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Is Dhaka Stock Exchange An Efficient Capital Market? - Evidence Of Weak-Form Efficient Market Hypothesis

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Abstract:
This paper uses Random walk hypothesis to test the efficiency of Dhaka Stock Exchange Ltd (DSE), an emerging capital market of Bangladesh. In this paper, with Runs test, Dickey-Fuller Unit root test have been processed and analyzed to observed the behavior of daily return of Dhaka Stock Exchange indices during the study period. The sample includes the daily price indices of all securities listed on the DSE general, DSI (All Share), DSE-30, and Daily indices listed with DSE. As a proxy of movement of individual stock prices, daily closing prices of 30 companies operating in the Banking sector has been analyzed. The results provide evidence that DSE does not follow the random walk model and so DSE is not efficient even in weak form. To improve this capital market, the timely disclosure and dissemination of information to the shareholders and investors on the performance of the listed companies should be given emphasized.

Key-words: *Efficient market hypothesis (EMH), random walk hypothesis, Serial Correlation Test, Run-Test, Unit-root-test.*

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I. Introduction

In finance, the efficient-market hypothesis (EMH) is a very well-known issue. The concept of an efficient capital market has been one of the dominant themes in academic literature since the 1960s. According to Elton and Gruber, "When someone refers to efficient capital markets, they mean that security prices fully reflect all available information". According to Eugene F. Fama, "in an efficient market, prices fully reflect all available information. The prices of securities observed at any time are based on correct evaluation of all information available at that time." The Random Walk Theory presupposes that the stock markets are so efficient and competitive that there is immediate adjustment. That is the result of good communication system through which information can be spread almost anywhere in the country instantaneously. Thus, this theory is based on the hypothesis that the stock markets are efficient. Hence, this theory later came to be known as the Efficient Market Hypothesis (EMH). It asserts that financial markets are "informationally efficient". In consequence of this, one cannot consistently achieve returns in excess of average market returns on a risk-adjusted basis, given the information available at the time the investment is made.

Efficient market hypothesis is an investment theory that states it is impossible to "beat the market" because stock market efficiency causes existing share prices to always incorporate and reflect all relevant information. According to the EMH, stocks always trade at their fair value on stock exchanges, making it impossible for investors to either purchase undervalued stocks or sell stocks for inflated prices. As such, it should be impossible to outperform the overall market through expert stock selection or market timing, and that the only way an investor can possibly obtain higher returns is by purchasing riskier investments. Although it is a cornerstone of modern financial theory, the EMH is highly controversial and often disputed. Believers argue it is pointless to search for undervalued stocks or to try to predict trends in the market through either fundamental or technical analysis. Meanwhile, academics point to a large body of evidence in support of EMH, an equal amount of dissension also exists. For example, investors, such as Warren Buffett have consistently beaten the

market over long periods of time, which by definition is impossible according to the EMH. Detractors of the EMH also point to events, such as some famous stock market crash.

Dhaka Stock Exchange has been the subject of significant changes in recent periods. DSE has also taken significant steps towards the development of its capital market. The stock market is one of the most important sources for companies to raise money. This allows businesses to be publicly traded, or raise additional capital for expansion by selling shares of ownership of the company in a public market. The liquidity that an exchange provides affords investors the ability to quickly and easily sell securities. This is an attractive feature of investing in stocks, compared to other less liquid investments. History has shown that the price of shares and other assets is an important part of the dynamics of economic activity, and can influence or be an indicator of social mood. Rising share prices, for instance, tend to be associated with increased business investment and vice versa. Measures have taken for privatization, Economic liberalization, and relaxation of foreign exchange controls and easing of regulations on profit repatriations.

The capital market plays various roles in an economy. It acts as an intermediary between surplus units and deficit units of the economy and facilitates savings into investments. By also providing liquidity of these investments, the capital market ensures optimum allocation of resources. The term efficiency is used to explain a market in which relevant information is impounded into the price of financial assets.

The rest of the paper is designed as follows: Section II focuses on the review of the literature. Section III exhibits the overview of the efficient market hypothesis which is followed by tests of market hypothesis in section IV. Section V devotes to the method of the collection of data and explain the methodology of the research. Analysis of data and findings of the research are furnished in section VI. Section VII concludes the study and provides the policy recommendation.

II. Literature Review

During the past half a century, there are many articles and papers examined the random walk characteristics in all kinds of markets. Evidence from International Real Estate Markets was also taken. In some paper, they used the Augmented Dickey-Fuller Unit root test to test the Real estate stock market indices and got the conclusion which demonstrates that both in real estate and broader stock markets in Europe, Asia and North America exhibit random walk behavior. They said that even in the less or not efficient markets like China, it also may perform to be random walk characteristic. That is random walk exit in all kinds of markets-at least in real estate stock markets and the stock markets in Europe, Asia and America are co-integrated in the long run. However, many studies by Godfrey et al. (1964), Jensen and Bennington (1970), Obaidullah (1990), Hoque (1992) argue that in efficient markets, it is not the completely random walk characteristic, not even less and not efficient markets. So random walk characteristic does not exist in any kinds of market efficiency. A fundamental question concerning capital markets is their efficiency. The term efficiency is important in the area of finance and economics. The findings from the empirical testing of the efficient market hypothesis (i.e., random walk) with stock prices have been mixed (Hussain el al.). According to Samuelson (1965) and Fama (1976), under the 'efficient market hypothesis' (EMH), stock market prices must always show a full reflection of all available and relevant information and should follow a random walk process. Fama (1976), in the most comprehensive study on the issue, claims to have found strong and voluminous evidence in support of the Random Walk hypothesis. In DSE, there are few studies have been conducted for market efficiency. Hassan et al. (1999) have a study on time-varying risk return relationship between stock prices and returns by utilizing a unique daily data set. They find that DSE equity returns held positive skewness, excess kurtosis and deviation from normality and the returns displayed significant serial correlation, implying the stock market is inefficient. Mobarek et al. (2008) investigates that Dhaka Stock Exchange does not follow random walk model and there is significant autocorrelation at different lag causes to DSE is not week-form efficient. Kader and Rahman (2005) find no evidence that Dhaka Stock Exchange is weak-form efficient by testing whether any technical trading strategy yielded abnormal profit or not by using technical trading rule (filter rule). Islam and Khaled (2005) analyze on the predictability of the share price in Dhaka Stock Exchange prior to the boom in 1996 and by using heteroscedasticity-robust tests, they find evidence in favor of short-term predictability of share prices in the Dhaka Stock Exchange prior to the 1996 boom, but not during the post-crash period. Alam at el. (2007) examine the linear relationship between share price and interest rate, share price and growth of interest rate, growth of share price and interest rate, and growth of share price and growth of interest rate through ordinary least- square (OLS) regression. For all of the cases, included and excluded outlier, they find that interest rate has significant negative relationship with share price and growth of interest rate has significant negative relationship with growth of share price in Dhaka Stock Market so that it is not weak-form efficient. Study by Uddin and Shakila (2008), Bala (1993) also show that Dhaka Stock Exchange is not weak-form efficient through analyzing the randomness of market return, market risk-return relationships and the frequency of the market depth or liquidity. Granger (1970) seek evidence supporting the existence of market efficiency in the Dhaka Stock Exchange. Islam (1999) experiences that underpricing of shares by Bangladeshi issuers and overpricing of

initial public offerings contribute to the abnormal initial returns implying that Bangladeshi stock market is subject to some inefficiencies under certain circumstances. Such inefficiencies may not always be sole determinants in the valuation of the shares in the market. Safa and Khan (1999) analyze the efficiency of Dhaka Stock Exchange by testing the weak-form of efficiency inferencing that the same is not efficient as the changes in the stock prices are not statistically independent and random. A very few researches have been conducted regarding the market efficiency as well as price behavior of firms listed with Dhaka Stock Exchange. A few important studies to test whether the Bangladesh stock markets are efficient have been conducted during the last two decades. A descriptive study of price changes may provide some inside into how investors react regarding the movements of the price changes. This study is an original and unique empirical investigation the object of which is test the efficiency of the capital market in the light of weak-form efficiency of Dhaka Stock Exchange, the emerging capital market of Bangladesh. No other study has been done elsewhere like the present one. The sample includes the daily price indices of all securities listed on the DSE for the period from January, 2014 to December, 2023. Again, as a proxy of the movement of individual stock prices, daily closing prices of 30 companies operating in the Banking sector of DSE has been analyzed. This industry is chosen as this sector is rapidly growing in Bangladesh stock markets.

III. Overview Of The Efficient Market Hypothesis

Efficient Market Hypothesis is one of the well-known methods for measuring the future value of stock prices. According to the hypothesis, a market is called to be efficient if the prices of the securities are formed on the basis of all disposable information. Stock markets are assumed to be efficient only if all relevant information about company is incorporated in stock price of this company. Business cycle theoreticians assume that multiple regression model can be used for forecasting business cycle movement. Scientist Maurice Kendall has tested a computer model for predicting share prices in 1953. Results were not satisfactory. Random movement of share process, their unpredictability goes in favor of EMH as this example shows that only new information can affect share price. According to EMH if there is a possibility to predict the future prices of shares, that is the first sign of an inefficient market. American economist Eugene F. Fama (1995a), proposes three types of market efficiency as:

i] Weak-form efficient market dealing with the information regarding the past sequence of the security price movements.

ii] Semi-strong form efficient market dealing with the publicly available information.

iii] Strong-from efficient market dealing with all the information both public and private (or inside information).

***Weak-form efficiency*:** Weak-form efficiency claims that all past prices of a stock are reflected in today's stock price. Therefore, technical analysis cannot be used to predict and beat a market. The weak-form efficient market hypothesis (EMH) implies that the market is efficient, reflecting all market information. This hypothesis assumes that the rates of return on the market should be independent; past rates of return have no effect on future rates. Given this assumption, rules: such as the one trader uses to buy or sell a stock, are invalid.

***Semi-strong efficiency*:** Semi-strong efficiency implies that all public information is calculated into a stock's current share price. It means that neither fundamental nor technical analysis can be used to achieve superior gains. The semi-strong form efficient market hypothesis (EMH) implies that the market is efficient reflecting all publicly available information. This hypothesis assumes that stocks adjust quickly to absorb new information. The semi-strong form EMH also incorporates the weak-form hypothesis. Given the assumption that stock prices reflect all new available information and investors purchase stocks after this information is released, an investor cannot benefit over and above the market by trading on new information.

***Strong-form efficiency*:** Strong-form efficiency is the strongest version of market efficiency. Strong-form efficiency market hypothesis states that all information in a market, whether public or private, is accounted for in a stock price. Random walk theory claims that stock market can be analyzed as random walk according to the facts as:

- Efficient markets respond very fast to new information;
- If the share price is a reflection of all available information, it is impossible to use that information for market predictions;
- It is impossible to predict market movement other than randomly.

There are a large number of direct and indirect tests as evidence for or against the EMH. Famous economists Krishna and Mukherjee (1971), Gupta and Gupta (1991), Mittal (1995) provide some basic explanations of what makes markets inefficient. This can be explained as the belief that what "goes up must come down." This phenomenon exhibits itself amongst investors whose stocks' price has risen for a period of time and so is deemed to be "due for a fall". Generally speaking, by knowing the relationship of the current

price to recent price movements, one can better estimate the likely direction of future price movements, i.e., historical data such as price movement can be used to predict future prices (Kulkarni, 1978). This provides credibility to the argument that the market is predictable and inefficient. Therefore, the issue is to see whether the stock market is predictable or not by detecting serial dependence of stock returns. Very popular tests of market efficiency presented in this paper are - Augmented Dickey-Fuller (ADF) test, Run test and Autocorrelation Function (ACF) test. Research will test if some well-known anomalies on the capital market of Montenegro do exist in order to show if critics of EMH are justifiable. Some of the main anomalies that have been identified are as follows: "January effect", "Monday effect", "Holiday effect" and "Turn-of-the-month effect". The strong-form EMH implies that the market is efficient if it reflects all information both public and private, building and incorporating the weak-form EMH and the semi-strong form EMH. Given the assumption that stock prices reflect all information (public as well as private) no investor would be able to profit above the average investor even if s/he was given new information.

IV. Tests Of The Market Efficiency

Empirical Tests of Weak-Form Efficiency

The weak-form of the EMH says that the current prices of stocks already fully reflect all the information that is contained in the historical sequence of prices (Chaudhari, 1991). The new price movements are completely random. They are produced by new pieces of information and are not related or dependent on past price movements. Therefore, there is no benefit in studying the historical sequence of prices to gain abnormal returns from trading in securities (Mittal, 1995). This implies that technical analysis, which relies on charts of price movements in the past, is not a meaningful analysis for making abnormal trading profits. Thus, Ranganatham and Subramanian (1993a) argue that the weak-form of the EMH is a direct repudiation of technical analysis. Two approaches have been used to test the weak-form of the EMH. One approach looks for statistically significant patterns in security price changes. The alternative approach searches for profitable short-term trading rules. They are:

a) Serial Correlation Test: Since the weak-form of the EMH postulates independence between successive price changes, such independence or randomness in stock price movements can be tested by calculating the correlation between price changes in one period and changes for the same stock in another period. The correlation coefficient can take on a value ranging from – 1 to + 1; a positive number indicates a direct (positive) relation; a negative value implies an inverse relationship and a value close to zero implies no relationship. Thus, if correlation coefficient is close to zero, the price changes can be considered to be serially independent.

b) Run test: It is another approach to test the randomness in stock price movements. Here, the absolute values of price changes are ignored, only the direction of change is considered. An increase in price is represented by "+" signs. The decrease is represented by "–" sign. When there is no change in prices, it is represented by "0". A consecutive sequence or the same sign is considered as a run. Here, the actual number of runs observed in a series of stock price movements is compared with the number of runs in a randomly generated number series. If no significant differences are found, then the security price changes are considered to be random in nature.

- **Filler test:** If stock price changes are random in nature, it would be extremely difficult to develop successful mechanical trading systems. Filter tests have been developed as direct tests of specific mechanical trading strategies to examine their validity and usefulness.
- **Distribution Pattern:** It is a rule of statistics that the distribution of random occurrences will conform to a normal distribution. Then if price changes are random, their distribution should also be approximately normal. Therefore, the distribution of price changes can be studied to test the randomness or otherwise of stock price movements.

Semi-Strong Form Tests

The semi-strong form of the efficient market hypothesis says that current prices of stock not only affect all informational content of historical prices but also reflect all publicly available information about the company being studied. Examples of publicly available information are: corporate annual reports, company announcements, press releases, announcements of forthcoming dividends, stock spills, etc. This hypothesis maintains that as soon as the information becomes public, the stock prices change and absorb the full information.

a) Event Tests: The semi-strong form assumes that the market is reflective of all publicly available information. An event test analyzes the security both before and after an event, such as earnings. The idea behind the event test is that an investor will not be able to reap an above average return by trading on an event.

b) Regression/Time Series Tests: A time series forecasts returns based on historical data. As a result, an investor should not be able to achieve an abnormal return using this method.

Strong-Form Tests

The strong-form EMH represents the extreme case of market efficiency. The strong-form of the efficient market hypothesis maintains that the current security prices reflect all information both publicly available and inside information. This implies that whether the information is public or inside, can be used to earn superior returns consistently. Given that the strong-form implies that the market is reflective of all information, both public and private, the tests for the strong-form center around groups of investors with excess information. These investors are as follows:

- **Insiders**
  Insiders to a company, such as senior managers, major stockholders, directors, auditor have the access to inside information. Regulations of Bangladesh Securities and Exchange Commission (BSEC) forbid insiders for using this information to achieve abnormal returns.
- **ExchangeSpecialists**
  An exchange specialist recalls runs on the orders for a specific equity. It has been found however, that exchange specialists can achieve above average returns with this specific order information.
- **Analysts**
  The equity analysts have been an interesting test. It analyzes whether an analyst's opinion can help an investor achieve above average returns. Analysts do typically cause movements in the equities they focus on.
- **InstitutionalMoneyManagers**
  Institutional money managers, working for mutual funds, pensions and other types of institutional accounts, have been found to have typically not perform above the overall market benchmark on a consistent basis.

The results of research on strong-form of efficient market hypothesis may be summarized as follows:

- Inside information can be used to earn above average returns.
- Mutual funds and investment analysts have not been able to earn superior returns by using their private information.

V. Data And Research Methodology

i] Collection of Data

This section of the study offers a brief description of the empirical setting and the data set. Monthly observations for the period February, 2014 through December, 2021 of DSE All Share Price Index (DSI) has been used to investigate the turn of the year effect in DSE. DSI is a value-weighted index which includes all the stocks listed on the DSE. All the index data have been collected from the Dhaka Stock Exchange library.

ii] Model Specification

Monthly return of DSI is calculated as the natural log [today's Index Value / previous day's Index Value]:

$R_t = \text{In } [P_t/P_{t-1}]$

where;

R_t = Monthly return of DSI,

P_t = Closing value of DSI at time t,

P_{t-1} = Closing value of DSI at time P_{t-1}.

The reasons to choose logarithm returns over general return are justified by both theoretically and empirically. Theoretically, logarithmic returns are analytically more tractable when linking together sub-period returns to form returns over longer intervals. Empirically, logarithmic returns are more likely to be normally distributed which is prior condition of standard statistical techniques (Fama, 1998).

To test the existence of monthly seasonality, the following basic regression model is used:

$$R_t = C + \beta_2 D_{Feb} + \beta_3 D_{Mar} + \beta_4 D_{Apr} + \beta_5 D_{May} + \beta_6 D_{Jun} + \beta_7 D_{Jul} + \beta_8 D_{Aug} + \beta_9 D_{Sep} + \beta_{10} D_{Oct} + \beta_{11} D_{Nov} + \beta_{12} D_{Dec} + \mu_t$$

where;

R_t is the monthly return and the intercept term,

C indicates the average return for January,

D_i refers a dummy variable that takes the value of 1 in month and i zero otherwise (For instance, D_{Feb} = 1 if the return is on February and 0 otherwise; D_{Mar} = 1 if the return is on March and 0 otherwise; D_{Dec} = 1 if the return is on December and 0 otherwise and so on),

β_2 to β_{12} refer OLS coefficients indicating the difference in return between January and the i th month of the year.

μ_t refers to the stochastic disturbance term in the model.

Runs test

This method was thought to be the least restrictive method for the test of the random walk and market efficiency and also it was one of the earliest methods used for the randomness tests by scholars. However, it is still just a necessary condition for the certification of random walk characteristic and it is not sufficient. So, all the results got only according to this test cannot be sufficient and convincible. During the last more than 30 years during the undeveloped markets such as Latin America, China, India there are a lot of scholars who used only this one method to do the test for the random walk. This is not scientific. Runs test is to judge whether or not the successive increasing or decreasing of the indices returns is random that is if the positive and negative value comes out with equal or lies within an efficient scope then the market can be called to be efficient.

The above mentioned runs test is to determine whether successive price changes are independent or not. If they are not independent then it must not conform to random walk characteristic. The concept of run-test postulates that a lots of sequences of successive price changes with the same sign in a sequence of price changes. Successive price changes should be random and not dependent other price changes if the series is random. In another words, the positive and negative value of the returns should be equal. According to this state we can construct a null hypothesis of randomness. Specific procession is this: Each return (the difference between two neighboring days' indices) or each price is classified to be a category according to its sign with the respect to the mean value of the return or the price. That is, a positive change is when the return or price is larger than the mean value while a negative change is when the return or price is less than the mean value. Of course, the zero change is those values when the return or price equals the mean value and it can be classified to be both of the kinds.

To the real test we can denote the letter n_1 to be each return or price that equals or more than the mean value and let the letter n_2 to be the returns or prices that are below the mean. The test statistic is TS and N is the total number of the data. For large sample sizes, where both n_1 and n_2 are greater than twenty, the test statistic is approximately normally distributed: n_1 is the number of return equal or more than the mean value of the indices in the stock market. n_2 is the number of returns less than the mean value of the indices in the stock market. And N is the total number of the data. TS is the statistical test of the runs in the indices which should be approximately normally distributed. Let G be the number of runs then the probability $P_{(R)}$ can be established as following:

$$\mu_G = \frac{2n_1 n_2}{n_1 + n_2} + 1; \qquad \sigma_G = \sqrt{\frac{(2n_1 n_2)(2n_1 n_2 - n_1 - n_2)}{(n_1 + n_2)^2 (n_1 + n_2 - 1)}} \qquad TS = \frac{G - \mu_G}{\sigma_G}$$

The critical value is from z table. where, N = total number of returns; n_1 = total number of returns equal and more than the mean value; n_2 = total number of returns less than the mean value. From this test we can have a preliminary idea to a market's randomness characteristics. That is if the market can not conform to this test, then it must not be called to be even weak-form efficiency. However, the markets conforming to this test may be still not efficient because of its looseness and not strict enough. So, in order to test a market's efficiency, we must test the market price indices using the following method.

Dickey-Fuller Unit root test:

There has been a stochastic process to describe autoregressive model that is there is memory or affection in the system in which it can generate internal dynamics. I think it is a good description to the model because the model is used to analyze the previous inner affections on the current conditions. Usually, the data used in the scientific experiments are demanded to be stationary only with this characteristic the studies are meaningful. So, if the studied data are non-stationary then the results have been deviated from original directions. Unit Root test is the method to inspect this kind of stationary characteristic. First let us have a look at the formal definition to the Unit Root test. A Unit Root test tests whether a time series variable is non-stationary using an autoregressive model. Unit Root test can be seemed to be autocorrelation that the order is larger than 1. In another way, a Unit Root test is a statistical test for the proposition that in an autoregressive statistical model of a time series, the autoregressive parameter is 1.

Conceptually, the Unit Root tests are straightforward. In practice, however, there are a number of difficulties. Firstly, Unit Root tests generally have nonstandard and non-normal asymptotic distributions. Secondly, their distributions are functions of standard Brownian motions and do not have convenient closed form expressions. Consequently, critical values must be calculated. Thirdly, the distributions are affected by the inclusion of deterministic terms for example the constant term, time trend. To test the EMH (Efficient Market Hypothesis) of DSE, the tools of stationary of share prices are tested by using daily market returns. DSE prepares daily price index from daily weighted-average price of daily transaction of each stock. Daily market returns at time t (R_{mt}) are calculated from the daily price indices such as:

$R_{mt} = \text{Ln} [PI_t / PI_{t-1}]$

where,
R_{mt} = market return at period t,
PI_t = price index at period t,
PI_{t-1} = the price index at period t – 1 and
Ln = natural log.

This calculation of market return is used in the efficiency test. The reasons to take logarithm returns are justified by both theoretically and empirically. Theoretically, logarithmic returns are analytically more tractable when linking returns over longer intervals. Empirically, logarithmic returns are more likely to be normally distributed which is a prior condition of standard statistical techniques (Jensen and Bennington, 1970). Unit Root test is symbolized as:

$$Y_t = \alpha + Y_{t-1} + \mu_t$$

where μ_t, is the error term with zero mean, constant variance, α is the intercept. Now the run is tested by the regression as:

$$Y_t = \alpha + \rho Y_{t-1} + \mu_t$$

The above equation assumes that $\rho = 1$ meaning that unit root is present and the series are random walk implying non-stationarity. If Y has a unit root, then ΔY will be stationary for this reason and therefore:

$$\Delta Y_t = \alpha + (\rho - 1) Y_{t-1} + \mu_t$$

For simplifying, the following equation can be assumed:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \mu_t$$

where $\delta = (\rho - 1)$ and Δ is the difference. Through adding lagged difference terms, modification can be obtained as:

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \alpha_i \Sigma \Delta Y_{t-1} + \varepsilon_t$$

where,
$\Delta Y_{t-1} = Y_{t-1} - Y_{t-2}$ etc.,
$\rho = 1$ and
$\delta = 0$.

Then proceed to add enough lagged difference terms until the error term, ε_t, becomes serially independent. This modification is the Augmented Dickey-Fuller test.

Hypothesis

H_0: Stock returns follow random walk (non-stationary)
H_1: Stock returns do not follow random return (stationary)

The critical values of the tests are simulated under the null that Y_t is a drift-less random walk. Moreover, the critical value will change depending on

- if both α and t are included,
- if only α is included, and
- no constant or time trend is included.

This test is very sensitive to deviations from Y_t being a random walk. If H_0 is rejected, it would be simple to conclude that Y_t does not contain a unit root.

VI. Analysis Of Data And Findings:

Results and Analysis from Runs test

This section of the paper displays the results got from Runs test using Minitab 15 software and then makes the analysis of the results. First let us have a look at Runs test. Runs Test (please see Table 1 in the appendix) has been observed that is the least restricted rules for judging the random walk and market efficiency because runs test is neither necessary nor sufficient. In another words, even if a market conforms to the runs test this can denote nothing but only that the market may be character of random walk. So, in my opinion, this test shows nothing meaningful in the usage of the academic purpose but just a kind of early method in use. The study attempts to conduct runs tests to three index values of Dhaka Stock Exchange like DSE General Index, DSI (All Share) Index, and DSE 30 Index and the results are shown in Table-1 in the appendix. The results show that the indices have much more than 20 cases so the results are dependable. Computation for TS statistics is made at 95% confidence interval. The critical number is 1.732. As absolute value of TS statistics of all indices shown in Table 1 along with p-value of zero which is smaller than significance level of 5% then on the basis of runs test, we can reject that there existed Random walk characteristic theoretically and vice versa. That is stock returns of DSE do not follow Random walk hypothesis. In Table 2 in the appendix, the study has conducted Runs test on all Banking firms (exhibited in appendix) listed with DSE, as a proxy of all companies**.** From the analysis of the results, it can be depicted that all the banks have much more than 20 cases so the results are dependable. Computation for TS statistics is also made at 95% confidence interval. The critical number is 1.732. Since the absolute value of the TS statistics of all banks is larger than 1.732 and also p-value is

lower than the significance level of 5% then we can conclude, on the basis of runs test, that DSE does not follow Random walk characteristic theoretically and vice versa. That is stock returns of DSE do not follow Random walk hypothesis.

Runs Test on DSE

The runs test has been performed to check the random-walk model or the EMH because this test ignores the properties of distribution of the series. The null hypothesis is that the observed series is a random series. The number of runs is computed as a sequence of the price changes of the same sign. When the expected number of runs is significantly different from the observed number of runs, the test rejects the null hypothesis that the daily returns are random. The runs test converts the total number of runs into a Z statistic. For large samples the Z statistics gives the probability of difference between the actual and expected number of runs. If the Z value is greater than or equal to ± 1.96, the null hypothesis is rejected at 5 percent level of significance. The Results of the runs test on the DSE General daily index and DSE 30 daily index return series for the period of February, 2014 to December, 2021 have been shown below:

Variable	Total number of runs	Z	Asymp Sig (2 tailed)
DES general daily return	455	– 6.764	.000
DSE 30	614	– 8.526	.000

The Z statistics of the runs test of daily market return series are greater than ± 1.96 and negative, the observed number of runs are fewer than the expected number of runs with observed significance level. This actually shows positive autocorrelation within the residuals. In other words, the prices change too seldom and therefore, trends in price changes of the DSE can be identified which in turn means possibility to design profitable trading strategies. Furthermore, if in an application it is found that the number of runs is equal to or less than 9 or equal to or greater than 20, one can reject (at the 5percent level of significance) the hypothesis that the observed sequence is random. The number of runs greater than 20 for both the index returns implies the return series do not follow the assumption of independent relationship of random walk model. Therefore, we can reject the hypothesis that the return series on the DSE follow a random walk pattern.

Results and Analysis from Augmented Dickey-Fuller Unit Root test

In order to obtain a better understanding of the behavior of stock process, a preliminary analysis of the data carried out in this section. The daily data set consists of DSE General Indices, DSI (All share) Indices and DSE 30 indices. Table-3 in the appendix presents the summary of the logarithms of the first differences of the stock price indices. Result shows that the standard deviations of the General stock price indices and DSE 30 indices closely move together while standard deviation of DSI (all share) indices is more than those of the both (DSE General and DSE Table-3 (see in the appendix) presents a summary of descriptive statistics of the daily returns for the DSE General, DSI (all share) and DSE 30 indices. This Table depicts the estimated sample means, maximum, minimum, standard deviation, skewness, kurtosis.30). The lowest mean returns are in DSI (All share) indices (– 0.2252) while it has also highest mean return (0.599033) and logically it has the highest standard deviation (0.020159). Table 4 (in the appendix) presents a summary of descriptive statistics of the daily returns for the sample banks. Sample Means, Maximum, Minimum, Standard Deviation, Skewness, Kurtosis are exhibited in this Table. The lowest mean (– 0.81450) return is with Rupali Bank Limited while BRAC Bank has the highest return (0.83022). Their after, this section examines daily stock returns of DSE General, DSI (all share) and DSE 30 stock price indices for Dhaka Stock Exchange using Eviews 5 software. The result of analysis is compared for the significant of 5% and 1 % with Augmented Dickey-Fuller (ADF) Test statistics table values. A common problem arises in determining the optimal number of lags of the dependent variables. The ADF results are analyzed by using by 10 lags. The ADF test is carried out by both trend and without trend which have been shown in Table 5 and Table 6 respectively in the appendix. ADF (t-value) of DSE General, DSI (all share) and DSE 30 stock price indices are comparing with the Mackinnon Critical values at the 1% and 5% level of significance. ADF calculated values are significant at 1% and 5% significance levels for all 10 degree of freedom (lags) suggests that the return series does not follow random walk hypothesis (as per Table 5 and Table 6 respectively in appendix) which means DSE is not efficient in weak-form. Table 5 and Table 6 showing the movements of the prices of individual stocks of the firms under banking sector listed with DSE are analyzed by taking a proxy of the daily closing prices. The data consists of price of 30 stocks covering the period commencing from February, 2014 to December, 2021. In order to obtain a better understanding of the behavior of stock prices, a preliminary analysis of the data carried out in this section. The statistical output (shown in Table 4) presents the summary for the logarithms of the first differences of the stock price indices or continuously compounding returns. The results of Augmented Dickey-Fuller test used for trend and no trend analysis in Table 7 and Table 8 respectively shown in the appendix. DSE day wise (ADF t-value) value is

comparing with the Mackinnon Critical values at the 1 % and 5 % level of significance. It is observed that ADF calculated values are significant at 1% and 5% levels for all 10 degree of freedom (lags) suggests that the return series does not follow random walk hypothesis (Table 7 and Table 8 in the appendix) which means the individual stock prices in the banking industry listed with DSE does not follow the random walk model. The results from the unit root test, the Augmented Dickey-Fuller (ADF) test on DSE price indices and also on individual stock prices of the proxy companies provide evidence that the Dhaka Stock Exchange is not efficient even in weak-form and it does not follow the random walk model.

VII. Conclusion

Overall results from the empirical analysis suggest that the Dhaka Stock Exchange of Bangladesh is not efficient in weak-form. The primary objective of this paper is to analyze the weak-form efficiency of DSE General, DSI (all share) and DSE 30 index and individual stock prices of the proxy companies (30 companies operating in the Banking industry under DSE). The results of this study show that the hypothesis of randomness of the stock returns are rejected for stock price index changes by using Runs test and at all lags using Augmented Dickey-Fuller test which means Dhaka Stock Exchange is not efficient even in the weak-form. The reason for the market inefficiency is the weak regulatory framework, poor corporate governance, lack of accountability, poor institutional infrastructure, lack of transparency of market transactions, and low level of capacity of major market players. The processing of new information in Bangladesh is rather weak, and may result from large number of non-actively traded shares, and the limited role of mutual funds. As an institutional policy to improve the capital market, the timely disclosure and dissemination of information to the shareholders and investors on the performance of the listed companies should be given emphasized. Using this information to project future returns the traders may able to earn abnormal profits. The EMH has its very own significances and application. This is undoubtedly a very renowned issue in Finance. Basically, it enriches Finance. Investors also can make a great use of it. And various tests have shown various results about stock markets. Proper application of these tests leads to valid hypothesis that can help in investment. DSE also have got tested through numerous techniques. To this end, it is undeniable that how important Efficient Market Hypothesis is. Though a perfectly efficient market doesn't exist, markets close enough to this sure do exist. The implication of the rejection of Randomness (which means weak-form efficiency) for the investors is that they cannot adopt a fair return strategy by holding a well-diversified portfolio in DSE.

Reference

[1] Alam, M. M., Kazi, A. A. And Uddin, M. G. S. (2007). Market Depth And Risk Return Analysis Of Dhaka Stock Exchange: An Empirical Test Of Market Efficiency, Asa Business Review, Vol.- No. 1, Pp. 93-101, July- December.

[2] Bala, S. K. (1993). A Test Of Market Efficiency: A Study Of Dhaka Stock Exchange, Journal Of

[3] Business Administration, Vol.-19, No. 3 & 4.

[4] Chaudhari, S. K. (1991). Short-Run Share Price Behaviour: New Evidence On Weak Form Of Market Efficiency, Vikalpa, Vol.-16, Pp. 17-21.

[5] Fama. E. F. (1965a). The Behavior Of Stock Market Prices, Journal Of Business, Vol.-28, Pp. 34-105.

[6] Fama, E. F. (1976). Efficient Capital Markets: A Review Of Theory And Empirical Work, Journal Of Finance, Vol.-25, May, Pp. 383-417.

[7] Fama, E. F. (1998). Market Efficiency, Long-Term Return, And Behavioral Finance, Journal Of Financial Economics, Vol.-49, Pp. 283-306.

[8] Godfrey, M. D., Granger, C. W. J. And Morgenstern, O. (1964). Random Walk Hypothesis Of Stock Market Behavior, Kyklos, Vol.-17, Pp. 1-30.

[9] Granger, C. W. J. (1970). What The Random Walk Model Does Not Say, Financial Analysts Journal, Vol.-26, Pp. 91-93.

[10] Gupta, O. P. And Gupta, A. (1991). Empirical Study Of Weak Level Efficiency In India, Finance India, Vol-5, Pp. 505-517.

[11] Hassan, M. Kabir, M. Islam, A. And Basher, S. A. (1999). Market Efficiency, Time-Varying Volatility And Equity Returns In Bangladesh Stock Market, Working Paper, York University, Department Of Economics, Revised June, 2002.

[12] Hoque, M. S. (1992). Development Of Capital Market In Bangladesh, Bank Parikrama, Vol.-17, Pp. 10-13.

[13] Hussain, T., Chakraborty, L., And Kabir, M. A. (2008). Is Dhaka Stock Exchange Efficient? An Application Of Technical Trading Rule, International Conference On Recent Development In Statistical Sciences (Icss), Bcfcc, Dhaka, Bangladesh.

[14] Islam, M. S. (1999). The Behavior Of Ipo Underpricing In Bangladesh, Finance And Banking, Vol.-5, Pp. 87-106.

[15] Islam, A And Khaled, M. (2005). Tests Of Weak-Form Efficiency Of The Dhaka Stock Exchange, Journal Of Business Finance & Accounting, Vol.-32 No. 7 & 8, Pp. 1613-1624.

[16] Jensen, M. And Bennington, G. (1970). Random Walks And Technical Theories: Some Additional Evidence, Journal Of Finance, Vol.- 25, Pp. 469-482.

[17] Kader, A. A. And Rahman, M. A. (2005). Testing The Weak-Form Efficiency Of An Emerging Market: Evidence From The Dhaka Stock Exchange Of Bangladesh, Aiub Journal, Vol.-4 No. 2, August.

[18] Krishna, R. N. And Mukherjee, K. (1971). Random Walk Hypothesis: An Empirical Study, Arthaniti, Vol.-14, Pp. 53-58.

[19] Kulkarni, N. S. (1978). Share Price Behavior In India: A Spectral Analysis Of Random Walk Hypothesis, Sankhya: The Indian Journal Of Statistics, Vol.-40, Series D, Pp. 135-162.

[20] Mittal, R. K. (1995). Weak Form Market Efficiency: Empirical Tests On The Indian Stock Market, Prajnan, Vol.-23, Pp. 297-312.

[21] Mobarek, A., Mollah, A. S. And Bhuyan, R. (2008). Market Efficiency In Emerging Stock Market: Evidence From Bangladesh, Journal Of Emerging Market Finance, Vol.-7, Pp. 117-141.

[22] Obaidullah, M. (1990). Stock Market Efficiency In India: A Statistical Inquiry, Chartered Financial Analyst, Vol.-5, Pp. 10-14.

[23] Ranganatham, M. And Subramanian, V. (1993a). Weak Form Of Efficient Market Hypothesis: A Spectral Analytic Investigation, Vikalpa, Vol.-18, Pp. 25-30.
[24] Safa, M. F. A. And Khan, S. H. (1999). Share Market Efficiency-A Test Of Random Walk Hypothesis In The Dhaka Stock Exchange Ltd., Finance And Banking, Vol.-5, Pp. 195-216.
[25] Samuelson, P. A. (1965). Proof That Properly Anticipated Prices Fluctuate Randomly, Industrial Management Review, Vol.-6, Spring, Pp. 41-49.
[26] Uddin, M. G. S. And Shakila, Y. (2008). Random Walk Model In The Dhaka Stock Exchange: An Empirical Evidence Of Daily Return, Journal Of Business Administration, Iba, Dhaka University. Bangladesh.