

## The Day of the Week Anomaly in Bahrain's Stock Market

Ahmad M. O. Gharaibeh and Fatima Ismail Hammadi

Ahlia University, Manama, Kingdom of Bahrain

**[Abstract]** The objective of this study is to examine the existence and the conditional nature of one of the most recognized anomalies, known as “the day-of-the-week anomaly,” that has jarred confidence in the conventional concepts of the efficient market hypothesis. A variety of statistical techniques -- multiple regression analysis, Pearson correlation coefficient, and t-test – have been employed to investigate the presence and the nature of the week-end effect on the Bahraini Stock Exchange. The study concludes that there is credible evidence for demonstrating the existence of the day-of-the-week effect in trading conducted through the medium of the Bahraini Stock market (albeit that the Bahraini market exemplifies only weak form market efficiency). In addition, this study demonstrates with respect to the Bahrain Stock Exchange that there is a positive correlation between returns on the first trading day of the week and the last trading day of the week and that the first trading day’s returns during the first half of the month exceeds that of the second half of the month.

**[Keywords]** Bahrain; stock market; the day-of-the-week-anomaly; market effect

### Introduction

The day-of-the-week effect has attracted considerable academic attention since its discovery back in 1930. Since then, an ample number of studies have examined the effect of the phenomenon on trades conducted in major equity bourses such as the New York Stock Exchange and the London Stock Exchange. Some of these studies have identified abnormally low stock returns measured on the first trading day of the week as compared to the rest of the week days. Contrary to what would be expected from application of efficient market theory, the average daily return in stock markets is not the same for all the days of the week.

### The Purpose and Objectives of the Study

The purpose of this study is to investigate the presence of the day-of-the-week effect in the Bahraini stock market over different periods of time and across companies of different sizes. This effect is of interest and great importance from a practical as well as from an academic point of view. If a calendar effect is prominent and systematic in the stock market, traders, speculators and portfolio managers can have useful clues regarding their investment decisions. Investors can also easily exploit such calendar effects to improve their returns by timing their investments. The study examines the daily stock returns of publicly traded companies listed on the Bahrain Stock Exchange to ascertain the correlation between the returns on the first trading day of the week and the last trading day of the week. The study also measures and compares first trading day returns in the first half of each month to the returns of the first trading day in the second half of the month.

### Literature Review

*“The concept of efficiency in economics is a general term for the value assigned to a situation by some measure designed to capture the amount of waste or friction or other undesirable economic features present”* (Sewell, 2011). Within this context, an efficient market is a market in which information is rapidly dispersed and reflected in prices. The modern literature of Market Efficiency begins with Samuelson (1965). Nonetheless, Eugene Fama (1965) was the first to introduce the term Efficient Markets into the economics literature. He suggested that stock prices are unexpected and pursue a random walk. An empirical antecedent of the random walk theory, however, can be traced back to 1933 when Cowles (1933) published his article following the 1929 crash of the U.S. stock market. He concluded that the forecasting performance was nothing but pure chance.

The hypothesis of efficient markets captured the imagination of economists and financial scholars alike. Further studies explored the reaction of the stock market to announcement of various events, such as earnings (Ball & Brown, 1968), stock splits (Fama, 1990), and capital expenditure (McConnell & Muscarella, 1985). However, more recently, certain anomalies, not consonant with the efficient market hypothesis (EMH), have been detected, mandating a refinement of the existing EMH concepts. For instance, several studies have proved that certain stock market anomalies deviate from the random walk with respect to stock prices generating predictable movements in assets prices that provide investors with opportunities to generate abnormal returns impossible according to the EMH (Aly, 2004). Other anomalies that have been identified that call into question the EMH include the January and November effects. Rozeff and Kinney (1976) document the high average returns in January as compared to the rest of the months. Bhabra, et al (1999) found evidence of a November effect after the U.S. Tax Reform Act of 1986.

Holiday and turn of the month effects have been well documented over stock returns. Ariel (1990) and Cadsby and Ratner (1992) provide evidence to show the returns are, on average, higher the day before a holiday than on other trading days. Banz (1981) revealed that excess returns would be earned by holding stocks of low capitalized companies. This is known as the Small Firm Effect or "size-effect." All other things being equal, the investor who held a low P/E ratio portfolio earned higher returns than an investor who held stocks with mixed P/E ratios. This P/E Ratio Effect was found by Basu (1977), who verified that stocks of companies with low P/E ratios earned a premium for investors.

People's moods change with weather changes. Saunders E. (1993) shows that sunny days elevate people's moods, and people enjoying good moods make more optimistic choices and judgments. Accordingly, he found that the New York Stock Exchange index tends to be negative when it is cloudy (the weather effect). Hirshleifer and Shumway (2001), who show that stock market returns are positively correlated with sunshine, corroborate Saunders (1993). These phenomena have been referred to as anomalies since they cannot be explained within the existing paradigm of EMH.

Among the most well-known anomalies is the week-end effect. French (1980) was the first to draw attention to the weekend effect, and, since then, many researchers, such as Gibbons and Hess (1981), Rogalski (1984), and Flannery and Protopapadakis (1988), have conducted further research with a view to explaining this anomaly. Miller (1988) hypothesized that individual investors tend to sell stocks on Mondays and cause the weekend effect. Lakonishok and Maberly (1990) supported Miller's hypothesis empirically by showing that investors do trade more on Mondays and their ratio of sell to buy orders is higher on Mondays than the rest of the week days. They attribute some of the Monday-Friday differential returns to the differential trading patterns of institutions and individuals.

Institutional features of the national stock markets, such as settlement procedures and delays between trading and settlement in stocks, pricing misquotes and measurement errors, specialists' behavior or dividend patterns have been considered as the main reasons for the presence of the weekend effect. (Gibbons & Hess, 1981; Keim & Stambaugh, 1984; Jaffe & Westerfield, 1985; Cross, 1973).

Damodaran (1989) argues that the cooperation's release of bad news on Friday after the markets close tends to depress Monday share prices. On the other hand, some studies have reported that the traditional weekend effect theory has reversed and became a positive Monday effect following the stock market crash of 1987. Consistently with such trends, Brusa et al (2000) reported that Monday returns were positive and Friday returns were small.

Moreover, Brusa et al (2003), Brusa and Lui (2004) and Gu (2004) have explained and reported the details of the reverse weekend effect. In addition, Chong et al. (2005), Keef and Roush (2005) note that once (an) anomaly is publicized, only too often it disappears or goes into reverse. Further, Mehdian and Perry (2001) statistically determined that negative Monday returns were significant for large U.S. stocks from 1987 to 1998. In contrast, other studies posit that a Tuesday effect exists instead of a Monday effect (Agrawal & Rivoli, 1989; Karan, 1995; Barone, 1990; Solnik & Bousquet, 1990; Brusa & Lui, 2004; Gu, 2006). More recently, Olson and Mossman (2010) found that a life cycle exists for the weekend effect in the U.S. Stock Market.

### Bahraini Stock market

The Bahrain Stock Exchange (BSE), currently known as Bahrain Bourse, was established in 1989. It has launched several initiatives to transform itself into a modern exchange patterned on a developed capital market system. The Bahrain Stock Market is an emerging exchange striving to reorient itself from being a well-protected, inwardly-focused institution into one that is regionally and internationally vibrant by offering a wide range of investment opportunities, liquidity, transparency, and appropriate regulations to safeguard investors. Its goal is to generate equity in the private sector and attract foreign investors. Empirical studies demonstrate that the Bahrain Stock Market is efficient in a weak form. It is abundantly clear that BSE still has major obstacles to overcome before it reaches the desired place on a global level and develops into a semi-strong market, even a strong form market (Shankaraiah & Rao, 2010).

### Methodology

This study uses a combination of regression analysis, correlation, and t-tests to assess the effect, if any, of the day-of-the-week effect in the Bahraini Stock Exchange; it will also ascertain whether Sunday returns are influenced by the returns of the preceding trading days. It will answer questions about whether or not there is a positive correlation between Sunday negative returns and Thursday positive returns, and whether or not the mean returns on Sundays are higher during the first half of the month and lower during the second half.

### Hypotheses

The hypotheses of this study include:

1.  $H_0$ : There is no weekend effect in the Bahraini market.  
 $H_A$ : There is a weekend effect in the Bahraini market.
2.  $H_0$ : There is no correlation between Sundays' and Thursdays' returns.  
 $H_A$ : There is a correlation between Sundays' and Thursdays' returns.
3.  $H_0$ : Mean returns on Sundays in the first half of the month do not exceed the mean returns on Sundays in the second half of the month.  
 $H_A$ : Mean returns on Sundays in the first half of the month exceed the mean returns on Sundays in the second half of the month.

The main source of data is the Bahrain Bourse (Bahrain Stock Exchange) publications. The data collected consists of daily closing prices of seven randomly selected companies listed in the Bahrain Stock Exchange, falling in the period (January 2006 to December 2010). Official religious holidays were excluded. The chosen companies are classified according to their activity in the market as either commercial banks, non-financial service companies, or industrial companies. The daily closing prices are used as a base for calculating the daily returns: the closing price of a certain day minus the closing price previous to that certain day divided by the previous day's closing price.

Mathematically:

$$R_i = \frac{P_t - P_{t-1}}{P_{t-1}}$$

Where,

$R_i$  is the percentage of the daily stock return.

$P_t$  is the closing price of new trading day;  $t$  is today's price.

$P_{t-1}$  is the closing price of the previous trading day;  $t-1$  is the previous day's price

### The Model

The following formula was used to examine the regression between the multiple independent variables (Week day) and the dependent variable (Stock return):

$$R_{i,t} = \beta_0 + \beta_2 Mon_{i,t} + \beta_3 Tue_{i,t} + \beta_4 Wed_{i,t} + \beta_5 Thu_{i,t} + \varepsilon_i$$

Where,

$R_{i,t}$  is the value of the dependent variable, stock return.

$\beta_0$  is the population's regression constant.

$\beta_{2Mon_{i,t}}$  is the independent variable's regression coefficient of the second trading day of the week, Monday.

$\beta_{3Tue_{i,t}}$  is the independent variable's regression coefficient of the third trading day of the week, Tuesday.

$\beta_{4Wed_{i,t}}$  is the independent variable's regression coefficient of the fourth trading day of the week, Wednesday.

$\beta_{5Thu_{i,t}}$  is the independent variable's regression coefficient of the fifth trading day of the week, Thursday.

$\varepsilon_i$  = Error term, or residual (i.e. the difference between the actual y-value and the value of y predicted by the population model).

Since the study hypotheses include several independent variables represented by the weekdays and a dependent variable represented by the mean daily stock returns, it is determined that the multiple linear regression analysis is the appropriate measure. The daily stock returns data for the seven companies was used to form a Dummy Variables table by assigning a value equal to 0 or 1, depending on whether or not the stock return possesses a given characteristic.

A t-test was utilized to assess whether the mean of Sunday returns in the first half of the month is *statistically* different from that of the second half of the month. This analysis is appropriate whenever comparing the means of two groups. The Pearson Correlation Coefficient or (Pearson's r) is utilized to measure the correlation (linear dependence) between Sunday stock returns and Thursday stock returns. It is widely used as a measure of the strength of linear dependence between two variables. Still, the correlation coefficient ranges from +1, indicating a perfect positive linear relationship, to -1, indicating a perfectly negative linear relationship (Groebner & Patrick, 2010).

## Results

By using statistical functions in Excel and SPSS, the daily returns for the five trading years were analyzed to answer the three questions of this study.

### *Multiple Regression Analysis:*

**Table 1.** Summary outputs for Coefficients and Multiple Regression Analysis

<i>Regression Statistics</i>	
Multiple R	0.60379158
R Square	0.4645643
Adjusted R Square	0.3696056
Standard Error	2.920575606
Observations	4202

**Table 2.** ANOVAs Outputs

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	130.9894	32.74735	3.839187	0.004059249
Residual	4197	35799.41	8.529762		
Total	4201	35930.4			

**Table 3. Coefficients and Multiple Regression Outputs**

	Coefficients	Standard Error	t Stat	P-value
Intercept $\beta_0$	-0.20625	0.097898	-2.10684	0.03519
Monday	-0.02420	0.141462	-0.17109	0.86416
Tuesday	0.15363111	0.139942	1.097821	0.272346
Wednesday	0.278029113	0.139651	1.990889	0.046558
Thursday	0.456632573	0.143198	3.188825	0.001439

The multiple coefficient of determination ( $R^2$ ), as shown in Table (1), indicates that only 46% of the variation in the daily stock returns is explained by the linear relationship of the four independent variables (Monday, Tuesday, Wednesday, and Thursday) in the regression model to the dependent variable (stock returns). A regression model is first constructed based on the selected sample;

$$R_{i,t} = \beta_0 + \beta_2 Mon_{i,t} + \beta_3 Tue_{i,t} + \beta_4 Wed_{i,t} + \beta_5 Thu_{i,t} + \varepsilon_i$$

Because regression models are subject to sampling errors, the researchers tested the statistical significance of the overall regression model. The specific null and alternative hypotheses for such test are

$$H_0: \beta_{Mon} = \beta_{Tue} = \beta_{Wed} = \beta_{Thu} = 0$$

$$H_A: \text{At least one } \beta_i \neq 0$$

At  $\alpha = 0.05$ , ( $\frac{0.05}{2} = 0.0025$ ) because it's a two tailed test.

Where,

$\beta_{Sun}$ ,  $\beta_{Mon}$ ,  $\beta_{Tue}$ ,  $\beta_{Wed}$ ,  $\beta_{Thu}$  are the regression slope coefficients for each independent variable (i.e. every week day)

$\beta_i$  regression slope coefficient for any independent variable which is not equal to zero.

$\alpha$  is the level of significance.

If the null hypothesis is true and all the slope coefficients are simultaneously equal to zero, the overall regression model is not significant and, therefore, not useful for predictive or descriptive purposes.

An  $F$ -test was used to check whether the regression model has any significance.

A comparison was conducted between the  $F$ -test value and the  $F$  critical value of the given level of significance  $\alpha$  which is equal to  $F_{0.05} = 2.75^1$ . If the  $F$ -test value is greater than the  $F$  critical value, the null hypothesis is rejected; otherwise it's accepted.

Because  $F = 3.839187 > F_{0.05} = 2.75$ , the null hypothesis is rejected. Therefore, it is concluded that the regression model is statistically significant and does explain a major proportion of the variation in stock returns along the week days. After concluding that the overall model is significant, the following hypotheses are tested to determine whether the stock returns are significantly negative on the first trading day of the week (Sunday):

$$H_0: \beta_{Sun} \leq 0$$

$$H_A: \beta_{Sun} > 0$$

$$\alpha = 0.05$$

Where,

$\beta_{Sun}$  is the regression slope coefficient for the stock returns on Sunday.

$\alpha$  is the level of significance.

T-test is used for these hypotheses. The  $t$ -value given in Table (1), which is also known as calculated test

<sup>1</sup>F critical value is calculated using Excel's FINV function.

statistics (or  $t$ -values), is compared to the critical  $t$ -value at the level of significance ( $\alpha$ ) of 0.05; if the  $t$ -value is greater than the critical  $t$ -value ( $t_{0.05}$ ) = 1.647<sup>1</sup>, then the null hypothesis is rejected.

Since,

$$T\text{-value} = -2.10684 < t_{0.05} = 1.647,$$

Then the null hypothesis is accepted, and we conclude that the regression slope ( $\beta_{\text{Sun}}$ ) for the Sunday returns is less than or equal to zero. In other words, stock returns on the first trading day of the week (Sundays) in the Bahraini market are either negative or equal to zero, which means there is a probability of the Week-End Effect in the Bahraini market.

### Independent Two-Sample T-Test

**Table 4.** *T-test: Two-sample*  
Assuming Equal Variances

	First Half	Second Half
Mean	0.169211	-0.8928
Variance	3.645648	278.157998
Observations	902	901
Pooled Variance	140.8256	
Hypothesized Mean Difference	0	
Df	1801	
t Stat	1.90002	
P(T<=t) one-tail	0.028795	
t Critical one-tail	1.6457	
P(T<=t) two-tail	0.05759	
t Critical two-tail	1.961282	

Using the data analysis function in Excel, an Independent two samples test assuming equal variances was performed to determine whether or not there is a difference in the mean Sunday returns on the first half of the month more than the second half of the month. To test this belief, all Sunday returns in the first half of each month in the five-year period were segmented versus all the Sunday returns in the second half of the each month. The specific null and alternative hypotheses for such test are

$$H_0: \mu_1 \leq \mu_2$$

$$H_A: \mu_1 > \mu_2$$

$$\text{At } \alpha = 0.05$$

Where,

$\mu_1$  is the mean Sunday returns in the first half of the month.

$\mu_2$  is the mean Sunday returns in the second half of the month.

$\alpha$  is the level of significance.

Table 4 Shows the outputs acquired from the Excel data analysis. The mean for the Sunday returns in the first half of the month is 0.169, whereas the mean for the Sunday returns in the second half of the month is -0.892. At issue is whether this difference (0.169 -0.892= 1.061) is sufficient to conclude that the mean Sunday returns in the first half of the month exceeds the mean Sunday returns in the second half of the month. Using the  $t$ -test technique again, the one-tail  $t$  critical value of  $\alpha = 0.05$  is shown in Table 4 to be,  $t_{0.05} = 1.6457$ . The Table also shows that the  $t$ -Stat value is equal to,  $t = 1.90002$ . As explained previously,

<sup>1</sup>  $t$  critical value is calculated using Excel's FINV function and it's positive because the test is a one tailed test and the rejection region would be located in the upper tail of the sampling distribution.

if the t-statistic is greater than the critical t-value, the null hypothesis is rejected, since,  $t = 1.90002 > t_{0.05} = 1.6457$ . As the null hypothesis is rejected, the sample data does provide sufficient evidence to conclude that mean Sunday returns in the first half of the month are greater than the mean Sunday returns in the second half of the month. The outputs shown in Table 4 also provide the p-value for the one-tailed test = 0.028795, which can also be used to test the null hypothesis. The decision rule would be as follows:

If  $p\text{-value} < \alpha$ , reject  $H_0$ ;

Otherwise, do not reject  $H_0$

The p-value for the one-tailed test is 0.0287. Because  $0.0287 < 0.05$ , the null hypothesis is rejected.

### Pearson Correlation

**Table 5.** Excel Pearson Correlation outputs

	$R_{SUN}$	$R_{THU}$
Mean	-0.18426	0.179823
Variance	6.894143	6.906064
Observations	1062	1062
Pearson Correlation	0.088686	
Hypothesized Mean Difference	0	
Df	1061	
t Stat	-3.3457	
P(T<=t) one-tail	0.000425	
t Critical one-tail	1.646291	
P(T<=t) two-tail	0.000849	
t Critical two-tail	1.962202	

**Table 6.** SPSS Pearson Correlation Outputs

		RSUNDAY	RTHURSDAY
RSUNDAY	Pearson Correlation	1	.089**
	Sig. (2-tailed)		.004
	N	1062	1062
RTHURSDAY	Pearson Correlation	.089**	1
	Sig. (2-tailed)	.004	
	N	1062	1062

\*\* Correlation is significant at the 0.01 level (tailed).

The outputs in Table (5) and Table (6) show Pearson Correlations between the first trading day of the week returns (Sunday), and the last trading day of the week returns (Thursday). The formula for the Pearson correlation coefficient,  $r$ , is

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

Where  $x$  and  $y$  are the sample means

The test to prove the positive correlation between Sunday returns and Thursday returns is conducted at a significance level of  $\alpha=0.05$ , and the hypothesis is formulated as follows:

$$H_0: \rho = 0$$

$$H_A: \rho \neq 0$$

$\alpha = 0.05$  ( $\frac{0.05}{2} = 0.0025$ ) because it's a two tailed test.

Where,

$\rho$  is the correlation coefficient between Sunday returns and Thursday returns.

$\alpha$  is the level of significance.

Using the t-test technique, since the  $t$  critical value for the test is approximately  $t_{0.0025} = 1.96^1$  at a significance level of 0.0025, as shown in Table (5). Then, if the  $t$ -value is greater than 1.96 or less than -1.96, this would lead to null hypothesis rejection. Because,  $T\text{-value} = -3.345 < t_{0.0025} = -1.96$ , then, the null hypothesis is rejected, and we would conclude that the correlation coefficient is not equal to zero. Thus, the 0.089 correlation coefficient between the Sunday returns and Thursday returns shows a significant correlation between the two returns.

### Conclusion and Recommendations

As the results of the study reveal, only 46%<sup>2</sup> of the deviation and movement in the stock returns along the weekdays is explained by the relationship between investors trading in the week days and stock returns, which mean that there is almost no relation between the investors trading on different week days and the stock returns. The daily mean returns for the seven companies prove to be significantly negative on Sundays (-0.184), which reveals the day-of-the-week effect anomaly presence in Bahrain. The measure that tests the degree of significance in the regression coefficient for Sunday returns ( $\beta_{\text{Sun}}$ ) also confirms the day-of-the-week effect presence. Furthermore, the findings imply that there is room for investors to adjust their portfolios by taking into account day of the week trading variations.

As per the nature of the Sunday returns in Bahrain, the Pearson correlation revealed that Sunday's returns are influenced by returns from preceding trading days. The Pearson Correlation is found to be 0.089, which indicates a weak positive correlation between the first trading day of the week and the last trading day of the week. This finding is, to some extent, consistent with Crosse (1973), who was the first to identify a positive correlation between the first and the last trading days of the week.

Besides, the independent, two-sample T-test results show that the day-of-the-week anomaly is influenced by a semi-monthly variation in weekday returns. As Sunday returns for the seven companies where segmented into two categories, first half of the month Sunday returns and second half of the month Sunday returns, it is observable that mean Sunday returns = 0.169, are higher in the first half of the month by 1.061 than the mean Thursday returns = -0.892, [0.169-(-0.892)]. This result is in line with Liano and Lindley (1995) findings, which revealed that the day-of-the-week effect is primarily attributable to low returns on the first trading day of the week in the second half of the month. The difference between first trading day and the last trading day may not be significant in the first half of the month.

Finally, it is important to recognize that the Bahraini stock market is deemed to be a weak market in terms of efficiency, and the day-of-the-week anomaly has still received no publicity or public attention and, therefore, the anomaly is still in the first stage of its life cycle.

### Recommendations

As investors realize that stock prices will rise by a significant amount on Thursday, then buying stocks at Wednesday's closing price and selling them at Thursday's closing price will most likely generate profit net of transactions costs. Investors could also shift their money into bank's deposit to avoid days of the weeks when average returns of the mutual fund class have historically been negative, then switch it back to riskier mutual funds. It is recommended that analysts and researchers further explore this putative weekday effect by applying a stochastic dominance model -- a method that requires making no assumption about the underlying returns across the weekdays.

<sup>1</sup>t critical value is calculated using Excel's FINV function.

<sup>2</sup>R Square=0. 4645643

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