UNIVERSITI PUTRA MALAYSIA

THE DAY-OF-THE-WEEK EFFECTS AS OBSERVED AT THE KUALA LUMPUR STOCK EXCHANGE AND THEIR IMPLICATIONS ON THE EFFICIENT MARKET HYPOTHESIS

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ABSTRACT

The Capital Asset Pricing Model relies on the mathematical notion of expected rates of return. It is thus important to determine just how well stock prices mirror the fundamental value of firms. Previous studies on stock returns have revealed certain empirical anomalies and irregularities. Past studies conducted primarily in the US indicated the existence of “day-of-the-week” seasonal anomaly where daily returns for certain days of the week are consistently above or below the average. This paper attempts to observe this phenomenon in the Malaysian stock market by using data of daily index returns. It was found that DOTW effects observed at the KLSE were only statistically significant during periods of economic expansion. A new finding revealed by this study was that Wednesday exhibited the highest mean daily returns at the KLSE as opposed to the finding of Friday having this distinction in earlier studies. However, in agreement with earlier studies; this study discovered that Monday has the lowest mean daily return among the days of the week. Furthermore, it was discovered that Monday persistently recorded negative daily returns. A formal model attempting to explain the anomaly is presented. The implications of the observed anomaly to the Efficient Market Hypothesis is then discussed.

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INTRODUCTION

The Capital Asset Pricing Model (CAPM) and most other pricing theories place great reliance on the mathematical notion of expected rates of return. To provide empirical content, researchers use the metaphor of “the market” as a single investor whose expectations are a type of weighted average of the expectations of real investors. Empirical tests of the theories proceed by investigating whether the market’s expectations provide a reasonable and accurate estimate of the future returns of a security.

Though the whole issue of market expectations may seem abstract, it actually has an immediate and practical importance for businesses as well as for public policy. If security prices are truly determined according to the pricing formula where the market’s expectations are based on sound analysis of everything that investors and managers may know, then the cost of raising capital for investment projects will be similarly well founded and firms will be encouraged to undertake the right investment projects. Managers will not fear that good investments they made in the hopes of long-term returns will depress the stock price and harm its stakeholders. Conversely, if the expectations as reflected in market prices are not well founded; then even the best-managed firms may be subject to takeover attempts and managers may be encouraged to manipulate investors' expectations rather than creating value. For these reasons, it is of great importance to determine just how well stock prices mirror the fundamental values of firms, i.e. the efficiency of stock markets.

An efficient market is one in which the prices of all securities quickly and fully reflect all available information about the assets. Standard practice since 1970 is to discuss market efficiency in the form of the Efficient Market Hypothesis (EMH). The EMH is concerned with the extent to which stock prices quickly and fully reflect the different types of information and can be divided into three cumulative forms. These forms differ about what information at a minimum is used in determining those expectations.

The Weak Form of the EMH holds that the relevant expectations are based at least on information about past and current market prices. In other words, an investor who knew only the pattern of past prices of securities could not, on that basis alone; pick stocks that would on average have higher excess returns than predicted by the pricing theory. If a market is Weak Form efficient, historical price and volume data should already be reflected in current prices and should be of no value in predicting future price changes. Tests of the usefulness of price data are called weak-form tests of the EMH.

A more comprehensive level of market efficiency involves not only known and publicly available market data, but all known and available data such as earnings, dividends, new product developments and accounting changes. A market that quickly incorporates all such information into prices is known as a Semi-Strong Form efficient market. Tests of the Semi-Strong Form EMH are tests of the speed of adjustment of prices to announcements of new information.

The most stringent form of market efficiency is the Strong Form, which asserts that stock prices fully reflect all information, both public and non-public. If the market is Strong Form efficient, no investor should be able to earn abnormal rates of return by using publicly available information in a superior manner. Strong Form efficiency encompasses the Weak and Semi-Strong forms and represents the highest level of market efficiency.

Behind the Efficient Market Hypothesis is the notion that securities markets are efficient, with the prices of securities reflecting their economic value. The theoretical arguments in favor of EMH are largely based on a simple theory of investor behavior. If the expectations manifested in the prices did not accurately reflect available information about future returns, then investors who used the available information would be led to purchase securities with the highest expected returns relative to their prices. This extra demand would drive the prices of these securities up and hence reduce their rate of return. Provided there are enough sophisticated investors who pay attention to the relevant information and act upon it, prices can never vary too far. In a perfectly efficient market, security prices always reflect immediately all available information, and investors are not able to use available information to earn abnormal returns because it is already impounded in prices. In such a market, every security's price is equal to its intrinsic value, which reflects all information about the security's prospects.

LITERATURE REVIEW

The Efficient Market Hypothesis has received considerable amount of attention by many researchers of finance. This hypothesis has important implications for the capital market because if a market is efficient, stock prices should reflect all available information thereby leading to an efficient allocation of scarce capital resources. Hence this hypothesis implies that past information cannot be used by investors to obtain abnormal returns. In other words, a simple buy-and-hold strategy would generate as much return as one that relies on complex trading rules.

Studies conducted on stock returns have revealed certain empirical irregularities or market anomalies. By definition, a market anomaly is an exception to the condition of market efficiency. Among the anomalies considered significant, prevalent and important are the January effect, the size effect, the value line and the day-of-the-week effect.

Some of the most anomalous empirical findings in finance are associated with the sample distributions of daily stock returns. Cross (1973), French (1980), Gibbons and Hess (1981), and Keim and Staumbaugh (1984) have documented that the average return on Friday is abnormally high, and that the average return on Monday is abnormally low. This so-called “day-of-the-week” (DOTW) anomaly continues to perplex researches as to its basis and has yet to be satisfactorily explained.

French (1980) studied the Standard and Poor’s 500 Composite Index daily returns for the period of 1953 to 1977 and found the average Monday return to be significantly negative. Gibbons and Hess (1981) also investigated the DOTW effects as observed on the Standard and Poor’s Composite Index, this time for the period of 1962-1978. They found that Monday returns tend to be abnormally low and negative at times. Utilising the same index over the longer period of 1928 to 1982, Keim and Staumbaugh (1984) examined the related weekend effect and found the existence of high negative Monday returns, consistent with earlier findings. They also discovered that smaller firms tend to yield higher average Friday returns than larger firms. Rogalski (1984) investigated the interrelationship between the weekend, the firm size and the January effects and found that small firms have higher returns on Mondays in the month of January than the larger ones.

Jaffe and Westerfield (1985a) investigated the DOTW effect as observed in the UK, Japanese, Australian and Canadian stock markets. They found that the markets in these countries exhibit statistically significant negative average Monday returns and high average Friday and Saturday returns. In the case of Japan, where until recently Saturday was a trading day; Jaffe and Westerfield (1985b) discovered that it is Saturdays and not Fridays that yielded the highest daily returns. Various possible explanations such as settlement procedures, specialist biases and measurement errors were examined but Jaffe and Westerfield failed to find any conclusive evidence to link these factors to the DOTW phenomenon.

Jaffe, Westerfield and Ma (1989) explored the possibility of a link between low Monday returns with the rise or decline of markets in Canada, Australia, the UK and Japan. The results showed pronounced low Monday returns during periods of market declines but surprisingly, no discernable pattern was observed during periods of market rises. Although the results showed the existence of a link as postulated, the researchers did not manage to satisfactorily explain the observed phenomena by looking at such factors as risk and serial correlation of the time series data.

Liano (1989) explored the DOTW effect in stock returns over business cycles by using the equally weighted and the value weighted stock indices provided by the Center for Research in Security Prices. The results revealed significantly low or negative Monday returns and high and positive Friday returns during periods of economic expansion. But for periods of economic contraction, while the results for Monday returns remained the same; the Friday returns were found to be significantly high only for small firms.

Lakonishok and Maberly (1990) examined the relationship between the DOTW effect and the trading patterns of investors. The results showed that individual investors tend to trade more on Monday at which time they also tend to increase the number of selling transactions relative to buying transactions, thus depressing stock prices and affecting the Monday returns.

Sias and Starks (1995) also investigated this relationship between the phenomenon and the behavior of investors. By comparing the daily returns of portfolios held primarily by institutional investors and those held primarily by retail investors, they found that stocks with high institutional holdings exhibit greater weekly seasonal effects compared to those with high individual holdings. These findings implicated institutional investors as the cause of the DOTW effect and generally contradicted the earlier findings of Lakonishok and Maberly who concluded that the anomaly is primarily caused by individual investors.

Closer to home, Wong and Ho (1986) investigated the DOTW effect on the Stock Exchange of Singapore (SES). Using the SES All-Share Index and six sectoral indices, they discovered a strong seasonal pattern that repeats itself weekly. This seasonal pattern takes the form of low or negative Monday returns and high positive Friday returns. Consistent with the findings of Rogalski, they also found that an interrelationship exists between the DOTW effect and a more generalised form of the January effect whereby Monday returns tend to be consistently high and positive in the months of December and January.

On the local front, Annuar and Shamser (1987) studied the DOTW effect as observed on the Kuala Lumpur Stock Exchange (KLSE) by using the New Straits Times Press Index (NSTPI) over the period of 1975 to 1985. Their findings of negative Monday and Tuesday returns are generally consistent with earlier studies. Meanwhile, Yong (1989) studied the seasonal January effect by using the Industrial, Finance, Hotel, Property, Tin and Plantation sectoral indices of the KLSE. He postulated that the anomaly is due to the investors in the Malaysian market being predominantly Chinese who execute trading strategies to derive speculative gains for the Chinese New Year celebrations that fall either in January or February each year.

OBJECTIVES OF STUDY

The Malaysian securities industry has undergone major structural changes and development since the 1980's. At one point in time, the Kuala Lumpur Stock Exchange (KLSE) was the third biggest bourse in the world in terms of capitalization. The Kuala Lumpur Composite Index (KLCI) is a weighted series of 100 leading stocks listed on the main board of the KLSE. The objective of this study is to describe the nature of the DOTW effect as observed at the KLSE for a sufficiently long time period. It will examine the DOTW effect of the KLCI and its implications on the EMH. It will also seek to determine whether there exists certain days which consistently provide the highest and lowest daily returns respectively on the KLSE.

PROBLEM STATEMENT

Specifically, this study sought to assess the nature and magnitude of the day-of-the-week effects observed at the Kuala Lumpur Stock Exchange and the implications that these findings may have on the Efficient Market Hypothesis.

IMPORTANCE OF STUDY

Because the DOTW anomaly has been reported primarily for US stock returns, it is appropriate to investigate whether similar results occur in other countries. Positive findings would strongly support the proposition that the weekly seasonal effect is indeed a general, worldwide phenomenon rather than the result of a special type of institutional arrangement or structural framework peculiar to the US market.

DATA

The data of this study consist of daily closing quotes of the Kuala Lumpur Composite Index over the period from January 4, 1993 to November 12, 1988 that has been provided by the KLSE. The KLCI is a weighted index of 100 stocks listed on the KLSE. These component stocks that constitute the index are listed in Appendix 1.

It is generally held that the Asian Currency Crisis was precipitated by the sudden and rapid devaluation of the Thai baht which occurred on July 4, 1997. The systematic risk that was introduced into Asian markets as a result of the crisis distorted these markets and essentially changed them into new entities that bore little resemblance to their pre-crisis characteristics. Thus for the purposes of this study data analysis was performed for two periods, namely the high growth Pre-Crisis Period (i.e., January 4, 1993 to July 3, 1997) and the Entire Period for which data is available (i.e., January 4, 1993 to November 12, 1988).

This raw data was further processed to yield the percentage daily return according to the formula:

$$R_t = [(V_t - V_{t-1})/ V_{t-1}] * 100$$

where v_t is the closing value of the KLCI index at the end of week day t

and v_{t-1} is the closing value of the KLCI index at the end of week day t-1 (i.e. the previous trading day) respectively

LIMITATIONS OF STUDY

One limiting factor of the study is that stock indexes such provide only a rather general picture of asset returns. But if the DOTW phenomenon has the same qualitative impact on all assets, it would be detected even if only an index such as the KLCI is used.

Tests on indices are valid but subject to an important limitation. It is well known (for example, see Scholes and Williams (1977)) that infrequent trading

The following null hypothesis will be tested:

1. **H_0:** $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5$, i.e. all average daily returns are equal.

In addition, because studies by Cross (1973), French (1980), Gibbons and Hess(1981), and Keim and Staumbaugh (1984) have shown that the average return on Monday is abnormally low and the average return on Friday is abnormally high, another two null hypotheses will be tested; specifically:

2. **H_0**: $\alpha_1=\alpha_{i,}$ i.e. the mean percentage daily return for Monday equals the mean percentage daily return of day i
3. **H_0**: $\alpha_5=\alpha_I$, i.e. the mean percentage daily return for Friday equals the mean percentage daily return of day i

8.1 Types of Tests

There are two general classes of tests of statistical significance: parametric and non-parametric. Parametric tests are more powerful because their data are derived from ratio and interval measurements. Non-parametric tests are used to test hypotheses with nominal and ordinal data or when certain assumptions of the parametric tests are violated.

8.1.1 Parametric Tests

Parametric techniques are the tests of choice if their assumptions are met. Assumptions for parametric tests include the following:

causes serial correlation in indices to be greater than serial correlation in individual stocks.

METHODOLOGY

The software used to process and analyze the data is the SPSS/PC+. First, the characteristics of the samples from the two periods are described and compared with the results from similar studies.

To test for the DOTW effects, a regression model was needed. Following French (1980), Gibbons and Hess (1981), and Keim and Staumbaugh (1984), a test of differences in mean return across the days of the week was constructed by computing the following regression for the KLCI:

$$\bar{R}_{it} = \alpha_{1i}D_{1t} + \alpha_{2i}D_{2t} + \alpha_{3i}D_{3t} + \alpha_{4i}D_{4t} + \alpha_{5i}D_{5t} + V_{it}, \qquad (1)$$

where $\bar{R}_{it}$ is the return of index i in period t, V_{it} is a disturbance, D_{1t} is a dummy variable for Monday (i.e., D_{1t} = 1 if observation t falls on a Monday and 0 otherwise), D_{2t} is a dummy variable for Tuesday, etc. The vector of disturbances, V_{it}; is assumed to be independently and identically distributed. The coefficients of (1) are the mean returns for Monday through Friday.

1. The observations must be independent i.e., the selection of any one case should not affect the chances for any other case to be included in the sample.
2. The observations should be drawn from normally distributed underlying populations.
3. These populations should have equal variances.
4. The measurement scales should be at least interval so that arithmetic operations can be used with them.

8.1.2 Normality Test

Although the sample data is interval and hence parametric, to use parametric statistical methods, normal distribution needs to established. The Kolmogorov-Smirnov (KS) method is usually used to test the normality of a distribution. The KS is a test of goodness fit in which the cumulative frequency distribution that would occur under theoretical distribution is specified. This is then compared with the observed cumulative frequency distribution. The theoretical distribution represents the expectations under H_0. To perform the comparison, the value of the D test statistic is then identified where

$$D = \text{maximum } |F_O(X) - F_T(X)|$$

in which

$F_O(X)$ = The observed cumulative frequency distribution of a random sample of n observations

$F_T(X)$ = The theoretical frequency distribution under H_0.

8.1.3 F-Test

To test the first null hypothesis, the one-way analysis of variance or the F-test was used. The observed value of the test statistic, F-observed can be calculated as:

$$\text{F-Observed} = \frac{\text{Between Groups Mean Square}}{\text{Within Groups Mean Square}}$$

The decision rule is that the null hypothesis is rejected if F-observed is greater than the critical F-statistic value from the table at the 5 percent level of significance. Degrees of freedom to obtain the correct F-statistic value from the table are C-1 and N-C, where C is the number of groups (five in this study) and N is the total number of observations (1447 and 1110 for the two periods respectively).

8.1.4 T-Test

To test the second null hypothesis parametrically, a difference of the means statistical test known as the independent samples t-test was performed by comparing Monday's average return with the average return of the remaining trading days for the KLCI index. This test was also repeated for the last trading day of the week, i.e. Friday; to test the third null hypothesis.

The independent samples t-test procedure compares means for two groups of cases. One major reason for choosing the test is that it is fairly robust to departures from normality. Robustness in statistics refers to the remarkable efficiency of the test even when the assumptions are violated. In general, the t-observed statistic can be calculated as

$(\bar{X}_1 - \bar{X}_i)$ / Standard Error (to test the second null hypothesis)

and

$(\bar{X}_5 - \bar{X}_i)$ / Standard Error (to test the third null hypothesis)

where $\bar{X}_1$, $\bar{X}_5$ and $\bar{X}_i$ are the average daily returns for Monday, Friday and day of the week i, respectively.

There are two ways in which the standard error can be derived, depending on whether the two populations have equal variance. This means that information regarding the variance must be known to be able to use the t-test effectively. Fortunately, the null hypothesis whether two groups have equal variance can be tested using the F-test. The F-statistic can be calculated as

F-Observed = S_1^2/S_i^2 (for the second null hypothesis)

and

F-Observed = S_5^2/S_i^2 (for the third null hypothesis) where S_1^2, S_5^2 and S_i^2 are the variances of two independent samples of sizes n_1, n_5 and n_i respectively.

The value of the F-observed statistic is then compared with the critical value from the F-statistic table. Degrees of freedom to obtain the correct F-statistic values from the table are $n_1 - 1$ and $n_i - 1$ for the first case and $n_5 - 1$ and $n_i - 1$ for the second case respectively. In this study, the value of the level of significance (α) is set at the 5 percent level.

If the variances of the two populations are significantly equal, the standard error can be calculated as:

$$\{[((n_1 - 1)S_1^2 + (n_i - 1)S_i^2)/(n_1 + n_i - 2)]\ [1/n_1 + 1/n_i]\}^{1/2}$$

(for the second null hypothesis)

and

$$\{[((n_5 - 1)S_5^2 + (n_i - 1)S_i^2)/(n_5 + n_i - 2)]\ [1/n_5 + 1/n_i]\}^{1/2}$$

(for the third null hypothesis)

where, n_1 is the number of daily returns for Monday

n_5 is the number of daily returns for Friday

n_i is the number of daily returns for day of the week i

S_1^2 is the variance of daily returns for Monday

S_5^2 is the variance of daily returns for Friday and S_i^2 is the variance of daily returns for day of the week i

If the variances of two populations are significantly unequal, the standard error can be calculated as:

$[s_1^2/n_1 + s_i^2/n_i]^{1/2}$ (for the second null hypothesis)

and

$[s_5^2/n_5 + s_i^2/n_i]^{1/2}$ (for the third null hypothesis)

where all the variables have been described in the previous paragraph.

The critical t-statistic value from the table is based on the 5 percent level of significance. The number of degrees of freedom to obtain the correct t-statistic values from the table is given by the lesser of n_1 or n_i (for the first case) and of n_5 or n_i (for the second case). The decision rule is similar to that of the F-test whereby the null hypothesis is rejected if the t-observed statistic exceeds the t-statistic from the table.

8.1.5 P-Value

Another method of presenting the results of statistical tests is to report the extent to which the test statistic disagrees with the null hypothesis. This method, which concentrates solely on the null hypothesis; has become popular because researchers and scholars want to know the percentage of the sampling distribution that lies beyond the sample statistic on the curve. Most statistical software packages report it as the probability value (p-value). These packages commonly compute the p-value during the execution of a hypothesis test (such as the F-statistics and t-statistics tests).

The p-value is defined as the probability the sample value would be as large as the value actually observed, given that the null hypothesis is true. It summarizes very clearly how much agreement there is between the data and the null hypothesis. It represents the probability of a Type I error that must be assumed if the null hypothesis is rejected. The p-value is compared against the significance level (α). The decision rule is if the p-value is less than the significance level, the null hypothesis is rejected.

The advantage of reporting the p-value is that the researcher can select whatever significance level he wants. If a statistical software package only reports that the null hypothesis was rejected at a particular significance level, the researcher would not be able to tell whether the same conclusion would result if some other significance level was used. For this reason, the p-values of the analyzed data will be reported in this study.

8.2.1 Non-Parametric Tests

Although parametric tests have been conducted in previous studies on the DOTW anomaly (in particular those parametric tests repeated in this study), the author felt that the methodology is not entirely appropriate due to possible