

The Day of the Week Effect in the U.S. Stock Market

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Abstract

This paper tests the efficiency of the U.S. stock market by examining the day-of-the-week effect for the average daily returns of the S&P 500 Index for a recent sample period and during the financial meltdown of 2008. The result of the pair-wise comparison of equal means show that the t-values for all pairs of daily returns are insignificant. The study then uses dummy variables to examine the day-of-the-week effect of the stock market by testing for equality of the mean returns across all trading days of the week. The empirical results of the study show that the individual t-values for the dummy variables and the F-value are insignificant for both time periods, signifying the absence of the day-of-the-week effect. The study concludes that there are no statistical differences among the daily returns of the S&P 500 Index for recent sample periods and provides additional support for the efficient market hypothesis.

I. Introduction

Investors have been trying for decades to find patterns in the stock market to increase their risk-adjusted rate of return. While some investors believe that the stock market is unpredictable, others are convinced that there are patterns in stock price movements that could be exploited to earn abnormal return. The claim of the random price changes in the equity market is best represented by the Efficient Market Hypothesis (EMH). This hypothesis has been one of the most common, and controversial, subjects in the field of finance. If the EMH is correct, the stock market appears to be unpredictable, thus the investing game is fair. However, in the absence of the efficient market, investors could take advantage of this inefficiency and make abnormal profits. In such cases, the market could exhibit some anomalies such as the “January effect” and the “weekend effect”. Seasonal and the day-of-the-week patterns have also provided examples of anomalies in the U.S. stock market.

A number of researchers have tested the efficient market hypothesis for equity markets. The overall results provide mixed signals about the existence of anomalies in the stock market. Furthermore, there is a lack of studies to test the efficiency of the U.S. equity market during the recent years and during the financial crisis in 2008. Therefore, the purpose of this paper is to examine the day-of-the-week effect of the U.S. stock market by comparing the average daily returns of the S&P 500 index in recent years and during the 2008 financial meltdown.

This paper will present the Review of Literature in the next part. Part III of the paper will present the methodology and the data for this research. In Part IV, the paper reports the results of the research. The last section of the paper provides the conclusions and offers suggestions for further studies.

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II. Literature Review

a. Efficient Market Hypothesis

The idea of the EMH has been around for a long time. One of the pioneers in the field, Eugene F. Fama, was the first person who wrote a definitive paper on the efficient market hypothesis in 1970. Fama's idea essentially follows the concept of the Random Walk Theory, where the stock prices move randomly and investors cannot predict the future pattern of stock returns on a consistent basis. Although, as stated by Jargic, Podobnik and Kolanovic (2005), the adjustment of price to arrival of information is imperfect, price movement is still unpredictable. Therefore, investors have no way of predicting the random nature of the market movements.

The efficient market hypothesis was widely accepted by scholars and many investors about a generation ago. Following Fama's studies, many researchers have published papers on randomness of stock price movements to demonstrate the efficiency of stock markets (Jarrett and Kyper, 2006). For example, in 1973, Burton G. Malkiel published the first edition of *A Random Walk down Wall Street*. In 1978, Michael C. Jensen famously wrote: "I believe there is no other proposition in economics which has more solid empirical evidence supporting it than the efficient market hypothesis". He claims that the EMH has been tested and, with a few exceptions, found consistent support for this hypothesis.

Contrary to supporting evidence, there are other studies arguing against the efficient market hypothesis. For instance, Andrew W. Lo and A. Craig MacKinlay (1988) strongly rejected the Random Walk Theory for weekly stock market returns using the variance-ratio test. In 1999, Lo and MacKinlay published a book, *A Non-Random Walk down Wall Street*, to provide counterarguments against the efficient market hypothesis.

Supporters of market inefficiencies provide evidence of permanent variations in stock markets. Controversies arise when evidence strongly suggests that there are specific trends within the stock market that could be predicted ahead of time. Advocates of the efficient market hypothesis argue that the predictability resulted from rational pricing in expected returns in an efficient market. In contrast, opponents believe that the predictability reflects irrational investors in a speculative market (Russel and Torbey, 2002).

Some analysts argue that the issue of market efficiency comes down to whether or not investors are rational. John Maynard Keynes pictures the stock market as a 'casino' guided by 'animal spirit'. He argues that investors are guided by short-run speculative motives rather than having long-term perspectives that are rational (Russel and Torbey, 2002). An article by Mike Clowes (2005) asks "If the market is efficient, and investors act rationally, why do so many investors still seek active management returns? And why do market bubbles occur?" According to recent studies by Andrew Lo, Harris & Harris Group investors are often irrational, "exhibiting predictable and financially ruinous behavior". Warren Buffett has also argued against the efficient market hypothesis. Buffett once said that "I'd be a bum in the street with a tin cup if markets were efficient" (Glassman, 2007).

b. Stock Market Anomalies

If the EMH holds, how do we explain many of the anomalies in the market? The irregularities of the markets include the January effect, the weekend effect, the day-of-the-week effect, the seasonal/holiday effect, etc. (Russel and Torbey, 2002). The January effect indicates that small-capitalization stocks tend to yield higher rates of return in January than in any other month of the year. A research study by Haug and Hirschey (2006) refers to data from the New York Stock Exchange Index during the year of 1904 to 1974 and calculates the average stock market return. The research concludes that the average return during the month of January was 3.48 percent whereas the monthly return during the other 11 months of the year was only 0.42 percent. Therefore, returns in January were more than eight times higher than returns for a typical month of the year. Furthermore, as Shell (2004) reports “the January effect has occurred 70% of the time since 1926”. After many years of intensive study, as Haug and Hirschey (2006) claim, the January effect becomes a compelling evidence of market inefficiency.

A study by Rozeff and Kinney (1976) used the data from 1904-1974 to show that the NYSE stock returns were 8 times higher than returns for a typical month. In a more recent study, Haug and Hirschey (2006) used the value-weighted returns from 1802-2004 and equal-weighted returns from 1927-2004 to test the January effect. They found a persistent January effect on small-cap stocks even for the period after the passage of the 1986 Tax Reform Act. They concluded that the January effect is a serious challenge to the efficient market hypothesis.

The other common anomaly in the stock market is the day-of-the-week effect that implies that the distribution of stock returns varies according to the day of the week. A number of researchers have tested the day-of-the-week effect in various exchanges, across many securities and for different indices. Most of the studies such as Cross (1973), French (1980), Rogalski (1984), Harris (1986), and Berument and Kiyamaz (2001) have used the data for the U.S. and have shown negative returns on Mondays and positive returns on Fridays.

The available literature shows that stock market anomalies exist in markets outside of the United States as well. In a study by Gultekin and Gulfekin (1983), the January returns were exceptionally large in 15 out of 16 countries. In another study, Jaffee and Westerfield (1985) found significant negative returns for Mondays for several countries whereas the mean returns for Tuesdays were significantly positive. According to Berument and Kiyamaz’s study (2001), the highest volatility occurs on Mondays for Germany and Japan, on Fridays for Canada and the United States, and on Thursdays for the United Kingdom. Aggarwal and Rivoli’s paper (1989) tested the January effect and the day-of-the-week effect in equity markets for four emerging economies. The results support the existence of both anomalies in the equity markets for the period under study. The day-of-the-week effect was also tested by Tsangarakis (2007) for the Athens stock exchange for the period of 1981 to 2002. He has concluded that the day-of-the-week effect was not a dominant phenomenon in his study.

Agrawal and Tandon (1994) have conducted a comprehensive study to examine five seasonal patterns in stock markets of eighteen countries from 1971 to 1987. The results of their study for the day-of-the-week effect show that Friday returns are large and significantly positive for almost all of the eighteen countries. They found negative returns on Mondays for thirteen countries. In comparison, their study showed negative returns on Tuesdays in twelve countries. Their overall findings cast some doubt on validity of the efficient market hypothesis.

Despite the existence of numerous studies about the existence of different anomalies in equity markets, there are other studies that have raised questions about the implications of such findings for investment purposes. Schwert (2002), for example, has conducted a number of tests about several common anomalies in the stock market and claims that the anomalies are more apparent than real. He concludes that even if the anomalies existed, the activities of practitioners who implement strategies to take advantage of such inefficiencies would cause the anomalies to disappear.

III. Methodology and Data

In order to test the efficient market hypothesis for the U.S. stock market in recent years, this study uses two sample periods for the S&P 500 Index from Yahoo Finance to test the day-of-the-week effect. The first sample is daily data from 08/25/2008 to 12/05/2008. This period is isolated mainly because it covers the period of high volatility of the recent financial meltdown in the U.S. stock market. The other sample includes daily information from 08/01/2003 to 08/22/2008. This five-year range data provides a longer time to avoid the focus only on abnormal changes in the market during the recent financial crisis. The information collected contains the closing prices of the S&P 500 Index for each day that the market was open. The actual number of trading days for the shorter sample ranged from 58 to 62 days. For the longer sample size, the number of observations for each trading day was from 1250 to 1268 days. The rate of return for each day was computed by assuming that we are buying stocks at the closing price on Friday and selling them at the closing price on Monday, etc. The computed rate of return for each day does not include any dividends payment.

The first step is to use the t-test to examine the equality of means of daily returns for both sample periods. The next step is to use dummy variables in a regression model to test for equality of all means. To do this task, this study follows the methodology used by Agrawal and Tandon (1994) and Aggarwal and Rivoli (1989), among others, to estimate the following equation:

$$R_t = \beta_1 D_{1t} M + \beta_2 D_{2t} Tu + \beta_3 D_{3t} W + \beta_4 D_{4t} Th + \beta_5 D_{5t} F + \mu_t$$

Where R_t is the average daily return for the S&P 500 index and beta coefficients represent the mean returns for Monday through Friday. The dummy variables indicate the day of the week on which the return is observed. For example, if day t is Monday, $D_{1t} = 1$ and zero otherwise, etc. Finally, μ_t is the error term with zero expectations.

If the estimated coefficients of β_1 , β_2 , β_3 , β_4 , and β_5 are statistically insignificant, the F-statistic measuring the joint effects of the dummy variables is also expected to be insignificant, then there is no evidence to support the day-of-the-week effect. In that case, the efficient market hypothesis is supported. On the other hand, if the F-statistic is significant, it implies that there is

a day-of-the-week effect and investors could earn abnormal returns on certain days of the week.

IV. Empirical Results

In order to test the null hypothesis of equal pair of means, a t-test was performed. The t-values show whether or not the means for all of two-day combinations are different from each other. The results are reported in Table 1 for both sample periods under study. As the findings indicate, there is no difference between the means of daily returns for any pairs of days, either during the fall of 2008 or for the 2003-2008 time periods. Given the results of the t-test, we could conclude that the average stock returns on any possible pairs of days are equal. These findings are supportive of the efficient market hypothesis, implying that investors are not able to earn an abnormal rate of return on any particular day of the week.

The next section of the study implements five dummy variables in a multiple regression function to test for equality of daily means for each day of the week for both sample periods. The results of the regression analysis, as reported in Table 2, show that the coefficients of the dummy variables for every day of the week, for both sample periods, are statistically insignificant. The computed F-statistics measuring the joint significance of the dummy variables for the shorter time period is 1.42 whereas the F-value for the 2003-2008 samples is only 1.17. The coefficient of determination is 8.9% and less than 1% respectively for the two samples in this study. Therefore, the results of the study show that the null hypothesis of equal rates of return across days of the week cannot be rejected; hence, this study does not find any evidence to support the day-of-the-week effect in the U.S. stock market for the recent five years or during the 2008 financial meltdown. This finding provides another piece of evidence in support of the efficient market hypothesis.

V. Conclusions

The main purpose of this paper is to compare the average daily returns in the U.S. stock market for a recent sample period and during the financial meltdown in 2008 to examine the efficiency of the stock market using the day-of-the-week effect. To determine if the average daily returns are statistically equal, the study first performs a pair-wise comparison of daily means. The results show that the t-values for all pairs of daily returns are insignificant. The study then uses dummy variables to test for the day-of-the-effect of the stock market by testing for the equality of means across all of the trading days of the week. The empirical results of the study show that the individual t-values for the dummy variables and the F-value are insignificant for both samples signifying the absence of the day-of-the-week anomaly. The conclusion of the study indicates that there are no statistical differences among the daily returns of the S&P 500 Index and it provides support for the efficient market hypothesis.

The results of this study are consistent with findings of a number of other studies to support the efficient market hypothesis, but they are in contrast with other findings where the evidence showed the existence of some anomalies such as the day-of-the-week-effect. The differences in such results could be due to the use of different market indexes or different time periods for the studies. It is also likely that the existence of anomalies has provided knowledgeable investors some opportunities to earn abnormal profits for a limited time, but once these anomalies are publicized, abnormal profitable opportunities may disappear. Such arbitrage actions make the market even more efficient

Future studies could identify some of the specific reasons for the anomalies, whenever they exist. One specific area of research is to examine the role of advances in technology and in communication of information across countries on market efficiency. Another area of future research is to investigate the effect of stock indexes and the growth of Exchange Traded Funds (ETFs) on efficiency of the stock markets.

TABLE 1

Test for Pair-wise Equality of Means

	Fall 2008 (N1*)	2003-2008 (N2**)
<u>Pair-wise trading days</u>	<u>t-values</u>	<u>t-values</u>
Monday & Tuesday	0.35	0.23
Monday & Wednesday	1.64	-.08
Monday & Thursday	0.84	0.57
Monday & Friday	0.50	0.31
Tuesday & Wednesday	1.08	-0.47
Tuesday & Thursday	0.72	0.48
Tuesday & Friday	0.21	0.10
Wednesday & Thursday	-1.15	1.06
Wednesday & Friday	-1.15	0.57
Thursday & Friday	-0.62	-0.34

N1* = # of observations = 58 to 62 trading days for Sample 1

N2** = # of observations = 1250 to 1268 trading days for Sample 2

TABLE 2

Results of the Regression Model with Dummy Variables to Test Equal Means

$$R_t = \beta_1 D_{1t} M + \beta_2 D_{2t} Tu + \beta_3 D_{3t} W + \beta_4 D_{4t} Th + \beta_5 D_{5t} F + \mu_t$$

Panel A: Shorter Sample (Fall 2008):					
	β_1	β_2	β_3	β_4	β_5
Coefficients	-0.012	0.002	-0.03	-0.004	-0.006
t-values	(-0.70)	(0.12)	(-1.05)	(-0.27)	(-0.85)
	$R^2 = .089$		$F = 1.42$		$N = 63$
Panel B: Longer Sample (2003-2008):					
	β_1	β_2	β_3	β_4	β_5
Coefficients	0.0003	-0.0006	0.0003	.0009	.0007
t-values	(0.417)	(-0.800)	(0.423)	(1.30)	(0.921)
	$R^2 = 0.003$		$F = 1.175$		$N = 1266$

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