

Friday The Thirteenth and The Stock Market*

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In this study, we investigate whether Friday the thirteenth has an effect on the stock market returns. We report the following findings: (1) The returns prior Friday the thirteenth are lower than normally prior the year 1981. (2) The returns after Friday the thirteenth are higher than normally after the year 1980. (3) Serial correlation in stock indexes is positive prior the year 1981 and negative after the year 1980. (4) Serial correlation between Friday and the following day is significantly lower after Friday the thirteenth. Thus, we conclude that the Monday anomaly is not more evident than Friday the thirteenth anomaly, and the anomalies may be interrelated.

Keywords: Friday the thirteenth, Monday effect, calendar anomalies, stock returns, persistence of anomalies

JEL codes: G11, G14

1. Introduction

Many calendar anomalies are considered to be persistent (see Lakonishok and Smidt, [1988]). Friday the thirteenth, however, even though being a very distinguishable calendar day, is not among these persistent anomalies. This potential calendar effect may be expected to exist as lower returns on Friday the thirteenth than normally, given that people are superstitious, and that Friday the thirteenth is attributed to bad luck. Investigating the existence of Friday the thirteenth effect on the stock market is important, because an abnormal market behavior would imply that the stock market is affected by human superstition, as indicated by Chamberlain, Cheung, and Kwan [1991]. The stock market participants, even though having said to be subject to fear and greed, do not seem to be affected by Friday the thirteenth. The early evidence on the existence of this possible anomaly by Kolb and Rodriguez [1987] is rejected by many studies, including Dyl and Maberly [1988], Chamberlain et al. [1991], Coutts [1999], Lucey [2001], and Patel [2009]. Zweig [2009] also presents in the *Wall Street Journal* that Friday the thirteenth have generated an average return of 0.28%, whereas, on average, the market goes up by 0.2% per day in a long run.

In this article, we re-examine whether Friday the thirteenth affect the stock market returns, but we take a new route in investigating the problem, in relation to the previous literature

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presented above. We argue that the superstition at Friday the thirteenth does not necessarily affect the Friday returns, but can instead be seen on the day close to Friday the thirteenth. Therefore, we also focus on the days before and after Friday the thirteenth. In our analyzes, we use the S&P 500 index returns over the period 1/1950–7/2009 and the Dow Jones Industrial average index returns over the period 10/1928–7/2009. We expect the stock returns to be lower on the trading day before Friday and higher on the trading day after Friday the thirteenth than normally. The reason is that the fear of Friday the thirteenth should cause selling during the day before Friday the thirteenth and, once the new trading day after Friday the thirteenth starts, the investors in relief should return to buy stocks. This analogy is simple; if one is afraid of a monster under the bed, one is probably not willing to look at under the bed to realize how afraid of the monster one can be. So, if one fears Friday the thirteenth and owns stocks, one dislikes holding them until Friday and, since no disaster existed, buys them back after Friday the thirteenth.

We also expect the relation between the returns on Friday the thirteenth and the following Monday to be negative, given that poor returns are considered as a buying opportunity on Monday due to Gambler's fallacy. This fallacy states that investors anchor on the information on prior Friday the thirteenth closing prices, and thereby **they** may see an opportunity after worse than expected returns on Friday the thirteenth. And this Friday is just considered as an unlucky day. This should also cause the returns on Monday after Friday the thirteenth to be higher than normally, as a result of relief. As the relation between the returns of Friday the thirteenth and the following Monday is considered, our paper also contributes to research on the weekend effect (see e.g., French [1980], Gibbons and Hess [1981], Keim and Stambaugh [1984], Lakonishok and Smidt [1988]) in addition to the research on Friday the thirteenth and stock returns (see, e.g. Lucey 2000; Patel, 2009).

Our results suggest that Friday the thirteenth affect stock returns, thus implying that the stock market is affected by superstition. We find that for most periods the returns prior Friday the thirteenth are lower than on average, and the returns after the day are higher than on average. The relation between Monday and Friday returns is also affected by Friday the thirteenth; the relation between the returns on Friday the thirteenth and the following Monday are found to be negative, while normally the relation is positive. The remainder of this paper is organized as follows. Section 2 revises the earlier literature on related financial anomalies and introduces the research hypotheses and their development. Section 3 proposes the data and methodologies employed in the statistical analyses, while Section 4 introduces the estimation results. Finally, the last section provides concluding remarks.

2. Literature Review and Hypothesis

2.1. Financial Anomalies

Previous literature has reported several irrational investment behavior patterns, so called anomalies. In a financial context, an anomaly is commonly determined as a documented pattern of price behavior, which is in contrast with the efficient market hypothesis (see e.g., Brav and Heaton [2002]). Among the most studied financial anomalies are the ones of size, season, and price ratio (see e.g., Zivney and Thompson [1987], Chen and Chan [1997], Dobbs [1999], Gaunt [2004]). The research on calendar anomalies is possibly the

avenue of research on financial anomalies which is the most closely related to this study. Perhaps the most well known anomaly is the January effect, which predicts that the January returns, particularly those of the small stocks, are higher than in the other months. This anomaly is evinced by many studies, such as Keim [1983], Reinagum [1983], and Lakonishok et al. [1988].

For monthly returns, Ariel [1987] finds that stock returns are on average positive only for the days immediately before and during the first half of calendar months. Cadsby and Ratner [1992] find further and statistically significant evidence for high returns around the turn of the month in Canada, the U.K., Australia, Switzerland, and West-Germany. For weekdays, a significant stream of literature has reported the existence of a Monday effect, i.e. the average stock returns of Mondays being negative (see e.g., French [1980], Gibbons and Hess [1981], Keim and Stambaugh [1984], Lakonishok and Smidt [1988]). In addition to stock markets, a similar Monday effect has been reported to exist e.g. in the gold price, exchange rates, and real estate investment trusts (see e.g., Ball et al. [1982], McFarland et al. [1982], Ma [1986], Redman et al. [1997], Thatcher and Blenman [2001]). There are various possible explanations for the Monday effect, but one the researchers could agree upon is still to be found. The so far suggested explanations include, for example, a misapplication of statistical methods, a response to market arrangements or to micro or macro information, and the trading patterns of market participants (see Pettengill [2003] for a review).

The Monday anomaly, however, is recently found to be nearly nonexistent. Connolly [1989] uses robust econometric methods to study the weekday returns. His results suggest that the Monday effect has disappeared by 1975. Brusa et al. [2000] use a sample period over the period January 1, 1990 to December 31, 1994 and find evidence for a reverse Monday effect. Mehdan and Perry [2001] consider more recent stock returns and find that the Monday effect is unstable and time-varying over the period 1964–1998. The evidence for the Monday effect is followed by Brusa et al. [2005] and Cho et al. [2007]. Yet, Brusa et al. [2003] still find evidence for Monday effect in foreign markets from U.S. investors' point of view. It is also objectionable whether the Monday day in itself is the cause for the Monday effect. Draper and Paudyal [2002] study Monday effect by controlling for various effects, such as trading activity, which may be associated with the Monday returns. Their results suggest that, after controlling for these effects, the Monday returns become positive.

In addition to the day of the week, several other types of factors have been reported to have an effect on the stock returns. For example, Kim and Park [1994] report abnormally high returns on the trading days preceding holidays. Moreover, also rain and time changes around daylight savings have been documented to effect the investor mood and, thus, also the stock returns (see e.g., Dowling and Lucey [2005]). The evidence for calendar anomalies gets a bit more eerie after considering the Halloween indicator. Bouman and Jacobsen [2002] report evidence suggesting the Halloween indicator 'sell in May and go Away' to be profitable, as the November–April returns are found to be higher than the May–October returns. Yet, Maberly and Pierce [2004] suggest that this anomaly is rather subject to the Crash of October 1987 and the Collapse of Long Term Capital Management in August 1998, than a phenomenon caused by the Halloween.

Friday the thirteenth, being an even eerier anomaly than the Halloween effect, is also considered as a potential calendar anomaly. In an early paper, Kolb and Rodriguez [1987]

examine whether the returns for Friday the thirteenth are significantly lower than the returns for other Fridays using a sample of CRSP value- and equally weighted indexes over the period July 1, 1962 –December 31, 1985. The authors find results suggesting that the market returns for Friday the thirteenth are significantly lower than the returns for other Fridays in general. Dyl and Maberly [1988] continue examining whether the returns for Friday the thirteenth are lower than for other Fridays using a Standard & Poor's 500 index over the period 1940–1987, and consider five sub-periods during this period. The authors state that there is no so-called Friday the thirteenth effect. In fact, their evidence indicates that the mean return of Friday the thirteenth is higher than the average Friday returns.

Chamberlain et al. [1991] also examine the S&P composite index and find evidence suggesting that the so-called Friday the thirteenth effect does not have an effect on the investment behavior. They conclude that, after considering the turn of the month anomaly, there is no evidence implying that Friday the thirteenth would influence market returns. Coutts [1999] examines the issue for the period 1935–1994 and reports that the returns for Friday the thirteenth are higher than on other Fridays. In a similar vein, by examining the FTSE world indices, Lucey [2000] proposes that the Friday the thirteenth returns are generally greater than the returns on other Fridays. In a recent study, Patel [2009] suggests that the U.S. stock returns do not show evidence supporting Friday the thirteenth phenomenon. By examining the S&P 500 firms over the period 1950–2007 he provides evidence indicating that Friday the thirteenth returns are not significantly different from the other Friday returns.

2.2. Hypothesis Development

People are, in general, prone to superstitious behavior. For example, Risen [2008] proposes that people tend to have an intuition that tempting the fate increases the possibility of a negative outcome. Friday the thirteenth is commonly believed to be an unlucky day, and many investors may expect these Fridays to be unprofitable also in the stock market. Social effect of Friday the thirteenth is evinced by many studies, and the fear of Friday the thirteenth is known as the paraskevidekatriaphobia. However, the Dutch Centre for Insurance Statistics reports that less accidents tend to happen on Friday the thirteenth, although the difference is statistically insignificant (Dutch Centre for Insurance Statistics [2008 p. 14])³. The evidence for the stock market is similar to the accidents reported by the Dutch Centre for Insurance Statistics. Dyl et al. [1988], Chamberlain et al. [1991], Coutts [1999], Lucey [2001], and Patel [2009] suggest that Friday the thirteenth returns are not lower, and may even be higher, than the other Friday returns. However, if investors fear Friday the thirteenth, they may anticipate bad luck on Friday and sell stocks on the trading day before Friday, thus affecting negatively on stocks returns. As a result, the following hypothesis is presented:

H1: Returns on the day before Friday the thirteenth are lower than on average.

Cross [1973], and Kleim and Stambaugh [1984] present evidence for a positive correlation between Friday and Monday returns. If Friday the thirteenth would be information used by

³ The information about the statistically not significant difference was provided by the staff of the centre which was consulted.

individuals, it should be seen in the returns following the day, thereby implying that it would also affect the relation between Friday and Monday returns. As the returns for Friday the thirteenth may be considered as bad luck, the Gambler's fallacy (see Kahneman and Trevisky [1974]) may act as a catalyst among investors to buy stocks after Friday the thirteenth if the downward deviations from the expected returns for Friday the thirteenth are considered to be bad luck. After Friday the thirteenth, people may believe that the bad luck was supposed to be present on Friday, but not anymore on Monday. The returns for Friday the thirteenth are also pieces of past information on which people may anchor (see Kahneman and Trevisky [1974]). Thursday price level may act as a motivator for superstitious investors to return to the market, thereby affecting positively on Monday returns if the price level is lower, and vice versa. Thus, Friday the thirteenth may affect both the serial correlation between Friday and Monday, and the Monday returns. As a result, we present the following hypotheses:

H2: The returns on Monday after Friday the thirteenth are higher than on other Mondays.

H3: The returns on Friday the thirteenth have a negative relation to Monday returns.

3. Data and Methodology

For the empirical analyses of this study, we use the returns for the S&P 500 index and the Dow Jones Industrial Average index. To test the Hypotheses 1 and 2, we carry out our analysis using time-series ordinary least squares (OLS) analysis. To test the Hypothesis 3, we carry out our analysis using a pooled OLS analysis of the returns on Thursdays, Fridays, and Mondays. Our model for the S&P 500 and the Dow Jones Industrial Average indexes (all returns used are expressed as percentages) to test the Hypotheses 1 and 2 is the following:

$$(1) \quad R_{i,t} = \alpha_0 + \alpha_1(\text{MONDAY})_t + \alpha_2(\text{THURSDAY})_t + \alpha_3(\text{FRIDAY})_t \\ + \alpha_4(\text{BEFORE})_t + \alpha_5(\text{THE13TH})_t + \alpha_6(\text{AFTER})_t + \alpha_7 R_{i,t-1} + e_{i,t},$$

where $R_{i,t}$ defines the return for an index; $(\text{MONDAY})_t$ indicates a dummy variable for a Monday return; $(\text{THURSDAY})_t$ denotes a dummy variable for a Thursday return; $(\text{FRIDAY})_t$ defines a dummy for a Friday return; $(\text{BEFORE})_t$ is a dummy variable indicating the trading days before Friday the thirteenth; $(\text{THE13TH})_t$ is a dummy variable indicating the trading days on Friday the thirteenth, and $(\text{AFTER})_t$ is a dummy variable indicating the trading days after Friday the thirteenth. Hypotheses 1 and 2 predict that α_4 is negative and α_6 positive.

To test the Hypothesis 3, data for Friday the thirteenth and the following trading day are respectively pooled and investigated using the following models:

$$(2) \quad R_{\text{Monday},t} = \alpha_0 + \alpha_1(\text{AFTER})_t + \alpha_2 R_{\text{Friday},t} + \alpha_3(\text{AFTER})_t * R_{\text{Friday},t} + e_{\text{Monday},t}$$

where $R_{\text{Monday},t}$ defines the return for Monday, and $\alpha_2 R_{\text{Friday},t}$ defines the return for Friday (or the prior trading day prior to Friday). In Equation 2, Hypothesis 3 predicts that α_3 has a negative value. As the empirical evidence suggests that there is also a correlation between the returns for Fridays and Mondays (see e.g., Kleim and Stambaugh [1984]), it is reasonable to control for this correlation. Therefore, a relative correlation between Friday the thirteenth and Monday returns is investigated using Equation 2, for which

Hypothesis 3 predicts that α_2 has a negative value. Equations 2 and 3 can also be used to test Hypothesis 2 which predicts that α_1 is positive.

We also test the association between Friday the thirteenth and its prior trading day using the following model:

$$(3) \quad R_{\text{Friday},t} = \alpha_0 + \alpha_1(\text{THE13TH})_t + \alpha_2 R_{\text{Thu},t} + \alpha_3(\text{THE13TH})_t * R_{\text{Thursday},t} + e_{\text{Friday},t}$$

where R_{Thu} defines the return for Thursday (or the prior trading day prior to Friday)⁴.

The descriptive statistics of the data used in the empirical analysis are reported in Exhibit 1. As can be seen from the Panel A of the table, the descriptive statistics for the S&P 500 and Dow Jones data are very similar. The mean return for *FR13* variable is positive in both data sets, but interestingly, the returns for *MON* seem to be significantly higher than the Friday the thirteenth returns.

Exhibit 1. Descriptive statistics

The exhibit presents the descriptive statistics for the data sets employed in the empirical analyses. Panel A reports the statistics for the regression analysis data and Panel B for the analysis of Friday and Monday returns.

Panel A. Descriptive statistics for the regression analysis data.

S&P 500 data, whole sample (n=14 980)

Variable	Mean	Median	Std.dev.	Max	Min
Return	0.032	0.045	0.965	11.580	-20.467
Lag return	0.032	0.045	0.965	11.580	-20.467
THE13TH	0.007	0.000	0.081	0.116	-0.205
BEFORE	0.007	0.000	0.082	1.000	0.000
AFTER	0.006	0.000	0.080	1.000	0.000
MONDAY	0.193	0.000	0.394	1.000	0.000
THURSDAY	0.201	0.000	0.401	1.000	0.000
FRIDAY	0.200	0.000	0.400	1.000	0.000

Dow Jones Industrial Average data, whole sample (n=20 288)

Variable	Mean	Median	Std.dev.	Max	Min
Return	0.025	0.040	1.164	15.342	-22.610
Lag return	0.025	0.040	1.164	15.342	-22.610
THE13TH	0.007	0.000	0.081	1.000	0.000
BEFORE	0.007	0.000	0.081	1.000	0.000
AFTER	0.007	0.000	0.081	1.000	0.000
MONDAY	0.193	0.000	0.395	1.000	0.000
THURSDAY	0.201	0.000	0.400	1.000	0.000
FRIDAY	0.200	0.000	0.400	1.000	0.000

Panel B. Descriptive statistics for Monday and Friday return analysis.

⁴ For this model, Friday returns are only for Fridays.

Fri S&P 500 (n=2 991)

Variable	Mean	Median	Std.dev.	Max	Min
Return (Friday)	0.074	0.097	0.870	6.325	-6.768
Lag return (Thursday)	0.039	0.048	0.914	6.921	-7.617
THE13TH (dummy)	0.033	0.000	0.200	1.000	0.000
Cond. lag return	0.001	0.000	0.181	4.073	-2.684

Mon S&P 500 (n=2 884)

Variable	Mean	Median	Std.dev.	Max	Min
Return (Monday)	-0.074	-0.035	1.129	11.580	-20.467
Lag return (Friday)	0.073	0.095	0.867	6.325	-6.768
AFTER (dummy)	0.033	0.000	0.179	1.000	0.000
Cond. lag return	0.004	0.000	0.187	3.338	-6.117

Fri Dow (n=4 053)

Variable	Mean	Median	Std.dev.	Max	Min
Return (Friday)	0.047	0.073	1.086	9.351	-8.403
Lag return (Thursday)	0.021	0.034	1.061	9.356	-7.333
THE13TH (dummy)	0.033	0.000	0.179	1.000	0.000
Cond. lag return	-0.005	0.000	0.207	3.458	-5.920

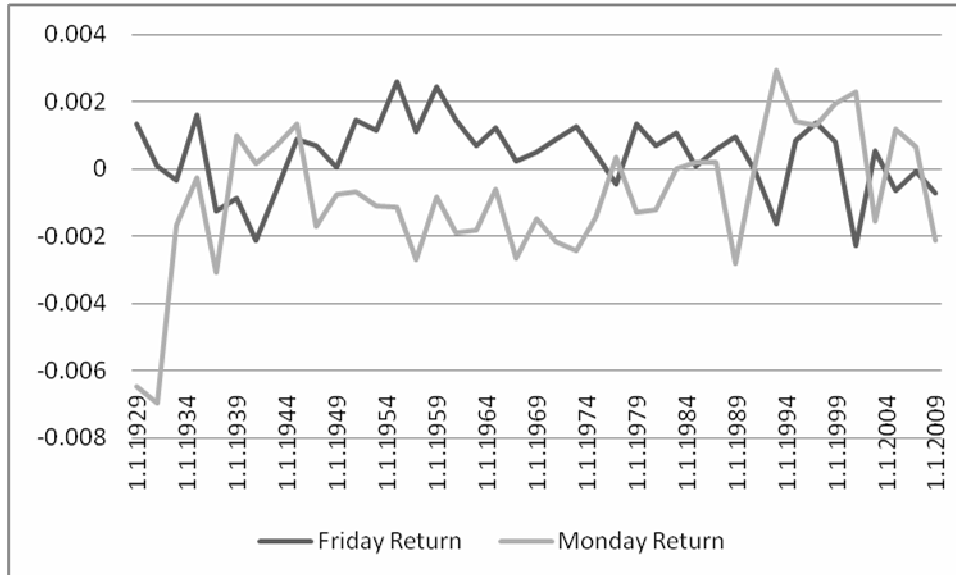
Mon Dow (n=3 922)

Variable	Mean	Median	Std.dev.	Max	Min
Return (Monday)	-0.072	-0.020	1.363	11.902	-22.610
Lagret (Friday)	0.046	0.070	1.099	9.471	-8.403
AFTER (dummy)	0.033	0.000	0.178	1.000	0.000
Cond. lag return (dummy)	0.001	0.000	0.033	1.530	0.000

Panel B of the Exhibit 1 presents the descriptive statistics for Monday and Friday returns and the associated data. In all the subsets of the data, the values for *FRI13* and *AFTER* are positive, thus indicating that Friday the thirteenth plays a role in the stock market. Figure 1 presents the average returns for Fridays and Mondays used for the analysis period in this study. The presentation is relevant because we focus on the returns of same days. The returns in the figure graphically present the negative correlation between the Monday and Friday returns; when Monday returns are high, the Friday returns have been low. The returns on Friday fairly decrease over time and the returns on Monday increase over the time. The returns on Friday relative to Monday appear to be highest in 1950s, 1960s, and 1970s.

Figure 1. 500 Trading Day Average Returns on Mondays and Fridays, 2/27/1929–7/20/2009.

The exhibit presents a time series of 500 trading day geometric means on Monday and Friday on Dow Jones Industrial Average Index for 40 subsequent periods, dating back to 7/20/2009.



Correlation between Monday and Friday returns are also presented as a recursive correlation in Figure 2, which starts from 20 observations in 12/4/2069 and ends to 40 observations in 7/20/2009. The figure clearly demonstrates that the correlation becomes more negative as time goes on. This finding is likely to occur as a result of the investors finding and learning the anomaly. The figure also points that the shift, which is considered as negative correlation between Friday and Monday returns, sharpens in the 1990s and in the 21st century. This characteristic is very evident, as the negative correlation is as large as over -0.3.

Figure 2. Recursive Correlation Between Monday and Friday Returns.

The figure presents recursive correlation between Monday and Friday returns on Dow Jones Industrial Average over the period 2/27/1929–7/20/2009. The minimum (maximum) number of observations for correlation statistics is 20 (40). The returns for Mondays and Fridays are 500 trading day geometric means. The first geometric mean is calculated for the period 12/4/2069–7/20/2009.



4. Results

Exhibit 2 presents the ordinary least squares (OLS) analysis for Friday the thirteenth and stock market returns using the Equation 1. The results do not provide any statistically significant evidence for the Friday the thirteenth return being lower than on other Fridays. This evidence is consistent with the previous evidence by Dyl et al. [1988], Chamberlain et al. [1991], Coutts [1999], Lucey [2001], and Patel [2009].

Exhibit 2. Friday the thirteenth and Stock Market Returns

This exhibit presents Ordinary Least Squares (OLS) analysis statistics of the analyses of Monday and Friday returns.

$$R_{i,t} = \alpha_0 + \alpha_1(\text{MONDAY})_t + \alpha_2(\text{THURSDAY})_t + \alpha_3(\text{FRIDAY})_t + \alpha_4(\text{BEFORE})_t + \alpha_5(\text{THE13TH})_t + \alpha_6(\text{AFTER})_t + \alpha_7 R_{i,t-1} + e_{i,t}$$

where $R_{i,t}$ defines the return for an index; $(\text{MONDAY})_t$ indicates a dummy variable for a Monday return; $(\text{THURSDAY})_t$ denotes a dummy variable for a Thursday return; $(\text{FRIDAY})_t$ defines a dummy for a Friday return; $(\text{BEFORE})_t$ is a dummy variable indicating the trading days before Friday the thirteenth; $(\text{THE13TH})_t$ is a dummy variable indicating the trading days on Friday the thirteenth, and $(\text{AFTER})_t$ is a dummy variable indicating the trading days after Friday the thirteenth. The standard errors are Newey-West (lag=12) heteroskedasticity and autocorrelation robust.

Panel A. Regression results for the S&P500 sample.

Variable	Exp. sign	whole sample	1/1950–1/1980	1/1981–7/2009
Constant	+	0.001 *** (4.95)	0.001 *** (5.19)	0.001 *** (2.95)
<i>Variables:</i>				
Lag return	+	0.038 *** (2.79)	0.180 *** (11.63)	-0.028 * (-1.77)
THE13TH	?	0.000 (0.13)	-0.001 (-1.02)	0.002 (0.83)
BEFORE	-	0.000 (0.12)	-0.002 ** (-2.44)	0.003 (1.48)
AFTER	+	0.002 (1.62)	0.000 (0.02)	0.004 *** (2.86)
MONDAY	-	-0.001 *** (-5.30)	-0.002 *** (-8.14)	-0.001 (-1.58)
THURSDAY	?	0.000 (-1.15)	0.000 (-1.05)	0.000 (-1.25)
FRIDAY	?	0.000 (0.67)	0.000 * (1.80)	0.000 (-1.03)
Adjusted R^2		0.004	0.045	0.001
F-stat.		9.850 ***	52.862 ***	2.314 **
n		14 980	7 777	7 203

Panel B. Regression results for the Dow Jones sample.

Variable	Exp. sign	whole sample	10/1928–12/1949	1/1950–12/1980	1/1981–7/2009
Constant	+	0.058 *** (4.72)	0.060 * (1.88)	0.061 *** (4.67)	0.062 *** (3.16)
<i>Variables:</i>					
Lag return	+	0.016 (1.15)	-0.008 (-0.34)	0.169 *** (11.38)	-0.026 * (-1.74)
THE13TH	?	-0.064 (-0.64)	-0.260 (-1.11)	-0.023 (-0.25)	0.071 (0.37)
BEFORE	-	-0.172 * (-1.76)	-0.630 *** (-2.92)	-0.232 ** (-2.37)	0.219 (1.18)
AFTER	+	0.090 (0.75)	-1.810 (-0.54)	0.007 (0.05)	0.391 ** (2.40)
MON	-	-0.133 *** (-4.86)	-0.180 ** (-2.54)	-0.220 *** (-8.16)	-0.027 (-0.58)
THU	?	-0.024 (-1.09)	0.003 (0.05)	-0.029 (-1.24)	-0.060 * (-1.68)
FRI	?	-0.009 (-0.46)	-0.053 (-1.00)	0.043 * (1.89)	-0.052 (-1.55)
Adjusted R^2		0.002	0.002	0.040	0.001
F-stat.		6.318 ***	2.461 **	47.508 ***	2.244 **
n		20 288	5 305	7 779	7 204

The results reported in Exhibit 2 provide partial support for Hypothesis 1, which predicts that the returns on the day before Friday the thirteenth are lower than otherwise. However, the evidence only concerns the subperiod 1/1950–1/1980 for the S&P 500 sample, and the subperiods 10/1928–1/1950 and 1/1950–12/1980 for the Dow Jones sample. As such, Hypothesis 1 is not supported for the most recent sample period. Exhibit 2 also presents relevant results for testing the Hypothesis 2, which predicts that the returns on Mondays after Friday the thirteenth are higher than during other Mondays. This hypothesis is only supported for the most recent sample period 1/1981–7/2009. In relation to the Monday anomaly (abnormally low returns on Mondays), it is an interesting observation that the Monday returns are not significantly lower in relation to the other days for the most recent sample period. For the earlier Dow Jones samples, the dummy variable for pre-Friday the thirteenth returns has relatively large values in comparison to the dummy variable for the Monday returns (-0.630 vs. -0.180 and -0.232 vs. -0.220), thus implying that Friday the thirteenth anomaly is economically significant when compared to the Monday effect. However, the value for the dummy variable for pre-Friday the thirteenth returns turns out to be positive for the latest sample period, while the value for the dummy variable for Monday returns is still negative, although statistically insignificant. Consistently, the value of the dummy variable for the Friday returns also appears to change from positive to negative, when moving to evaluate the latest period. This may be an effect of investors avoiding to adverse the previously documented low Monday returns, and the Monday effect has therefore shifted to Friday returns.

One more interesting finding in Exhibit 2 related to the shift in the above mentioned characteristics over time is the serial correlation; for the period 1/1950–12/1980 it is positive and statistically significant, while for the period 1/1981–7/2009 it is negative and statistically significant, using both indexes. This shift and the shift in the Monday anomaly are contemporaneous with the shift from the support for Hypothesis 1 to support for Hypothesis 2. To sum up the evidence presented in Exhibit 2, there appears to be a change in the anomalous behavior of the stock market after the year 1980.

Exhibit 3 presents the results of Monday and Friday returns to test Hypotheses 2 and 3. Hypothesis 2 is still supported as the coefficients for after Friday the thirteenth a return are statistically significant and positive. The results presented suggest that there is a statistically significant and positive serial correlation between the returns for Friday and Monday. The result is consistent with the study by Kleim and Stambaugh [1984]. The results also present evidence for statistically significant and positive serial correlation between Thursday and Friday returns. However, the coefficient for the relation between Thursday and Friday returns is not as high as for the relation between Friday and Monday returns. The results also support Hypothesis 3, as the serial correlation between the returns for Friday and Monday is significantly lower after Friday the thirteenth for the S&P 500 index. This result implies that the investors use the closing price of the preceding trading day before Friday the thirteenth as a reference point; returns on Friday the thirteenth are likely to be reversed on Monday. The result is evident for both indexes used.

Exhibit 3. Analysis of the Friday and Monday Returns

This exhibit presents Ordinary Least Squares (OLS) analysis statistics of the analyses of Monday and Friday returns. The models used are the following:

$$(1) \quad R_{\text{Monday},t} = \alpha_0 + \alpha_1(\text{AFTER}) + \alpha_2 R_{\text{Friday},t} + \alpha_3(\text{AFTER})_t * R_{\text{Friday},t} + e_{\text{Monday},t}$$

$$(2) \quad R_{\text{Friday},t} = \alpha_0 + \alpha_1(\text{THE13TH}) + \alpha_2 R_{\text{Thu},t} + \alpha_3(\text{THE13TH})_t * R_{\text{Thursday},t} + e_{\text{Friday},t}$$

where $(\text{BEFORE})_t$ is a dummy variable indicating the trading days before Friday the thirteenth; $(\text{THE13TH})_t$ is a dummy variable indicating the trading days on Friday the thirteenth; $(\text{AFTER})_t$ is a dummy variable indicating the trading days after Friday the thirteenth; $R_{\text{Monday},t}$ defines the return for Monday; R_{Thu} defines the return for Thursday, and $\alpha_2 R_{\text{Friday},t}$ defines the return for Friday. The standard errors are White heteroskedasticity robust.

Variable	Exp. sign	Fri S&P500	Mon S&P500	Fri Dow	Mon Dow
Constant	?	0,070 *** (4,32)	-0,097 *** (-4,22)	0,047 *** (2,72)	-0,073 *** (-3,20)
<u>Variables:</u>					
THE13TH	-	0,013 (0,13)		-0,052 (-0,56)	
Lag return	+	0,091 *** (2,63)	0,259 *** (4,15)	0,059 * (1,79)	0,227 *** (3,84)
AFTER	-		0,200 ** (2,10)		0,253 ** (2,48)
Cond. lag return	-	0,011 (0,08)	-0,480 *** (-3,82)	0,036 (0,23)	-0,536 *** (-4,57)
Adjusted R^2		0,008	0,039	0,003	0,033
F-stat.		9,353 ***	39,551 ***	4,909 ***	33,271 ***

5. Conclusion

The objective of our paper is to re-examine Friday the thirteenth effect by focusing on the trading days which precede and follow it. As such, this paper also focuses on the Monday effect, as Monday is normally the following trading day after Friday the thirteenth. We show that the earlier studies on the topic by Dyl et al. [1988], Chamberlain et al. [1991], Coutts [1999], Lucey [2001], and Patel [2009] do not find Friday the thirteenth to affect stocks markets because they do not investigate the returns for the preceding and following days. The preceding returns are statistically significant and negative prior 1981, and the following returns are statistically significant and positive after 1980. The change in the Friday the thirteenth effect appears to be somewhat contemporaneous to the Monday effect, for which statistically significant and negative returns disappear, while statistically significant and positive Friday returns also disappear. For this structural shift in the anomaly, we provide evidence indicating that the shift was slowly caused by the investor behavior anticipating poor Monday returns on Friday. This can be seen as increasing negative correlation between Friday and Monday returns over our sample period. This evidence is in line with the studies by Connolly (1989), Brusa et al. [2000], Mehdan et al. [2001], Brusa et al. [2005] and et al. [2007] indicating that the Monday effect is not a robust anomaly. Change from statistically significant and positive serial correlation to statistically significant and negative correlation in stock returns is also in line with the structural change.

The alternative route taken by us to evince the Friday the thirteenth effect in the stock market is to consider the preceding closing price before Friday the thirteenth as a reference point for which the investors take on. After Friday the thirteenth the stock prices should have a tendency to revert, as bad returns on Friday the thirteenth may be interpreted as bad luck. Our evidence supports this behavior, which makes it even more evident that investors are irrational, and that Friday the thirteenth affects the stock market. As Friday and Monday returns are in earlier studies by Cross [1973], and Kleim et al. [1984] found to be positively correlated with each other and Friday the thirteenth has an effect on Monday returns, Friday the thirteenth and the Weekend effects are interrelated.

Finally, we argue that our study provides evidence indicating that anomalies are not robust, as they disappear, are unpredictable, and therefore cannot offer certain returns. However, as we find that the Friday the thirteenth appears to affect the stock market, we cannot conclude that the stock market would run rationally either. Moreover, the anomalies considered in this paper appear to be persistent over short periods of time and change their location from one to another. Turn of the 1980s decade also appears to be associated with a significant change in stock return behavior, and this scope is left open for the future research.

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Exhibit 1. Descriptive statistics

The exhibit presents the descriptive statistics for the data sets employed in the empirical analyses. Panel A reports the statistics for the regression analysis data and Panel B for the analysis of Friday and Monday returns.

Panel A. Descriptive statistics for the regression analysis data.
S&P 500 data, whole sample (n=14 980)

Variable	Mean	Median	Std.dev.	Max	Min
Return	0.032	0.045	0.965	11.580	-20.467
Lag return	0.032	0.045	0.965	11.580	-20.467
THE13TH	0.007	0.000	0.081	0.116	-0.205
BEFORE	0.007	0.000	0.082	1.000	0.000
AFTER	0.006	0.000	0.080	1.000	0.000
MONDAY	0.193	0.000	0.394	1.000	0.000
THURSDAY	0.201	0.000	0.401	1.000	0.000
FRIDAY	0.200	0.000	0.400	1.000	0.000

Dow Jones Industrial Average data, whole sample (n=20 288)

Variable	Mean	Median	Std.dev.	Max	Min
Return	0.025	0.040	1.164	15.342	-22.610
Lag return	0.025	0.040	1.164	15.342	-22.610
THE13TH	0.007	0.000	0.081	1.000	0.000
BEFORE	0.007	0.000	0.081	1.000	0.000
AFTER	0.007	0.000	0.081	1.000	0.000
MONDAY	0.193	0.000	0.395	1.000	0.000
THURSDAY	0.201	0.000	0.400	1.000	0.000
FRIDAY	0.200	0.000	0.400	1.000	0.000

Panel B. Descriptive statistics for Monday and Friday return analysis.*Fri S&P 500 (n=2 991)*

Variable	Mean	Median	Std.dev.	Max	Min
Return (Friday)	0.074	0.097	0.870	6.325	-6.768
Lag return (Thursday)	0.039	0.048	0.914	6.921	-7.617
THE13TH (dummy)	0.033	0.000	0.200	1.000	0.000
Cond. lag return	0.001	0.000	0.181	4.073	-2.684

Mon S&P 500 (n=2 884)

Variable	Mean	Median	Std.dev.	Max	Min
Return (Monday)	-0.074	-0.035	1.129	11.580	-20.467
Lag return (Friday)	0.073	0.095	0.867	6.325	-6.768
AFTER (dummy)	0.033	0.000	0.179	1.000	0.000
Cond. lag return	0.004	0.000	0.187	3.338	-6.117

Fri Dow (n=4 053)

Variable	Mean	Median	Std.dev.	Max	Min
Return (Friday)	0.047	0.073	1.086	9.351	-8.403
Lag return (Thursday)	0.021	0.034	1.061	9.356	-7.333
THE13TH (dummy)	0.033	0.000	0.179	1.000	0.000
Cond. lag return	-0.005	0.000	0.207	3.458	-5.920

Mon Dow (n=3 922)

Variable	Mean	Median	Std.dev.	Max	Min
Return (Monday)	-0.072	-0.020	1.363	11.902	-22.610
Lagret (Friday)	0.046	0.070	1.099	9.471	-8.403
AFTER (dummy)	0.033	0.000	0.178	1.000	0.000
Cond. lag return (dummy)	0.001	0.000	0.033	1.530	0.000

Exhibit 2. Friday the thirteenth and Stock Market Returns

This exhibit presents Ordinary Least Squares (OLS) analysis statistics of the analyses of Monday and Friday returns.

$$R_{i,t} = \alpha_0 + \alpha_1(\text{MONDAY})_t + \alpha_2(\text{THURSDAY})_t + \alpha_3(\text{FRIDAY})_t + \alpha_4(\text{BEFORE})_t + \alpha_5(\text{THE13TH})_t + \alpha_6(\text{AFTER})_t + \alpha_7 R_{i,t-1} + e_{i,t}$$

where $R_{i,t}$ defines the return for an index; $(\text{MONDAY})_t$ indicates a dummy variable for a Monday return; $(\text{THURSDAY})_t$ denotes a dummy variable for a Thursday return; $(\text{FRIDAY})_t$ defines a dummy for a Friday return; $(\text{BEFORE})_t$ is a dummy variable indicating the trading days before Friday the thirteenth; $(\text{THE13TH})_t$ is a dummy variable indicating the trading days on Friday the thirteenth, and $(\text{AFTER})_t$ is a dummy variable indicating the trading days after Friday the thirteenth. The standard errors are Newey-West (lag=12) heteroskedasticity and autocorrelation robust.

Panel A. Regression results for the S&P500 sample.

Variable	Exp. sign	whole sample	1/1950–1/1980	1/1981–7/2009
Constant	+	0.001 *** (4.95)	0.001 *** (5.19)	0.001 *** (2.95)
<i>Variables:</i>				
Lag return	+	0.038 *** (2.79)	0.180 *** (11.63)	-0.028 * (-1.77)
THE13TH	?	0.000 (0.13)	-0.001 (-1.02)	0.002 (0.83)
BEFORE	-	0.000 (0.12)	-0.002 ** (-2.44)	0.003 (1.48)
AFTER	+	0.002 (1.62)	0.000 (0.02)	0.004 *** (2.86)
MONDAY	-	-0.001 *** (-5.30)	-0.002 *** (-8.14)	-0.001 (-1.58)
THURSDAY	?	0.000 (-1.15)	0.000 (-1.05)	0.000 (-1.25)
FRIDAY	?	0.000 (0.67)	0.000 * (1.80)	0.000 (-1.03)
Adjusted R^2		0.004	0.045	0.001
F-stat.		9.850 ***	52.862 ***	2.314 **
n		14 980	7 777	7 203

Panel B. Regression results for the Dow Jones sample.

Variable	Exp. sign	whole sample	10/1928–12/1949	1/1950–12/1980	1/1981–7/2009
Constant	+	0.058 *** (4.72)	0.060 * (1.88)	0.061 *** (4.67)	0.062 *** (3.16)
<i>Variables:</i>					
Lag return	+	0.016 (1.15)	-0.008 (-0.34)	0.169 *** (11.38)	-0.026 * (-1.74)
THE13TH	?	-0.064 (-0.64)	-0.260 (-1.11)	-0.023 (-0.25)	0.071 (0.37)
BEFORE	-	-0.172 * (-1.76)	-0.630 *** (-2.92)	-0.232 ** (-2.37)	0.219 (1.18)
AFTER	+	0.090 (0.75)	-1.810 (-0.54)	0.007 (0.05)	0.391 ** (2.40)
MON	-	-0.133 *** (-4.86)	-0.180 ** (-2.54)	-0.220 *** (-8.16)	-0.027 (-0.58)
THU	?	-0.024 (-1.09)	0.003 (0.05)	-0.029 (-1.24)	-0.060 * (-1.68)
FRI	?	-0.009 (-0.46)	-0.053 (-1.00)	0.043 * (1.89)	-0.052 (-1.55)
Adjusted R^2		0.002	0.002	0.040	0.001
F-stat.		6.318 ***	2.461 **	47.508 ***	2.244 **
n		20 288	5 305	7 779	7 204

Exhibit 3. Analysis of the Friday and Monday Returns

This exhibit presents Ordinary Least Squares (OLS) analysis statistics of the analyses of Monday and Friday returns. The models used are the following:

$$(1) \quad R_{\text{Monday},t} = \alpha_0 + \alpha_1(\text{AFTER}) + \alpha_2 R_{\text{Friday},t} + \alpha_3(\text{AFTER})_t * R_{\text{Friday},t} + e_{\text{Monday},t}$$

$$(2) \quad R_{\text{Friday},t} = \alpha_0 + \alpha_1(\text{THE13TH}) + \alpha_2 R_{\text{Thu},t} + \alpha_3(\text{THE13TH})_t * R_{\text{Thursday},t} + e_{\text{Friday},t}$$

where $(\text{BEFORE})_t$ is a dummy variable indicating the trading days before Friday the thirteenth; $(\text{THE13TH})_t$ is a dummy variable indicating the trading days on Friday the thirteenth; $(\text{AFTER})_t$ is a dummy variable indicating the trading days after Friday the thirteenth; $R_{\text{Monday},t}$ defines the return for Monday; R_{Thu} defines the return for Thursday, and $\alpha_2 R_{\text{Friday},t}$ defines the return for Friday. The standard errors are White heteroskedasticity robust.

Variable	Exp. sign	Fri S&P500	Mon S&P500	Fri Dow	Mon Dow
Constant	?	0,070 *** (4,32)	-0,097 *** (-4,22)	0,047 *** (2,72)	-0,073 *** (-3,20)
<u>Variables:</u>					
THE13TH	-	0,013 (0,13)		-0,052 (-0,56)	
Lag return	+	0,091 *** (2,63)	0,259 *** (4,15)	0,059 * (1,79)	0,227 *** (3,84)
AFTER	-		0,200 ** (2,10)		0,253 ** (2,48)
Cond. lag return	-	0,011 (0,08)	-0,480 *** (-3,82)	0,036 (0,23)	-0,536 *** (-4,57)
Adjusted R^2		0,008	0,039	0,003	0,033
F-stat.		9,353 ***	39,551 ***	4,909 ***	33,271 ***

Figure 1. 500 Trading Day Average Returns on Mondays and Fridays, 2/27/1929–7/20/2009.

The exhibit presents a time series of 500 trading day geometric means on Monday and Friday on Dow Jones Industrial Average Index for 40 subsequent periods, dating back to 7/20/2009.

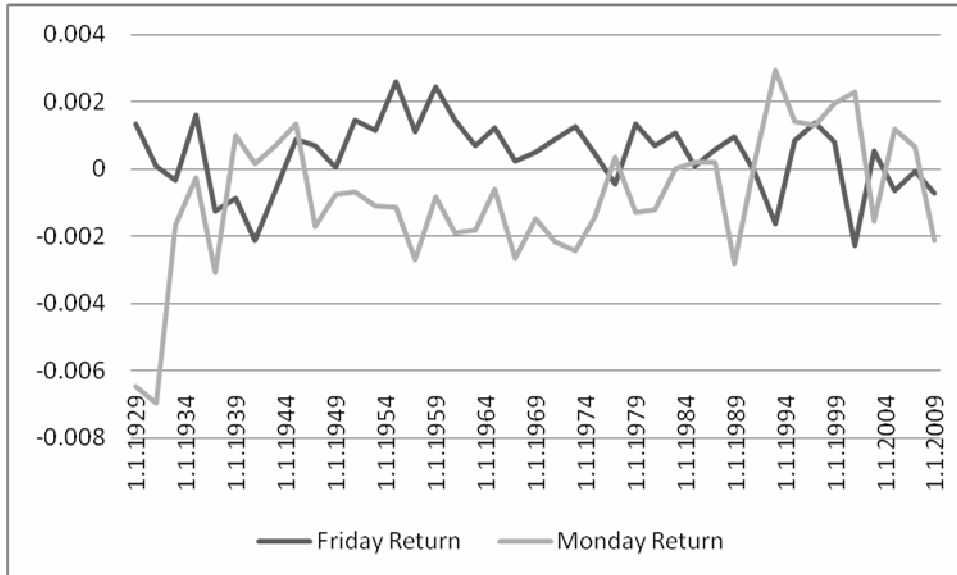


Figure 2. Recursive Correlation Between Monday and Friday Returns.

The figure presents recursive correlation between Monday and Friday returns on Dow Jones Industrial Average over the period 2/27/1929–7/20/2009. The minimum (maximum) number of observations for correlation statistics is 20 (40). The returns for Mondays and Fridays are 500 trading day geometric means. The first geometric mean is calculated for the period 12/4/2069–7/20/2009.

