# Assessment of Capital Market Efficiency in COVID-19

## Fakrul Ahmed

## **ABSTRACT**

The study tries to focus on the efficiency of the capital market through investigating the randomness of return series of Dhaka Stock Exchange of Bangladesh. Due to COVID-19 pandemic the worldwide capital market faces higher volatility than before. The study finds the week form of efficiency level of Bangladesh capital market. Special focus on Run test, Auto correlation test, predictability of tock return using ARIMA model the weekend effect anomaly and momentum strategy investing. The study found that the hypothesis of randomness of the stock returns are rejected for stock price index changes by using random walk tests, normality of return distributions, runs test and at different lags using ARIMA and the momentum tests which assert Dhaka Stock Exchange is not efficient even in the weak form.

**Keywords:** DSE, COVID-19, capital market, Bangladesh.

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#### I. Introduction

Dhaka Stock Exchange is growing both in market capitalization and trading volume. The growth is fueled by increased demand for financial assets and influx of liquid money. The growth is outpacing the growth of the national economy. Sudden rise of capitalization in DSE has raised the question, whether the growth has been healthy, and market is functioning in a justifiable manner. The economic development of a country is deeply related the development of country [2]. If the market grows and functions in an unhealthy manner, allocation of capital may go to less productive sector. Good entrepreneurs may feel discouraged. Excess volatility in the capital market may deter investors to invest in the emerging capital market. This may hamper government's effort to increase the savings ratio and increase investment. High volatility and inefficient market impose premium on return and increase the cost of funds for businesses to raise money.

Regulators, stakeholders, government, and development partners should always keep their eye on the emerging capital market like Bangladesh whether it is growing in a healthy manner and functioning efficiently. In order to access the efficiency level of the capital market we have to test whether the trading activities in Dhaka Stock Exchange and the value of the securities are properly reflected in their price.

## II. MARKET EFFICIENCY IN COVID-19

The Efficient Market Theory (EMT) was first introduced by Fama [9]. According to him - "an efficient market is a market where the stock prices at every point in time give a correct estimate of the intrinsic value". Fama [10], [11]. describes the EMT as efficient if it fulfils three different conditions. Firstly, trading in securities is not attached with transaction costs. Secondly, all information is available to all of the investors and Thirdly, all of the investors agree that the price of the security reflects the information available [12].

If security price reflects all information, then the price pattern will not be predictable using past history of return and information available in present. However, empirical investigations have found evidence of stock price anomalies and patterns of predictable rates of return. "An anomaly is a deviation of what is claimed by theory and implies that the stock market is not efficient". Explanations for why anomalies exist have still not been found [15]. There are so many examples of anomaly. Researchers have used different tests and examined these anomalies which refute different levels of market efficiency [10]. For example of an anomaly is the day-of-the-week effect, which more specifically can be a Monday effect (Sunday effect in the country). In many countries it is seen that average Monday is lower than that of the other days. In another case it is seen that in many countries return of last working day of the week is much higher compared to other days of the week. The day of-the-week effect is however not specific for only Mondays, but can occur on any weekday. Another well-known anomaly is the turn-of-the-year effect, which implies abnormally high positive stock returns during January [13].

The outbreak of the COVID-19 has enormous implications in the stock market. This pandemic forced the market to face liquidity crisis and increases the volatility. Capital markets all over the world were very resilient during the pandemic period. The Broad Index of Dhaka Stock Exchange (DSEX) rose by 21.31% to 5402.07 points in 2020 year-end compared to 4452.93 points in 2019. The DS30 index, also known as the blue-chip index, also increased by 36.41% to 2078.95 points in 2020. Market Capitalization of Dhaka Stock Exchange went up by 32% as of December 2020 compare to the same period in 2019 [1]. Market turnover increased almost the folds during the period.

The change in the country's capital market regulatory body also transformed the investors' confidence and attracted new investments. The trading volume in both stock exchanges increased substantially. The portfolio investment in foreign currencies in the July-November'2021 period was -\$164 million (approx.), which demonstrates foreign investors are willing to keep liquidity in the pandemic period.

#### III. LITERATURE REVIEW

With the development of Efficient Market Hypothesis, some contradicting studies market efficiency anomalies are also going on. Market efficiency anomalies are evidence that seems inconsistent with the efficient market hypothesis. There are some very significant studies we should mention here.

Basu [4] has used the P/E (price earnings ratio) to test the market efficiency, he assumed that the low P/E securities can over perform the high P/E ratio securities, and he chose data from April 1957 to March 1971. Finally, Basu draw the conclusion that "On average information that was implicit in P/E ratio was not fully reflected in security prices in as rapid a manner as postulated by the efficient markets hypothesis. Rather, it seems that during the period studies, disequilibria persisted in the NYSE, and securities with different P/E's, on average, were inappropriately priced vis-a-vis one another", the solution of Basu in a sense is against Fama's EMH, as the test is pretty valid.

Ball [3] documented that the "post-announcement earnings consist excessive returns. If the information is publicly good, then it is inconsistent with the market efficiency." This anomaly is named post-announcement earning drift. He has examined the relationship between the return and total market value of NYSE common stocks, he found the problem that the smaller firms had the higher value than the big firms in risk-adjusted returns on average, and the size effect existed more than 40 years and the CAPM has been mispriced. The earning and size anomalies are not the only challenge to the market efficiency hypothesis. We can review more studies from the other famous researchers. DeBondt and Thaler [8] mentioned that most of the time the investor will overreact to the dramatic event. They tried to test whether the events will affect the stock price. Months after the portfolio formation; the losing stocks have earned 25% more than the winners, even though the latter are significantly riskier.

Ritter [14] said "using a sample of 1526 IPO's that went public in the US in the 1975-84 period, I find that in the years after going public these firms underperformed a set of comparable firms matched by size and industry", the initial investment in these shares have underperformed at the first date of trading. According to the above-mentioned studies, market efficiency anomalies can be defined as, a phenomenon, which is persistent, that contradicts the hypothesis of market efficiency. Ever since the announcement of Fama's efficient market hypothesis in 1970, the inconsistent studies has been performing against continually. In the real science, there is much clear evidence that beat the market by using some investment strategies, for instance the famous Warren Buffett has focused on the undervalued stock strategy to generate millions of profits and some funds managers have showed their capability in making better portfolio than the average investors. The above mentioned facts happened indeed in the real life, but if we want to have a thorough understanding of the market efficiency anomalies, we have to look at some theoretical frameworks systematically. Therefore the following we will present some very popular studies done by the former researchers, since we cannot present all the studies due to the huge amount of the former people's works.

Bepari and Mollik [5] investigated whether the monthly return of DSE All Share price index shows any seasonality. Specially they looked for the year end effect. In the developed markets there is January effect. They used combined regression time series model for the examination of with used month of the year as dummy variable for testing monthly effect. Their result shows that return of Dse All Share price Index do not show any January effect, but found that the return in the month of April is significant. They termed it as "April effect" in DSE.

#### IV. RESEARCH VARIABLE AND METHODOLOGY

The purpose of this study is to investigate the weak form efficiency level of Dhaka Stock Exchange (DSE) of Bangladesh. In order to do that we have conducted Seasonality effect in stock price effect test, auto correlation test and run test, momentum effect test.

Data of each trading day's last return is collected from the website DSE and DSE library. Dse All Share price Index is collected on daily basis and monthly basis from 1987 to 2020. In addition, sizes of dividends paid out with its respective dates, splits, bonus issues, new is-sues, and special offers to the stockowners are considered and reflected in the data. These adjusted data of individual stocks are used to calculate the momentum effect. DSE All Share price Index is used to calculate the autocorrelation, day-of-the-week effect and the turn-of-the-year effect.

The weak form of the efficient market theory is tested by autocorrelation. The semi-strong form of efficiency is tested by examining the day-of-the-week effect and the turn-of-theyear effect. The adjusted stock prices of the two categories are used to calculate the returns between two months with transactions over the seven-year period for each of the 30

The returns are calculated both in terms of percental- and logarithmic returns according to equations [1] and [2]. Percental daily return:

$$rt = ((pt - pt-1) + d) / pt-1$$
 (1)

The current day's stock price is denoted by pt, and the previous day's stock price is de-noted by pt-1. If a potential dividend is paid out during the current day, the value of it, d, is added to the numerator.

Logarithmic daily return:

$$r't = \ln((pt + d) / pt-1)$$
 (2)

The average return of each month is the sum of the daily returns during the month, displayed in (3) and (4).

Percental monthly return:

$$(1+Rm) = (1+r1) x (1+r2) x ... x (1+rt)$$
 (3)

Logarithmic monthly return:

$$ln(1+Rm) = ln(1+r1) + ln(1+r2) + ... + ln(1+rt)$$
 (4)

The relationship between the percental and logarithmic return is demonstrated in equation [5].

$$(1+rt) = e^{(r't)}$$
 (5)

The average yearly returns of the companies and as a total are calculated as the sum of the monthly returns divided by the number of observations.

#### V. EMPIRICAL TESTS AND ANALYSIS

## A. Descriptive Statistics of the Return Series

Return series of the DSE All Share price index is examined whether return series is normally distributed. The skewness and kurtosis of the distribution is compared with that of the supposed normal distribution. If the return distribution deviates from the normal distribution, it implies that the return series of DSE do not follow random walk model.

#### B. Nonparametric Tests

#### 1. Kolmogrov-Smirnov Goodness of fit test (K-S test)

Kolmogrov-Smirnov Goodness of fit test (K-S test) is a non-parametric test and is used to determine how well a random sample of data fits a particular distribution (uniform, normal and Poisson). The one sample K-S test compares the cumulative distribution function for a variable with a uniform or normal distribution and test whether the distributions are homogeneous Both normal and uniform parameters used to test the distribution.

## 2. Runs Test

The Runs Test procedure tests whether the order of occurrence of two values of a variable is random. A run is a sequence of like observations. A sample with too many or too few runs suggests that the sample is not random.

The run test, also called Geary test, is a non-parametric test whereby the number of sequences of consecutive positive and negative returns is tabulated and compared against its sampling distribution under the random walk hypothesis [6]. "A run is defined as the repeated occurrence of the same value or category of a variable".

It is indexed by two parameters, which are the type of the run and the length. Stock price runs can be positive, negative, or have no change. The length is how often a run type occurs in succession. Under the null hypothesis that successive outcomes are independent, the total expected number of runs is distributed as normal with the following mean:

$$\mu = \frac{N(N+1) - \sum_{i=1}^{3} n_i^2}{N}$$

and the following standard deviation:

$$\sigma_{\mu} = \left[ \frac{\sum_{i=1}^{3} \left[ \sum_{i=1}^{3} n_{i}^{2} + N(N+1) \right] - 2N(\sum_{i=1}^{3} n_{i}^{3} - N^{3})}{N^{2}(N-1)} \right]^{\frac{1}{2}}$$

where  $n_i$  is the number of runs of type i. The test for serial dependence is carried out by comparing the actual number of runs,  $a_r$  in the price series, to the expected number  $\mu$ . The null proposition is:

$$H0: E(runs) = \mu$$

If there are too many runs more or less than expected the hypothesis of statistical independence of the elements may be

In my data series the null hypothesis is that the market (represented by DSE All Share Price Index) follows random walk behavior.

So, monthly return from 1987-2010 of DSE All Share price Index is used for run test. Number of runs will compared with the expected number of runs and determined whether the return series of DSE All Share price index follows a random walk behavior or there is a tendency to follow pattern and dependent on previous days return.

#### 3. Autocorrelation's test

The reason why autocorrelation is examined is to reveal if there exists a potential linear dependency between returns from one day to another. If the investigation finds a dependency between returns, it indicates that the stock market is not efficient in the weak form. The null and alternative hypotheses are presented below. The null hypo-thesis predicts that the stock market is efficient with no linear relationship between two following days' stock prices.

> $H_0$ :  $\beta$  (auto correlation coefficient) = 0  $H_A$ :  $\beta$  (auto correlation coefficient)  $\neq 0$

The coefficient  $\beta$  is estimated from the time-series of returns and received by the soft-ware program SPSS. The value of it can range from minus one to plus one. According to an efficient market the value of  $\beta$  should be close to zero.

The returns used in the autocorrelation model are logarithmic, and computed according to the first category of returns; i.e. returns are calculated between dates of trading, ignoring the dates with no trade activity. The time-series of returns are shifted one day.

# 4. Testing Randomness between Stock Returns Using ARIMA Model

ARIMA models are, in theory, the most general class of models for forecasting a time series which can be stationarized by transformations such as differencing and logging. In fact, the easiest way to think of ARIMA models is as fine-tuned versions of random-walk and random-trend models: the fine-tuning consists of adding lags of the differenced series and/or lags of the forecast errors to the prediction equation, as needed to remove any last traces of autocorrelation from the forecast errors.

### C. Empirical Analysis and Findings

One of the important assumptions of random walk model is that the distribution of the return series should be normal. In order to test the distribution of the log of the market returns are calculated and presented in the table:

		~	~
TABL	Æ1:	DESCRIPTIVE	STATISTICS

	N	Min	Max	Mean	Std. Dev.	Ske	ewness	Ku	ırtosis
	Stat	Stat	Stat	Stat	Stat	Stat	Std. Error	Stat	Std. Error
Daily Return	4048	-0.22	0.30	0.0006	0.0155	1.485	0.038	72.318	0.077

From the table it can be seen that the frequency distribution of this series is not normal. The skewness coefficient is greater than 1. Researchers consider it as extreme [7]. But skewness of Bangladeshi return series (1.485) is much higher than that of the Indian counterpart (0.98).

Kurtosis calculation (72.31) shows that the return series is an extreme leptokurtic distribution. Generally, values for skewness zero and kurtosis value 3 represents that the observed distribution is perfectly normally distributed. So, skewness and leptokurtic frequency distribution of index return series on DSE indicates that the distribution is not normal. Non-normal frequency distributions of the stock return series asserts that return series of DSE may not follow random walk model.

It is also to be noted that in another study conducted by Professor Kevin Keasey and Asma Mobarek found the similar result in 2000. But this result shows that the extremity of both skewness and kurtosis has increased. This may imply further deviation from the random walk model.

#### D. Non-Parametric Test

This study conducts two parametric tests:

- 1. Kolmogorov-Smirnov goodness of fit test.
- 2. Run test.

Three parametric tests were conducted to confirm whether the findings of nonparametric tests are valid or not.

TABLE II: ONE-SAMPLE KOLMOGOROV-SMIRNOV TEST

		Daily Return lognormal
N		4048
Normal Parameters <sup>a</sup>	Mean	.0006
Normal Parameters	Std. Deviation	.01685
	Absolute	.170
Most Extreme Differences	Positive	.170
Differences	Negative	165
Kolmogorov-Smirnov Z		10.827
Asymp. Sig. (2-tailed)		.000
a. Test distribution is	Normal.	

Null Hypothesis: market follows the random walk behavior i.e., market is efficient in weak form.

From the run test results of run test we see that the actual number of runs significantly lower than expected number of runs for daily return of DSE All Share Price Index. It rejects the null hypothesis the return patterns of DSE follows the random walk behavior. On the whole the results of the runs test shows that the daily return of Dhaka Stock Exchange are not random as the probabilities associated with expected number of runs are all greater than the observed number of runs.

TABLE III: RUNS TEST

	Market return	Log market return
Test Value a	0.01515302	0.010284698
Cases < Test Value	172	161
Cases >= Test Value	109	120
Total Cases	281	281
Number of Runs	109	109
Z	-3.2019318	-3.604011033
Asymp. Sig. (2-tailed)	0.00136509	0.000313344
a. Mean		

TABLE IV: MODEL DESCRIPTION

TABLE IV. WOBEL DESCRIPTION				
Model Name		MOD_1		
Series Name	1	Market return		
	2	Log market return		
Transformation		None		
Non-Seasonal Differencing		0		
Seasonal Differencing		0		
Length of Seasonal Period		No periodicity		
Maximum Number of Lags	12			
Process Assumed for Calculating	Independence (white			
Errors of the Autocorrelations	noise) a			
Display and Plot		All lags		
Applying the model specifications from MOD_1				

The above run tests shows that positive changes of return are 109 and the negative change in return is 172 out of 281 cases. The number of actual observation where the actual price changes equals or exceeds the test value ( average daily changes in DSE All share price index) is 109 and the actual number of changes where the actual price changes gets below the test value ( average daily changes in DSE All share price index) is 172.

The model shows the critical value of 3.20 and 3.60 is cases of percentile daily return and logarithmatic daily return which is quite higher than the table value of 1.96. Furthermore p value of 0.136% and 0.031% in case of percentile return and log return being significantly lower than that of acceptable table of risk of 5% indicates that 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.

#### VI. CONCLUSION

Finally, in the study, we found that 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 nonactively 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 emphasized. The traders make their living by analyzing historical returns of the stock. Using this information to project future returns the traders may able to earn abnormal profits. 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 the Dhaka stock

#### REFERENCES

- [1] Ahamed, F. (2021). Macroeconomic Impact of Covid-19: A case study on Bangladesh. IOSR Journal of Economics and Finance (IOSR-JEF),
- Alam, M. M., Khondker, R. K., & Molla, M. S. (2013). Current Account Dynamics, Adjustment and Capital Mobility in Bangladesh. Global Disclosure of Economics and Business, 2(2), 117-126.
- Ball, R. (1978). Anomalies in relationships between securities' yields and yield-surrogates. Journal of financial economics, 6(2-3), 103-126.
- Basu, S. (1977). Investment performance of common stocks in relation to their price-earnings ratios: A test of the efficient market hypothesis. The journal of Finance, 32(3), 663-682.
- Bepari, M. K., & Mollik, A. T. (2015). Effect of audit quality and accounting and finance backgrounds of audit committee members on firms' compliance with IFRS for goodwill impairment testing. Journal of Applied Accounting Research.
- Campbell, J. Y., Lo, A. W., & MacKinlay, A. C. (2012). The econometrics of financial markets. princeton University press.
- Chou, C. (1969). On the size of the set of left invariant means on a semigroup. Proceedings of the American Mathematical Society, 23(1),
- De Bondt, W. F., & Thaler, R. (1985). Does the stock market overreact? The Journal of finance, 40(3), 793-805.
- Fama, E. F. (1965). Portfolio analysis in a stable Paretian market. Management science, 11(3), 404-419.
- [10] Fama, E. F. (1965). The behavior of stock-market prices. The journal of Business, 38(1), 34-105.
- Fama, E. F. (1970). Session topic: stock market price behavior. The Journal of Finance, 25(2), 383-417.
- [12] Pramanik, P. (2020, December). Optimization of Market Stochastic Dynamics. In SN Operations Research Forum (Vol. 1, No. 4, pp. 1-17). Springer International Publishing.
- [13] Ritter, J. R. (1988). The buying and selling behavior of individual investors at the turn of the year. The Journal of Finance, 43(3), 701-717.
- [14] Ritter, J. R. (1991). The long-run performance of initial public offerings. The journal of finance, 46(1), 3-27.
- [15] Williams, I. S., & Claesson, S. (1987). Isotopic evidence for the Precambrian provenance and Caledonian metamorphism of high grade paragneisses from the Seve Nappes, Scandinavian Caledonides. Contributions to Mineralogy and Petrology, 97(2), 205-217.



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