

## **EFFICIENCY IN STOCK MARKETS**

### **A REVIEW OF LITERATURE**

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#### **Abstract**

*This study aimed at revisiting and divulging the existing empirical evidence regarding the informational efficiency and random walk in stock markets of developed and emergent markets. The critical analysis of statistical tools used is out of the purview of this study. Most of the empirical literature on the topic after the seminal work of Fama (1965a) is based on the developed markets. However, emergent markets received greater attention of the researchers after the huge inflow of capital in these markets after financial liberalization. Review of literature reveals varied results for efficiency and random walk in case of developed and emerging markets. Developed markets empirically found to be more efficient than emergent markets. Highly contradictory results are observed for emerging markets depending on the size, influence of insider trader, market integration, liberalization, trading volume, trading process, and infrequent trading. Empirical evidence in favour or against efficiency is a major contribution towards the strategic trading adeptness of a portfolio manager and of a proficient investor.*

*Keywords: Efficient market hypothesis (EMH); literature review; efficient markets; random walk; emergent markets.*

## INTRODUCTION

The concept of market efficiency by in large connected to the informational efficiency in the markets. In context with the financial market it refers to the incorporation of available information in setting up of current security prices. Efficiency does not require the security price to be equal to the true value of the security, all it requires the equilibrium in the market. There is an equal chance of prices to be higher or lower than the true value of the security at any point in time, all it requires these deviations from the true value to be random and the errors to be unbiased. Consequently, the market is efficient implies that prices adjust quickly in an unbiased manner after arrival of new and relevant information.

According to the Efficient Market Hypothesis (EMH), by Fama (1965b) in his article, an efficient market is one where returns cannot be exploited by trading in a specific pattern. The efficient market hypothesis is linked with the notion of random walk (RW), which in finance literature portray random changes in prices of stocks such that the current prices cannot be predicted from previous prices. The rationale of random walk is that the successive price changes are independent, identically distributed random variables which imply that the series of prices changes has no memory and past cannot be used to predict the future in any meaningful trend (Fama, 1965b).

The concept of random walk in stock market was first introduced by French economist Jules Augustin Frédéric Regnault (1863) and later was conceded by Louis Bachelier, a French mathematician (1900). The concept was further got strengthen by empirical research of Cowles (1933). The random nature of changes in the prices does not allow the investor to always beat the market to gain above normal profits. (Kendal, 1953; Cootner, 1962; Samuelson, 1965) supported the random walk behavior of stock prices. A decade after Samuelson's (1965) and Fama's (1965a; 1965b; 1970) landmark papers, many other researchers like LeRoy (1973); Rubinstein (1976); and Lucas (1978), extended the basic framework to cater the risk-averse investors. Thus a 'neoclassical' version of the EMH was developed where price changes are random and unpredictable and all investors have 'rational expectations' and prices do fully reflect all available information.

However, efficient market hypothesis became a controversial issue on the basis of empirical evidence against efficiency and seasonal anomalies in the stock market. Supporters of this school of thought Summers (1986); Fama & French (1988); Lo & MacKinlay (1988); Poterba and Summers (1988) contradicted random walk characteristic on the basis of certain psychological and behavioral elements and presented evidence against the hypothesis and concluded that stock market returns to a considerable extent are predictable. Since then it has become a debatable issue (Osborne, 1962; Jensen, 1978; Black, 1986; Poshakwale, 1996;

Campbell et al., 1997; Malkiel, 2005; Granger, 1993; Gupta, 2006; Agwuegbo et al., 2010) and major interest of research. De Bondt & Thaler (1985; 1987); Barberis et al., (1998); Lehmann (1990); Hong and Stein (1999), revealed an anomaly of random walk in the presence of presence of under- and over-reaction of price changes and autocorrelation in the stock markets. Calendar anomaly is another consistent deviation from random walk hypothesis observed in the stock markets. Among them day-of-the-week (DOW) effect (Cross, 1973; French, 1980), week-of-the-month effect (Ariel, 1987; Lakonishok and Smidt, 1988), month-of-the-year effect (Rozeff and Kinney, 1976) and turn-of-the-month (TOM) effect (Cadsby & Ratner, 1992) are highly pervasive ones. In a nutshell, even after thousands of articles published on the topic there is no single consensus developed among the researchers and the economists about efficiency of financial markets (Lo, 2008). However, empirical evidence in favour or against EMH can be considered a major contribution towards the strategic trading adeptness of a portfolio manager and of a proficient investor.

Ko & Lee (1991) argued that "if the random walk hypothesis holds, the weak-form of the efficient market hypothesis must hold, but not vice versa." Thus, evidence supporting the random walk model is the evidence of market efficiency. However, violation of the random walk model need not be the evidence of market inefficiency in the weak-form.

According to Kendal (1953) stock prices following a random walk implies that the price changes are independent of one another as well as the gains and the losses. The efficient market increases the investor's confidence over the market. In an efficient market, prices of the assets will reflect best estimate for the risk and expected return of the asset, taking into consideration all available information at that point in time (Gupta & Basu, 2007).

Lagoard & Lucey (2008) claimed that an informationally efficient stock market is essential for the positive relationship between developed stock markets' activities and economic growth. On the other hand an inefficient market can result in profitable investment opportunities based upon technical trading strategies.

Enormous studies have been conducted since the seminal work of Fama (1965a) to investigate the degree of efficiency in developed and in emergent markets of the world using various techniques. The investigation of EMH has been continuously receiving an overwhelming response owing to two basic facts; i) informational efficiency plays a significant role in portfolio decision making of investor and the findings have serious implications on investor and on portfolio manager; ii) Contradictory and inconsistent results, even after the extensive published work in this field calls for diversified approaches with innovative methodologies. The scheme of the rest of the study is as follows: Section 2, provides the empirical evidence of weak-form efficiency and random walk behaviour in previous researches. Section 2 and 3 present the

empirical evidence of developed and emerging markets, respectively. Evidence related to emerging markets is further segregated into regional subdivisions of emerging markets. Section 4, presents the summary of the presented empirical evidence.

## **EMPIRICAL EVIDENCE OF DEVELOPED FINANCIAL MARKETS**

Earlier studies mostly probed into the behaviour of developed financial markets, mostly of European and US financial markets. Traditionally markets of developed economies are more efficient as compared to emergent markets (Gupta, 2006).

Kendall (1953) investigated British industrial and US commodity share price indices. The study supported random walk on zero correlation rationale. Similar rationale was provided by Working (1934) with small sample. Cootner (1962) picked 45 stocks from New York stock exchange and found similar results at low levels of correlation. Lo & MacKinlay (1988) conducted a vital study on US security prices for the period 1962-1985, by first introducing variance ratio test. The study rejected random walk based on positive serial correlation of weekly and monthly returns. Fama & French (1988) conducted a study on New York Stock Exchange (NYSE) stocks for the 1926-85 period and found large negative autocorrelations for longer periods. Poterba & Summers (1986;1988) applied variance ratio test on Standard and Poor's composite stock index for the period 1928-1984, for US stocks market as whole for the period 1871-1986, and for sixteen other countries for 1957-1985. They rejected the random walk and found the evidence of positive serial correlation over short periods and negative autocorrelation for longer periods. Contradictory to this Lee (1992) found existence of random walk for the stock markets of US and ten other industrialized nations namely United Kingdom, France, West Germany, Australia, Belgium, Netherlands, Switzerland, Italy, Japan and Canada, for 1967–1988. Similarly, Choudhry (1994) examined stock indices of United States, United Kingdom, Canada, France, Japan, Italy and Germany for the period 1953–1989, by applying unit root test and Johansen method of cointegration using monthly return series and also found unit root and presence of random walk in all stocks.

Poon (1996) tested UK stock markets for random walk, serial correlation, and persistence of volatility and found presence of random walk and found no evidence of mean reversion. Al-Loughani & Chappel (1997) found heteroscedasticity in FTSE 30 index of London Stock Exchange for the period 1983-1989, by employing Lagrange Multiplier (LM) serial correlation test, unit root test and generalized autoregressive conditional heteroscedasticity-in-mean (GARCHM) model.

Chan et al. (1997) conducted a study on 18 international stock markets (Australia, Belgium, Canada, Denmark, Finland, France, Germany, India, Italy, Japan, Netherlands, Norway,

Pakistan, Spain, Sweden, Switzerland, the United Kingdom, and the United States ) with 16 amongst them belong to developed world and the rest two; Pakistan and India among the emergent markets for the period 1962-1992. The study was aimed at testing weak-form efficiency. The result from unit root testing revealed the weak-form efficiency in developed market. However, cointegration test revealed significant cointegration in the return series.

Groenewold (1997) vetted the markets of Australia (Statex Actuaries' Index) and New Zealand (NZSE-40 Index) for the period 1975-1992. The study tested weak-form and semi-strong form efficiency in those markets and used stationarity and autocorrelation tests and found result consistent with weak-form efficiency. However, the granger causality rejected the semi-strong form and at the same time revealed cointegration between the two stock markets.

Lee et al. (2000) tested French futures and options markets using unit root and variance ratio tests. The study found presence of random walk in the markets.

Worthington & Higgs (2004) examined sixteen European equity markets for random walk including, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom and four emerging markets of Czech Republic, Hungary, Poland and Russia. Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and multiple variance ratio (MVR) tests were applied. It was found that only Hungary amongst the emergent markets and Germany, Ireland, Portugal, Sweden and the United Kingdom amongst the developed markets follow random walk criterion.

Gan et al. (2005) looked into the stock markets of New Zealand, Australia, US and Japan for the period 1990-2003, and reaffirmed the findings of Groenewold (1997) except for the granger causality between New Zealand and Australian stock markets. The study used conventional methods (ADF and PP unit root test) for finding efficiency levels.

Nakamura & Small (2007) used "small-shuffle surrogate" method to investigate random walk on Standard & Poor's 500 in US market and Nikkei225 in Japanese market, exchange rate and commodity markets and found existence of RW in markets whose first differences are independently distributed random variables.

Torun & Kurt (2008) conducted a study on European Monetary Union Countries taking panel data of stock price index, consumer price index and purchasing power of euro for the period 2000-2007 to investigate weak-form and semi-strong efficiency. The study used panel unit root test, panel cointegration and causality test and found result consistent with weak-form efficiency.

Borges (2010) investigated the stock markets indices of France, Germany, UK, Greece, Portugal and Spain, from January 1993 to December 2007 for the presence of random walk by taking monthly and daily stock returns. He used both parametric and non parametric tests

including serial correlation test, runs test, multiple variance ratio test proposed by Lo & MacKinlay (1988), and ADF test. Evidence of random walk was found in all six countries for monthly returns. However, for the daily returns hypothesis of random walk was rejected for Greece and Portugal.

Shaker (2013) tested the weak-form efficiency of Finnish and Swedish stock markets by using ADF, variance ratio test proposed by Lo & MacKinlay (1988). This particular study rejected the hypothesis of random walk in these markets.

The above empirical literature revealed the evidence weak-form efficiency and random walk in most of the developed financial markets.

## **EMPIRICAL EVIDENCE OF EMERGING FINANCIAL MARKETS**

An emerging economy is a transitional phase between a developed and developing economy. Compared to developed markets, emerging markets are relatively isolated from capital markets of other countries and have relatively low correlation with developed markets. But during last two decades huge amount of capital inflow from developed economies as a result of globalization and liberalization of financial markets have attracted the researchers to investigate the implications of these changing trends on market efficiency of emerging markets. Therefore particular attention is being paid by researchers to find trends in emerging markets. However, contribution of equity markets in the process of development in developing countries is less and the resultant is weak markets with restrictions and controls (Gupta, 2006).

In emerging stock markets, stock price manipulation by intermediaries (brokers) is a common issue. Greater returns by inside traders (brokers) than outside traders in emerging markets accounts for weak market reforms and limited capital increase (Khwaja & Mian, 2005). China's worst stock market crime came out as a result of collusion of brokers in the market (Zhou & Mei, 2003). In 2005, the Securities and Exchange Board of India barred 11 brokers for engaging in price manipulation. An intermediary (broker) can manipulate outcomes in equilibrium without losing credibility in the market (Khwaja & Mian, 2005; Siddiqi, 2007). Therefore, efficiency levels in emerging economies are sensitive to the manipulation capacities in the markets (Magnusson & Wydick, 2002).

### **East European emerging markets**

Areal & Armada (2002) studied Portuguese stock market to check for weak-form efficiency. Parametric and non-parametric test were used and found mixed evidence mostly sensitive to methodology used. The study did not reject weak-form efficiency.

Siourounis (2002) investigated Athens stock exchange (ASE) for weak-form efficiency and heteroscedasticity from 1988-1998. The study employed GARCH model and concluded that current volatility is positively related to past realizations. It was also concluded that negative shocks have an asymmetric impact on returns. Chow test, Granger causality test and Newbold test were used for non linearity. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests with first difference log values of return series were employed to check unit root in the daily return series. The two tests failed to reject random walk at 5% significance level. However, for first difference there is no evidence of unit root. Later another study examined Athens stock market (Samitas, 2004) by using Johansson's Maximum likelihood procedure and unit root test which showed consistency with the former study. While a recent study by Dicle & Levendis (2011) revealed appearance of inefficiency with DOW effects after performing runs test and Granger causality test on Athens stock market.

Smith & Ryoo (2003) analysed five European emerging markets namely Greece, Hungary, Poland, Portugal and Turkey, by employing multiple variance ratio test. The hypothesis of random walk was rejected in all markets except for Istanbul stock exchange due to higher turnover than other markets.

Guidi et al. (2011) investigated Central and Eastern Europe (CEE) equity markets for the period 1999-2009. Study used autocorrelation analysis, runs test, and variance ratio test for test the hypothesis of random walk. It was concluded that most of the CEE markets don not follow random walk and abnormal profits can be accrued by a well informed investor.

Another study on Istanbul stock exchange (ISE) National 100 index was conducted by Kapusuzoglu (2013) for the period 1996-2012 found contradictory evidence as compared to the findings of Smith & Ryoo (2003). The study aimed at detecting the presence of random walk in the returns by using unit root test on daily stock returns and rejected the hypothesis of random walk.

A very recent study by Dragota & Tilica (2014) examined Post Communist East-European Countries. The study aimed at tracing any improvement in efficiency based on the past record and used 20 countries namely Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Latvia, Lithuania, Former Yugoslav Republic of Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, and Ukraine for the period 2008-2010, a period of financial crises. Unit root tests, runs test, filter rules test and variance ration tests were used. In some of the markets the hypothesis of EMH was not rejected. However, the results were not consistent in all markets. Moreover, the heterogeneity of results was revealed suggesting variable portfolio management techniques for different levels of market efficiency.

Mixed results were observed in case of Eastern European financial markets with traces of weak-form efficiency in stock exchanges of Athens and Turkey.

### **Latin American emerging markets**

Urrutia (1995) scrutinized Latin American emerging markets namely Argentina, Brazil, Chile and Mexico stockmarkets for random walk hypothesis for the period 1975-1991. By applying variance ratio test it was found that serial correlation is present in all markets. However, runs test indicated weak-form efficiency in studied Latin American markets.

However, when parametric test along with non-parametric test were applied by Worthington & Higgs (2003) to investigate weak-form market efficiency in Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela; it rejected the random walk hypothesis. In another study Mexico and Brazil stocks markets are re-examined for random walk by Grieb & Reyes (1999) by employing variance ratio tests on individual firms and on indices. The result revealed greater tendency of Brazil stock index for random walk than for Mexican stock markets.

Literature revealed that Brazilian stock markets has shown random walk behaviour and favourable tendencies towards efficiency.

### **African emerging markets**

Smith et al. (2002) conducted a study on five medium-sized African stock markets namely, Egypt, Kenya, Morocco, Nigeria and Zimbabwe and two small and comparatively newer markets of Botswana and Mauritius for testing the hypothesis of random walk. The stock market of South Africa was also put under question of random walk. The study used multiple variance ratio tests of Chow & Denning (1993). The hypothesis of random walk was rejected in all seven markets, except for South African market which was found to follow random walk.

Another study in the same era by Magnusson & Wydick (2002) found presence of weak-form efficiency on monthly returns of six out of eight African markets namely Botswana, Cote d'Ivoire, Kenya, Mauritius, South Africa, Ghana, Nigeria and Zimbabwe. The results were then compared with US stock market, Latin American and Asian emerging markets and it was concluded that efficiency levels are sensitive to the efficiency hurdles in developed and emerging economies and market manipulation capacities.

Appiah-Kusia & Menyah (2003) tested weak-form efficiency of 11 African stock markets comprising of Nigeria, Egypt, Kenya, Zimbabwe, Mauritius, Morocco, Botswana, Ghana, Ivory Coast, Swaziland and South Africa. Conditional volatility (heteroscedasticity) was captured by using exponential GARCH-M model. The result showed evidence of weak-form efficiency in

Egypt, Kenya, and Zimbabwe. The result also revealed traces of efficiency in Mauritius and Moroccan stock exchanges. Rejection of weak-form efficiency in Botswana stock market was also found very recently when parametric and non parametric (autocorrelation test, Kolmogorov-Smirnov Test, Runs Test, ADF and Phillips-Parron (PP) unit root test ) were applied (Chiwira & Muyambiri, 2012).

Jefferis & Smith (2005) studied changing patterns of market efficiency of African stock markets of South Africa, Egypt, Morocco, Nigeria, Zimbabwe, Mauritius and Kenya over time. The study period started in early 1990's and ended in June 2001. GARCH approach with time-varying parameters and test of evolving efficiency (TEE) were used to detect efficiency over the period of time. The study found Johannesburg stock market (JSE) weak-form efficient throughout the study period, while Egypt, Morocco and Nigeria became efficient at the end of the period. However contradictory results were revealed with respect to Appiah-Kusia & Menyah (2003) in case of Kenya and Zimbabwe stock markets which show no tendency towards weak-form efficiency over time. Mauritius stock market exhibits slow tendency to eliminate inefficiency, which is consistent with Appiah-Kusia & Menyah (2003).

Gupta & Basu (2007) investigated market efficiency on emerging African stock markets of Egypt, Kenya, Zimbabwe, Morocco, Mauritius, Tunisia, Ghana, Namibia, Botswana and the West African regional stock exchanges. Non parametric tests (Kolmogorov-Smirnov correlation test and runs tests) were applied. Random walk was rejected except for Namibia, Kenya and Zimbabwe. The results are consistent with Appiah-Kusia & Menyah (2003) in case of Kenya and Zimbabwe.

Mlambo & Biekpe (2007) examined ten African stock markets including, Botswana, Egypt, Ghana, Johannesburg, Kenya, Mauritius, Morocco, Namibia, Tunisia and Zimbabwe and West African Regional Stock Exchange (Bourse Regionale des Valeurs Mobilieres (BRVM)). In order to cater thin- trading in almost all the markets returns were calculated on trade-to-trade basis. In Namibia random walk hypothesis was not rejected due to its correlation with Johannesburg stock exchange. Similarly Kenya and Zimbabwe were not rejected as weak-form efficient. On the other hand, Mauritius, Egypt, Botswana and BRVM deviated from random walk hypothesis. The study suggested the need for non linear serial correlation testing in these markets for testing efficiency level, since markets with weak microstructures where return generating process is expected to be non-linear. Therefore, a test on linear correlation could lead to wrong inferences.

Lagoarde-Segot & Lucey (2008) studied Middle-Eastern North African (MENA) stock markets (Turkey, Israel, Jordan, Tunisia, Egypt, Lebanon and Morocco) for the period 1998-2004, by employing individual and multiple variance ratio tests, unit root test and ordered logit

model to test the efficiency level in these markets. Result revealed distinctive efficiency levels explained by differences in size of stock markets and corporate governance. Prior to this study Al-Khazali et al. (2007) already confirmed random walk hypothesis on MENA stock markets by applying non-parametric variance ratio test.

Another study by Emenike (2010) revealed rejection of random walk in Nigerian Stock Exchange (NSE) across three time periods selected from 1985-2007, by using runs test, Kolmogorov-Smirnov, and Q-Q normal chart. The study also revealed the improvements in NSE trading system over time, have positive impact on efficiency.

Comparatively, recent study conducted by Ntim et al. (2011) sheds light on 24 African markets across continent along with eight African national stock price indices. The purpose of the study was to demonstrate the comparison between continent-wide stock prices with the national based African indices. The study used variance ratio test and concluded that continent-wide stock markets are have better weak-form informational efficiency as compare to their national counterparts. The study suggests improvements in efficiency of national price indices by integrating their operations continent-wide.

The empirical studies on emerging African markets demonstrated conflicting results for efficiency. Small sized markets with low integration showed evidence against weak-form efficiency and random walk. Studies noticed presence of random walk and weak-form efficiency in markets where improvements in trading systems, liberalization, market integration and better governance is experienced with the passage of time.

### **Middle Eastern emerging markets**

Abraham et al. (2002) tested weak-form efficiency in three major Gulf stock markets, of Kuwait, Saudi Arabia, and Bahrain by employing variance ratio test and the runs test for the period 1992 to 1998. The study aimed at identifying the systematic bias in finding efficiency in the market when it is thinly-traded and taking corrective measures to cater that problem. The Beveridge & Nelson (1981) methodology was used to separate the effects of infrequent trading thus allowed to draw un-biased inferences. After separating the effects of thin-trading, for three markets random walk hypothesis was not rejected.

Omran & Farrar (2006) tested the random walk hypothesis and calendar anomalies in the emerging stock markets of the Middle Eastern countries. The markets rejected the random walk for all five markets and instead supported the presence of the calendar anomalies. However, the evidence for the Israel Tel100 stock market showed traces of random walk.

(Marashdeh & Shrestha, 2008) vetted Emirates securities markets namely Abu Dhabi Securities Exchange (ADX) and Dubai Financial Market (DFM) for the period 2003-2008 by

applying unit root and PP tests. Both of the markets were found to follow random walk and weak-form efficient.

Oskooe (2011) selected Iran stock market for testing weak-form efficiency in the market for the period 1999-2009. He employed unit root test for the purpose and concluded that market does not follow random walk and is not weak-form efficient.

Asiri (2008) conducted a study on 40 listed companies in different sectors of Bahrain Stock Exchange (BSE) to test the weak-form efficiency for the period 1990-2000. The techniques used were Dickey-Fuller tests and autoregressive integrated moving average (ARIMA). Both tests supported random walk in each individual sector.

Asiri & Alzeera (2013) tested hypothesis of weak-form efficiency in Saudi Arabia's stock market; Tadawul. For the purpose the author selected daily returns of sectoral indices as well as all-share index belongs to Tadawul for the period 2006-2012. Parametric and non-parametric tests including Dickey-Fuller, Pearson correlation test, Durbin-Watson test and Wald-Wolfowitz runs test were applied. The result confirmed the presence of weak-form market efficiency for all-share price index and for 11 individual sectors.

The above review shows that Iranian, Gulf and Saudi Arabia markets on the whole are found weak-form efficient after using parametric and non-parametric tests on daily, weekly and monthly returns.

### **Asian emerging markets**

A great deal of research can be found in Asian emerging markets, over last two decades especially after liberalization of financial markets in 1990's, which increased the integration of world markets and huge amount of capital transfer from developed world in emerging markets.

Poshakwale (1996) tested the weak-form efficiency of Indian stock market by taking Bombay Stock Exchange (BSE) into consideration. The study followed the path of concluding market inefficiency with the presence of day-of-the-week effect and serial correlation in the return series. The study found absence of random walk in BSE. Gupta & Basu (2007) investigated market efficiency in two major stock markets of India; Mumbai Stock Exchange (BSE) and National Stock Exchange (NSE) of India for the period 1991-2006. The results are consistent with the results of BSE in Poshakwale (1996) with evidence of serial correlation and rejection of random walk hypothesis.

Abeysekera (2001) investigated informational market efficiency in another South Asian market of Sri Lanka by testing Colombo Stock Exchange for the period 1991-1996. Correlation coefficient test and runs test were applied on daily, weekly and monthly returns of Sensitive

Share Index (SSI), which revealed serial correlation in returns and rejected null hypothesis of weak-form efficiency.

Quite a number of studies have been conducted for testing random walk in Bangladesh stock markets and both similar and contradictory results have been found. Most of the work is based on Dhaka Stock Exchange (DSE). Alam et al. (1999) examined DSE from 1986-1995 and concluded that DSE follows random walk. Mobarak & Keasey (2000) examined market efficiency on all listed Dhaka Stock Exchange (DSE) securities. The study applied autocorrelation test, runs test and autoregression test on daily stock prices from 1988-1997. The result revealed presence of autocorrelation which rejects the weak-form efficiency in DSE. On the other hand Islam & Khaled (2005) applied heteroscedasticity-robust Box-Pierce test which reversed the result presented in the previous studies. This particular study showed evidence of weak-form efficiency when monthly data was used. Alam et al. (1999) also concluded similar phenomena about Bangladesh stock market. However, rejection of random walk and efficiency was found by Mobarek et al. (2008) when auto-regressive model (ARIMA) along with runs tests and Kolmogorov-Smirnov normality test were applied. Similar results were captured when Wald test of Dickey & Kavussanos (1996) was applied (Khandoker et al. 2011; Nguyen & Ali, 2011). Wald test was re-employed by Nguyen et al. (2012) on Taiwan stock market to check random walk. The result also showed rejection of random walk in Taiwan stock market.

Mixed results were found in case of five Asian stock markets of Bangladesh, Hong Kong, Malaysia, Sri Lanka and Taiwan by applying variance ratio test developed by Lo & MacKinlay (1988) for period 1986-1995 (Alam et al., 1999). Except Sri Lanka random walk was followed in all markets. Similarly Cooray & Wickramasighe (2007) examined four emerging markets of South Asia including Pakistan, India, Sri Lanka and Bangladesh and found traces of weak-form efficiency except for Bangladesh. Contradictory results were observed about emerging Asian market of Korea, Malaysia, Hong Kong, Singapore and Thailand (Huang, 1995) where rejection of random walk hypothesis on the basis of variance ratio test of Lo & MacKinlay (1988) was found. However, runs test suggested weak-form efficiency in most of the emerging markets (Karemera et al., 1999).

Kim & Shamsuddin (2008) used weekly and monthly data for testing market efficiency by applying non-parametric tests on Asian markets of Hong Kong, Japanese, Korean and Taiwan, Indonesia, Malaysia, Philippines, Thailand and Singapore. They showed how multiple variance ratio test based on wild bootstrap is better to apply over conventional Chow-Denning variance test when the sample size is not very big. The markets of Hong Kong, Japanese, Korean and Taiwan found weak-form efficient by using that technique. The markets of Indonesia, Malaysia and Philippines had shown no traces of efficiency even after liberalization of these markets in

eighties. On the other hand Singaporean and Thai markets became efficient after Asian financial crises of nineties revealing the non-sensitiveness of financial crises on efficiency. The result of Hong Kong and Singapore market efficiency are consistent with the previous study of Lima & Tabak (2004). Nikita & Soekarno (2012) also revealed weak-form inefficiency and autocorrelation in Indonesian stock market during 2008-2011.

Another study conducted by Munir et al. (2012) to investigate efficiency of Asean (Association of Southeast Asian Nations) security markets by selecting five Asean stock markets of Indonesia, Malaysia, Philippines, Singapore and Thailand. The data used for the study ranges from 1990-2009. Two regime threshold auto regressive (TAR) approach was used to cater the possible non-linearity in stock returns. Diversified results were again found. Malaysia and Thailand stock returns followed random walk, while Indonesia, Philippines and Singapore revealed non-linear stationary process inconsistent with efficient market hypothesis.

Chinese stock market was tested for random walk by Charles & Darne (2009). Multiple variance ratio tests, Wang-Kim subsampling model, Kim's wild bootstrap test and multiple Chow-Denning test were employed on two types of return series; first one 'A' shares, and the other one 'B' shares. 'A' shares are only traded in local currency, for domestic investors only. While 'B' shares are traded in foreign currencies and are for domestic and international investors both. It was concluded that shares of 'B' class having international integration followed did not random walk in their returns, while class 'A' is more efficient. The results are also consistent with the previous study of Lima & Tabak (2004)

Phan & Zhou (2014) tested emerging stock market of Vietnam for the period 2000-2013. Using autocorrelation test, variance ratio test, and runs tests Vietnamese stock market was not found efficient in the initial periods of the study but shown gradual improvement in the operations of the market by evidence supporting random walk hypothesis in only VN-index (one of the indices of Vietnamese stock market) during the last years of study period. Phan & Zhou (2014) hold strong influence of investor in the market responsible for the rejection of random walk in the Vietnamese stock market.

Choudhuri & Wu (2003) scrutinized ten emerging stock markets by identifying structural breaks from the time of liberalization of stock markets, and concluded that the extent and period of liberalization of stock markets is sensitive to efficiency levels and ignoring structural breaks that arise due to the liberalization can lead to misguided inferences about efficiency. The study selected Argentina, Brazil, Chile, Colombia, Greece, India, Jordan, Korea, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Taiwan, Thailand, Venezuela, and Zimbabwe for the period 1985-1997. By applying Zivot-Andrews sequential test for a random walk to take into account the effects of structural changes in stock prices. The study rejected the random walk hypothesis.

They further concluded these structural changes can be explained by other major economic events in the underlying economies.

Uppal, (1993) determined the relationship between Pakistani equity market and international equity markets of Japan, Korea, USA, UK, Australia, and India using GARCH (1,1) technique. However, the weak-form efficiency results seemed to be consistent with only Japan and Korea. Pakistani stock market has emerged as one of the outperforming markets of South East Asia in the last two decades. However, the market is found inefficient with speculative bubbles and strong non-linear dependent returns (Khilji, 1994; Husain, 1997; Ahmad & Rosser, 1995) the market is subject to instability and oscillation due to the erratic and complex dynamics of its stock (Ahmed & Rosser, 1995). Furthermore, evidence of inside traders in Pakistani stock market is another factor price manipulations and abnormal profit earnings in the markets (Khwaja & Mian, 2005). Cooray & Wickramasighe (2007) examined Pakistani stock market along with three other South Asian markets and witnessed weak-form efficiency in Pakistani stock market. Mustafa and Nishat (2007) also confirmed the presence of weak-form efficiency in Pakistan stock market after adjustment for thin trading. However, serial correlation and volatility clustering was found in the Pakistani stock market by using cointegration test, variance ratio test, runs tests and GARCH (Haque et al., 2011; Mishra, 2011). However, volatility was found declining with the imposition of circuit breakers in the markets and switching on to T+3 from T+2 (Hameed & Ashraf, 2006). Volatility is highly persistent in KSE-100 index and least persistent in KSE-30 index; two most traded indices of Pakistani stock market (Shamshir & Mustafa, 2014).

Quite mixed results have been found in various studies conducted on diversified Asian markets depending on; size of the markets, market capital, trading volume, trading process, infrequent trading, influence of inside trader, the level of manipulation capacity, financial liberalization and integration, rules and regulations and various methodologies applied. But mostly Asian markets are found to be weak-form inefficient with absence of random walk.

## SUMMARY

Informational efficiency and random walk in stock markets has always been a controversial issue but at the same time supreme focus of interest amongst researchers and investors in the share market since the seminal work of Fama (1965a). This study aimed at revisiting and divulging the existing empirical evidence regarding the informational efficiency and random walk in stock markets of developed and emergent markets. The critical analysis of statistical tools used is out of the purview of this study. Earlier studies were based on the examination of the phenomenon in developed markets. However, examination of efficiency on emergent markets received particular attention of the researcher after the huge inflow of capital in these markets

as a result financial liberalization. Empirical evidence in favour or against EMH can be considered a major contribution towards the strategic trading adeptness of a portfolio manager and of a proficient investor. Mixed results for efficiency and random walk revealed from the review of large amount of literature in case of developed and emerging markets. Existence of random walk was found in US financial markets (Lee, 1992; Choudhry, 1994), while French (1980); Poterba & Summers (1986;1988) rejected random walk for US markets. On the other hand Nakamura and Small (2007) found random walk when “small-shuffle surrogate” method was applied on US stock market data. Similarly, for UK financial markets random walk was not rejected (Lee, 1992; Poon, 1996; Chan et al., 1997; Worthington & Higgs, 2004; Borges, 2010). While Al-Loughani & Chappell (1997) found no evidence of random walk for UK stock exchange.

Highly contradictory results have been found in case of emerging markets depending on the size of market, influence of insider trader, market integration, liberalization, trading volume, trading process, and infrequent trading. Various factors are identified for stock market inefficiency in various studies in emerging markets. Weak institutions (Johnson & Mitton, 2003; Fisman, 2001; Bertrand et al., 2002), weak property rights protection, and political shocks (Morck et al., 2000) broker and insider influences (Khwaja & Mian, 2005; Siddiqi, 2007; Phan & Zhou , 2014) size of stock market (Lagoarde-Segot & Lucey, 2008), volume of turn over (Smith & Ryoo, 2003), market manipulation capacity (Magnusson & Wydick , 2002). The markets of Nigeria, Namibia, Kenya & Zimbabwe and MENA stock markets amongst the African markets revealed traces of efficiency with the passage of time due to improvements in the trading processes, integration with much developed markets, size of the markets, and corporate governance (Lagoarde-Segot & Lucey, 2008; Emenike, 2010; Ntim et al., 2011). But opposite results have been found in case of China’s class ‘B’ and ‘A’ shares. Return series of class ‘B’ shares having international linkages and international investors were found inefficient, while of class ‘A’ shares were found efficient despite of having only domestic investor and trade only in local currency (Charles & Darne, 2009). Similarly, Kim & Shamsuddin (2008) investigated the effects of liberalization and Asian financial crises on the efficiency of Asian emerging markets and found quite astounding results. Their study revealed that markets of Indonesia, Malaysia and Philippines remained inefficient even after liberalization of these markets in eighties. On the other hand Singaporean and Thai markets became efficient after Asian financial crises of nineties.

Laurence (1986), identified that index level returns may result in misleading findings about efficiency due to the thinly traded emerging markets. Abraham et al. (2002) found three Gulf stock markets of Kuwait, Saudi Arabia, and Bahrain weak-form efficient when adjusted for

thin trading. Similarly, Mustafa & Nishat (2007) found efficiency in Karachi stock market when adjusted for thin trading.

Choudhuri & Wu (2003) recommended 'structural breaks' in returns series with the occurrence of economic and political event(s) that may have the tendency to change the behaviour of stock markets. In that case ignoring the structural break(s) may result in misguided inferences about efficiency.

Various studies have employed various techniques for investigating serial correlation and market efficiency levels in emerging markets. Lots of studies used cointegration test, Lo & MacKinlay (1988) variance ratio test, multiple variance ratio tests of Chow & Denning (1993), runs test for testing serial correlation. ADF unit root test and (PP) test for finding out weak-form efficiency and GARCH (1,1) for determining time varying variance. Levels of efficiency and existence or non-existence of random walk is highly sensitive to the methodology used (Areal & Armada, 2002). For example, Istanbul stock exchange was found weak-form efficient by applying variance ratio test while found inefficient when unit root test was applied (Kapusuzoglu, 2013). Similarly, in another study rejection of random walk hypothesis was concluded for African emerging markets by employing variance ratio test (Smith et al., 2002), while presence of weak-form efficiency was noticed in the same era in African markets after using partial auto-correlation function and Box-Pierce Q-statistics (Magnusson & Wydick, 2002). Rejection of random walk in major Asian emerging stock markets was observed when variance ratio test of Lo & Mackinlay (1988) was used (Huang, 1995) and runs test suggested weak-form efficiency in most of the emerging markets (Karemera et al., 1999). Conversely, some Latin American emerging markets when tested with variance ratio test, serial correlation was found. And the same countries were found weak-form efficient for the same period when runs test was applied (Urrutia, 1995). Kim & Shamsuddin (2008) preferred multiple variance ratio test based on wild bootstrap over conventional Chow-Denning variance test, when the sample size is not very big. Mobarak & Keasey (2000) found Dhaka stock exchange inefficient by applying autocorrelation test, runs test and autoregression test, while Islam & Khaled (2005) applied heteroscedasticity-robust Box-Pierce test which reversed the results.

Serial correlation and volatility clustering was found in most of the studies on Pakistani stock market by using cointegration test, variance ratio test, runs tests and GARCH (1,1) model. In a comparative study between different indices of Karachi stock market. Shamshir & Mustafa (2014) by using GARCH (1,1) model found least persistent shocks in KSE-30 index and highest persistent volatility in KSE-100 index. However, further studies using weekly and monthly stock returns of share markets are suggested.

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