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Weak form market efficiency test of Bangladesh Stock Exchange: an empirical evidence from Dhaka Stock Exchange and Chittagong Stock Exchange

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ABSTRACT

Investors need to have an idea about stock market before making investment whether the stock markets are efficient or not to take investment decision in stock market. For that reason, measurement of market efficiency of stock market bears significance to investors. Bearing it in mind, the study is undertaken to find out the existence of weak form efficiency prevails in largest stock market of Bangladesh. In order to get perfect result Parametric and Non Parametric tests were conducted of DSE & CSE for 2013 to 2017. It was found from all tests that Dhaka and Chittagong Stock exchange are not weak form efficient. Therefore, the result of the study will act as a helping hand to researchers to find out the reason of Bangladesh stock market not being weak form efficient as well as providing measurement to make the stock market weak form efficient.

ABSTRAK

Investor perlu memiliki gagasan tentang pasar saham sebelum melakukan investasi apakah pasar saham efisien atau tidak untuk mengambil keputusan investasi di pasar saham. Untuk alasan itu, pengukuran efisiensi pasar pasar saham menjadi penting bagi investor. Mengingat pentingnya hal itu, penelitian ini dilakukan untuk mengetahui adanya efisiensi bentuk lemah yang berlaku di pasar saham terbesar Bangladesh. Untuk mendapatkan hasil temuan itu, uji Parametrik dan Non Parametrik dilakukan DSE & CSE dari 2013 sampai 2017. Hasilnya menunjukkan, dari semua uji tes, bahwa Bursa Efek Dhaka dan Chittagong tidak lemah dalam bentuk efisien. Oleh karena itu, hasil penelitian ini bisa dijadikan sebagai strategi bagi para peneliti untuk mengetahui alasan pasar saham Bangladesh tidak lemah dari bentuk efisien serta memberikan pengukuran untuk membuat pasar saham lemah bentuk efisien.

1. INTRODUCTION:

An efficient capital market is essential in the economic growth of Bangladesh. It is a mechanism through which fund can be raised by government or other business enterprises. In the efficient capital market, all the information available should be reflected in the prices of the stock and new available information should be adjusted to the price (Nisar & Hanif, 2012). Cost efficiency is the primary concentration of the present efficient capital market (Blume, Durlauf, 2008). The term Efficient Market was given by an American economist Eugene Fama in early 60's. He opined efficient market as the market which makes adjustment to newly available

information. Market efficiency hypothesis predicates that security prices mull over all information backed by it.

It is assumed for the hypothesis that the information and the trading cost i.e. the cost of getting prices to reflect information are always zero (Grossman and Stieglitz, 1980). Yet, there are three forms of market efficiency measures such as weak form efficiency, semi-strong form efficiency, and strong form efficiency. Less developed markets due to lack of information are better suited to weak form of efficiency rather than semi-strong & strong form of efficiency. In an inefficient market, return is assumed to be higher. The weak-form of EMH

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states that the market is efficient and reflects all market information. This means that the rates of return for the market ought to be free; past rates of return have no impact for future rates (Fama, 1970). Bangladesh as a developing country should try to see weak form efficiency is consistently prevailing in existing two stock exchanges: Dhaka Stock Exchange & Chittagong Stock Exchange. Although there are previous works done on this topic but market efficiency is changing. This is a new work done on the newly introduced DSEX and CSCX index. So the study main objective is to explore whether the stock market: Dhaka Stock Exchange and Chittagong Stock Exchange are weak form of efficient.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

Several studies were conducted for testing market efficiency by researchers all over the World. Their study found different types of results. A study on weak form efficiency test of twenty one stocks listed on Nigerian stock exchange for 1978 to 1979 was done by (Samuels & Yacout, 1981). The study took the weekly price of stock exchange. Autocorrelation tests were conducted. The result did not find the existence of random walk behavior of the stock price and concluded that the Nigerian stock market is weak-form efficient. Another study on Taiwan stock exchange from 1967 to 1993 by Fawson, Glover, Fang and Chang (1996) were undertaken by conducting run test, unit root test, the Ljung-Box Q by taking monthly data showed the existence of weak form efficiency. A similar type of result also found by (Moustafa, 2004) in UAE stock exchange from 2001 to 2003. The study took 43 stocks of UAE stock exchange and noticed the absence of normal distribution.

Stock markets of Turkey and Jordan also showed the absence of weak form efficiency in the study of (El-Erian and Kumar, 1995). Run test and serial correlations test were performed by them to find out the result. Another study conducted on Kuala Lumpur Stock Exchange by (Barnes, 1986) revealed the absence of the weak form efficiency. To find the existence of random walk behavior of Shanghai stock exchange & Shenzhen stock exchange research was conducted by (Darrat and Zhong, 2000). The study applied variance ratio test & model comparison method. The research revealed that variance ratio test & model comparison method did not follow a random walk and are not weak form efficient. A study on South Asian securities exchanges of Bangladesh, India, Pakistan, and

Srilanka was done by Cooray and Wickermasigle, (2005) with applying the unit root tests and Elliot-Rothenber-Stock (ERS) test. The result indicated that Bangladesh stock market was not weak form efficient.

Similar types of study by (Mobarek and Keavin, 2000) on Dhaka stock exchange for 1988 to 1997 with parametric and non-parametric test reveal autocorrelation at different lags which dismiss the existence of weak form efficiency. A large study conducted on Kuwait, Saudi Arabia and Bahrain stock exchange by (Abraham, Seyyed, and Al-sakran, 2002) with variance ratio and runs tests for October 1992 to December 1998. Weekly data were taken from the above mentioned stock exchanges. The result of the test dismissed the random walk hypothesis. A similar study on Nigeria, Ghana and Zimbabwe stock exchange by (Magnusson and Wydick, 2002) with autocorrelation test found significant correlations which indicate the absence of weak form efficiency.

To test the weak form of the efficiency of Bombay Stock Exchange and National Stock Exchange of India (Basu dan Gupta 2007) conducted a study for period 1991 and 2006 by taking daily data. Unit root tests named ADF, PP, and KPSS revealed National Stock Exchange and Bombay Stock Exchange are not weak form efficient. Another test on Palestinian stock exchange by (Awad and Daraghma, 2009) with Augmented Dickey fuller Test, Phillips-Perron test, unit root test, serial correlations and runs test also found the absence of weak form efficiency. Autocorrelation test, Augmented Dickey Fuller test, Phillips Perron test, ARIMA models & GARCH models were applied by (Hossain and Uddin, 2011) to test the weak form efficiency on index of Dhaka Stock Exchange found absence of weak form efficiency. Studies done by (Siddik and Azam, 2011), (Ali, 2012), (Alom and Raquib 2014) also found the stock exchange of Bangladesh has absence of weak form efficient.

3. RESEARCH METHOD:

Population and Sample:

The population and sample were collected from website of Dhaka and Chittagong Stock Exchange for period 2013 and 2017.

Types and Source of Research Data:

Time Series Data was being used in the study. Secondary Data were collected on daily basis from the website of Dhaka and Chittagong stock exchange. In case of DSEX and CSCX index, daily data has been taken from 27 January 2013 to 31 August 2017,

and from 1 January 2013 to 31 August 2017.

Analysis technique:

As weak form market efficiency measurement tests include both Parametric and Non Parametric tests the study undertook both the tests to find out the actual result.

Return of DSEX and CSCX are required to be calculated for conducting Parametric and Non Parametric tests.

The lognormal return data is required to the tests.

The lognormal return is calculated by using the following formula.

$$R_t = \ln (P_t/P_{t-1}) \times 100$$

Where,

R_t = logarithmic return in period t

P_t = stock index price at time t

P_{t-1} = stock index price at time t-1

Parametric tests are Autocorrelation test, Augmented Dickey-fuller test, and Variance Ratio test non-parametric tests are Runs test and Phillips-Perron test.

Software used to conduct the test:

Descriptive statistics, Autocorrelation test, Run test is done with the help IBM SPSS software. Unit root test and Variance ratio test are done with the help of E-Views software.

4. DATA ANALYSIS & DISCUSSION:

Descriptive statistics Analysis:

Descriptive statistics are used to check the normality of the data

Table 1
Descriptive statistics of the returns of DSE & CSE index return

Descriptive statistics	DSEX Index	CSCX Index
N	1108	1126
Minimum	-3.684720146	-3.733150296
Maximum	5.358362441	31.18407264
Mean	-.04	.00
Standard deviation	.850	1.253
Variance	.722	1.571
Skewness	.157	13.705
Kurtosis	3.540	340.787

From table-1, the results of descriptive statistics are found. It is seen that the mean value is negative in case of dsex index & .0 in case of cscx index. Standard deviation & variance, both are higher for cscx index than dsex index which indicate greater spread of data. Skewness value of dse index return & kurtosis value of both dsex & cscx index return is greater than 0. This implies that data lacks normal

distribution.

Autocorrelation Test:

Autocorrelation test is used to find out the level of autocorrelation in a period arrangement. It measures the correlation between the current and lagged observations of the time series of stock returns (Tasy, 2010).

The serial correlation is calculated by

$$p_k = \frac{\sum_{t=1}^{n-k} (R_t - \bar{R})(R_{t+k} - \bar{R})}{\sum_{t=1}^n (R_t - \bar{R})^2}$$

Here k = the number of lags, and

R_t = Real rate of return.

Ljung-Box Q Test: The Ljung-Box Q test is used to find out whether the observations over time are random and independent or not.

In particular, for a given k , it tests the following:

The test statistic is:

$$LB = n(n+2) \sum_{k=1}^m \left(\frac{p^2 k}{n-k} \right) \sim \chi^2_m$$

Where n = sample size

and m = lag length.

LB statistic follows the chi-square distribution with m degree of freedom.

The hypothesis for LB statistic can be written as

follows:

H1: Stock Returns Do Not Follow Random Walk.

Table 2
Autocorrelation tests for DSE & CSE Index return:
DSEX Index **CSCX Index**

Lag	Autocorrelation	Std. Error ^a	Box-Ljung Statistic			Autocorrelation	Std. Error ^a	Box-Ljung Statistic		
			Value	df	Sig ^b			Value	df	Sig ^b
1	.104	.030	12.004	1	.001	.052	.030	3.110	1	.078
2	.046	.030	14.377	2	.001	.021	.030	3.587	2	.166
3	.070	.030	19.756	3	.000	.045	.030	5.890	3	.117
4	.096	.030	30.117	4	.000	.046	.030	8.280	4	.082
5	.072	.030	35.824	5	.000	.027	.030	9.076	5	.106
6	-.011	.030	35.963	6	.000	-.009	.030	9.174	6	.164
7	-.021	.030	36.456	7	.000	-.002	.030	9.180	7	.240
8	-.004	.030	36.476	8	.000	.004	.030	9.196	8	.326
9	-.001	.030	36.477	9	.000	.000	.030	9.196	9	.419
10	.061	.030	40.621	10	.000	.010	.030	9.319	10	.502
11	-.001	.030	40.622	11	.000	-.006	.030	9.366	11	.588
12	.016	.030	40.896	12	.000	.018	.030	9.728	12	.640
13	-.001	.030	40.898	13	.000	.010	.030	9.832	13	.708
14	-.020	.030	41.329	14	.000	-.016	.030	10.122	14	.753
15	.000	.030	41.329	15	.000	-.008	.030	10.192	15	.807
16	-.010	.030	41.446	16	.000	-.004	.030	10.209	16	.855

a. The underlying process assumed in independence (white noise)

b. Based on the asymptotic chi-square approximation.

Note: Significance level at 5%

From Table -2, the results of autocorrelation & Ljung Box statistic, are found. In lag1 to lag 5 there exists positive autocorrelation in both DSEX & CSCX index. The positive autocorrelation in the returns of DSE & CSE index are an indicator of the absence of random of random walk & this implies that Dhaka & Chittagong stock exchange are not weak form efficient. In Ljung box statistics of return of DSEX index, p-value (0.000) in 3rd lag to 16 lag indicates that the stocks do not follow a random walk and it can be said that Dhaka stock exchange market is not weak form efficient. But in case of CSCX index return, p value (>000) indicates that Chittagong stock exchange is weak form of efficient market.

Run test

Run test is used to find out the randomness of data. Run test is done to find out whether or not positive or negative autocorrelation exists in the data. Run test provides result of the stock price behavior whether it is behaving randomly or not. Too many runs is an indicator of negative serial correlation. On the other hand too few runs is a sign of positive serial correlation,(Gujarati,2003)

Under the null hypothesis that successive outcomes are unbiased, the total expected number of runs is distributed as normal with the following mean:

$$\frac{n(n+1) \sum_{i=1}^n i}{n}$$

Here N= Return observations of all total number

Ni = Number of runs in type i.

Z- statistic used to perform run test is :

$$Z = \frac{R - \mu}{\sqrt{\mu}}$$

The z statistic is performed to find out the serial dependence by making comparison between the actual number of runs to the expected number μ in the price series.

From Table-3, the results of return of run test of DSE & CSE are found. Index return shows that DSEX and CSCX index, Z value is negative which mean the actual number of runs is less than expected number of runs. The results indicate DSE and CSE do not follow random walk & are not efficient in weak form.

Table 3
Run test of DSE and CSE Index Return:

	DSEX Return		CSCX Return
Test Value	0.021398962	Test Value	0.0226860375
Cases < Test Value	554	Cases < Test Value	563
Cases >= Test Value	554	Cases >= Test Value	563
Total Cases	1108	Total Cases	1126
Number of Runs	453	Number of Runs	482
Z	-6.131	Z	-4.890
Asymp. Sig. (2-tailed)	.000	Asymp.Sig. (2-tailed)	.000

Unit root test:

A unit root test is a test which helps to measure the non-stationary effect on the time series data. So the hypothesis under this test is as follows:

H1: Data in DSE and CSE are not non-stationary and it is not unit root.

There are two mostly used unit root test. They are : Augmented Dickey Fuller Test.

Phillips-Perron (PP) test

Augmented Dickey Fuller Test:

The augmented dickey fuller test was developed by American statisticians David Dickey and Wayne

Fuller. ADF test is done to find out the existence of unit root in time series sample by considering null hypothesis (ADF,1979) .The alternative hypothesis is stationary or trend stationary.

The augmented dickey fuller test can be written as follows;

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \delta_1 \Delta Y_{t-1} + \dots + \delta_p \Delta Y_{t-p} + \varepsilon_t$$

where, α is a constant, β is the coefficient of time trend, γ , δ are the parameters, p is the lag order of the autoregressive process, δy is the first difference of y series and ε is the error term.

Table 4
Unit root test of DSEX and CSCX Index Return:

	With no trend and Intercept	With trend & Intercept	With In-tercept	With no trend and Intercept	With trend & Intercept	With In-tercept
T Statistic v	-29.92356	-29.96066	-29.95515	-47.51070	-47.48646	-47.52071
1% level of significance	-2.567053	-3.966359	-3.436041	-2.567019	-3.966225	-3.435947
5% level of significance	-1.941110	-3.413877	-2.863941	-1.941105	-3.413812	-2.863899
10% level of significance	-1.616507	-3.129019	-2.568099	-1.616510	-3.128980	-2.568077

From the results of Augmented Dickey Fuller test in table-4 it is found that the test statistics value is lower than critical value in case of both DSEX & CSCX Index, the null hypothesis can be rejected & can be concluded that both DSE & CSE Index data have no unit root. Therefore DSEX & CSCX index do not follow random walk and lack weak form efficiency.

Phillips- Perron (PP) test:

PP test is a non-parametric test. PP is done to test the null hypothesis that a time series is integrated of order 1. The PP test considers serial correlation by using a non- parametric serial correlation correc-

tion factor(Phillips-Perron,1988).

The equation of PP test is as follows:

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \varepsilon_t$$

Where , α is a constant, β is the coefficient of time trend, γ is the parameter and ε is the error term

In table 5 Phillips Perron (PP) test also found the test statistics value is lower than critical value in case of both DSEX & CSCX index. Therefore, the null hypothesis can be rejected & can be concluded that both DSEX & CSCX index return have no unit root. Therefore DSEX & CSCX index do not follow random walk & weak form efficiency is absent.

Table 5
Phillips- Perron test of DSEX and CSCX Index return :

	With trend and Intercept	no trend and Intercept	With trend & Intercept	With Intercept	With trend and Intercept	no trend and Intercept	With trend & Intercept	With Intercept
T Statistic value	-30.64096	-30.63129	-30.64118	-43.43787	-43.52188	-43.51485		
1% level of significance	-2.567063	-3.966359	-3.436041	-2.567019	-3.966225	-3.435947		
5% level of significance	-1.941110	-3.413877	-2.863941	-1.941105	-3.413812	-2.863899		
10% level Of significance	-1.616507	-3.129019	-2.568099	-1.616510	-3.128980	-2.568077		

Variance ratio test:

Lo and Mackinlay (1988) developed variance ratio test. Variance ratio test are widely used in judging the behavior of stock price indices in which returns are not properly distributed. Most statisticians opine that Variance ratio test is more reliable than ADF test, Phillips- Perron Test and autocorrelation test. A variance ratio that is greater than one results in returns series is positively serially correlated. A variance ratio less than one gives an indication that the return series is negatively serially correlated.

The variance ratio can be defined as the following:

$$VR(q) = \frac{\delta^2(q)}{\delta^2(1)}$$

Where $\zeta(2q)$ is $1/q$ the variance of the q -differences and $\zeta(21)$ is the variance of the first Differences.

H_0 : $vr(q) = 1$ indicates markets are weak-form efficient

H_a : $VR(q) \neq 1$ means markets are not weak-form efficient.

Table 6
Variance ratio test of DSE & CSE Index:

Period	Variance ratio of DSEX	Z statistic	Variance ratio of CSCX	Z statistic
2	0.532346	-6.900686	0.524821	-13.06108
4	0.252897	-6.451855	0.254473	-11.78828
6	0.141417	-5.267511	0.137896	-9.479036
8	0.071957	-4.314197	0.074712	-7.489540

Table-6 shows the results of variance ratio test of DSE and CSE Index return the Variance ratio is not equal to 1. From the above information it can be revealed that DSEX & CSCX index are not weak form efficient.

5. CONCLUSION, IMPLICATION, LIMITATION AND SUGGESTION:

Conclusion:

Stock market is the life blood of the economy. Investors are the key variable in the stock market. Investors will only invest in stock in stock market if there is consistency in the prices of index in the stock market. But both Parametric tests (autocorrelation test, Augmented Dickey-fuller test, and variance ratio test) and Non parametric test (Run Test, Phillips-Perron test) give the result of DSEX & CSCX index weak form inefficiency. If the stock exchange authority Security and Exchange Commission do not investigate the reasons of absence of

weak form efficiency and probable measure to resolve the condition in stock market then investors will move from investing in stock market which will have a negative impact on economy of Bangladesh.

Implication:

The study will help researchers, investors and stock exchange authority to see the actual stock market condition of Bangladesh. The study will also pave the way for further research to find out the possible reasons of absence of weak form efficiency of largest indexes of Bangladesh stock exchange and also provide measurement to resolve the condition.

Limitations and Suggestion:

The research took daily data of CSEX and DSCX index of Dhaka and Chittagong Stock exchange from 2013 to 2017. Other Indexes may have been included in the study and time frame can also be

extended. The research creates a platform to discover the possible reasons of weak form inefficiency of Dhaka and Chittagong Stock exchange and provide solution so that stock exchange of Bangladesh can come in the range of weak form efficiency and attain Investors faith which will ensure economic sustainability.

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