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Testing the weak efficient market hypothesis using Bangladeshi panel data

Abstract

This empirical study investigates whether the Dhaka Stock Exchange market in Bangladesh is weakly efficient by modifying and estimating Dockery and Kavussanos' multivariate model using a set of panel data. Consistent with a priori expectation, and previous research results, the findings suggest that the Dhaka Stock Market is not informationally efficient. The results also indicate that when the number of stocks included in the sample exceeds 3, the null hypothesis of the efficient market hypothesis is rejected throughout. A well developed market economy is a necessary condition for an efficient equity market. Thus, to build an efficient stock market, Bangladeshi authority should first concentrate its effort on developing its market infrastructure.

Keywords: efficient market hypothesis, panel data, Dhaka Stock Exchange, regression model.
JEL Classification: C01, E32, E44, E51.

Introduction

The growth of equity markets and the globalization of financial markets are often the subject of major research studies in developing countries. Additionally, testing different forms of the efficient market hypothesis seems to be the most popular theme of these empirical investigations. Institutional and large investors strive for portfolios with international stocks because of the potential higher returns. Even with the 5 percent and 10 percent stipulations in the U.S. mutual funds, transactions by these investors are nowhere near odd lot orders. These, in turn, prevent most developing economies from benefiting from recent increases in the internationalization of portfolio investments. This phenomenon pushes most developing economies into a downward spiral or a vicious circle: because their equity markets are not deep and broad enough. In addition, they lack the necessary infrastructures to attract international portfolio investments; but because they cannot attract the international portfolio investments, their markets cannot be deep and broad and they cannot improve their infrastructures. Information on the characteristics of markets and the listed companies in the equity markets cannot be dissimilated quickly due to insufficient electronic and other infrastructure issues that renders equity markets in developing countries not even weakly efficient. Earlier research findings, including that of Hoque, Kabir, and Rahman (2005) reported that the Bangladeshi and the Indian equity markets show significant mean-reversion and predictable behaviors in their daily return series. However, the authors found that the U.S. and Japanese stock markets exhibit some mean-reversion, but largely follow unpredictable patterns over the 1990-2005 period.

This study proposes to assess whether the Dhaka Stock Exchange exhibits a weak form of the efficient market hypothesis.

Tha paper is organized as follow. Section 1 presents a literature review. Section 2 describes Bangladeshi equity market. Section 3 presents methodology. Section 4 show data. Section 5 reports and discusses the empirical results. The final section provides the concluding remarks and some policy implications.

1. Literature review

The efficient market hypothesis dates back to when the business cycle theorists tried to analyze the behavior of stock markets over time in search of indicators of the business cycles. Kendall (1953) examined the stock market behavior, and to his surprise, he could not identify any predictable patterns in the stock prices. Over time, as equities became increasingly important sources of corporate finance, theorists such as Fama (1970) and numerous others began to hypothesize and to empirically test stock price behaviors leading to the formulation of efficient market hypothesis. The two most common procedures for testing the efficient market hypothesis are the runs test DeFusco, McLeavey, Pinto and Runkle (2004) and serial correlation analysis (Conrad and Kaul, 1988; Lo and McKinlay, 1988).

The correlation analysis tests for the significance of positive or negative correlations in stock returns over time. Specifically, the correlation tests for independence, i.e., random walk, by statistically determining whether the rate of return on day t correlates to the return on day t - 1, t - 2, or t - 3. The runs test examines a series of stock price changes and these changes are designated a plus (+) if it is an increase in price or a minus (–) if it is a decrease in stock price. The result is a set of pluses and minuses. A run occurs when two consecutive changes are the same: two or more consecutive positive or negative changes are defined as one run. When the price changes in a different direction, for example, when a negative price change is followed by a positive price change, the run ends and a new run may begin. To test for random walk, the number of runs

for a given series is compared to a table of expected values for the number of runs that should occur in a random series.

Empirical studies, using these testing procedures, have yielded mixed results. Historically, earlier evidence was quite favorable to the hypothesis, but in recent years, deeper analyses of evidence cast doubt on their validity as a whole. The following are taken as evidence in favor of the efficient market hypothesis. The investments in mutual funds cannot be expected to earn an abnormally high return. Good performance in the past does not guarantee that the investment advisor or a mutual fund will perform well in the future. Favorable earnings announcements or announcements of stock splits do not, on average, cause stock price to increase. Future changes in stock prices, for all purposes, are unpredictable. On average, technical analysts do not fare better than other financial analysts nor do they outperform the market. However, small-firm effect, January effect, market overreaction, excessive volatility, mean reversion, new information not being immediately incorporated in stock prices are taken as evidence against the efficient market hypothesis.

Dockery and Kavussanos (1996) applied a regression model to the panel data to test the weak form of the efficient market hypothesis on the Athens Stock Market. Dockery and Kavussanos began by considering a simple regression model, where the current stock price is regressed on an intercept constant, the price in the last period, and a disturbance. The authors argued that the necessary condition for the Athens Stock Market to be weakly efficient is that the estimated constant and the estimated coefficient of the past period price cannot be statistically different from 0 and 1, respectively. However, they posited that since the stock prices are not stationary, they have to model their first differences. To this end, periodic changes in stock prices are regressed on an intercept constant and a disturbance. Dockery and Kavussanos articulated that in the new expression, the necessary condition for the market to be weakly efficient is that the estimated intercept constant could not be statistically different from zero.

2. Bangladeshi equity market

Formal trading on the Bangladesh Stock Exchange, known as the Dhaka Stock Exchange (DSE), began in 1956, two years after the establishment of the East Pakistan Stock Exchange Ltd. on April 28, 1954. The trading was suspended for five years starting from the independence war of the country which held in 1971. The Chittagong Stock Exchange (CSE) was established in December 1995. The Bangladeshi Security and Exchange Commission (SEC) was established on June 8, 1993 by the SEC Act of 1993 to regulate the trading of stocks, to protect security investors, to ensure proper insurance and compliances, and to promote fair, transparent and efficient security markets (Source: http://www.sai.uni-heidelberg.de/workgroups/bdlaw/-1993-a15.htm). The common characteristics of equity markets in poor, developing countries are that the markets are narrow and shallow as a consequence of slow progress. These phenomena provide opportunities for unethical and even illegal manipulations often causing stock market crashes. These crashes usually cause severe financial damages to investors. This painful situation occurred with both the Bangladeshi stock exchanges in the summer and fall of 1996. During this episode, the DSE index increased from 832 in January 1966 to a peak of 3,567 on November 14, 1996 and dropped back down to 507.33 in November 1996. To control the financial damages and decrease in investors' confidence caused by the early episodes leading to the November 1996 crash and with support from the Asia Development Bank, the Bangladeshi government introduced the Capital Market Development Program on November 20, 1997. The purpose of the program was to (1) strengthen market regulation and supervision; (2) develop the stock market infrastructure; (3) modernize stock market support facilities; (4) increase the limited supply of securities in the market; (5) develop institutional sources of demand for securities in the market; and (6) improve policy coordination (Source: http://www.adb.org/documents/rrps/ban/rrp-ban-24103.pdf).

Wise and Ali (2007) argued that a strong and vibrant securities market is an important source of capital funding: institutional and private investors invariably become a major source of investment capital for private firms. Due to the relatively underdeveloped state of the securities markets in Bangladesh, long-term industrial financing is supported largely by the banking sector.

As to the Bangladeshi equity market, Alom, Khan, Morshed (2010) suggested that the weak-form inefficiency of the stock market is most likely caused by a combination of the lack of its development and policy choices resulting in inappropriate regulations. Uddin (2009) observed that market inefficiency in Bangladesh is more likely the consequences of an inefficiency regulatory system and information transparency. Moreover, as recently as of November 2007, Bepari and Mollik (2008) argue that the DSE is still in the primitive stages of development with only 273 listed companies whose total market capitalization to GDP ratio equals 16 percent. Out of the listed companies, as measured by the percentage of the total market capitalization, the market share of the banking sector, share of the largest five sectors

in the economy, and share of the five largest corporations are respectively 58.8 percent, 87.41 percent, and 22.37 percent. These statistics clearly suggest market concentration and the dominance of the banking industry. Additionally, the fiscal policy of the country has been very weak and, hence, not conducive to promoting investments in the capital markets, especially in the secondary markets.

In light of the introduction of the Capital Market Development Program a decade or so ago and other improvements in the recent past; the Bangladeshi stock market is of particular interest for further empirical research. This study differs from previous endeavors in which it modifies Dockery and Kavussanos' multivariate model to allow the use of a set of panel data as a set of pooled data from the Dhaka Stock Exchange market to test the weak-form of the efficient market hypothesis. This investigation also examines the sensitivity of the numbers of stocks included in the sample to the results.

4. Methodology

In testing the weak form of the efficient market hypothesis using panel data from Athens Stock Market, Dockery and Kavussanos defined P_{it} and $P_{i,t-1}$ as the prices of stock *i* at time *t and t* - 1 and postulated the following regression model:

$$P_{it} = \alpha_i + \rho_i P_{i,t-1} + \varepsilon_{it}, \quad (1)$$

where *i* = 1, 2, ...*N* and *t* = 1, 2,.....*I*, *N* is number of individual stocks and *I* is number of observations for stocks. α_i and ρ_i are respectively intercept and slope constants. ε_{it} is a Gaussian error term which may exhibits contemporaneous correlation between stocks. The weak efficient market hypothesis may be stated as:

H_0: ρ_i=1 and α_i=0,

H_a: $\rho_i \neq 1$ and $\alpha_i \neq 0$.

Dockery and Kavussanos (1996, p. 122) argued that "it is usually the case that stock prices are non-stationary, in which case in order to avoid inference problems stock returns are considered". The authors defined the stock returns as the differences between the logarithmic values of the stock prices prevailing in the current period and the last period, and rewrote their regression equation as:

$$r_{it} = \alpha_i + \varepsilon_{it}, \quad (2)$$

where *i* = 1, 2, ...*N* and *t* = 1, 2,.....*T*. They posited that the weak efficient market hypothesis becomes:

H_0: α_i=0,

H_a: $\alpha_i \neq 0$.

Equation (2) is a system of *N* equations with cross equation correlations allowed in the residuals. Dockery and Kavussanos (1996) articulated that the seemingly unrelated estimation procedure, proposed by Zeller (1962), would yield more efficient parameter estimates than the ordinary least squares method. A Wald test statistics, using only the unrestricted model (2), can be used to test the set of null and alternate hypotheses of the efficient market hypothesis. Let $h(a)=0$ be the set of restrictions, given a vector of estimates *a*, the associated covariance estimate $V(a)$, and the covariance matrix of the restricted $V[h(a)] = (\partial h/\partial a)'V(a)(\partial h/\partial a)$, the Wald test statistics, evaluated at the unrestricted estimate *a*, is:

$$W = h(a)V[h(a]^{-1}h(a)'. \quad (3)$$

This test statistics has an asymptotical Chi-squared distribution with the degrees of freedom equal to the number of restrictions (Dockery and Kavussanos, 1996, p. 122).

In formulating their model, specified by equation (2), Dockery and Kavussanos (1996) defined r_{it} as the differences between the logarithmic values of the stock prices in the current period and the previous period. Therefore, the value of r_{it} for any stock *i* is inevitably affected by the price level of that stock, as measured by the unit of currency. Because of the differences in their prices, the same percentage change in the prices of two stocks traded in the previous day would result in two different quantity changes. Therefore, to account for this difference, Dockery and Kavussanos (1996) used the multivariate model in which each stock included in the sample is modeled and estimated by one of the equations in the system. However, most of the financial reports on changes in stock prices are in percentage changes from one period to another. If the return is expressed in terms of percentage change, then it can be interpreted as the return on one unit of currency invested in a stock, magnified by one hundred times; therefore, the impacts of the price level is removed from it. As a result, different magnitudes of daily changes reflect only the impact of the good or bad news about the stock, excluding the impact of price level prevailing at the end of the last period.

Let s_{it} be the percentage change from $P_{i,t-1}$ to P_{it}, where P_{it} and $P_{i,t-1}$ are the prices of stock *i* at time *t and t* – 1, then equation (2) can be *rewritten* as:

$$s_{it} = \delta_i + \upsilon_{it}, \quad (4)$$

where $i = 1, 2, \ldots\ldots N$ and $t = 1, 2, \ldots T$; δ_i, υ_{it} are respectively an intercept constant and a Gaussian error term which may exhibits contemporaneous correlation between the stocks. Equation (4) is of a univariate nature which can be estimated using all data points in the panel data set as the set of pooled data. The hypothesis for the weak efficient market hypothesis may be stated as:

H_0: $\delta_i = 0$,

H_a: $\delta_i \neq 0$.

and a Wald test statistics, using only the unrestricted model (4), can be used to test the set of null and alternate hypotheses of the efficient market hypothesis with only one restriction. Thus, the asymptotical Chi-squared has one degree of freedom.

4. Data

This empirical investigation utilizes daily data from the Dhaka Stock Exchange, for the months of March, April, December 2006 and January 2007, which are randomly selected and they provide a total of 75 trading days (19 days in March, 18 days in April, 18 days in December 2006 and 20 days in January 2007). Among the group A, of almost one hundred listed stocks, only 30 of them were traded in every day of the 75 trading days. This yields 2,250 panel data points (30 stocks x 75 days) that can be pooled. The reported percentage change on returns on the stocks was used to estimate the model specified by equation (4).

5. Empirical results

This section examines the empirical findings on whether or not the Bangladeshi stock market is weakly efficient. Specifically, equation (4) is estimated using the percentage changes in the prices of 30 sample stocks for the months of March, April, December 2006 and January 2007. The calculated Chi-squared test statistic and the p-value are reported in Table 1. Based on the calculated Chi-squared statistic with one degree of freedom of 241.7361, the null hypothesis of the weak form of the efficient market hypothesis should be rejected at any conventional level of significance. This rejection strongly suggests that the Bangladeshi stock market has not been informationally efficient despite the introduction of the Capital Market Development Program a decade or so ago. Due to insufficient technological infrastructure, information about listed companies cannot be dissimilated through the financial community quickly. The data shows the daily trading volumes are low and much more unsteady. Therefore, the Dhaka Exchange traded stocks are likely less liquid as compared to the well developed markets. Consequently, the market, collectively, would be very slow to respond to relevant information, which allows investors the ability to make forecasts based on conditional means of stock prices. This is not a characteristic of the perfect capital market structure.

Table 1. Wald test statistic and p-value

$\chi^2_{(1)}$ *value*	241.7361
p-value	0.0000

One of the issues in applied statistics is the question of how representative the samples are. The issue is more relevant when researchers do not have much flexibility in selecting their samples. The sample used in this empirical investigation is an example of this. Out of almost one hundred stocks in group A – the best stocks traded on the Dhaka Stock Exchange – only thirty of the stocks traded every day in the seventy five trading days in March, April, December 2006 and January 2007. If a longer period were selected, the number of stocks, which are traded every day, would be even lower. For example, there were forty eight stocks traded every day in the thirty seven trading days in March and April, 2006; but only thirty stocks traded in all seventy five days in the sample period selected by this study.

Therefore, it is of some interest to investigate whether the result reported in Table 1 is sensitive to the number of the stocks selected and, hence, how representative they are of the whole Dhaka Stock Exchange. To this end, this study performs the cumulative Wald test by including 1, 2, 3, 4, 5, 10, 15, 20, 25, and the whole sample of 30 stocks. The results are summarized in Table 2.

Table 2. Wald statistics for various numbers of stocks

Number of stocks in the sample	$\chi^2_{(1)}$ statistic	p-value
1	0.0693	0.7923
2	1.0086	0.3152
3	8.8486	0.0029
4	9.8247	0.0017
5	17.9525	0.0000
10	33.3950	0.0000
15	81.3873	0.0000
20	143.2215	0.0000
25	153.2417	0.0000
30	241.7361	0.0000

Analysis of the findings, reported in Table 2, reveals that when the number of stocks in the sample exceeds 3, the weak form of the efficient market is rejected at any conventional significant level.

Concluding remarks and policy implications

In light of the introduction of the Capital Market Development Program a decade or so ago and other recent improvements in capital markets, the Bangladeshi stock market is of particular interest for empirical work. To this end, this empirical investigation modifies Dockery and Kavussanos' multivariate model and uses a set of panel data from the Dhaka Stock Exchange market to test the weak-form of the efficient market hypothesis. Consistent with a priori expectation, the known characteristics of the Dhaka Stock Exchange, and earlier empirical research results, the empirical findings strongly suggest that Dhaka Exchange stock market is not informationally efficient. The findings further indicate that when the number of stocks included in the sample exceeds 3, the null hypothesis of the efficient market hypothesis is rejected throughout.

Due to the common characteristics associated with poor developing countries, their equity markets are not even weakly efficient. This is not viewed positively given that most well developed countries have efficient equity markets. This observation coupled with the status of a poor developing country and their attendant problems suggest that to develop an efficient equity market, Bangladesh should first concentrate its effort on developing better market infrastructures for a more effective market economy. Measures should be taken to stop corruption in the equity market so that distortion can not take place. Cartel among issuers, traders, bourses, regulators, large investors and auditors may be prevented in the equity market. Practice of corporate governance should be properly done. Legal infrastructure ought to be developed. Fiscal policy should be properly re-designed. In this environment, a strong political will to reform the system and a strong commitment to implement the reforms are needed to establish a more competitive and efficient overall market economy that would be conducive for building an efficient stock market.

References

1. Alom, K., Khan, A.I., and M., Mokdum (2010). "Are the Emerging Capital Markets Weak form Efficient? Evidence from the Model of the Dhaka Stock Exchange", Conference proceedings of paper presented in the International Conference on Knowledge Globalization 2010 on "Empowerment through Knowledge Sharing and Progress through Knowledge Transfer" jointly organized by North South University, Bangladesh and Suffolk University, USA held on May 8 to May 10, pp. 364-369.
2. Bepari, M.K., and Mollik, A. (2008). Bangladesh Stock Market Growing? Key indicators based assessment'', *Journal of Business Administration Online*, Vol. 7, No. 2, available at www.atu.edu/business/jbao/ Fall 2008.
3. Conrad, J. and Kaul, G. (1988). "Time Variation in Expected Returns", *Journal of Business*, Vol. 61, pp. 409-425.
4. DeBondt, W.F.M., and Thaler, R. (1985). "Does the Stock Market Overreact?", *Journal of Finance*, Vol. 40, No. 3, pp. 793-805.
5. DeFusco, R.A., McLeavey, D.W., Pinto, J.E. and Runkle, D.E. (2004). *Quantitative Methods for Investment Analysis,* 2nd Edition, Charlottesville, VA: CFA Institute.
6. Dockery, E., and Kavussanos, M. G. (1996). "Testing the Efficient Market Hypothesis Using Panel Data, with Application to the Athens Stock Market", *Applied Economic Letters*, Vol. 3, pp. 121-123.
7. Fama, E.F. (1970). "Efficient capital markets: a review of theory and empirical work", *Journal of Finance*, Vol. 25, No. 2, pp. 383-417.
8. Hoque, H. Al A.B., Kabir, M.M., and Rahman, M. (2005). Predictability in stock returns evidence from conventional and new variance ratio tests'', *Journal of Finance and Banking*, Vol.7, No. 1,2, June-December, pp.1-19.
9. http://www.adb.org/documents/rrps/ban/rrp-ban-24103.pdf
10. http://www.sai.uni-heidelberg.de/workgroups/bdlaw/1993-a15.htm
11. Kendal, M. (1953). "The Analysis of Economic Time Series, Part A: Prices", *Journal of Royal Statistical Society, Series A*, Vol. 96, pp. 11-25.
12. Lo, A.W. and MacKinlay, A.C. (1988). "Stock Market Prices Do Not Follow Random Walks: Evidence from a Sample Specification Test", *Review of Financial Studies*, Vol. 1, pp. 41-66.
13. Uddin, M.B. (2009). "Determinants of market price of stock: a study on bank leasing and insurance companies of Bangladesh", *Journal of Modern Accounting and Auditing*, July, Vol.5, No. 7 (Serial No.50), pp.1-7.
14. Zellner, A. (1962). "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests of Aggregation Bias", *Journal of American Statistical Association*, Vol. 57, pp. 500-509.
15. Wise, V. and Ali, M.M. (2007). "Equity Funding Through Initial Public Offerings: the Case of Bangladesh", *Global Business & Economics Anthology*, USA, Volume 2, December, pp. 260-266.