwait market, however, fails to follow a random walk even after the correction.

**Jun Nagayasu and J.R. Rosalcs (2003)** used the Auto Regressive Fractionally Integrated Moving Average (ARFIMA), Fractionally Integrated General Auto Regressive Conditional Heteroscedasticity (FIGARCH) model, in their paper studied the efficiency of the Japanese Equity Market by examining the statistical properties of the return and volatility of the Nikkei 225. It showed that both followed a long range dependence, which stood against the EMH. The result was valid for all sample periods, suggesting that the recent equity market reform did not produce major efficiency gains.

The main purpose of study by **Alovsat Muslunov, Gular Aras and Bora Kurtulus (2003)** was testing weak-form market efficiency hypothesis in the ISTANBUL STOCK MARKET (ISE) using the broadcast sample and time series coverage that have been used. They used stock prices data of all companies that constituted ISE-10 index with time series covering 1990-2002 years. They tested
not only whenever ISE was efficient in the weak-form sense, but also whether and how it was becoming more efficient. For this purpose, they used generalized GARCH model.

Their research findings showed that the stock returns of the individual stocks that constituted 65% of the sample space did not show random walk behavior. However, remaining part of the individual stocks exhibited significant random walk behavior. The findings for the ISE-100 national index provided support to the evolving market efficiency hypothesis. While ISE-100 index does follow random walk for the initial period of the analysis, it gained random-walk behavior in the second period. The discrimination analysis between stocks whose returns did not follow random walk behavior and those, whose returns followed random behavior, did not significantly discriminate them.

D.N. Rao and Dr. K. Shankaraiah (2003) presented methodology and results of an empirical study for testing the weak form of Efficient Market Hypothesis of the Bahrain Stock Market. The paper also reviewed and highlighted some of the recent strategic initiatives ushered in by the Bahrain Stock Exchange to expand and strengthen Bahrain’s financial market in terms of listing procedures, regulatory mechanism, trading and settlement procedures, which had implications and learning for the stock exchanges of the GCC countries. Further, strategies for developing GCC financial markets had been suggested based on the experiences of other developing and developed financial markets.
Anand Pandey (2003) has brought out that the Market Efficiency has an influence on the investment strategy of an investor because if the market is efficient, trying to pickup winners will be a waste of time. In an efficient market there will be no undervalued securities offering higher than deserved expected returns, given their risk. On the other hand if markets are not efficient, excess returns can be made by correctly picking the winners. In his paper, an analysis of three popular stock indices was carried out to test the efficiency level of the Indian Stock Market and the random walk nature of the stock market by using the run test and the autocorrelation function ACF (k) for the period from January 1996 to June 2002. The study carried out in his paper presented the evidence of the inefficient form of the Indian Stock Market. From autocorrelation analyses and runs test he was able to conclude that the series of stock indices in the Indian Stock Market were biased random time series. The auto correlation analysis indicated that the behavior of share prices did not confirm the applicability of the random walk model in the India Stock Market. Thus there were undervalued securities in the market and the investors could always get excess returns by correctly picking them.

Kabir M. Hassan, Waleed S. Al-Sultan and Jamal A. Al-Saleem (2003) in their paper, unlike previous studies in stock market efficiency literature on the Kuwait Stock Exchange (KSE), examined the weak-form efficiency by taking into consideration the institutional features of the KSE. They employed a testing methodology that empowered them to recognize the non-linearity and infrequent trading of the KSE. Furthermore, as a robustness check on the
predictability of returns, they employed EGARCH and GARCH-M to account for
time-varying risk premier in the KSE. They found that the KSE was weak-form
inefficient, even though the efficiency improved towards the end of the 1990s. In
order to make the KSE informationally more efficient, the policymakers should
have improved the liquidity of the market, ensure that participants had access to
high quality and reliable timely information, and minimized institutional
restrictions on trading.

The study of **Eduardo Jose Araujo and Benjamin Miranda (2004)** tested the
random walk hypothesis for China, Hong Kong and Singapore using Variance
Ratio tests, robust heteroskedasticity and employing a recently developed
bootstrap technique to customize percentiles for inference purposes. It was
found that Class A shares for Chinese stock exchanges and the Hong Kong
equity markets were weak from efficient. However, Singapore and Class B
shares for Chinese stock exchanges did not follow the random walk hypothesis;
they suggested that liquidity and market capitalization may play a role in
explaining results of weak form efficiency tests.

**Andrew C. Worthington and Helen Higgs (2004)** have noted in their
examinations the weak-form market efficiency of the Latin American equity
markets. Daily returns for Argentina, Brazil, Chile, Colombia, Mexico, Peru and
Venezuela were examined for random walks using serial correlation coefficient
and runs tests, Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and
Kwiatkowski, Phillips, Schmidt and Shin (KPSS) unit root tests and multiple
variance ratio (MVR) tests. The results, which were in broad agreement across the approaches employed, indicated that none of the markets are characterized by random walks and hence were not weak-form efficient, even under some less stringent random walk criteria.

In their paper Andrew C. Worthington and Helen Higgs (2004) tested for random walks and weak-form market efficiency in European equity markets. Daily returns for sixteen developed markets (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom) and four emerging markets (Czech Republic, Hungary, Poland and Russia) were examined for random walks using a combination of serial correlation coefficient and runs tests, ADF, PP and KPSS unit root tests and MVR tests. The results, which in broad agreement across the approaches employed, indicated that, out of the emerging markets, only Hungary was characterized by a random walk and hence is weak-form efficient, while in the developed markets only Germany, Ireland, Portugal, Sweden and the United Kingdom complied with the most stringent random walk criteria.

Ibrahim A. Onour (2004) has stated that Market efficiency had influence on the investment strategy of investors because, if a market is efficient no one can benefit from information advantage as there was no consistency in underperforming securities while they deserved higher prices. On the other hand, if a market was inefficient there were always chances for some to benefit from
asymmetry of information to pick up the winners. In his paper two statistical tests had been conducted to test the efficiency performance of the Khartoum Stock Exchange (KSE) market. He found indications that the inefficiency hypothesis cannot be rejected.

Theodore Panagiotidis (2004)\textsuperscript{93} has highlighted that the EMH was tested in the case of the Athens Stock Exchange (ASE) after the introduction of the Euro for three different indices. The underlying assumption was that stock prices would be more transparent; their performance easier to compare; the exchange rate risk eliminated and as a result they expected the new currency to strengthen the argument in favor of the EMH. The FTSE/ASE 20, which consisted of “high capitalization” companies, the FTSE/ASE 40, which consisted of medium sized companies and the FTSE/ASE small cap, which covered the next 80 companies, were used. Five statistical tests were employed to test the residuals of the random walk model: the BDS, McLeod-Li, Engle LM, Tsay and Bicovariance test. Bootstrap as well as asymptotic values of these tests were estimated. The Random walk hypothesis was rejected in all three cases and alternative GARCH models were estimated.

M.A.Moustafa (2004)\textsuperscript{67} in his study has examined the behavior of stock prices in the United Arab Emirates (UAE) stock market. The data consisted of the daily prices of 43 stocks included in the Emirates market index from October 2, 2001 to September 1, 2003. The returns of all the 43 sample stocks did not follow the normal distribution, so the study utilized only the nonparametric runs to test for
randomness. The results revealed that the returns of 40 stocks out of the 43 were random at a 5% level of significance. Hence, the empirical study supported the weak-form EMH of the UAE stock market.

These results are surprising and challenging to traditional views because the UAE stock market was newly developed and had just recently become official with sound regulations. Furthermore, the market was very small and thin suffering from infrequent trading. However, the results of the paper may be attributed to the essential steps that were already been taken by the authorities to improve the operating and pricing efficiency of the UAE stock market during the last two years. The UAE stock market needed to be studied further with longer stock price time series and other tests to test the efficiency of the market.

In his paper Mohammad S. Hasan (2004) has employed a battery of statistical tests to examine the random walk variant of the weak-form EMH using the daily data of the Dhaka Stock Exchange, the major equity market of Bangladesh, from January 1990 to December 2000. The test results, however, were at variance across testing procedures and sub-periods. Results were based on the random walk model and unit root tests showed that the null hypothesis of randomness could not be rejected and stock prices had a significant random walk or permanent component. The analysis of autocorrelation functions indicated mean-reversion behavior of stock returns in most cases albeit with stock returns exhibiting some memory and predictable components during the bubble and post-speculation periods. The evaluation of the EGARCH-M model suggested significant asymmetric and leverage effects during the sub-period of speculative
bubbles of 1996-1997. The Braock, Dechart and Scheinkman (BDS) test indicated evidence of nonlinear, long-term dependence during the pre-speculation period, while during the speculation and post-speculation periods, the null hypothesis of nonlinear independence was not rejected. Overall, based on this evidence they did not categorically claim that the Dhaka Stock Exchange was weak-form efficient. However, these findings underscored the predictive significance and relevance of the random walk hypothesis as a generalized theory in explaining movements of share prices.

Though there was no universally accepted concept of the Efficient Market Hypothesis (EMH), Shelina Akhter and M. Abu Misir (2005) have suggested that all publicly available information be reflected so quickly and rapidly in the prices of the securities, that no investor would be benefited by earning abnormal profits. The study analyzed three forms of efficient market hypothesis – weak form EMH, indicating the current prices fully reflecting historical data; semi strong-form EMH, suggesting the prices of the securities reflecting all publicly available information and the strong-form EMH, indicating the prices of the securities that were reflected by all private and publicly available information. The principal object of the study was to test the weak-form efficiency of the Dhaka Stock Exchange (DSE), an emerging capital market in Bangladesh. The study found that under the weak-form of efficiency, stock prices of the listed companies of the DSE changed independently over time and that no investor was able to earn abnormal profits. Fundamental analysis of the study dealt with the financial analysis and determinants of valuation of the stock prices. On the other hand, the
technical analysis emphasized on the past price and volume data, as well as associated market trends to predict future prices of the stocks.

Oluyele Akinkugbe (2005) has renewed the focus in recent years on financial systems of developing countries reflecting the rapid and often spectacular deepening in the scale and complexity of the financial system of advanced economies. However, finance only adapted when there is real economic progress and development can only be met in Botswana if there is an efficient financial market. In an attempt to understand the issues of efficiency – particularly, pricing efficiency – in the financial system of Botswana, the Efficient Market Hypothesis (EMH) was tested using data from the Botswana Stock Exchange. The random walk model was adopted to test the weak form efficiency while the standard market model was adopted to test for semi-strong efficiency. His findings revealed that the Botswana Stock Exchange demonstrated efficiency both in the weak and semi strong forms. The article concluded by recommending that efficiency in the Botswana stock exchange can be further enhanced by providing information at low cost and on time; as well as by improving the role of markets in aggregating and conveying such information.

Gishan Dissanaike, Dirk Linowski and Natalia Abrosimova (2005) have stressed on the existence of weak-form efficiency in the Russian Stock market as examined from 1st September 1995 to 1st May 2001 using daily, weekly and monthly Russian Trading System index time series. Unit root, autocorrelation and variance ratio tests were conducted for the null hypothesis of a random walk
model. The results supported the null hypothesis for the monthly data only. Further analysis was performed for the daily and weekly data. Linear and non-linear modeling of the serial dependence was conducted using ARIMA and GARCH models estimated on the in-sample period from 1st September 1995 to 1st January 2001. Forecasts based on the best fitting models were performed for the out-of-sample period from 1st September 1995 to 1st May 2001. Comparisons of the forecasts revealed that none of the models outperformed the others, and the most accurate forecasts were obtained for just the first out-of-sample observation. Whilst their research results provided some limited evidence of short-term market predictability on the Russian Trading System (RTS), there was insufficient evidence to suggest that it would lead to a profitable trading rule, once transaction costs and risk were taken into account.

In their paper Mufeed Rawashdeh and Jay Squalli (2005) have brought out details of tests for market efficiency across the four sectors of the Amman Stock Exchange (ASE). Using daily sectoral indices between 1992 and 2004 and a variance ratio and runs tests, they found that the random walk and weak form efficiency hypotheses were rejected for all sectors. Furthermore, they found that the returns fitted a mean-reverting process which could suggest abnormally high volatility, over inflated stock prices, and frequent market corrections from a bubble effect. This also indicated that investments in all sectors of the ASE may be very risky in the short run.
Ibrahim A. Onour (2005)\textsuperscript{43} has highlighted that the Stock market inefficiency has important implications for both investors and authorities. In an inefficient market, investors should 'doubt the strategy “hold-the-market” and adopt the strategy “beat-the-market” to pick up the winners. In the meantime the authorities on their part should consider restructuring the institutional infrastructure of the stock market by enacting an effective capital market law and enhancing financial media that rectify the asymmetry of information among the market participants. In his paper two statistical tests had been employed to assess the efficiency performance of the Saudi Stock Exchange Market. He found that the inefficiency hypothesis cannot be rejected.

Ainul Islam and Mohammed Khaled (2005)\textsuperscript{3} have produced conflicting evidence on weak form efficiency of the Dhaka Stock Market which appeared to stem from the use of monthly versus daily data, structural changes after the 1996 market crash and the use of tests with or without heteroscedasticity adjustment. Heteroscedasticity-robust tests indicated short term predictability of share prices prior to the crash, but not afterwards. Although a heteroscedasticity-robust Box-Pierce test was used by Lo and MacKinlay (1989) in their simulations, the study appeared to be the first to apply this test to stock prices. Typical rejection of weak-form market efficiency by the usual autocorrelation tests could be reversed by a heteroscedasticity-robust test.

Rodolfo Q. Aquino (2006)\textsuperscript{78} has examined the efficiency of the Philippines stock market using stock price movements during from July 1987 to May 2004.
Characterizing stock price movements as an AR (1) process with Laplace residuals; the statistical evidence supported the hypothesis that the Philippines stock market was weak-form efficient. An examination of major events that could plausibly affect share prices and large price movements from an event study perspective indicated fairly rapid absorption of information by the market, except in cases of extreme stress caused by political and economic shocks. Furthermore, factors other than information about fundamentals appeared to be able to cause major share price movements. Given these, the support for the semi strong-form efficiency of the stock market was mixed.

**Jana Hanclova and Eva Rublikova (2006)** have elucidated in their article that deals with the testing of the weak form of efficiency on the Czech and the Slovak stock markets during the period 2000-2004, based on daily returns representing index PX 50 and SAX30 in the form of martingale as well as in the form of random walk. Concerning functional model forms of conditional variance, the linear and nonlinear volatility models had been estimated and half-life of the variance on the markets, presence of leverage effect or risk aversion had been evaluated.

The Conclusions for the Czech stock market are: The weak form of efficiency has not been rejected in any of the periods. In the time period 2000-2002, the weak form was not rejected even in the form of the random walk. Leverage effect was apparent and good utilizability of the nonlinear models was related to this.

The conclusions for the Slovak stock market are: Evaluated as more or less INEFFICIENT; only in the time period 2000-2002, the martingale form of
efficiency was not noticed. Leverage effect had failed to be proved with the exception of the period 2000-2002.

Graham Smith and Gillian Rogers (2006) have stressed on the hypothesis that stock futures followed a random walk, tested for four stock index futures and a sample of 36 single stock futures traded on the Johannesburg Stock Exchange (JSE), South Africa, using joint variance ratio tests based on (i) ranks and signs and (ii) wild bootstrapping. Overall, there was a high degree of weak-form efficiency; all four stock index futures and twenty-five of the samples of 36 single stock futures followed a random walk.

Kapil Gupta and Dr. Balwinder Singh (2006) have presented a study which has investigated weak form of efficiency in Indian equity futures market. For this purpose, informational efficiency of the Nifty futures and 24 stock futures were examined. The Nifty and stock futures returns were found to be deviating from normal distribution. The futures prices were found to be non stationary at levels, whereas first difference futures returns were stationary. Empirical analysis found evidence of statistical dependence in the returns generating process. Further analysis through Autoregressive Integrated Moving Average (ARIMA) process revealed that the Nifty and stock futures returns were not independent and showed strong dependencies.

Shofiqur Rahman and Mohammad Farhad Hossain (2006) have focused in their paper to seek evidence whether the Dhaka Stock Exchange (DSE) was
efficient in the weak form or not by hypothesizing normality of the distribution series and random walk assumption. Both non-parametric tests (Kolmogrov-Smirov goodness of fit test), run test, Lilliefors test), Q-Q probability plots and parametric-tests (Auto correlation coefficient test and ARIMA (0, 1, 0) for testing random walk model] had been used. Each statistical test had been performed separately on two data sets. The data sets included daily All-Share price Indices (ASPI) and DSE General Price Indices (DSE-GEN) for 12 years ranging 1994 to 2005. In addition, daily stock price data for 33 companies had been used. The daily return series, in the aspect of skewness and kurtosis, were found non-normal, which could be categorized as positively skewed distribution. Same thing resulted from the Kolmogrov-Smirov (K-S) test. As a result, null hypothesis of normality had been rejected and alternative hypothesis had remained in effect. Run test and auto-correlation results rejected the randomness of the return series of DSE simultaneously. Overall results from the empirical analysis suggested that the Dhaka Stock Market of Bangladesh was not efficient in weak-form.

**Jay Squali (2006)**[^48] in his paper has tested for market efficiency in the represented sectors of the Dubai Financial Market (DFM) and the Abu Dhabi Securities Market (ADSM). Using daily sectoral indices between 2000 and 2005, variance ratio tests rejected the random walk hypothesis in all sectors of the UAE financial market except in the banking sector of the DFM. Returns in the two financial markets were negatively serially correlated, thus suggesting the
presence of a bull market. Runs test found insurance in the ADSM to be the only weak form efficient sector.

Abid Hameed and Hammad Ashraf (2007) in their paper have attempted to model the volatility of stock returns and to test for weak-from efficiency for the Pakistani stock market, using daily closing prices from December 1998 to March 2006. Results pointed out that returns exhibited persistence and volatility clustering. Weak-form efficiency hypothesis was rejected as it was found that past information helped in predicting future prices. Mean variance hypothesis did not hold for Pakistani stock market as no evidence was found that investors were rewarded for taking increased risk. The impact of reformed efforts of Securities and Exchange Commission (SEC), as captured by introduction of circuit breakers, on return volatility had a dampening effect, albeit of a very small magnitude. This highlighted the questionable efficacy of the circuit breakers and the trade-off faced by the policy makers: decrease in volatility versus impeding the price discovery process. Given the very small decline in volatility, it seemed that costs associated with the introduction of circuit breakers outweighed the benefits and their viability needed to be rethought. Lastly, it is found that the 9/11 incident had led to decrease in volatility, contrary to the widely held belief that it had increased volatility.

Osamah M Al-Khazali, David K Ding and Chong Soo Pyum (2007) have used a nonparametric variance ratio (VR) test. They revisited the empirical validity of the random walk hypothesis in eight emerging market, in the Middle
East and North Africa (MENA). After correcting for measurement biases caused by thin and infrequent trading prevalent in nascent and small stock market, they could not reject emerging random walk hypothesis for the MENA market. They concluded that a nonparametric VR test was appropriate for emerging stock market and argued that their finding could reconcile previously contradictory results regarding the efficiency of the MENA markets.

**Arshad Hassan and Muhammad Shoaib Abdullah and Zulfiquar Ali shah** (2007) have examined the weak form market efficiency of the Karachi Stock Exchange. Daily, weekly and monthly returns for the last 6 years in dynamic macroeconomic context were examined for random walks using Kolmogrov-Smirov test, Jarque-Bera test, autocorrelation coefficient, runs test, Augmented Dickey-Fuller (ADF), Phillips-Perron (pp) and unit root test and multiple variance ratio (MVR) test. The result, which were in broad agreement across the approaches employed, indicated that none of the markets were characterized by random walk and hence were not weak form efficient, therefore technical analysis could be helpful in forecasting markets behaviors at least in the short run.

**Nauzer J Balsara, Gary Chen and Lin Zheng** (2007) have used the variance ratio test, for the Chinese Stock Market and they rejected the random walk null hypothesis for class A and class B stock market indexes traded on the Shanghai and Shenzhen stock exchanges. Consistent with this result, they found that ARIMA forecasting model generated more accurate forecasts as compared to the
naïve model based on the random walk assumption. They also observed significant positive return for individual stock after transaction costs on buy trades generated by the contrarian’s version of three commonly used technical trading rules; the moving average crossover rule, the channel breakout rule and the Bollinger band breakout rule.

Sabur Mollah (2007) has studied weak-form market efficiency in the emerging market: evidence from the BOTSWANA Stock Exchange. Market efficiency is an area of enormous interest in financial literature. Numerous research conducted empirical studies in testing weak form market efficiency in several stock markets and employed various techniques but the empirical evidence was controversial. Triangulation econometric approach was employed to assess the predictability of daily return series of Botswana Stock Exchange (BSE) and to test the null hypothesis of the random walk model. The empirical result rejected the null hypothesis of random walk model for the daily return series of the BSE for the period 1989-2005 and evidenced serial autocorrelation of return series, which clearly indicated predictability and volatility of security prices of Botswana market. However, the empirical evidence of both non-parametric (Kolmogrov-Smirnov test: normality test and run test) and parametric test (Auto-correlation test, Auto-regressive model, ARIMA model) rejected the hypothesis of random walk model and indeed violated the notion of weak form market efficiency.
Ashutosh Verma and Nageshwar Rao (2007) have in their paper examined the weak form efficiency of the companies included the BSE 100 index as on March 31, 2001 by applying serial correlation and run test. The analysis had been done for three years, i.e, 1998-1999, 1999-2000 and 2000-2001 taking the sample of share prices from April1 to March31. While the results for the first two years show that the market was not weak form efficient, the results of 2000-2001 indicated that the market was weak form efficient. The study raised an important question regarding the selection of the sample period. By analysis of the findings, it could be said that the market was moving towards better assimilation and reflection of historical information in stock prices.

Collins Gyakari Ntim, Kwaku K. Opong and Jo Danbolt (2007) have categorically mentioned in their study that empirically re-examines the weak form efficiency market hypothesis of the Ghana Stock Market using a new robust non-parametric variance ratio test in addition to its parametric alternative. They mainly found that the stock returns were conclusively not efficient in the weak form, neither from the perspective of the strict random walk nor in the relaxed martingale difference sequence sense. Unlike previous evidence, they found it robust to thin-trading, sub-sample periods as well as the choice of data set. Consistent with prior studies, the results of the parametric variance ratios test were ambiguous. By contrast, its non-parametric alternative provided conclusive results.
Dhirendar Pratap Ray and Rahul Sharma (2008)22 in their paper have analyzed how efficient is the Indian Capital Market and have described what kind of form of efficiency the Indian capital market follows. The research showed that in spite of the Market Index not showing Random Walk property, it was very much possible that individual securities within the index may have exhibited this property. Thus, terming market efficient or non-efficient solely on the basis of index could give wrong results. It also showed that the Indian Capital Market is financially quite strong and the regulatory mechanisms in place, have ensured that in spite of the booming growth, the market had remained efficient and there was no unfair advantage to any person.

Swati Ghosh and Ernesto Revilla (2007)89 have studied East Asian stock market and they explored the relative efficiency of stock markets across the countries using newly available data on transaction costs and the quality of the informational environment of stock markets. These measures were constructed from firm-level stock returns in a panel of 60 countries during the period 2000-2004. They then developed a framework to understand the linkages between efficiency, liquidity and their determinants. To give empirical content to the framework, they studied the determinants of transactions costs and the quality of the information environment. They found that some institutional arrangements – such as the availability of stock lending and short selling – and the openness of markets were associated with lower transactions costs. They also found that, although disclosure rules for directors and officers of listed firms were essential, the ability of shareholders to seek redress was more conducive to a better
informational environment in stock markets. This in turn serves as the basis for the policy framework and recommendations for the East Asian region. In particular, the region needed to continue to strengthen the implementation and enforcement of corporate governance, to further enhance the market and institutional infrastructure, and focus on policy measures, to foster a larger and more diversified investor base, to continue to see gains in the efficiency of stock markets.

Alok Kumar Mishra and M Thomas Paul (2008)⁴ in their article have examined the integration and efficiency of the Indian stock and foreign exchange markets. Their study employed the Time series ordinary least square regression, Unit Root test, Grangers Casualty test, vector Auto Regression techniques on monthly data of stock return and exchange rate return for the period from February 1995 to March 2005. The major findings of their study were as follows; both the stock indices return (RSensex and Rnifty) were near normal, whereas exchange rate return was not normal and more peak. The stock return and exchange rate return were positively related. The policy implication of this result of the positive relation between stock return and exchange rate return for foreign investors in India could be further studied. From the Grangers causality test, it was found that there was no causality for the return series of stock indices and exchange rate except return Nifty and return exchange rate. Weak form of market efficiency hypothesis was also corroborated for stock and foreign exchange markets.
In their paper Dr. Elango Rengasamy and Mohammad I. Hussein (2008) have highlighted market efficiency across the seven stock markets in the GCC (Gulf Cooperation Council) countries. The GCC countries, of late, have been striving to strengthen their capital markets by introducing various innovative changes in relation to listing, regulatory, trading and settlement norms in order to improve transparency and informational efficiency. Using daily indices of the above market between October 2001 and October 2006 and the Kolmogrov-Smirov test, they found that the seven markets above rejected the null hypothesis that the returns follow a normal distribution. Again, based on runs test for randomness, they found that the hypothesis pertaining to random walk and weak form efficiency of the GCC market was rejected for all the seven markets during the study period. This conclusion corroborates with the conclusions of the past studies carried out in the GCC context and the developing and underdeveloped markets. The paper reiterates the need for an integrated GCC stock market. The result and suggestions had wider implications for security analysts, investing community, stock exchanges, and other regulatory authorities in their policy decisions to improve their capital market functioning.