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Effects of Seasonal Volatility in Monthly Stock Return: Evidence from Dhaka Stock Exchange

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Abstract : *This study is designed to find out the existence of seasonal effects in Dhaka Stock Exchange (DSE). By using the DSE General Index a 2-step analysis has been done. At first, it is examined whether the DSE is an efficient market. Then the existence of seasonality is evaluated. For testing the efficiency of the market (DSE), Run Test and Autocorrelation Test has been done. For examining the seasonality effect in DSE the Regression analysis has been done. After completing all the analysis it is observed that DSE is not an efficient market. There are some instances of non stationary data in DSE market return for various lag (Month). This is an evidence of market inefficiency. The capital market is not an efficient one, there exist some seasonality effects. The effects lie in the month of February. Thus there exists a 'February effects' in DSE.*

Introduction

Today's world stock market is one of the most important factors for the economy of any country. Share business has become a lucrative one for both the individual and institutional investor. So, analysis of capital market efficiency become a very popular topic for empirical analysis since Fama (1970) introduced the theoretical analysis of market efficiency and proclaimed Efficient Market Hypothesis. For analyzing the market efficiency it is very important to examine the randomness of the stock price volatility or the stock return. The inconsistency of the share price can be the result of Calendar effects. Calendar effects include seasonal effect (mostly known as January effect), the day of the week effect and the holiday effect. This study is an effort to show the seasonal effect in capital market of Bangladesh. In Bangladesh there are two capital markets, one is Dhaka Stock Exchange (DSE) and the other is Chittagong Stock Exchange (CSE). Our study considers only DSE data to analyze the seasonal effect.

Rational of the Study

Seasonal volatility or seasonal effect is a characteristic of a time series in which the data experiences regular and predictable changes which recur every calendar year. A clear understanding of seasonal effect in DSE stocks return can give the investors a better idea of taking advantages of additional gain/loss from return on

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investment of different stocks. Through this study, our focuses would be to find out whether any the seasonal pattern is available in monthly stock returns in Dhaka Stock Exchange or not.

Objective of the Study

The objective of the study is to examine the seasonal effect in DSE stock return and thereby using the monthly closing share price data of the DSE General Index from 2001 to June 2011.

Data and Methodology

To find out the monthly seasonal pattern of stock market return DSE General Indices from the period of November 2001 to June 30, 2011 is used. The data have been collected from the Research and Library Centre of DSE. To test the seasonal effect, this study focuses on the efficiency market hypothesis (hence the randomness of returns can be assumed). It is evident that where the market is efficient there is no seasonal effect (Gao and Kling 2005).

The Null and Alternative hypothesis of the study would be-

- H_o: Seasonal effects on monthly stock return are not present in DSE.
- H_a: Seasonal effects on monthly stock return are present in DSE.

The Stock market returns are calculated from the daily price index (without adjustment of dividend) for a particular month. Stock Market Returns (Rm) calculated are as follows:

$$Rm = Ln\ (PI_t / PI_{t-1})$$

Where, Rm measures market return in period t; PI_t indicates price index at day t and PI_{t-1} follows the price index at time period t-1. Ln = natural log, Logarithmic returns are more likely to be normally distributed which is prior condition of standard statistical techniques (Strong 1992; Mubarak 2000; Hossain 2010).

One way to prove the market efficiency is that the distribution should be random in nature. The basic assumption of random walk model is that the distribution of return series should be normal. According to random process, all the properties of random variable (such as mean, correlation etc) do not vary with time i.e. stationary. To find out the randomness of distribution series, we conducted Descriptive analysis, Run test and Autocorrelation test. Run test is an approach to detect randomness (stationary) in a distribution series. To test the monthly seasonal pattern, regression analysis is used.

In creating seasonal dummy variables, "N-1" rule is followed, as a set of 12 monthly seasonal dummy variables would be perfectly collinear. The return

series for the month of June is not considered because of the possibility of having extreme effect due to financial year end. To document the monthly effect on the DSE return series we run Equation (1). The following multiple regression model designed to account for data seasonality is estimated using SPSS 11.5.

$$Yt = \alpha - \sum_{j=1}^{11} \delta j Mi - \varepsilon t \qquad (1)$$

Where Y_t denotes each months average return, α is the y intercept; *Mi* denotes a set of dummy variable (A dummy variable is a numerical variable used in regression analysis to represent subgroups of the sample in a study) that controls the monthly effects (M1 = January, M2 = February, M3 = March, M4 = April, M5 = May, M7 = July, M8 = August, M9 = September, M10 = October, M11 = November and M12 = December) of a year at time 't'. We test the hypothesis that coefficients δj are jointly not significantly different from zero. εt is the error term.

Limitation of the Study

- This literature concentrates only the seasonal effect that will show only the seasonal pattern.
- No day of the week effect and holiday effect is analyzed here which is also very important to show the stock market return pattern.
- In this analysis only the DSE General Index is considered. Using the DSE All price Index and the DSE 20 Index can give a more concrete result.

Literature Review

Several studies have investigated the Calendar effects in stock market returns of a number of countries. Very few studies have done on Bangladesh capital market (DSE). The literature review on such studies is as follows.

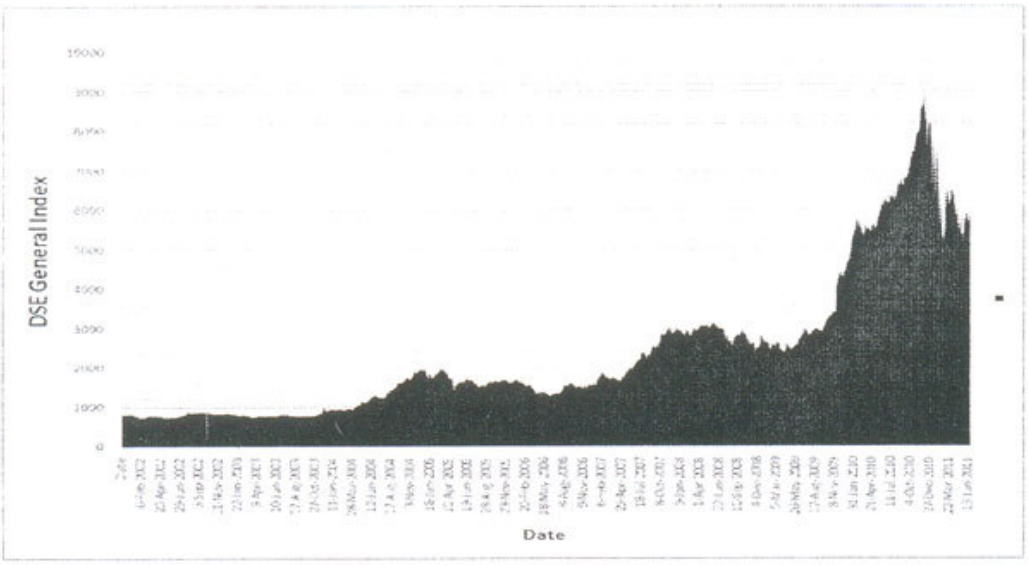
Khokan Bepari & Abu Taher Mollik (2009) found out the seasonal or monthly effect in stock return of Dhaka Stock Exchange (DSE). They used the monthly return data of the DSE all share price index (DSE All Index) and observed an "April effect" instead of "January effect". Md. Lutfur Rahman (2009) examined the presence of day of the week effect anomaly in Dhaka Stock exchange and observed the existence of day of the week effect in DSE. He concluded by identifying some results. The result indicates that Sunday and Monday returns are negative and only positive returns on Thursday are statistically significant. Result also reveals that the mean daily returns between two consecutive days differ significantly for the pairs Monday-Tuesday, Wednesday-Thursday and Thursday-Sunday.

The Calendar effect is also observed in stock markets of other countries. Here are some literature reviews on such studies. Paul Alagidede (2008) worked on the calendar effects in African Stock Market. In his study, he considered the month of the year effect and the pre holiday effect in African Stock Market that included the stock market of South Africa, Egypt, Nigeria, Zimbabwe, Kenya, Tunisia and Morocco. The result of his study revealed that the pre-holiday effects is only significant for South Africa. The January returns are positive and significant for Egypt, Nigeria and Zimbabwe. February returns are higher for Kenya, Morocco and South Africa. Tunisia has no monthly seasonality. Zhiguang Cao, Richard D. F. Harris and Anxing Wang (2007) investigated seasonality in the Chinese stock markets. They found out a significant weekend effect on returns that means returns are higher in Friday and lower in Monday. They also observed a very significant Spring Festival holiday effect and a little evidence of significant seasonality. Lennart Berg (2003) evaluated the seasonal and day of the week effect on Sweden Stock Market. His study revealed no distinct seasonal pattern for the conditional volatility for Swedish stock market. The daily turnover in the Swedish Stock Market has an impact on conditional volatility and it eliminates to some extent seasonal pattern in conditional volatility. Sunil Poshakwale (1996) has examined the Bombay Stock Exchange (BSE) and originated the existence of day of the week effect on BSE. The result showed that the average returns are different on each day of the week. The weekend effect is significant as the returns achieved on Fridays are higher compare to rest of the days of the week. Lei Gao and Gerhard Kling (2005) observed Calendar effect in Chinese Stock Market, particularly monthly and daily effects. By using the individual stock returns they concluded that the yearend effect was strong in 1991 but disappeared later. As the Chinese year end is in February, the highest return can be achieved in March and April. Studying daily effects, they found that Fridays are profitable. Faryad, Kashif, Rana and Majid (2011) made an analysis on equity market practices in Pakistan. They showed that there exists day effect in Pakistani Stock market. The returns of Tuesday on an average are greater in comparison to rest of the days. Nayan Krishna Joshi (2005) examined the seasonality effects in Nepalese stock market and concluded by showing the Kartik effects in Nepalese stock market. Jaffe and Westerfield (1985) had analyzed the weakened effect in Australian, Canadian, Japanese and UK equity market. The result in Australian and Japanese equity market is that the lowest mean return for both the market was on Tuesday. Solnik and Bousquet (1990) examined the Paris stock market (Paris Bourse) and concluded that the market faces a strong and persistent negative return on Tuesday. Barone (1990) analyzed the Italian stock market and identified the largest decline in Italian stock prices mostly on Tuesday.

About Dhaka Stock Exchange

Dhaka Stock Exchange (Generally known as DSE) is the main and first stock exchange of Bangladesh. It is located in Motijheel at the heart of the Dhaka city. It was incorporated in 1954. It is a public limited company. It is formed and managed under Companies Act 1994, Securities and Exchange Commission Act 1993, Securities and Exchange Commission Regulation 1994, and Securities Exchange (Inside Trading) Regulation 1994. The issued capital of this company is Tk. 500,000 which is divided into 250 shares each pricing at Tk. 2000. No individual or firm can buy more than one share.

Figure 1: DSE General Index (From 2001 to June, 2011)



Analysis of Findings

For examining the seasonality effects in DSE stock market return, a 2-Step analysis has been done:

- Market Efficiency Analysis
- Seasonal Effect Analysis

For evaluating the existence of seasonality in market return, it is essential to prove the market to be inefficient one (Gao and Kling 2005). From some previous works regarding these issues it has already been proved that the existence of seasonal effect can happen only be in an inefficient market. So, at first the market efficiency analysis has been done by Descriptive Statistics test, Run test Autocorrelation test. Analyze further the second test (seasonal effect) by Regression analysis.

Market Efficiency Analysis

From the Table 1, the descriptive statistics shows the positive mean returns for the whole period and maximum average return shows in the month of February, November and December. Skewness is a measure of symmetry, or more precisely, the lack of symmetry. Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution. Data sets with high kurtosis tend to have a distinct peak near the mean, decline rather rapidly, and have heavy tails. Data sets with low kurtosis tend to have a flat top near the mean rather than a sharp peak. It is evident that in a normal distribution skewness would be equal to zero and kurtosis would be 3(Three). The Histogram is an effective graphical technique for showing both the skewness and kurtosis of data set.

From Table-1, return series show positive skewness for the entire period and positive kurtosis. So we can say that the return series is more leptokurtic (A distribution with positive excess kurtosis is called **leptokurtic**) in nature. So we can conclude that the return series are not following the normal distribution hence not random.

Table 1: Descriptive Statistics

Month	N	Mean	Min	Max	SD	Variance	Skewness	Kurtosis
JAN	240	0.0105	-0.01448	0.7326	0.0849	0.0072	6.562	47.678
FEB	210	0.0121	-0.1107	0.7714	0.0836	0.0070	6.869	53.494
MARCH	242	0.0091	-0.2106	0.8248	0.0803	0.0068	7.307	63.141
APRL	225	0.0104	-0.2293	0.7949	0.0803	0.0069	6.981	57.691
MAY	241	0.0092	-0.2213	0.8648	0.0732	0.0053	8.040	85.383
JUNE	246	0.0084	-0.2384	0.8648	0.0672	0.0045	6.948	63.113
JULY	227	0.0095	-0.1186	0.7760	0.0737	0.0054	7.522	65.235
AUGST	219	0.0104	-0.0803	0.8170	0.0756	0.0057	7.94	71.707
SEPT	206	0.0114	-0.0969	0.8335	0.0839	0.0070	7.868	66.141
OCT	213	0.0108	-0.0880	0.8609	0.0876	0.0076	7.80	64.90
NOV	201	0.0125	-0.2038	0.1033	0.1033	0.011	6.502	46.836
DEC	189	0.0125	-0.1812	0.0892	0.0892	0.008	6.044	39.556

Additionally to test the randomness of return series, Run test is conducted. Run test is an approach to test and detect randomness (dependencies) in a return series. If the expected number of run is significantly different from the observed number of runs, the test rejects hypothesis. Table 2 represents the run test for the return series of different months. Expected number of runs differs from observed number of runs and thus reject the Null hypothesis (H_0) that states seasonal effects on monthly stock returns are not present in DSE. So, Alternative Hypothesis (H_a) is accepted that states seasonal effects on monthly stock returns are present in DSE.

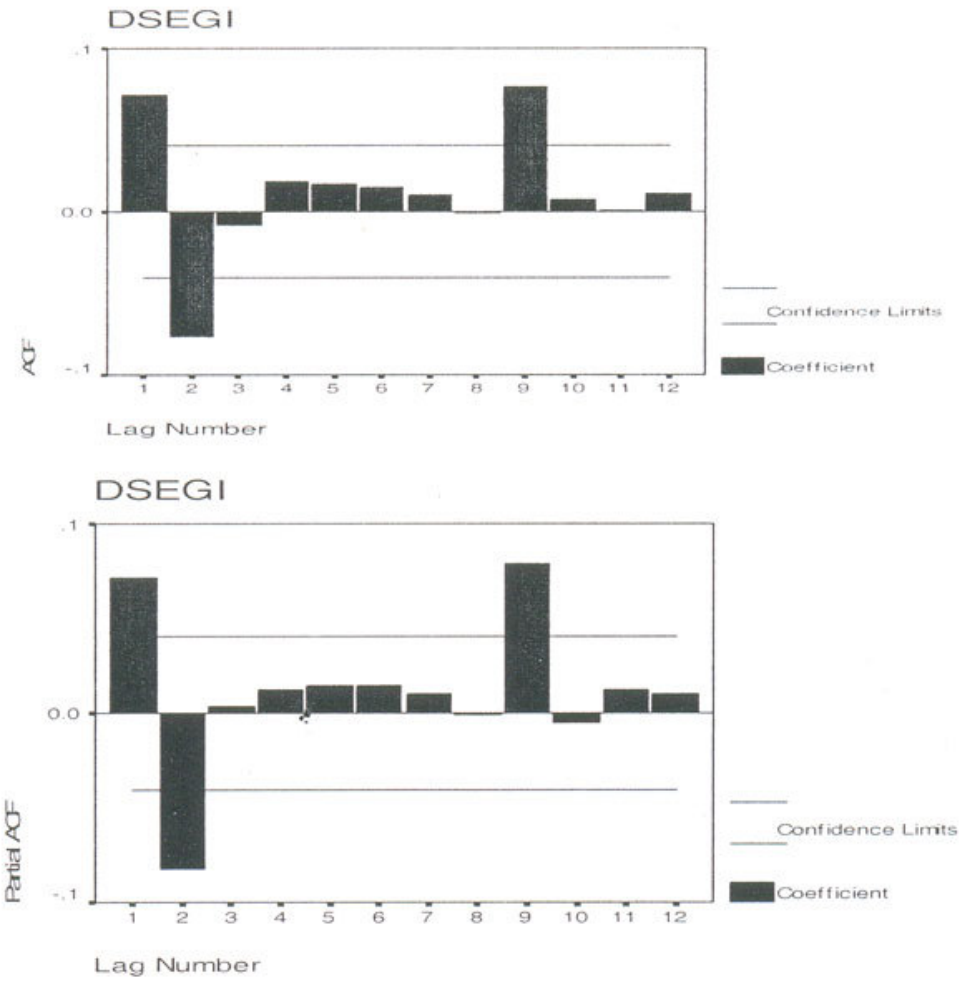
Run test converts the total number of runs into Z-statistics. The Z value gives the probability of difference between the actual and expected number of runs. At 5% level of significance, it is evident from the above table that the return series for January, February, August and December are not purely random in nature.

Table 2: Test of Randomness (Run Test)

Test Statistic	Test Value (Mean)	Cases < Test Value	Cases >= Test Value	Total Cases	No. of Runs	Z Value	Significant level @ 5%, 2 tailed test
JAN	0.0105	203	37	240	54	-2.388	0.017
FEB	0.0121	163	38	201	47	-3.616	0.000
MRC	0.0091	194	48	242	78	0.008	0.993
APRL	0.0104	189	36	225	55	-1.617	0.106
MAY	0.0092	187	54	241	76	-1.637	0.102
JUNE	0.0084	195	51	246	77	-0.945	0.344
JULY	0.0095	192	35	227	59	-0.309	0.757
AUG	0.0104	185	34	219	47	-2.967	0.003
SEPT	0.01146	181	25	206	41	-1.296	0.195
OCT	0.0108	182	31	213	51	-0.826	0.409
NOV	0.0125	175	26	201	47	0.229	0.819
DEC	0.0125	162	27	189	39	-2.481	0.013

Autocorrelation Plots are a commonly used tool for checking randomness in a data set. This randomness is ascertained by computing autocorrelations for data values at different time lags. Autocorrelation test finds out whether ACF (Auto correlation) or PACF (Partial Autocorrelation) different from Zero to find out the dependence or independence in a return series. The ACF and PACF show the existence of non stationary data in DSE return series at different lag. It can be said that DSE return series are not stationary in process and non random, which is against the efficient market hypothesis.

Figure 2: Auto Correlation (ACF and PACF) of DSE Return Series



Seasonal Effect Test

The output from the regression analysis has been presented in the following table. The analysis has been done at 1% significant level. Here, it is seen that the monthly return of January has a coefficient of -.003 and significant level of .108. Return for this month is not statistically significant because .108 is greater than .01 (10.8% > 1%) significant levels. The same thing happens for other months return except February return. For March return the coefficient is -.001 and

significant level is .424 that is greater than .01 (1%) significant level. It is statistically insignificant. Monthly return for April, May, July the coefficients are respectively -.003, -.001 and -.002. The significant level for these months is respectively .107, .719 and .226 those are greater than .01 (1%) significant levels. So the coefficient for these months also is not statistically significant that means the return for these months is not significant. The return for the rest of the months (August, September, October, November December except February) having a coefficient respectively -7.95^{-07}, .000, -.001..001 and .000. The significant level of these months is 1, .850, .719, .699 and .877. In all cases the grater significant level than .01 proved them to be statistically insignificant. Comparing with the other months, it is found that only the return for the month of February has statistically significant coefficient. The coefficient for February return is -0.005 and significant level is 0.009 that is less than .01. Monthly return for February is statistically significant at 1% level of significance. It is evident that only the month having a statistically significant monthly return can be proved to have a seasonal effect (Paul Alagidede, 2008). So, in DSE the seasonal effects exist in February. In this month the market return is in maximum range. Though our financial year ends on June, most of the companies follow the financial year January to December. Investor's perception depends on the different decision of companies taken at the end of the year. For this reason the February effects are shown in DSE. Therefore the Null Hypothesis (H_o) is rejected. Accepting the Alternative Hypothesis (H_a) , it is evident that the monthly seasonal effect is present in the DSE stock return series and the effect lies in February.

Table 3: Regression Model to test Seasonality

Variable	Coefficient	t-Statistics	Significance Level
Constant	*.002*	*1.733*	*.086*
M1 (January)	*-.003*	*-1.62*	*.108*
M2 (February)	*-.005*	*-2.679*	*.009*
M3 (March)	*-.001*	*-.802*	*.424*
M4 (April)	*-.003*	*-1.625*	*.107*
M5 (May)	*-.001*	*-.361*	*.719*
M7 (July)	*-.002*	*-1.219*	*.226*
M8 (August)	*-7.95^{-07}*	*.000*	*1.000*
M9 (September)	*.000*	*-.190*	*.850*
M10 (October)	*-.001*	*-.360*	*.719*
M11 (November)	*.001*	*.388*	*.699*
M12 (December)	*.000*	*-.155*	*.877*

From Table 4 it is evident that the insignificant F-statistic suggests poor model fit. Durbin-Watson statistic of less than 2 indicates serial correlation in the residual.

Table 4: Model Fit

Test Statistics	Result	Significance level
Durbin- Watson	*1.99*	-
F- Statistics	*1.564*	*0.121*

Conclusion

The existence of seasonality pattern can be shown in the stock market return if the market is not an efficient one. This study is an effort to demonstrate the effect of seasonality in DSE by using the DSE General Index. For this two steps of analysis have been done. At first the efficient market hypothesis has been tested through Run test and Autocorrelation test. The result we have got from the analysis is such that DSE is an inefficient market. That means there is some existence of non stationary data in different lags. The study has also found that a "February effects" instead of "January effects" (In most developed countries the seasonal effects lies in the month of January) exist in DSE. The findings of this study may be varied with the previous studies due to dividend adjustment with return series, different indices and different time period. If the seasonal effects are prominent and systematic in the stock markets, investors can have useful clues regarding their investment decisions. Speculators and portfolio managers can engage in playing games in derivative markets such as futures, options, and mutual funds portfolio rebalancing. However further research is needed involving other stock indices of DSE such as All Price Index and DSE 20 Index. Again including the day of the week effect and holiday effect can give more accurate result for DSE.

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