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Abnormal Returns and Stock Price Movements:
Some Evidence from Developed and Emerging
Markets

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**ABNORMAL RETURNS AND STOCK PRICE MOVEMENTS:
SOME EVIDENCE FROM DEVELOPED AND EMERGING MARKETS**

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Abstract

This paper investigates the impact of abnormal returns on stock prices by using daily and hourly data for some developed (US, UK, Japan) and emerging (China, India) markets over the period 01.01.2010-01.01.2020. Average analysis, t-tests, CAR and trading simulation methods are used to test the following hypotheses: H1) abnormal returns can be detected before the end of the day; H2) there are price effects on the day after abnormal returns occur; H3) these effects are different for developed vis-à-vis emerging markets; H4) they can be used to generate profits from intraday trading. The results suggest that there is a 2-hour window before close of business to exploit momentum effects on days with abnormal returns. On the following day momentum effects occur after positive abnormal returns, and contrarian (momentum) effects in the case of developed (emerging) stock markets after negative abnormal returns. Trading simulations show that some of these effects can be exploited to generate abnormal profits with an appropriate calibration of the timing parameters.

Keywords: *stock market, anomalies, momentum effect, contrarian effect, abnormal returns*

JEL classification: G12, G17, C63

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1. Introduction

According to the Efficient Market Hypothesis (EMH) (Fama, 1970) prices should follow a random walk and therefore be unpredictable; moreover, if they fully reflect all available information, it should not be possible for agents to make abnormal profits. However, there is extensive empirical evidence against market efficiency including price bubbles, calendar and seasonal patterns in price behaviour, market over- and under-reactions, momentum and contrarian effects, etc.; this implies the possible existence of arbitrage opportunities enabling agents to “beat the market”. Inefficiency might reflect cognitive biases; in particular, agents might need time to process news and incorporate them into their information set, which can result in over- or under-reactions, with prices temporarily deviating from their fundamental (fair) values and momentum or contrarian effects occurring (De Bondt and Thaler, 1985). A number of papers (Caporale and Plastun, 2020a,b,c; Wan and Kao, 2009) show that it is possible to design profitable trading strategies exploiting such effects.

Abnormal returns and their effects have been analysed in the context of stock markets in some previous studies (Wong, 1997; Govindaraj et al., 2014; Cox and Peterson, 1994). However, various questions remain unanswered. In particular, can abnormal returns be detected before the end of the day? Is there a time gap between the detection of an “abnormal” day and the moment when the momentum effect fades? Are there any price effects on the next day? Do the detected effects last the whole day or are there timing patterns? Can these be used to beat the market? Are there any differences in price behaviour between developed and emerging stock markets? The present paper aims to address these issues by using daily and hourly data for some developed (US, UK, Japan) and emerging (China, India) stock markets over the period 01.01.2010-01.01.2020. It complements related papers focusing on cryptocurrencies (Caporale and Plastun, 2020a), the Forex (Caporale and Plastun, 2020b) and commodity markets (Caporale and Plastun, 2020c). The approach taken is the same (namely a number of hypotheses of interest are tested using average analysis, t-tests, cumulative abnormal returns (CAR) and trading simulation methods), but it is applied to various stock markets for which new empirical evidence is obtained.

The remainder of the paper is organised as follows. Section 2 reviews the relevant literature. Section 3 describes the data and the methodology. Section 4 discusses the empirical results. Section 5 offers some concluding remarks.

2. Literature Review

There exists a large literature on abnormal returns and their impact on prices. Some studies attribute them to irrational behaviour (Madura and Nivine, 2004) which might reflect panic and crowd effects, cognitive biases etc. (Chen, 2017). According to Rees

and Wayne (2008), abnormal returns can be caused by new information arrivals (earnings announcements, new economic data, force-major events, political news etc.). Other possible reasons include insider trading (Inca et al., 2010), lack of liquidity in the market (Jegadeesh and Titman 1993), technical analysis and the execution of stop-losses (Mynhardt and Plastun, 2013).

In their seminal paper De Bondt and Thaler (1985) defined the overreaction hypothesis according to which contrarian effects appear after abnormal price changes. This was confirmed empirically by Parikakis and Syriopoulos (2008) for the Forex after one-day abnormal returns and for the US stock market by Ferri and Min (1996) and Berkman et al. (2011). Branch and Ma (2012) found instead strong negative autocorrelation between overnight and intraday returns. Cox and Peterson (1994) detected momentum effects after abnormal returns. Jegadeesh and Titman (1993, 2001) confirmed the existence of momentum effects in equity markets. Miffre and Rallis (2007) and Erb and Harvey (2006) showed that a momentum strategy is profitable in the commodity futures markets, whilst Wang and Yu (2004) found strong evidence of weekly return reversals in futures prices. Finally, Parikakis and Syriopoulos (2008) investigated patterns following excess one-day fluctuations for various currencies and found that a contrarian strategy is profitable in the Forex.

3. Methodology

Daily and hourly data for some developed (US, UK, Japan) and emerging (China, India) stock markets have been collected. Specifically, the following indices are used for the analysis: SP500 (USA), FTSE100 (UK), NIKKEI 225 (Japan), SSE Composite (China) and SENSEX (India). In the case of the US the SP500 Futures (USA) with 24-hour coverage is also included. The sample period is 01.01.2010-01.01.2020 (GMT +0 time zone), and the data source is MetaQuotes Software Corp.

Returns (R_i) are computed as follows:

$$R_i = \left(\frac{\text{Close}_i}{\text{Open}_i} - 1 \right) \times 100\% , \quad (1)$$

where R_i – returns on the i -th day (hour) in %;

Open_i – open price on the i -th day (hour);

Close_i – close price on the i -th day (hour).

Open_i is used instead of Close_{i-1} in order to avoid the distortions caused by price gaps.

As in Caporale and Plastun (2020a,b,c) a dynamic approach with 2 standard deviations as the threshold is used to detect abnormal returns.

Positive abnormal returns are defined as follows:

$$R_i > (\bar{R}_n + 2 \times \sigma_n) \quad (2)$$

and negative abnormal returns as:

$$R_i < (\bar{R}_n - 2 \times \sigma_n) \quad (3)$$

where \bar{R}_n stands for average daily returns and σ_n is their standard deviation for period n .

The following hypotheses are then tested:

H1) abnormal returns can be detected before the end of the day during which they occur;

H2) there are price effects on the day after abnormal returns occur;

H3) there are differences in these effects between developed and emerging markets;

H4) the detected price effects can be used to generate profits from intraday trading.

The following methods are used to test the first three hypotheses: average analysis, Student's t-tests, modified cumulative abnormal returns (CARs); trading simulation methods are applied for the fourth hypothesis.

The algorithm used for cumulative abnormal returns (CAR) is the same as in the study by MacKinlay (1997). First, abnormal returns are calculated as:

$$AR_t = R_t - E(R_t) \quad (4)$$

where R_t is the return at time t and $E(R_t)$ is corresponding average return computed over the whole sample period as follows:

$$E(R_t) = \left(\frac{1}{T}\right) \sum_{i=1}^T R_i \quad (5)$$

where T is the sample size.

Next the cumulative abnormal return (CAR_i) is defined:

$$CAR_i = \sum_{i=1}^t AR_i \quad (6)$$

where i starts goes from 1 (the first hour of trading day) to t (the last hour of the trading day). Usually a trading day in the stock market consists of 8 hours (24 hours in the case of SP500 futures).

Parametric t-tests are used to find out whether or not differences in returns are statistically significant, where the Null Hypothesis (H_0) is that the data (hourly returns on the abnormal return days and in the full sample) belong to the same population. A rejection of the null implies the existence of a statistical anomaly in price behaviour on the days with abnormal returns. The test is carried out at the 95% confidence level, and the degrees of freedom are $N - 1$ (N being equal to $N_1 + N_2$).

The trading simulations replicate the actions of traders aiming to exploit the effects detected in the analysis; the aim is to establish whether there exist profitable trading strategies based on them. Transaction costs (spreads, broker or bank fees, swaps etc.) are not incorporated; however, this does not affect the results since nowadays variable transaction costs are insignificant (for example, the spread for the SP500 futures is less than 0.02%) and fixed transaction costs (such as commission fees and broker fees) are also minimal owing to scale effects and the high degree of competitiveness in Internet trading.

Total profits are defined as the sum of those obtained from each trade; an exploitable market anomaly exists when they are positive. Another important indicator is the percentage of successful trades; this provides additional evidence that the strategy is successful if above 50%. T-tests are carried out to establish whether or not the trading results are statistically different from the random ones. The null is that the mean is the same in both cases, i.e. that they both come from the same population. Failure to reject the null implies that there are no advantages from following the trading strategy being considered, whilst a rejection suggests that the adopted strategy can generate abnormal profits since the trading results are not random.

4. Empirical Results

This section discusses the main empirical findings; detailed results can be found in a supplementary file. Table 1 provides an overview of the results for the days with abnormal returns. Average hourly returns on days with positive/negative abnormal returns are much higher/lower than those on normal days. These differences are statistically significant for most hours of the day. The CAR analysis implies that abnormal returns can be detected before the end of the day. Table 1 also reports the timing parameters for positive and negative abnormal returns respectively. In most

cases only a few hours before the end of the trading session does it become clear that the day in question is characterised by abnormal returns; specifically, there are strong momentum effects which last till the close of business. This means that it is possible to open the position in the direction of abnormal returns and hold it for a few hours (on average 2 hours) knowing that prices tend to change in that direction.

Table 1: Overall results for the days with abnormal returns

Index	Are there significant differences in returns (abnormal day vs usual day)?	Are there any patterns in cumulative abnormal returns dynamics?	Timing of abnormal returns (hours before the end of the trading session)
Case of positive abnormal returns			
SP500 Futures	Yes	Yes. CARs increase till the end of the day	23:00 (0)
SP500	Yes	Yes. CARs increase till the end of the day	16:00 (2)
FTSE 100	Yes	Yes. CARs increase till the end of the day	14:00 (7)
NIKKEI 225	Yes	Yes. CARs increase till the end of the day	16:00 (0)
SSE Composite	Yes	Yes. CARs increase till the end of the day	12:00 (4)
SENSEX	Yes	Yes. CARs increase till the end of the day	15:00 (2)
Case of negative abnormal returns			
SP500 Futures	Yes	Yes. CARs increase till the end of the day	22:00 (1)
SP500	Yes	Yes. CARs increase till the end of the day	15:00 (3)
FTSE 100	Yes	Yes. CARs increase till the end of the day	14:00 (7)
NIKKEI 225	Yes	Yes. CARs increase till the end of the day	15:00 (2)
SSE Composite	Yes	Yes. CARs increase till the end of the day	14:00 (3)
SENSEX	Yes	Yes. CARs increase till the end of the day	15:00 (2)

This table presents the overall results for the case of the day with abnormal returns. The first column reports the index being considered, the second, third and fourth columns show the results for the parameter of interest.

Some interesting patterns are observed on the day after one with abnormal returns. These results are summarised in Table 2. Full estimation results are provided in the supplementary file.

Table 2: Overall results for the day after of the abnormal returns: case of positive abnormal returns

Instrument/Parameter	Is there momentum/contrarian effect on the day after the abnormal returns?	Timing parameters of momentum/contrarian movements
Case of positive abnormal returns		
SP500 Futures	momentum	Since the start of the day till the end of the day with peak at 20:00
SP500	momentum	Since the start of the day till the end of the day with peak at 12:00
FTSE 100	contrarian	Since the start of the day till the end of the day with peak at the end of the day
NIKKEI 225	momentum	Since the start of the day till the end of the day with peak at the end of the day
SSE Composite	momentum	Since the start of the day till the end of the day with peak at 13:00
SENSEX	momentum	Since the start of the day till the end of the day with peak at 11:00
Case of negative abnormal returns		
SP500 Futures	momentum	Since the start of the day till the end of the day with peak at 03:00
SP500	contrarian	Since the start of the day till the end of the day with peak at 16:00
FTSE 100	contrarian	Since the start of the day till the end of the day with peak at the end of the day
NIKKEI 225	contrarian	Since the start of the day till the end of the day with peak at 11:00
SSE Composite	momentum	Since the start of the day till the end of the day with peak at 12:00
SENSEX	momentum	Since the start of the day till the end of the day with peak at 12:00

This table presents the overall results for the case of the day after the day of the abnormal returns. The first column reports the assets being considered, the second and third columns show the results for the parameter of interest.

As can be seen, in the case of positive abnormal returns there is a momentum effect on the following day peaking during the trading session rather than at its end. The only exception is FTSE100 for which a strong contrarian effect is detected. The results for negative abnormal returns (reported in Table 2) differ from those for the positive ones; specifically, the developed (emerging) stock markets (SP500, FTSE100, NIKKEI 225) exhibit contrarian (momentum) effects after days with negative abnormal returns. This suggests that emerging markets need longer than one day to process and incorporate new information into prices, whilst developed markets tend to overreact to negative news and revert to the norm the following day.

To sum up, the first three null hypotheses cannot be rejected, since there is a time gap between the detection of an abnormal return day and its end (H1); in the case of positive abnormal returns there is a momentum effect (H2); in the case of negative abnormal returns there is a contrarian (momentum) effect in the developed (emerging) stock markets. On the basis of these results the following trading rules can be used to try to “beat the market” and to test H4:

- (i) When it becomes clear that a day is characterised by abnormal returns (see the timing of the abnormal return parameter in Table 1) a position in their direction should be opened and then closed at the end of the same day.
- (ii) On the following day, a position should be opened in the direction of the momentum/contrarian effect previously detected and this should then be closed on the basis of the timing parameters displayed in Table 2.

The trading simulation results for the two strategies in the case of positive and negative abnormal returns are presented in Tables 3 and 4 respectively.

Table 3: Trading simulation results for the case of positive abnormal returns

Series used	Number of trades. units	Number of successful trades. units	Number of successful trades. %	Profit. %	Profit % per year	Profit % per trade	t-test calculated value	Null hypothesis for the t-test
Day of abnormal returns								
SP500 Futures	-	-	-	-	-	-	-	-
SP500	51	47	92%	34.70%	3.47%	0.68%	5.37	rejected
FTSE 100	63	58	92%	62.22%	6.22%	0.99%	9.82	rejected
NIKKEI 225	-	-	-	-	-	-	-	-
SSE Composite	40	25	63%	5.30%	0.53%	0.13%	1.55	not rejected
SENSEX	29	29	100%	56.15%	5.61%	1.94%	10.90	rejected
Day after the day of abnormal returns								
SP500 Futures	85	43	51%	15.59%	1.56%	0.18%	1.34	not rejected
SP500	51	29	57%	5.58%	0.56%	0.11%	1.09	not rejected
FTSE 100*	63	27	43%	-2.94%	-0.29%	0.05%	-0.19	not rejected
NIKKEI 225	94	39	41%	9.36%	0.94%	0.10%	0.85	not rejected
SSE Composite	36	24	67%	6.63%	0.66%	0.18%	2.19	rejected
SENSEX	27	13	48%	2.01%	0.20%	0.07%	0.78	not rejected

* A contrarian trading strategy is used

Table 4: Trading simulation results for the case of negative abnormal returns

Series used	Number of trades. units	Number of successful trades. units	Number of successful trades. %	Profit. %	Profit % per year	Profit % per trade	t-test calculated value	Null hypothesis for the t-test
Day of abnormal returns								
SP500 Futures	-	-	-	-	-	-	-	-
SP500	56	49	88%	24.48%	2.45%	0.44%	5.82	rejected
FTSE 100	58	55	95%	66.35%	6.64%	1.14%	11.44	rejected
NIKKEI 225	67	48	72%	4.95%	0.50%	0.07%	4.21	rejected
SSE Composite	38	14	36.8%	-3.4%	-0.3%	-0.09%	-0.99	not rejected
SENSEX	54	53	98%	113.36%	11.34%	2.10%	18.53	rejected
Day after the day of abnormal returns								
SP500 Futures	70	46	65.7%	39.6%	4.0%	0.57%	2.48	rejected
SP500*	55	30	54.5%	7.3%	0.7%	0.13%	0.61	not rejected
FTSE 100*	58	30	51.7%	4.2%	0.4%	0.07%	0.32	not rejected
NIKKEI 225*	58	40	69.0%	15.5%	1.6%	0.27%	1.78	not rejected
SSE Composite	42	24	57.1%	0.4%	0.0%	0.01%	0.10	not rejected
SENSEX	55	34	61.8%	11.7%	1.2%	0.21%	2.37	rejected

* A contrarian trading strategy is used

These tables present the trading simulation results. The first column specifies the series used; the second column shows the number of trades in units; the third column provides the number of successful trades in units and the fourth column shows this parameter in %; the fifth column shows the profit generated by the trading strategy over the whole period in %; the sixth column shows the annual profit in % and the seventh column provides information about the size of profit per trade; the eighth column reports the t-test statistics and the ninth whether or not they imply a rejection of the null.

As can be seen, the strategy for the day with abnormal returns is highly profitable, whether these are positive or negative. The average number of successful trades is close to 80%-90% and profits are positive and significant in almost all cases; moreover, with a single exception (the case of SSE Composite), all trading simulation results are statistically different from the random ones. By contrast, the strategy for the following day, though generally profitable, does not produce results which are statistically different from the random ones.

To sum up, daily abnormal returns generate detectable patterns in price behaviour: on the day with abnormal returns there is a strong momentum effect which lasts till the end of the day; on the following day there is a momentum (contrarian) effect in the case of emerging (developed) markets. Some of these patterns can be used

to generate profits from trading and “beat the market”, which represents evidence of inefficiency. These results for the stock market are consistent with those reported by Caporale and Plastun (2020a,b,c) for cryptocurrencies, the Forex and commodity markets respectively.

5. Conclusions

This paper investigates the impact of abnormal returns on stock prices by using daily and hourly data for some developed (US, UK, Japan) and emerging (China, India) markets over the period 01.01.2010-01.01.2020. Average analysis, t-tests, CAR and trading simulation methods are used to test various hypotheses of interest. The results suggest that there is a 2-hour window before close of business to exploit momentum effects on days with abnormal returns. On the following day momentum effects occur after positive abnormal returns, and contrarian (momentum) effects in the case of developed (emerging) stock markets after negative abnormal returns. Trading simulations show that some of these effects can be exploited to generate abnormal profits with an appropriate calibration of the timing parameters. On the whole, this evidence points to market inefficiency and confirms the previous findings of Caporale and Plastun (2020a,b,c) for other types of markets.

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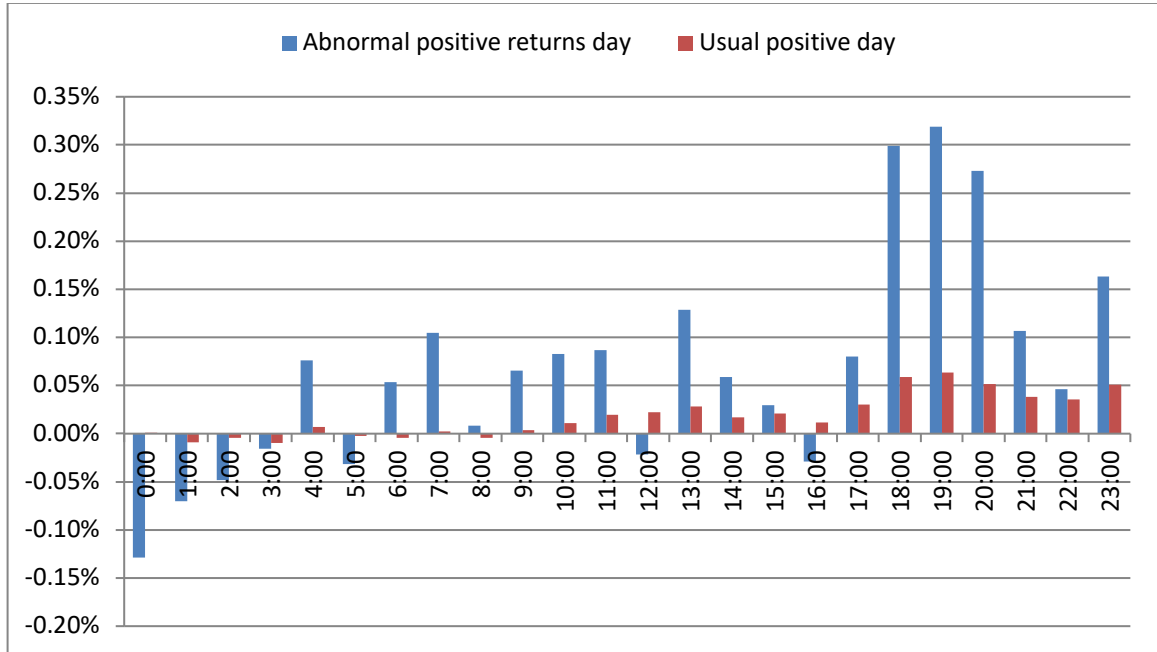
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Appendix A

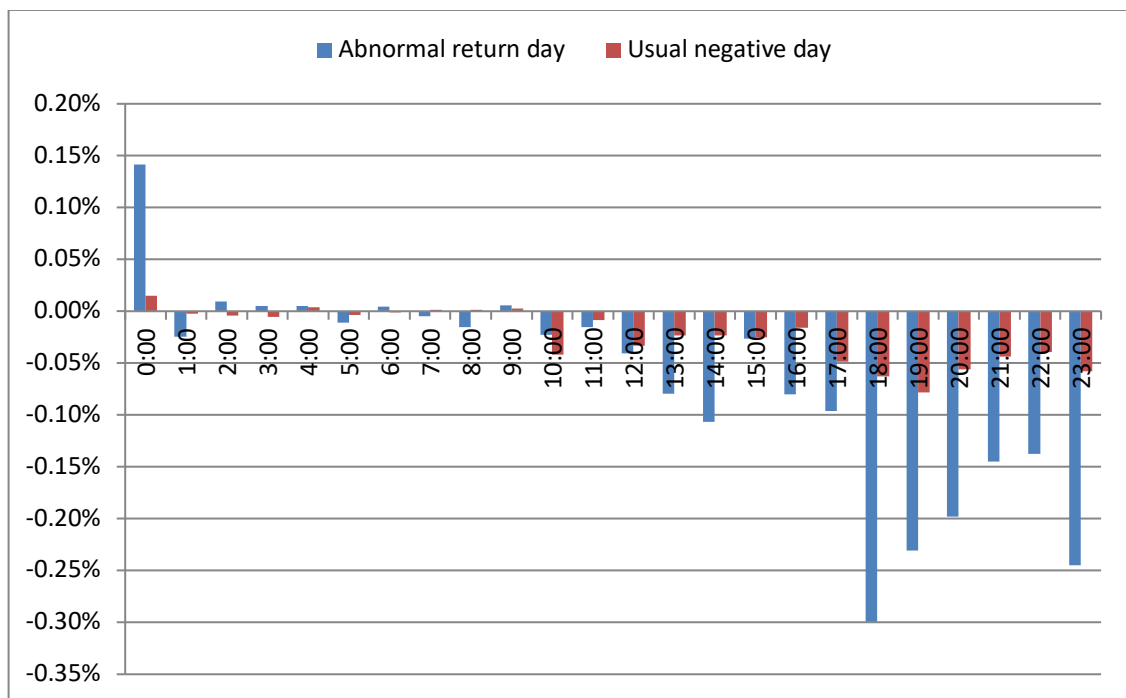
SP500 Futures: day of abnormal returns

Figure A.1: Average hourly returns on abnormal and normal days: the case of positive abnormal returns, SP500 Futures



This figure presents estimates and a comparison between average hourly SP500 Futures returns on abnormal and normal days for the case of positive abnormal returns

Figure A.2: Average hourly returns on abnormal and normal days: the case of negative abnormal returns, SP500 Futures



This figure presents estimates and a comparison between average hourly SP500 Futures returns on abnormal and normal days for the case of negative abnormal returns

Table A.2: t-test of hourly returns on abnormal and normal days: the case of positive abnormal returns, SP500 Futures

Hour	Average return on positive abnormal returns day (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day with positive returns (UD)	Standard deviation (UD)	Number of observation (UD)	t-statistic
0:00	-0.13%	0.72%	41	0.00%	0.30%	873	-1.14
1:00	-0.07%	0.35%	43	-0.01%	0.19%	699	-1.14
2:00	-0.05%	0.15%	34	0.00%	0.09%	696	-1.69
3:00	-0.02%	0.28%	46	-0.01%	0.13%	985	-0.15
4:00	0.08%	0.29%	46	0.01%	0.12%	903	1.63
5:00	-0.03%	0.45%	49	0.00%	0.13%	958	-0.46
6:00	0.05%	0.27%	47	0.00%	0.15%	957	1.44
7:00	0.11%	0.24%	48	0.00%	0.13%	878	2.88
8:00	0.01%	0.23%	43	0.00%	0.11%	829	0.35
9:00	0.07%	0.31%	46	0.00%	0.10%	908	1.34
10:00	0.08%	0.24%	50	0.01%	0.11%	1059	2.09
11:00	0.09%	0.38%	47	0.02%	0.16%	1061	1.20
12:00	-0.02%	0.39%	49	0.02%	0.19%	1081	-0.79
13:00	0.13%	0.32%	49	0.03%	0.17%	1091	2.17
14:00	0.06%	0.33%	49	0.02%	0.15%	1077	0.89
15:00	0.03%	0.37%	49	0.02%	0.14%	1095	0.16
16:00	-0.03%	0.43%	49	0.01%	0.17%	1111	-0.66
17:00	0.08%	0.34%	50	0.03%	0.20%	1115	1.04
18:00	0.30%	0.59%	50	0.06%	0.27%	1121	2.84
19:00	0.32%	0.43%	50	0.06%	0.27%	1119	4.16
20:00	0.27%	0.36%	49	0.05%	0.23%	1115	4.22
21:00	0.11%	0.36%	50	0.04%	0.20%	1099	1.35
22:00	0.05%	0.41%	50	0.04%	0.20%	1083	0.18
23:00	0.16%	0.54%	50	0.05%	0.22%	1080	1.47

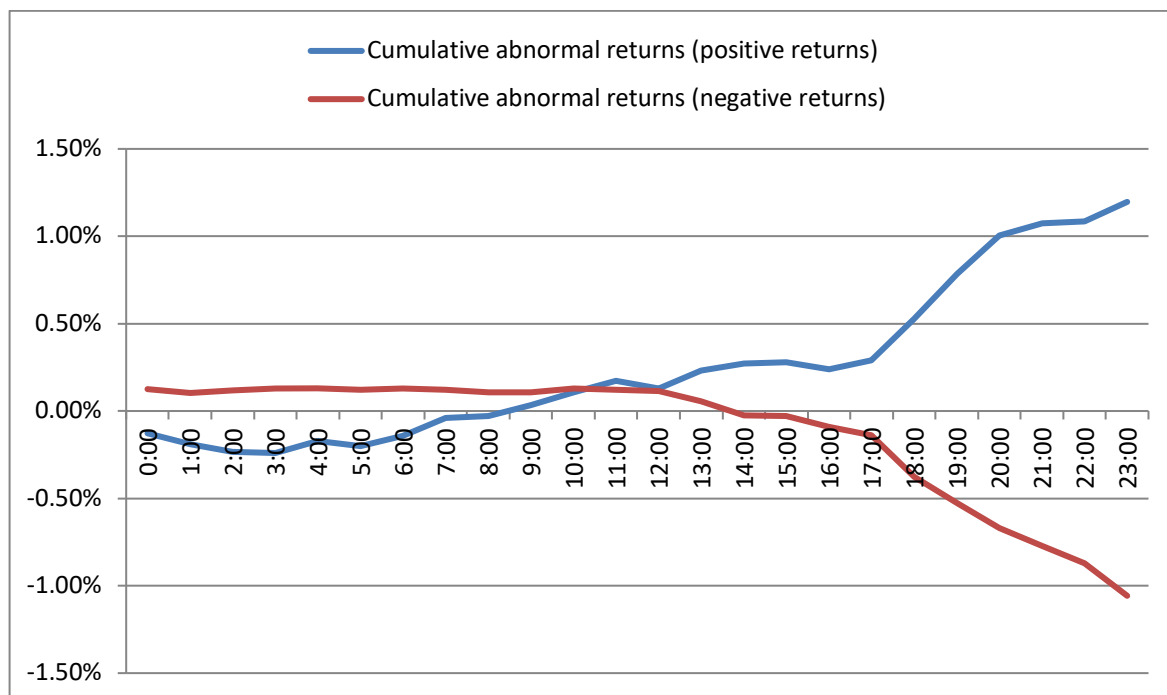
This table presents estimates from the t-tests of SP500 Futures hourly returns on abnormal and normal days for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on positive abnormal returns day and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table A.3: t-test of hourly returns on abnormal and normal days: the case of negative abnormal returns, SP500 Futures

Hour	Average return on positive abnormal returns day (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day with positive returns (UD)	Standard deviation (UD)	Number of observation (UD)	t-statistic
0:00	0.14%	0.72%	66	0.01%	0.33%	825	1.41
1:00	-0.02%	0.34%	58	0.00%	0.19%	612	-0.50
2:00	0.01%	0.13%	54	0.00%	0.12%	634	0.74
3:00	0.00%	0.18%	79	-0.01%	0.12%	910	0.51
4:00	0.01%	0.14%	76	0.00%	0.11%	840	0.10
5:00	-0.01%	0.22%	84	0.00%	0.13%	868	-0.31
6:00	0.00%	0.16%	77	0.00%	0.12%	884	0.32
7:00	0.00%	0.17%	76	0.00%	0.11%	780	-0.31
8:00	-0.02%	0.13%	73	0.00%	0.09%	755	-1.11
9:00	0.01%	0.10%	77	0.00%	0.10%	804	0.25
10:00	-0.02%	0.14%	83	-0.04%	0.18%	1231	1.18
11:00	-0.02%	0.22%	91	-0.01%	0.16%	1236	-0.31
12:00	-0.04%	0.25%	89	-0.03%	0.19%	1271	-0.27
13:00	-0.08%	0.25%	89	-0.02%	0.16%	1272	-2.07
14:00	-0.11%	0.21%	89	-0.02%	0.17%	1252	-3.71
15:00	-0.03%	0.20%	87	-0.03%	0.17%	1179	-0.04
16:00	-0.08%	0.25%	91	-0.02%	0.16%	1093	-2.38
17:00	-0.10%	0.32%	91	-0.05%	0.22%	1104	-1.40
18:00	-0.30%	0.40%	91	-0.06%	0.27%	1084	-5.59
19:00	-0.23%	0.44%	91	-0.08%	0.29%	1077	-3.22
20:00	-0.20%	0.41%	90	-0.06%	0.26%	1071	-3.24
21:00	-0.15%	0.32%	90	-0.04%	0.22%	1035	-2.93
22:00	-0.14%	0.37%	90	-0.04%	0.24%	1025	-2.47
23:00	-0.24%	0.43%	89	-0.06%	0.29%	1036	-4.03

This table presents estimates from the t-tests of SP500 Futures hourly returns on abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on negative abnormal returns day and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Figure A.3: Dynamics of cumulative abnormal returns: case of SP500 Futures



This figure displays the dynamics of cumulative abnormal returns in SP500 Futures prices for the case of negative and positive abnormal returns on the day of abnormal returns

Table A.4: Cumulative abnormal returns: the case of positive and negative abnormal returns, SP500 Futures

Hour	Positive abnormal returns			Negative abnormal returns		
	Abnormal returns	CAR	Abnormal returns cross	Abnormal returns	CAR	Abnormal returns cross
0:00	-0.13%	-0.13%	1.92%	0.13%	0.13%	-1.72%
1:00	-0.06%	-0.19%	1.99%	-0.02%	0.10%	-1.70%
2:00	-0.04%	-0.23%	2.04%	0.01%	0.12%	-1.71%
3:00	-0.01%	-0.24%	2.06%	0.01%	0.13%	-1.71%
4:00	0.07%	-0.17%	1.98%	0.00%	0.13%	-1.72%
5:00	-0.03%	-0.20%	2.01%	-0.01%	0.12%	-1.71%
6:00	0.06%	-0.14%	1.96%	0.01%	0.13%	-1.71%
7:00	0.10%	-0.04%	1.85%	-0.01%	0.12%	-1.71%
8:00	0.01%	-0.03%	1.85%	-0.02%	0.11%	-1.69%
9:00	0.06%	0.03%	1.78%	0.00%	0.11%	-1.70%
10:00	0.07%	0.11%	1.70%	0.02%	0.13%	-1.67%
11:00	0.07%	0.17%	1.61%	-0.01%	0.12%	-1.66%
12:00	-0.04%	0.13%	1.63%	-0.01%	0.11%	-1.62%
13:00	0.10%	0.23%	1.50%	-0.06%	0.06%	-1.54%
14:00	0.04%	0.27%	1.44%	-0.08%	-0.03%	-1.43%
15:00	0.01%	0.28%	1.41%	0.00%	-0.03%	-1.40%
16:00	-0.04%	0.24%	1.44%	-0.06%	-0.09%	-1.32%
17:00	0.05%	0.29%	1.36%	-0.05%	-0.14%	-1.23%

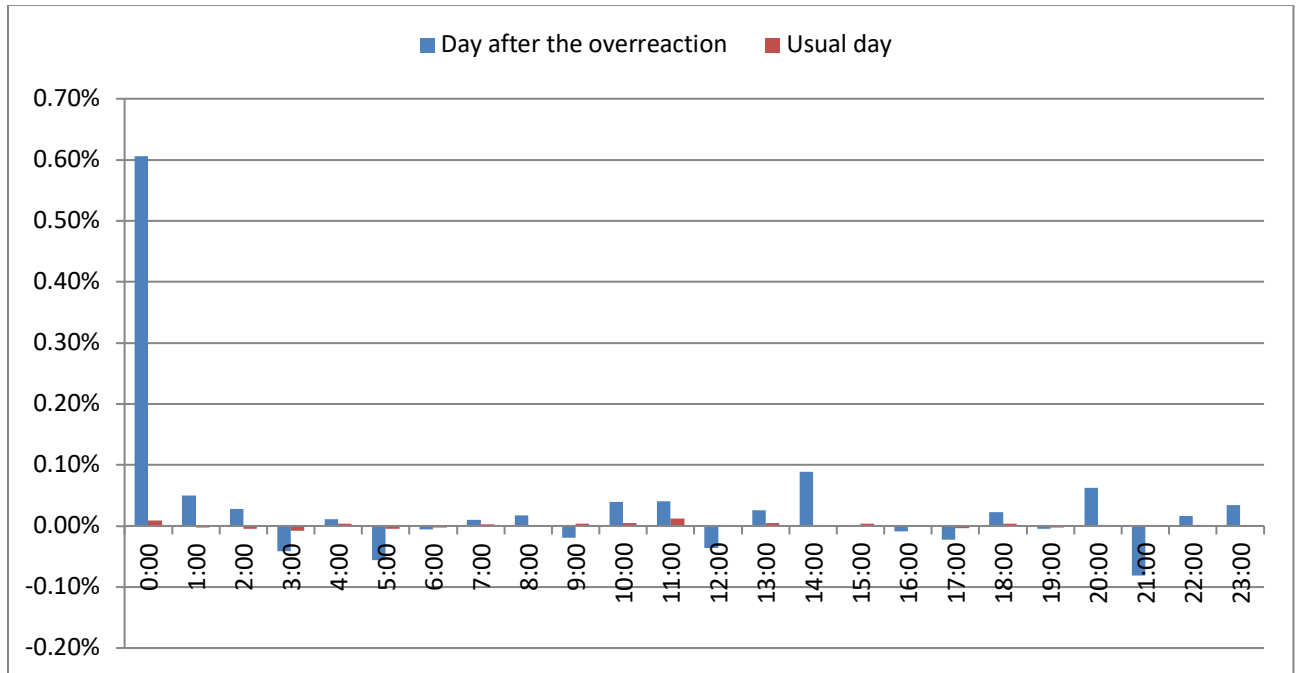
18:00	0.24%	0.53%	1.06%	-0.24%	-0.38%	-0.93%
19:00	0.26%	0.78%	0.75%	-0.15%	-0.53%	-0.70%
20:00	0.22%	1.01%	0.47%	-0.14%	-0.67%	-0.50%
21:00	0.07%	1.07%	0.37%	-0.10%	-0.77%	-0.36%
22:00	0.01%	1.08%	0.32%	-0.10%	-0.87%	-0.22%
23:00	0.11%	1.20%	0.16%	-0.19%	-1.06%	0.03%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns on abnormal days in SP500 Futures prices. The first column reports hours of the day, the second and fifth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and sixth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns; the fourth and seventh columns show respectively abnormal returns cross for the case of positive and negative abnormal returns;

Appendix B

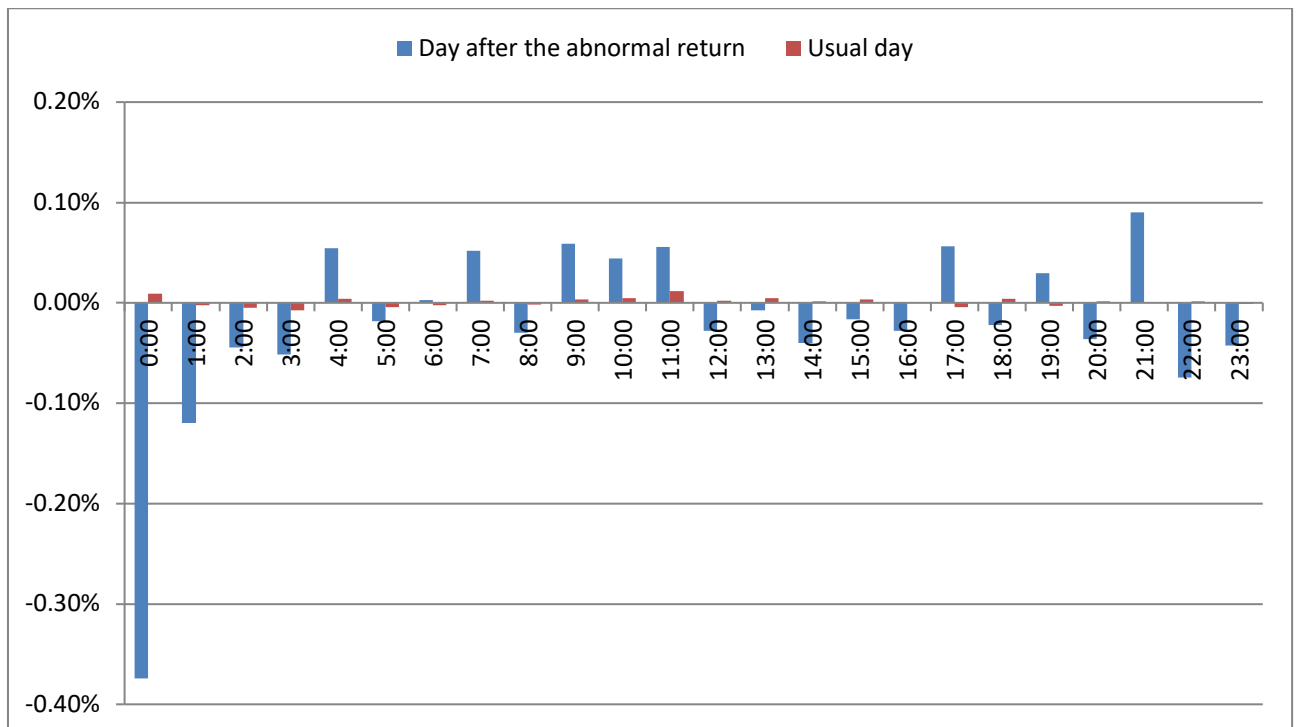
SP500 Futures: day after the abnormal returns

Figure B.1: Average hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, SP500 Futures



This figure presents estimates and comparison between average hourly SP500 Futures returns after the abnormal and normal days for the case of positive abnormal returns

Figure B.2: Average hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, SP500 Futures



This figure presents estimates and comparison between average hourly SP500 Futures returns after the abnormal and normal days for the case of negative abnormal returns

Table B.1: t-test of hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, SP500 Futures

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
0:00	0.61%	0.99%	41	0.01%	0.29%	2445	3.87
1:00	0.05%	0.24%	40	0.00%	0.18%	1749	1.36
2:00	0.03%	0.11%	34	-0.01%	0.12%	1580	1.77
3:00	-0.04%	0.13%	46	-0.01%	0.12%	2204	-1.71
4:00	0.01%	0.16%	48	0.00%	0.12%	1930	0.32
5:00	-0.06%	0.13%	50	0.00%	0.14%	2036	-2.72
6:00	-0.01%	0.14%	47	0.00%	0.13%	2010	-0.17
7:00	0.01%	0.12%	46	0.00%	0.12%	1786	0.41
8:00	0.02%	0.15%	44	0.00%	0.10%	1703	0.81
9:00	-0.02%	0.15%	49	0.00%	0.10%	1854	-1.05
10:00	0.04%	0.20%	50	0.00%	0.10%	2363	1.24
11:00	0.04%	0.19%	51	0.01%	0.14%	2296	1.05
12:00	-0.04%	0.21%	51	0.00%	0.18%	2372	-1.30
13:00	0.03%	0.25%	51	0.00%	0.16%	2385	0.61
14:00	0.09%	0.25%	49	0.00%	0.14%	2332	2.45
15:00	0.00%	0.22%	51	0.00%	0.15%	2370	-0.07
16:00	-0.01%	0.24%	51	0.00%	0.16%	2456	-0.28
17:00	-0.02%	0.36%	51	0.00%	0.21%	2524	-0.38
18:00	0.02%	0.38%	51	0.00%	0.27%	2565	0.34
19:00	0.00%	0.38%	51	0.00%	0.28%	2533	-0.04
20:00	0.06%	0.27%	50	0.00%	0.24%	2499	1.58
21:00	-0.08%	0.30%	51	0.00%	0.21%	2422	-1.96
22:00	0.02%	0.38%	51	0.00%	0.22%	2370	0.27
23:00	0.03%	0.47%	51	0.00%	0.26%	2393	0.54

This table presents estimates from the t-tests of SP500 Futures hourly returns on day after abnormal returns for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after positive abnormal returns and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on day after positive abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table B.2: t-test of hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, SP500 Futures

Hour	Average return on day after negative abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t-statistic
0:00	-0.37%	0.66%	55	0.01%	0.29%	2445	-4.29
1:00	-0.12%	0.40%	47	0.00%	0.18%	1749	-1.99
2:00	-0.04%	0.24%	53	-0.01%	0.12%	1580	-1.21
3:00	-0.05%	0.25%	71	-0.01%	0.12%	2204	-1.45
4:00	0.05%	0.19%	72	0.00%	0.12%	1930	2.22
5:00	-0.02%	0.41%	72	0.00%	0.14%	2036	-0.29
6:00	0.00%	0.26%	72	0.00%	0.13%	2010	0.17
7:00	0.05%	0.23%	67	0.00%	0.12%	1786	1.77
8:00	-0.03%	0.17%	66	0.00%	0.10%	1703	-1.31
9:00	0.06%	0.31%	71	0.00%	0.10%	1854	1.49
10:00	0.04%	0.21%	72	0.00%	0.10%	2363	1.60
11:00	0.06%	0.37%	71	0.01%	0.14%	2296	1.00
12:00	-0.03%	0.39%	72	0.00%	0.18%	2372	-0.65
13:00	-0.01%	0.31%	72	0.00%	0.16%	2385	-0.34
14:00	-0.04%	0.30%	72	0.00%	0.14%	2332	-1.16
15:00	-0.02%	0.45%	71	0.00%	0.15%	2370	-0.37
16:00	-0.03%	0.40%	71	0.00%	0.16%	2456	-0.60
17:00	0.06%	0.38%	72	0.00%	0.21%	2524	1.34
18:00	-0.02%	0.64%	72	0.00%	0.27%	2565	-0.34
19:00	0.03%	0.60%	72	0.00%	0.28%	2533	0.45
20:00	-0.04%	0.50%	72	0.00%	0.24%	2499	-0.63
21:00	0.09%	0.58%	71	0.00%	0.21%	2422	1.30
22:00	-0.07%	0.47%	70	0.00%	0.22%	2370	-1.35
23:00	-0.04%	0.63%	69	0.00%	0.26%	2393	-0.55

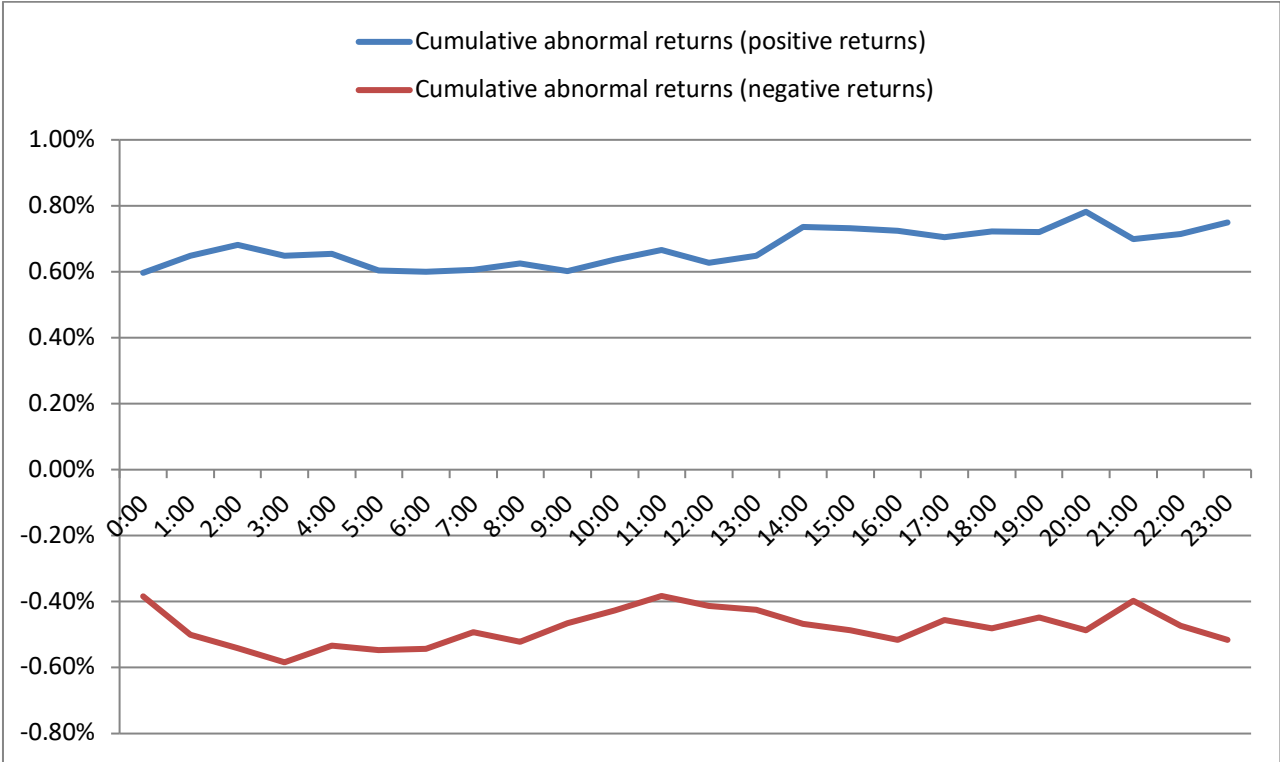
This table presents estimates from the t-tests of SP500 Futures hourly returns on the day after the abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after negative abnormal returns and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on day after negative abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table B.3: Cumulative abnormal returns: the case of positive and negative abnormal returns, SP500 Futures

Hour	Positive abnormal returns		Negative abnormal returns	
	Abnormal returns	Cumulative abnormal returns	Abnormal returns	Cumulative abnormal returns
0:00	0.60%	0.60%	-0.38%	-0.38%
1:00	0.05%	0.65%	-0.12%	-0.50%
2:00	0.03%	0.68%	-0.04%	-0.54%
3:00	-0.03%	0.65%	-0.04%	-0.58%
4:00	0.01%	0.66%	0.05%	-0.53%
5:00	-0.05%	0.60%	-0.01%	-0.55%
6:00	0.00%	0.60%	0.01%	-0.54%
7:00	0.01%	0.61%	0.05%	-0.49%
8:00	0.02%	0.63%	-0.03%	-0.52%
9:00	-0.02%	0.60%	0.06%	-0.47%
10:00	0.03%	0.64%	0.04%	-0.43%
11:00	0.03%	0.67%	0.04%	-0.38%
12:00	-0.04%	0.63%	-0.03%	-0.41%
13:00	0.02%	0.65%	-0.01%	-0.43%
14:00	0.09%	0.74%	-0.04%	-0.47%
15:00	0.00%	0.73%	-0.02%	-0.49%
16:00	-0.01%	0.72%	-0.03%	-0.52%
17:00	-0.02%	0.70%	0.06%	-0.46%
18:00	0.02%	0.72%	-0.03%	-0.48%
19:00	0.00%	0.72%	0.03%	-0.45%
20:00	0.06%	0.78%	-0.04%	-0.49%
21:00	-0.08%	0.70%	0.09%	-0.40%
22:00	0.01%	0.71%	-0.08%	-0.47%
23:00	0.04%	0.75%	-0.04%	-0.52%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns after abnormal days in SP500 Futures prices. The first column reports hours of the day, the second and fourth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and fifth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns.

Figure B.3: Dynamics of cumulative abnormal returns, SP500 Futures

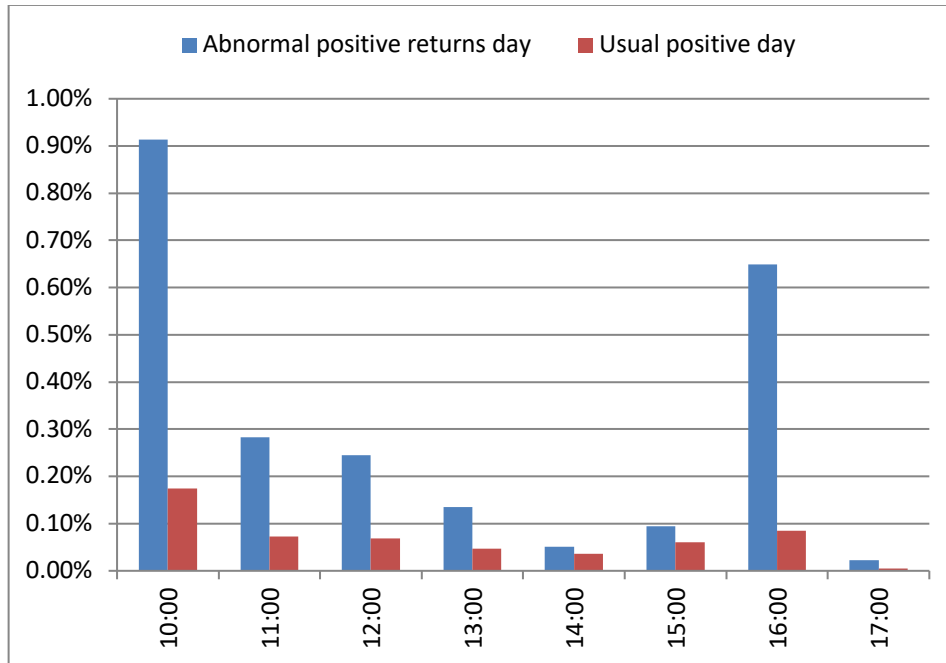


This figure displays the dynamics of cumulative abnormal returns in SP500 Futures prices for the case of negative and positive abnormal returns after the day of abnormal returns

Appendix C

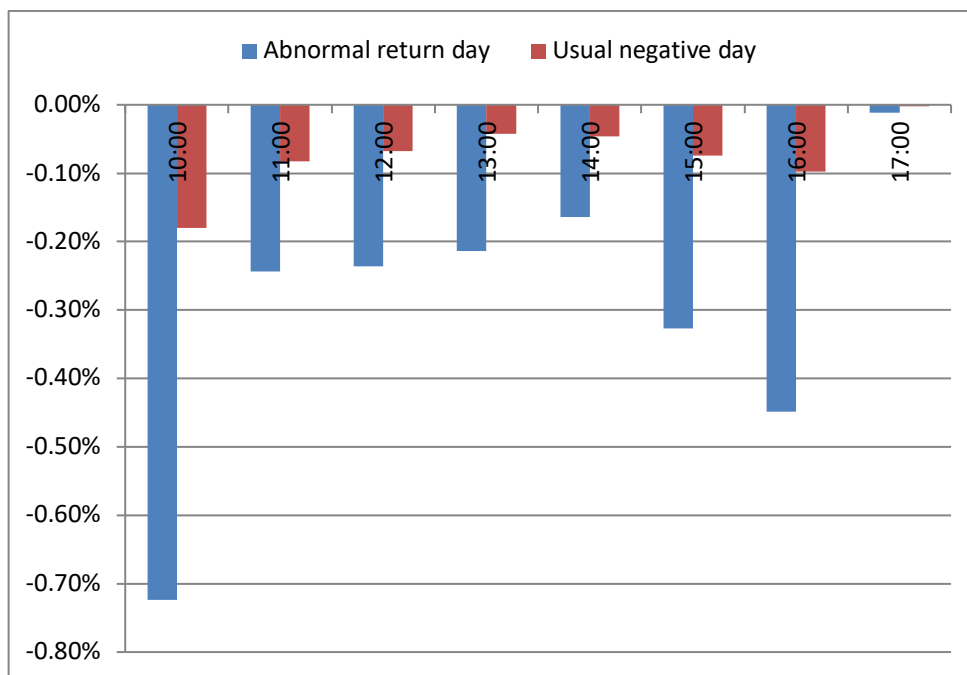
SP500: day of abnormal returns

Figure C.1: Average hourly returns on abnormal and normal days: the case of positive abnormal returns, SP500



This figure presents estimates and comparison between average hourly SP500 returns on abnormal and normal days for the case of positive abnormal returns

Figure C.2: Average hourly returns on abnormal and normal days: the case of negative abnormal returns, SP500



This figure presents estimates and comparison between average hourly SP500 returns on abnormal and normal days for the case of negative abnormal returns

Table C.2: t-test of hourly returns on abnormal and normal days: the case of positive abnormal returns, SP500

Hour	Average return on positive abnormal returns day (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day with positive returns (UD)	Standard deviation (UD)	Number of observation (UD)	t-statistic
10:00	0.91%	0.93%	50	0.17%	0.40%	1332	5.63
11:00	0.28%	0.46%	50	0.07%	0.28%	1333	3.19
12:00	0.24%	0.42%	50	0.07%	0.22%	1333	2.93
13:00	0.14%	0.36%	50	0.05%	0.18%	1331	1.73
14:00	0.05%	0.35%	50	0.04%	0.19%	1332	0.30
15:00	0.09%	0.51%	50	0.06%	0.22%	1324	0.49
16:00	0.65%	0.90%	50	0.09%	0.29%	1323	4.41
17:00	0.02%	0.04%	50	0.01%	0.02%	1318	2.96

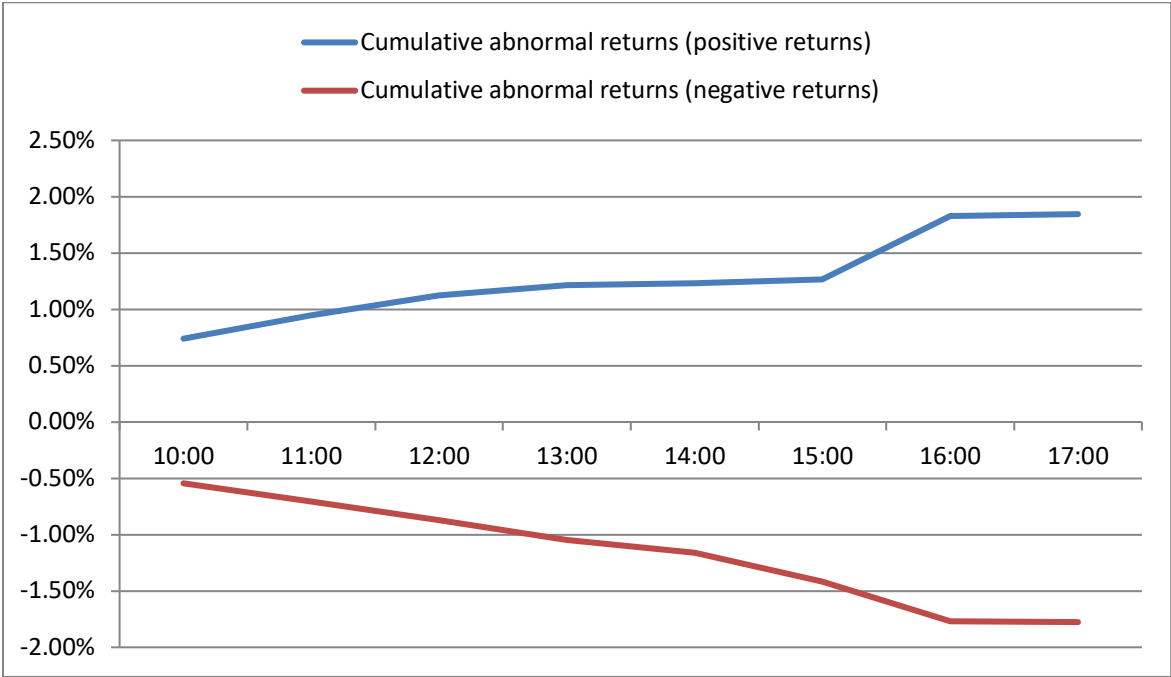
This table presents estimates from the t-tests of SP500 hourly returns on abnormal and normal days for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on positive abnormal returns day and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table C.3: t-test of hourly returns on abnormal and normal days: the case of negative abnormal returns, SP500

Hour	Average return on positive abnormal returns day (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day with positive returns (UD)	Standard deviation (UD)	Number of observation (UD)	t-statistic
10:00	-0.72%	0.81%	72	-0.18%	0.41%	1336	-5.69
11:00	-0.24%	0.48%	72	-0.08%	0.28%	1339	-2.83
12:00	-0.24%	0.48%	72	-0.07%	0.27%	1339	-2.95
13:00	-0.21%	0.36%	72	-0.04%	0.23%	1340	-4.03
14:00	-0.16%	0.48%	72	-0.05%	0.23%	1336	-2.09
15:00	-0.33%	0.48%	71	-0.07%	0.28%	1244	-4.38
16:00	-0.45%	0.61%	71	-0.10%	0.34%	1132	-4.78
17:00	-0.01%	0.04%	71	0.00%	0.02%	1128	-1.79

This table presents estimates from the t-tests of SP500 hourly returns on abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on negative abnormal returns day and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Figure C.3: Dynamics of cumulative abnormal returns, SP500



This figure displays the dynamics of cumulative abnormal returns in SP500 prices for the case of negative and positive abnormal returns on the day of abnormal returns

Table C.4: Cumulative abnormal returns: the case of positive and negative abnormal returns, SP500

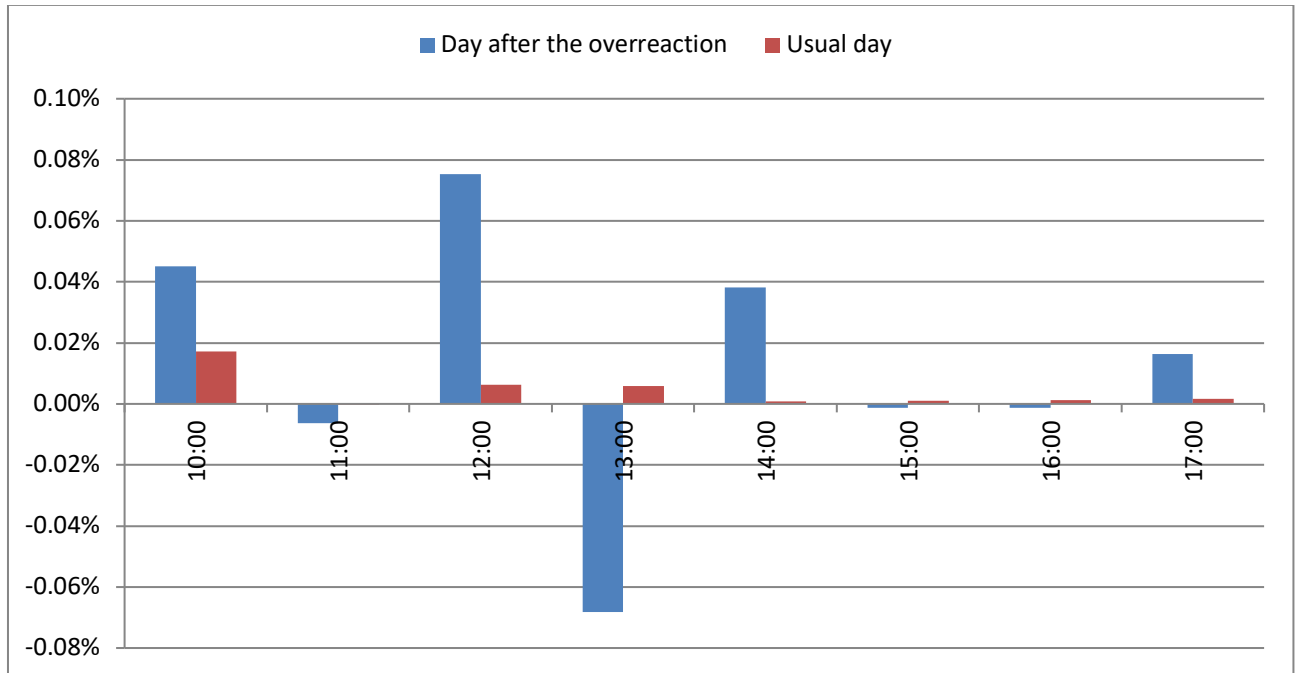
Hour	Positive abnormal returns			Negative abnormal returns		
	Abnormal returns	Cumulative abnormal returns	Abnormal returns cross	Abnormal returns	Cumulative abnormal returns	Abnormal returns cross
10:00	0.74%	0.74%	0.90%	-0.54%	-0.54%	-1.01%
11:00	0.21%	0.95%	0.62%	-0.16%	-0.70%	-0.77%
12:00	0.18%	1.13%	0.37%	-0.17%	-0.87%	-0.53%
13:00	0.09%	1.21%	0.24%	-0.17%	-1.05%	-0.32%
14:00	0.01%	1.23%	0.19%	-0.12%	-1.16%	-0.16%
15:00	0.04%	1.26%	0.09%	-0.25%	-1.42%	0.17%
16:00	0.56%	1.83%	-0.56%	-0.35%	-1.77%	0.62%
17:00	0.02%	1.85%	-0.58%	-0.01%	-1.78%	0.63%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns on abnormal days in SP500 prices. The first column reports hours of the day, the second and fifth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and sixth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns; the fourth and seventh columns show respectively abnormal returns cross for the case of positive and negative abnormal returns.

Appendix D

SP500: day after the abnormal returns

Figure D.1: Average hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, SP500



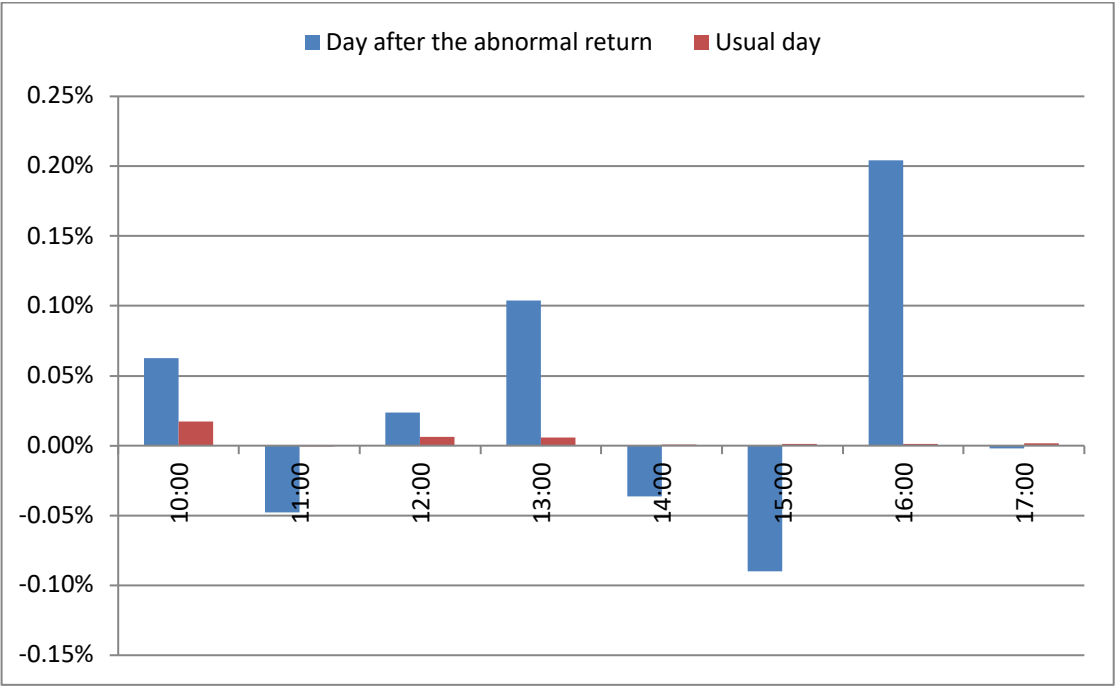
This figure presents estimates and comparison between average hourly SP500 returns after the abnormal and normal days for the case of positive abnormal returns

Table D.1: t-test of hourly returns on the day after the abnormal and normal days: the case of positive abnormal, SP500

Hour	Average return on positive abnormal returns day (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day with positive returns (UD)	Standard deviation (UD)	Number of observation (UD)	t-statistic
10:00	0.05%	0.61%	51	0.02%	0.44%	2515	0.33
11:00	-0.01%	0.39%	51	0.00%	0.30%	2515	-0.12
12:00	0.08%	0.28%	51	0.01%	0.25%	2515	1.74
13:00	-0.07%	0.29%	51	0.01%	0.21%	2514	-1.82
14:00	0.04%	0.35%	51	0.00%	0.21%	2513	0.76
15:00	0.00%	0.46%	51	0.00%	0.26%	2494	-0.04
16:00	0.00%	0.67%	51	0.00%	0.32%	2497	-0.03
17:00	0.02%	0.03%	51	0.00%	0.02%	2485	3.39

This table presents estimates from the t-tests of SP500 hourly returns on the day after the abnormal and normal days for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after positive abnormal returns and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on day after positive abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Figure D.2: Average hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, SP500



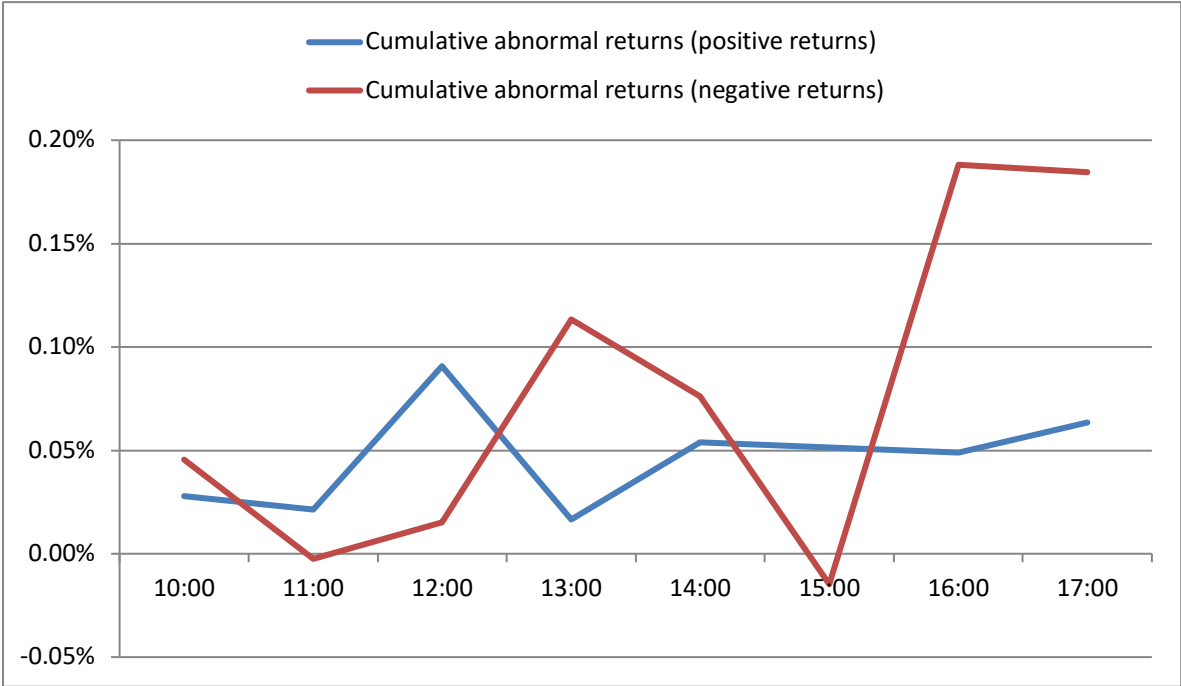
This figure presents estimates and comparison between average hourly SP500 returns after the abnormal and normal days for the case of negative abnormal returns

Table D.2: t-test of hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, SP500

Hour	Average return on positive abnormal returns day (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day with positive returns (UD)	Standard deviation (UD)	Number of observation (UD)	t-statistic
10:00	0.43	0.43	0.43	0.43	0.43	0.43	0.43
11:00	-0.61	-0.61	-0.61	-0.61	-0.61	-0.61	-0.61
12:00	0.26	0.26	0.26	0.26	0.26	0.26	0.26
13:00	1.49	1.49	1.49	1.49	1.49	1.49	1.49
14:00	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70
15:00	-1.32	-1.32	-1.32	-1.32	-1.32	-1.32	-1.32
16:00	1.70	1.70	1.70	1.70	1.70	1.70	1.70
17:00	-0.88	-0.88	-0.88	-0.88	-0.88	-0.88	-0.88

This table presents estimates from the t-tests of SP500 hourly returns on the day after the abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after negative abnormal returns and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on day after negative abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Figure D.3: Dynamics of cumulative abnormal returns on the day after the abnormal returns, SP500



This figure displays the dynamics of cumulative abnormal returns in SP500 prices for the case of negative and positive abnormal returns on the day after the abnormal returns

Table D.3: Cumulative abnormal returns on the day after the abnormal returns: the case of positive and negative abnormal returns, SP500

Hour	Positive abnormal returns		Negative abnormal returns	
	Abnormal returns	Cumulative abnormal returns	Abnormal returns	Cumulative abnormal returns
10:00	0.03%	0.03%	0.05%	0.05%
11:00	-0.01%	0.02%	-0.05%	0.00%
12:00	0.07%	0.09%	0.02%	0.02%
13:00	-0.07%	0.02%	0.10%	0.11%
14:00	0.04%	0.05%	-0.04%	0.08%
15:00	0.00%	0.05%	-0.09%	-0.01%
16:00*	0.00%	0.05%	0.20%	0.19%
17:00	0.01%	0.06%	0.00%	0.18%

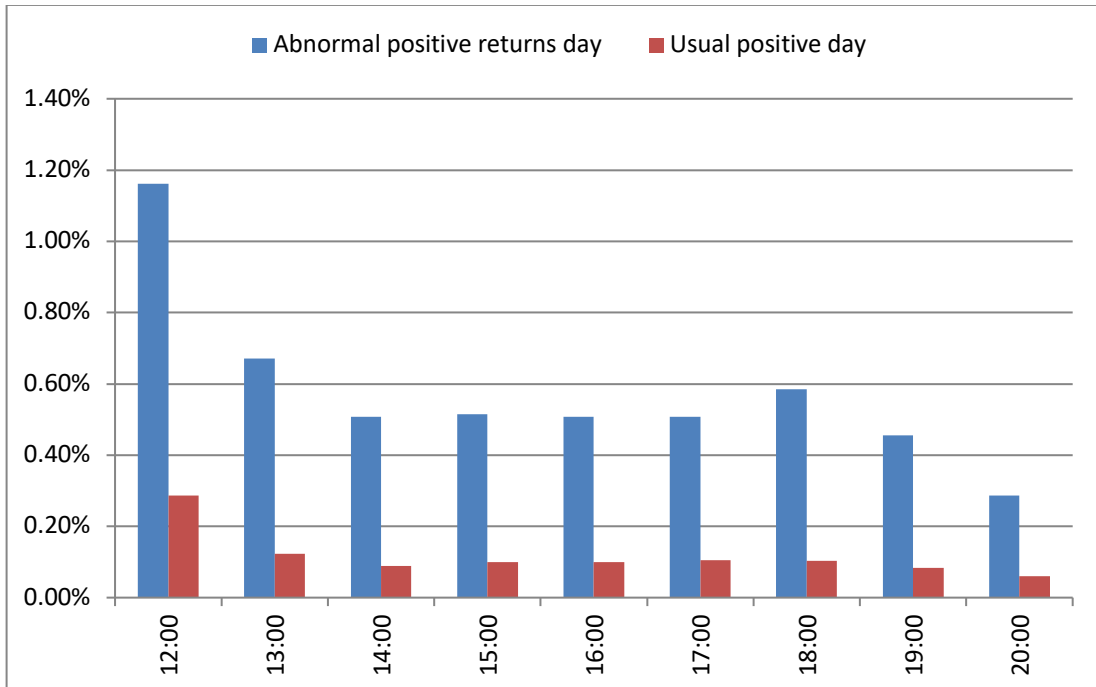
*contrarian effect

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns after abnormal days in SP500 prices. The first column reports hours of the day, the second and fourth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and fifth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns.

Appendix E

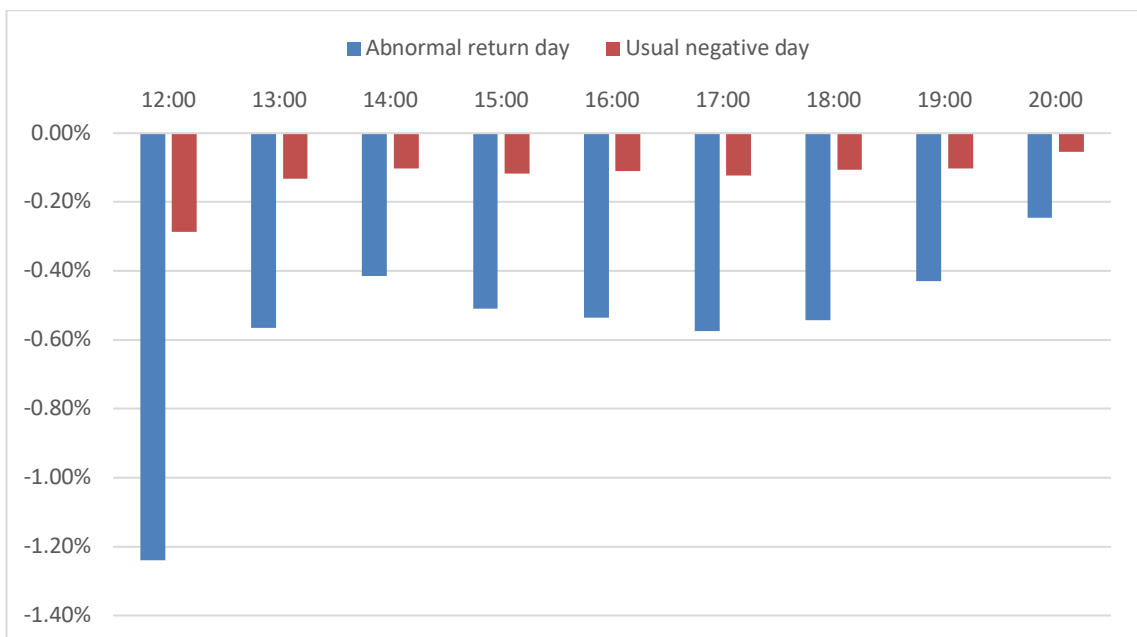
FTSE 100: day of abnormal returns

Figure E.1: Average hourly returns on abnormal and normal days: the case of positive abnormal returns, FTSE 100



This figure presents estimates and a comparison between average hourly FTSE 100 returns on abnormal and normal days for the case of positive abnormal returns

Figure E.2: Average hourly returns on abnormal and normal days: the case of negative abnormal returns, FTSE 100



This figure presents estimates and a comparison between average hourly FTSE 100 returns on abnormal and normal days for the case of negative abnormal returns

Table E.2: t-test of hourly returns on abnormal and normal days: the case of positive abnormal returns, FTSE 100

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
12:00	1.16%	0.97%	63	0.29%	0.51%	1149	7.08
13:00	0.67%	0.87%	70	0.12%	0.39%	1312	5.26
14:00	0.51%	0.95%	70	0.09%	0.35%	1311	3.70
15:00	0.51%	0.96%	70	0.10%	0.40%	1312	3.61
16:00	0.51%	0.87%	70	0.10%	0.39%	1314	3.91
17:00	0.51%	0.96%	70	0.10%	0.43%	1306	3.49
18:00	0.58%	0.87%	70	0.10%	0.47%	1303	4.59
19:00	0.46%	0.80%	70	0.08%	0.45%	1303	3.87
20:00	0.29%	0.68%	56	0.06%	0.50%	917	2.43

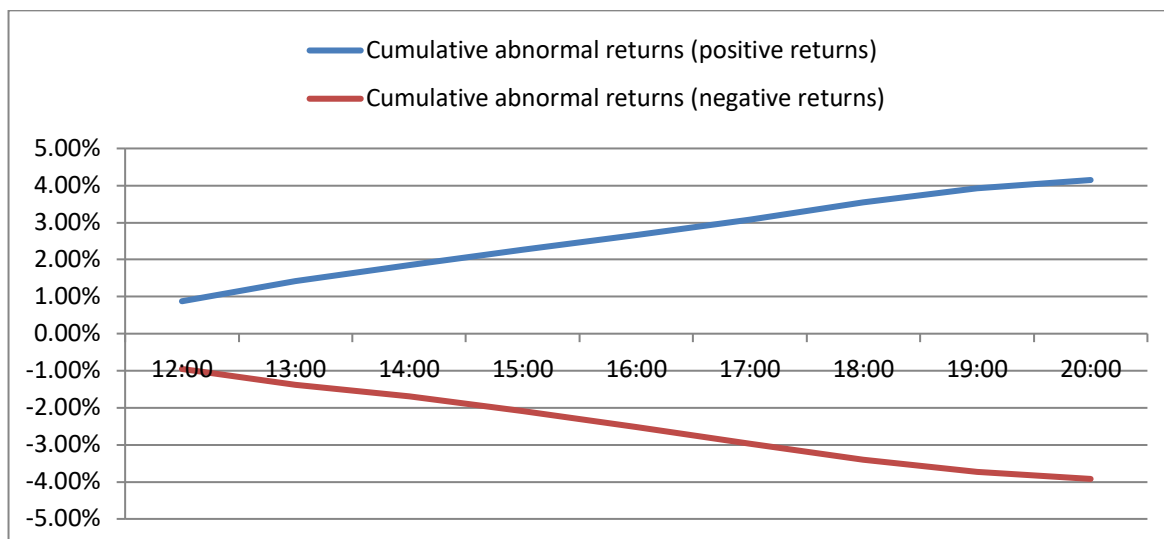
This table presents estimates from the t-tests of FTSE 100 hourly returns on abnormal and normal days for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on positive abnormal returns day and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table E.3: t-test of hourly returns on abnormal and normal days: the case of negative abnormal returns, FTSE 100

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
12:00	-1.24%	1.09%	82	-0.29%	0.57%	1201	-7.82
13:00	-0.57%	0.91%	82	-0.13%	0.44%	1200	-4.29
14:00	-0.42%	0.80%	82	-0.10%	0.41%	1199	-3.50
15:00	-0.51%	0.99%	82	-0.12%	0.50%	1199	-3.54
16:00	-0.54%	1.20%	82	-0.11%	0.56%	1200	-3.19
17:00	-0.57%	1.26%	82	-0.12%	0.58%	1194	-3.23
18:00	-0.54%	1.20%	82	-0.11%	0.62%	1193	-3.27
19:00	-0.43%	1.14%	82	-0.10%	0.59%	1193	-2.58
20:00	-0.24%	1.32%	70	-0.05%	0.61%	991	-1.20

This table presents estimates from the t-tests of FTSE 100 hourly returns on abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on negative abnormal returns day and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Figure E.3: Dynamics of cumulative abnormal returns: case of FTSE 100



This figure displays the dynamics of cumulative abnormal returns in FTSE 100 prices for the case of negative and positive abnormal returns on the day of abnormal returns

Table E.4: Cumulative abnormal returns: the case of positive and negative abnormal returns, FTSE 100

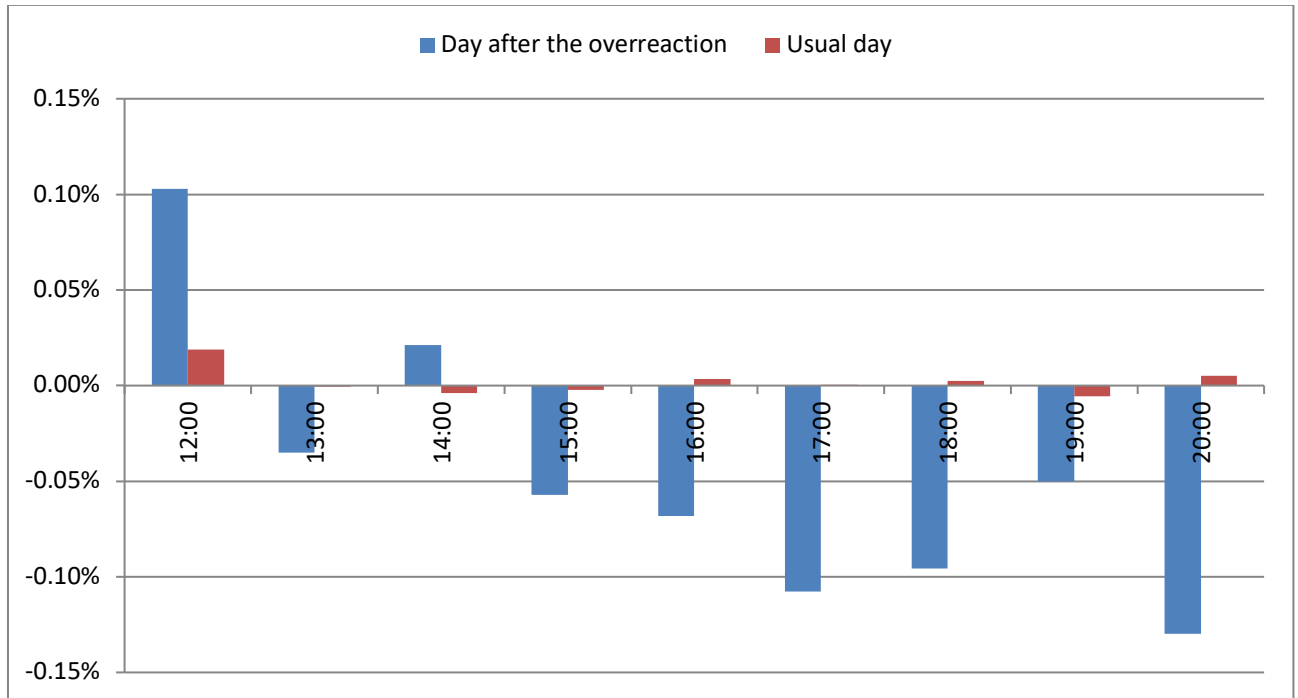
Hour	Positive abnormal returns			Negative abnormal returns		
	Abnormal returns	CAR	Abnormal returns cross	Abnormal returns	CAR	Abnormal returns cross
12:00	0.88%	0.88%	0.68%	-0.95%	-0.95%	-0.58%
13:00	0.55%	1.42%	0.01%	-0.43%	-1.39%	-0.01%
14:00	0.42%	1.84%	-0.50%	-0.31%	-1.70%	0.40%
15:00	0.42%	2.26%	-1.02%	-0.39%	-2.09%	0.91%
16:00	0.41%	2.67%	-1.52%	-0.43%	-2.52%	1.45%
17:00	0.40%	3.07%	-2.03%	-0.45%	-2.97%	2.02%
18:00	0.48%	3.55%	-2.62%	-0.44%	-3.40%	2.56%
19:00	0.37%	3.92%	-3.07%	-0.33%	-3.73%	2.99%
20:00	0.23%	4.15%	-3.36%	-0.19%	-3.92%	3.24%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns on abnormal days in FTSE 100 prices. The first column reports hours of the day, the second and fifth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and sixth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns; the fourth and seventh columns show respectively abnormal returns cross for the case of positive and negative abnormal returns;

Appendix F

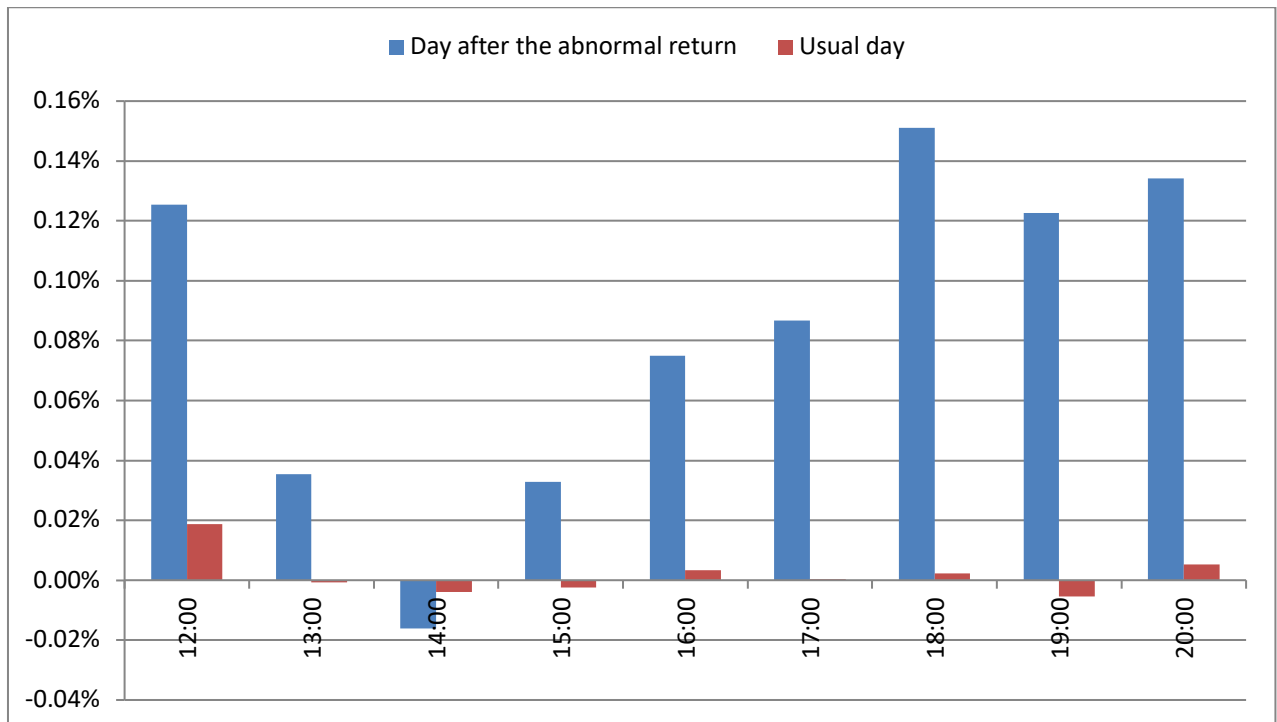
FTSE 100: day after the abnormal returns

Figure F.1: Average hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, FTSE 100



This figure presents estimates and comparison between average hourly FTSE 100 returns after the abnormal and normal days for the case of positive abnormal returns

Figure F.2: Average hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, FTSE 100



This figure presents estimates and comparison between average hourly FTSE 100 returns after the abnormal and normal days for the case of negative abnormal returns

Table F.1: t-test of hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, FTSE 100

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
12:00	0.10%	0.78%	61	0.02%	0.51%	2400	0.84
13:00	-0.03%	0.68%	68	0.00%	0.35%	2396	-0.41
14:00	0.02%	0.74%	68	0.00%	0.32%	2391	0.28
15:00	-0.06%	0.82%	68	0.00%	0.38%	2393	-0.55
16:00	-0.07%	0.91%	68	0.00%	0.40%	2396	-0.64
17:00	-0.11%	0.99%	66	0.00%	0.43%	2381	-0.88
18:00	-0.10%	1.11%	66	0.00%	0.48%	2379	-0.72
19:00	-0.05%	1.07%	66	-0.01%	0.47%	2379	-0.34
20:00	-0.13%	1.03%	52	0.01%	0.49%	1958	-0.94

This table presents estimates from the t-tests of FTSE 100 hourly returns on day after abnormal returns for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after positive abnormal returns and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on day after positive abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table F.2: t-test of hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, FTSE 100

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
12:00	0.13%	1.04%	79	0.02%	0.51%	2400	0.91
13:00	0.04%	1.08%	79	0.00%	0.35%	2396	0.29
14:00	-0.02%	0.97%	79	0.00%	0.32%	2391	-0.11
15:00	0.03%	1.27%	79	0.00%	0.38%	2393	0.25
16:00	0.07%	1.16%	79	0.00%	0.40%	2396	0.55
17:00	0.09%	1.30%	79	0.00%	0.43%	2381	0.59
18:00	0.15%	1.24%	79	0.00%	0.48%	2379	1.06
19:00	0.12%	1.05%	79	-0.01%	0.47%	2379	1.08
20:00	0.13%	0.94%	68	0.01%	0.49%	1958	1.13

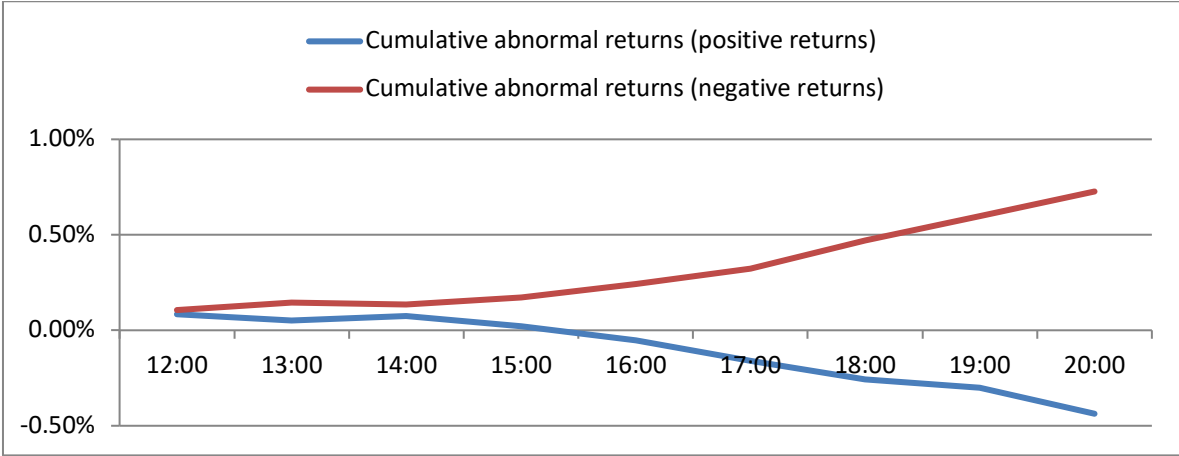
This table presents estimates from the t-tests of FTSE 100 hourly returns on the day after the abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after negative abnormal returns and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on day after negative abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table F.3: Cumulative abnormal returns: the case of positive and negative abnormal returns, FTSE 100

Hour	Positive abnormal returns		Negative abnormal returns	
	Abnormal returns	Cumulative abnormal returns	Abnormal returns	Cumulative abnormal returns
12:00	0.08%	0.08%	0.11%	0.11%
13:00	-0.03%	0.05%	0.04%	0.14%
14:00	0.02%	0.07%	-0.01%	0.13%
15:00	-0.05%	0.02%	0.04%	0.17%
16:00	-0.07%	-0.05%	0.07%	0.24%
17:00	-0.11%	-0.16%	0.09%	0.32%
18:00	-0.10%	-0.26%	0.15%	0.47%
19:00	-0.04%	-0.30%	0.13%	0.60%
20:00	-0.13%	-0.44%	0.13%	0.73%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns after abnormal days in FTSE 100 prices. The first column reports hours of the day, the second and fourth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and fifth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns.

Figure F.3: Dynamics of cumulative abnormal returns, FTSE 100

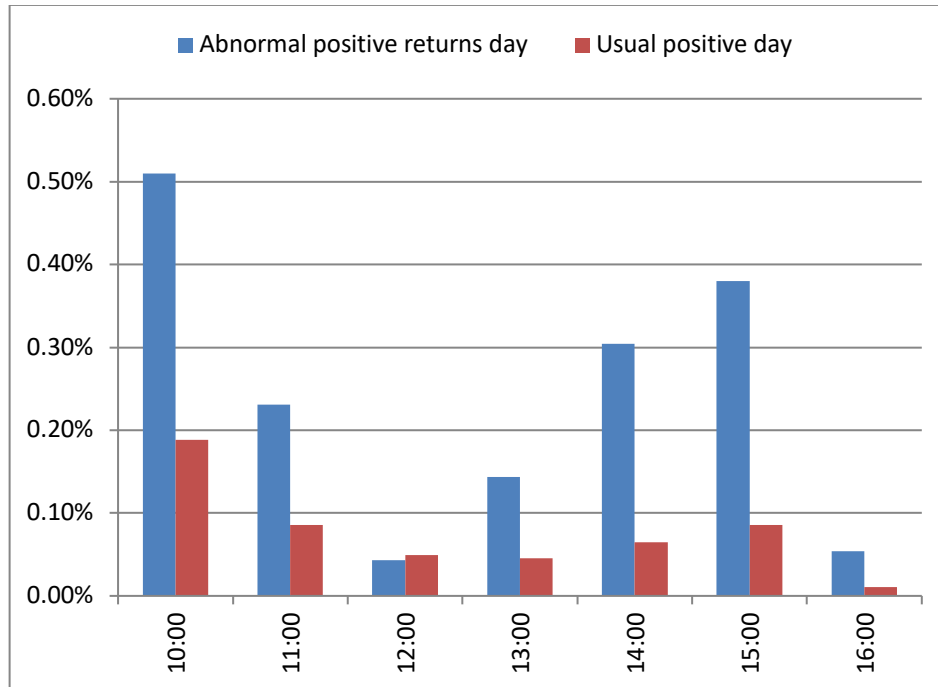


This figure displays the dynamics of cumulative abnormal returns in FTSE 100 prices for the case of negative and positive abnormal returns after the day of abnormal returns

Appendix G

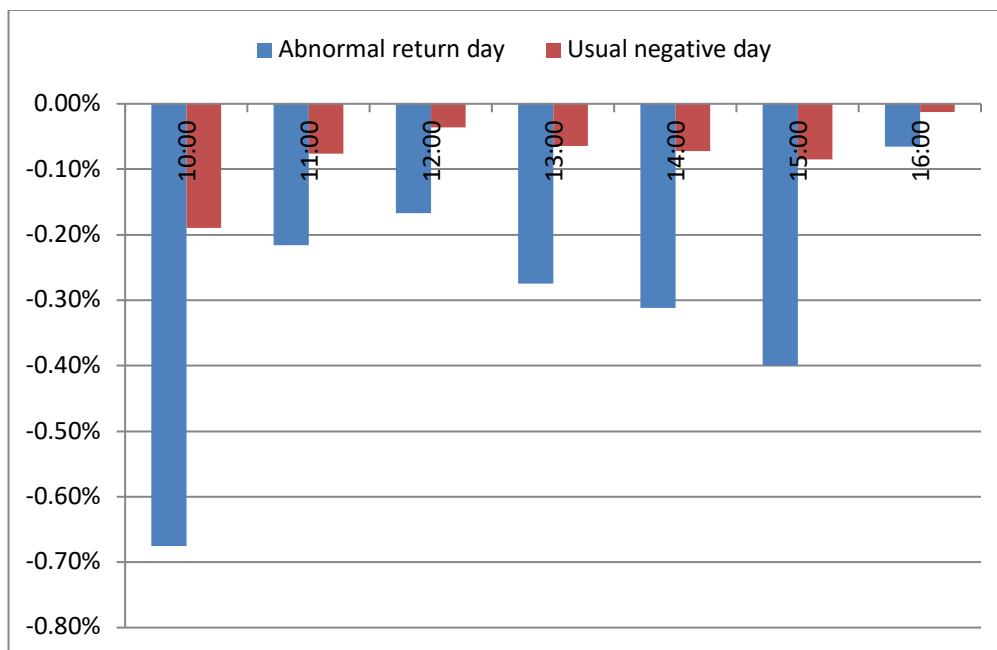
NIKKEI 225: day of abnormal returns

Figure G.1: Average hourly returns on abnormal and normal days: the case of positive abnormal returns, NIKKEI 225



This figure presents estimates and a comparison between average hourly NIKKEI 225 returns on abnormal and normal days for the case of positive abnormal returns

Figure G.2: Average hourly returns on abnormal and normal days: the case of negative abnormal returns, NIKKEI 225



This figure presents estimates and a comparison between average hourly NIKKEI 225 returns on abnormal and normal days for the case of negative abnormal returns

Table G.2: t-test of hourly returns on abnormal and normal days: the case of positive abnormal returns, NIKKEI 225

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	0.51%	0.77%	80	0.19%	0.41%	1 217	3.68
11:00	0.23%	0.55%	80	0.09%	0.31%	1 216	2.35
12:00	0.04%	0.21%	79	0.05%	0.22%	1 311	- 0.26
13:00	0.14%	0.33%	80	0.05%	0.22%	1 304	2.60
14:00	0.30%	0.48%	81	0.06%	0.28%	1 310	4.42
15:00	0.38%	0.53%	81	0.09%	0.31%	1 311	4.93
16:00	0.05%	0.08%	80	0.01%	0.07%	1 301	4.58

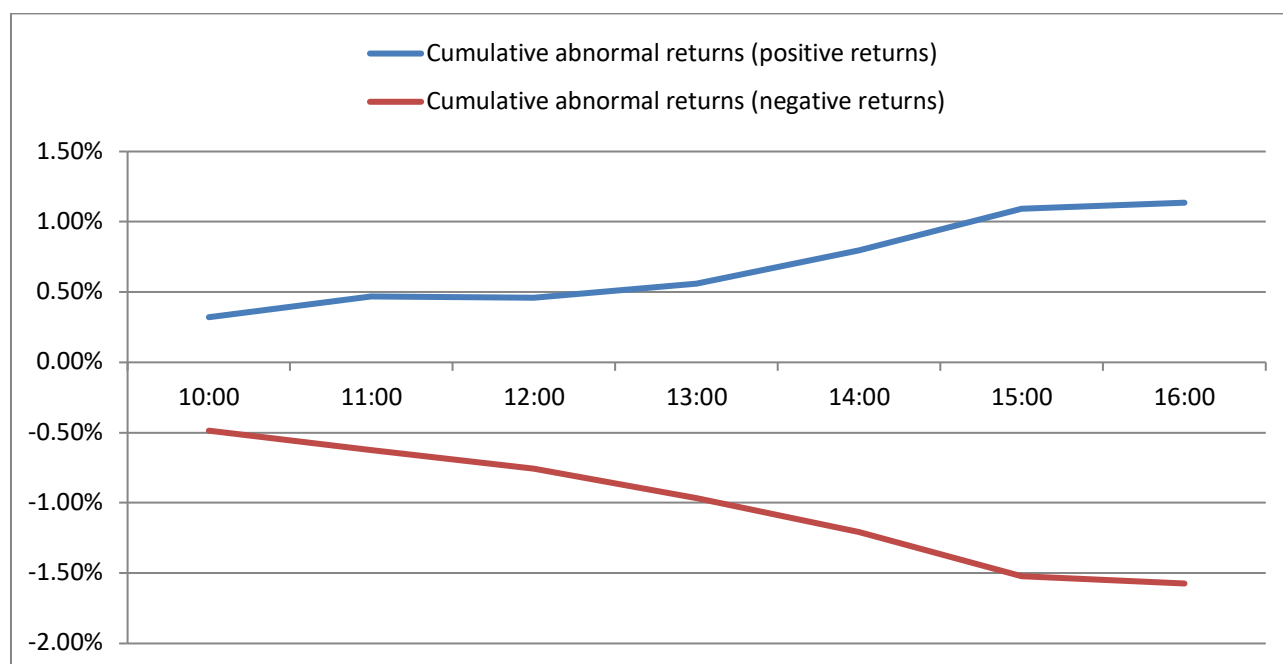
This table presents estimates from the t-tests of NIKKEI 225 hourly returns on abnormal and normal days for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on positive abnormal returns day and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table G.3: t-test of hourly returns on abnormal and normal days: the case of negative abnormal returns, NIKKEI 225

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	-0.68%	0.85%	77	-0.19%	0.44%	1214	-4.98
11:00	-0.22%	0.60%	76	-0.08%	0.33%	1212	-2.02
12:00	-0.17%	0.50%	76	-0.04%	0.22%	1203	-2.26
13:00	-0.27%	0.78%	76	-0.06%	0.30%	1208	-2.33
14:00	-0.31%	0.50%	76	-0.07%	0.30%	1215	-4.16
15:00	-0.40%	0.80%	76	-0.08%	0.36%	1217	-3.41
16:00	-0.07%	0.14%	76	-0.01%	0.06%	1207	-3.35

This table presents estimates from the t-tests of NIKKEI 225 hourly returns on abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on negative abnormal returns day and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Figure G.3: Dynamics of cumulative abnormal returns: case of NIKKEI 225



This figure displays the dynamics of cumulative abnormal returns in NIKKEI 225 prices for the case of negative and positive abnormal returns on the day of abnormal returns

Table G.4: Cumulative abnormal returns: the case of positive and negative abnormal returns, NIKKEI 225

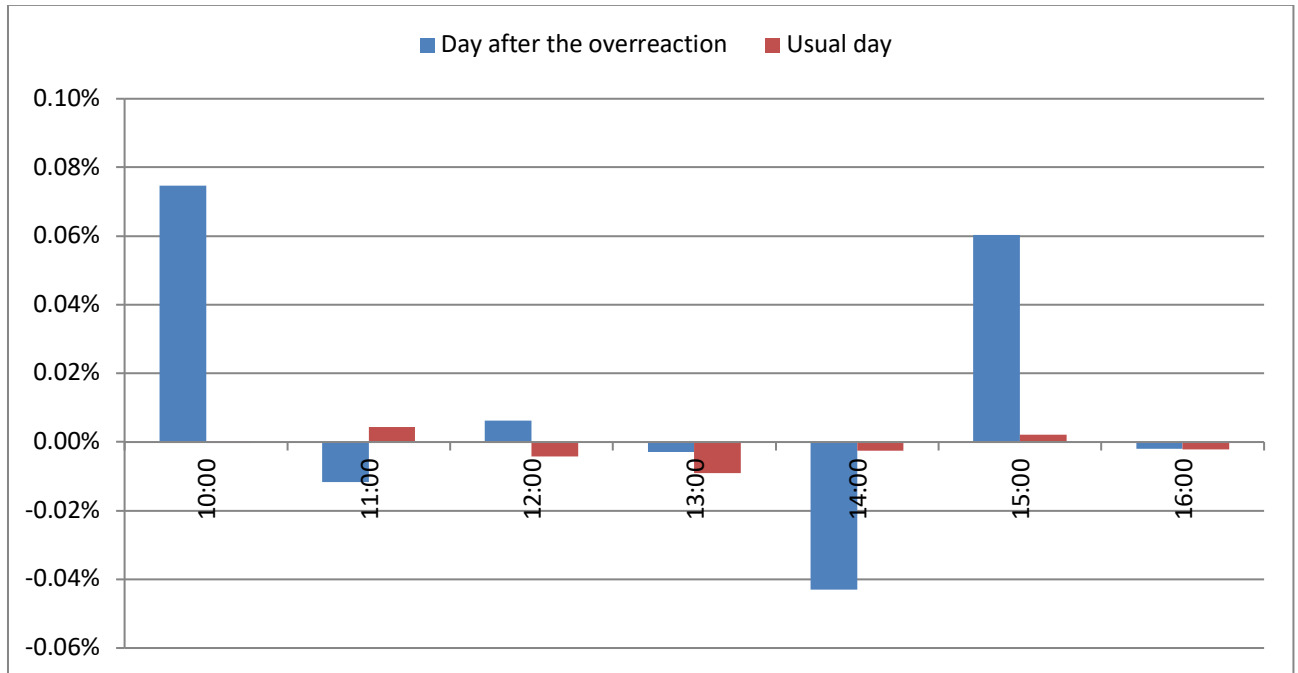
Hour	Positive abnormal returns			Negative abnormal returns		
	Abnormal returns	CAR	Abnormal returns cross	Abnormal returns	CAR	Abnormal returns cross
10:00	0.32%	0.32%	1.49%	-0.49%	-0.49%	-1.14%
11:00	0.15%	0.47%	1.25%	-0.14%	-0.63%	-0.92%
12:00	-0.01%	0.46%	1.21%	-0.13%	-0.76%	-0.76%
13:00	0.10%	0.56%	1.07%	-0.21%	-0.97%	-0.48%
14:00	0.24%	0.80%	0.76%	-0.24%	-1.21%	-0.17%
15:00	0.29%	1.09%	0.38%	-0.31%	-1.52%	0.23%
16:00	0.04%	1.14%	0.33%	-0.05%	-1.57%	0.29%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns on abnormal days in NIKKEI 225 prices. The first column reports hours of the day, the second and fifth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and sixth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns; the fourth and seventh columns show respectively abnormal returns cross for the case of positive and negative abnormal returns;

Appendix H

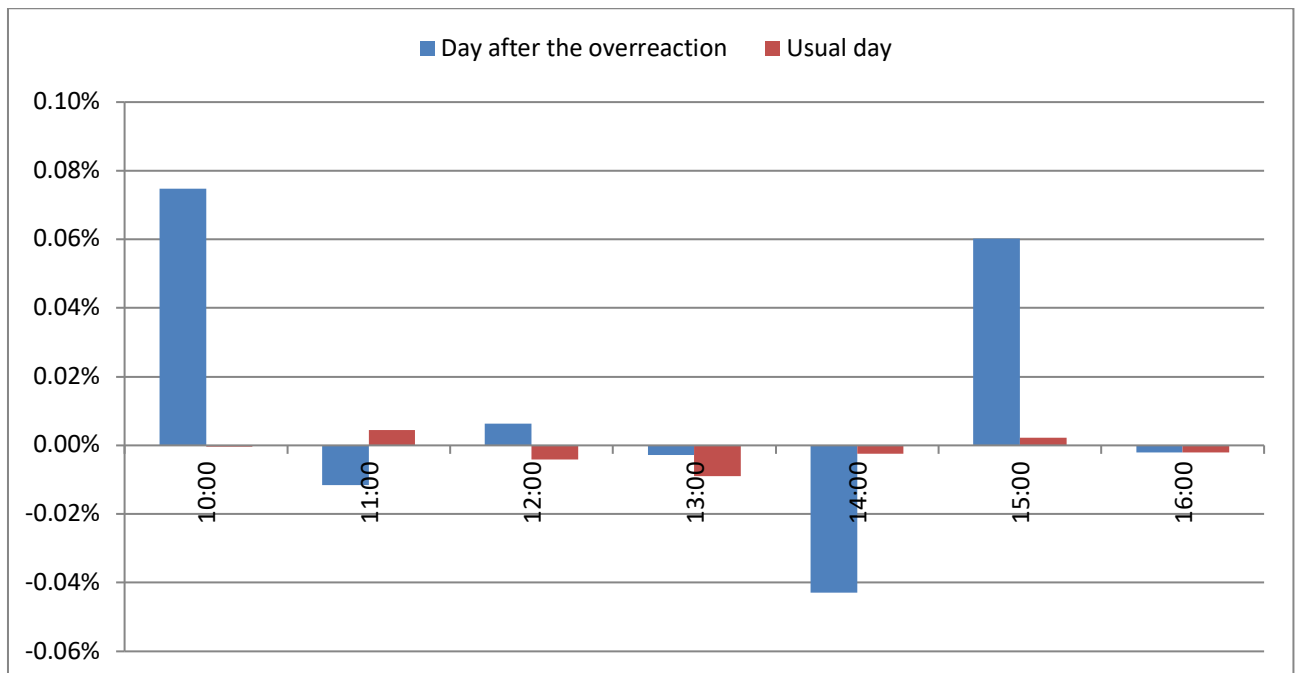
NIKKEI 225: day after the abnormal returns

Figure H.1: Average hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, NIKKEI 225



This figure presents estimates and comparison between average hourly NIKKEI 225 returns after the abnormal and normal days for the case of positive abnormal returns

Figure H.2: Average hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, NIKKEI 225



This figure presents estimates and comparison between average hourly NIKKEI 225 returns after the abnormal and normal days for the case of negative abnormal returns

Table H.1: t-test of hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, NIKKEI 225

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	0.07%	0.64%	66	0.00%	0.47%	2439	0.94
11:00	-0.01%	0.36%	66	0.00%	0.32%	2540	-0.36
12:00	0.01%	0.26%	66	0.00%	0.19%	2419	0.33
13:00	0.00%	0.29%	66	-0.01%	0.27%	2427	0.17
14:00	-0.04%	0.52%	66	0.00%	0.30%	2440	-0.63
15:00	0.06%	0.43%	68	0.00%	0.33%	2743	1.11
16:00	0.00%	0.08%	66	0.00%	0.06%	2459	0.01

This table presents estimates from the t-tests of NIKKEI 225 hourly returns on day after abnormal returns for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after positive abnormal returns and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on day after positive abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table H.2: t-test of hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, NIKKEI 225

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	0.26%	1.15%	68	0.00%	0.47%	2439	1.86
11:00	0.08%	0.63%	68	0.00%	0.32%	2540	0.95
12:00	-0.02%	0.40%	68	0.00%	0.19%	2419	-0.25
13:00	-0.17%	0.79%	68	-0.01%	0.27%	2427	-1.63
14:00	-0.01%	0.68%	70	0.00%	0.30%	2440	-0.12
15:00	0.05%	0.90%	77	0.00%	0.33%	2743	0.48
16:00	0.00%	0.10%	70	0.00%	0.06%	2459	-0.03

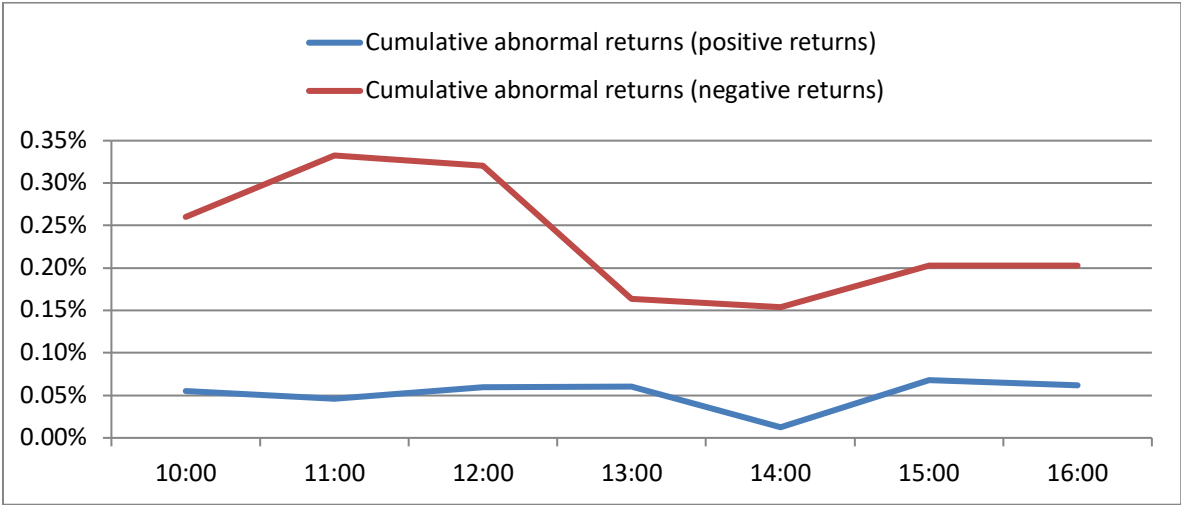
This table presents estimates from the t-tests of NIKKEI 225 hourly returns on the day after the abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after negative abnormal returns and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on day after negative abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table H.3: Cumulative abnormal returns: the case of positive and negative abnormal returns, NIKKEI 225

Hour	Positive abnormal returns		Negative abnormal returns	
	Abnormal returns	Cumulative abnormal returns	Abnormal returns	Cumulative abnormal returns
10:00	0.08%	0.08%	0.26%	0.26%
11:00	-0.02%	0.06%	0.07%	0.33%
12:00	0.01%	0.07%	-0.01%	0.32%
13:00	0.01%	0.08%	-0.16%	0.16%
14:00	-0.04%	0.04%	-0.01%	0.15%
15:00	0.06%	0.09%	0.05%	0.20%
16:00	0.00%	0.09%	0.00%	0.20%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns after abnormal days in NIKKEI 225 prices. The first column reports hours of the day, the second and fourth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and fifth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns.

Figure H.3: Dynamics of cumulative abnormal returns, NIKKEI 225

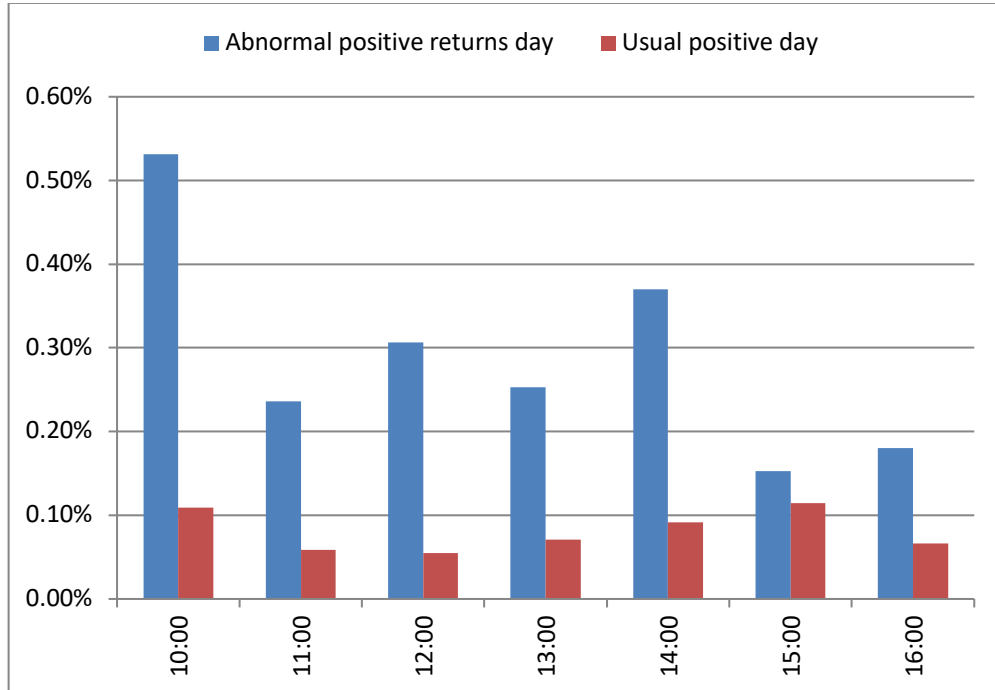


This figure displays the dynamics of cumulative abnormal returns in NIKKEI 225 prices for the case of negative and positive abnormal returns after the day of abnormal returns

Appendix I

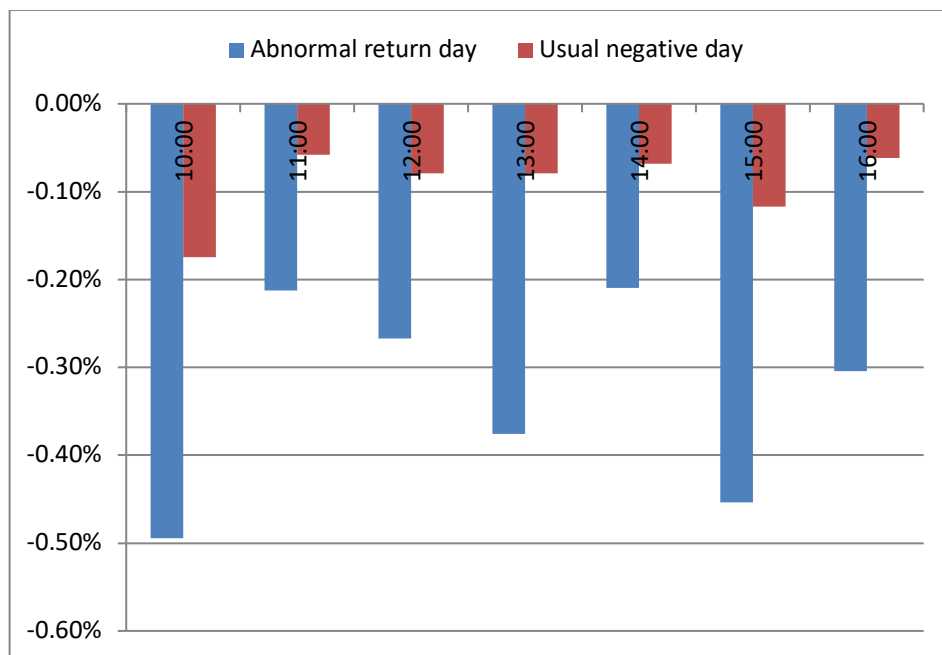
SENSEX: day of abnormal returns

Figure I.1: Average hourly returns on abnormal and normal days: the case of positive abnormal returns, SENSEX



This figure presents estimates and a comparison between average hourly SENSEX returns on abnormal and normal days for the case of positive abnormal returns

Figure I.2: Average hourly returns on abnormal and normal days: the case of negative abnormal returns, SENSEX



This figure presents estimates and a comparison between average hourly SENSEX returns on abnormal and normal days for the case of negative abnormal returns

Table I.2: t-test of hourly returns on abnormal and normal days: the case of positive abnormal returns, SENSEX

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	0.53%	0.60%	28	0.11%	0.34%	1064	3.70
11:00	0.24%	0.51%	27	0.06%	0.25%	1066	1.81
12:00	0.31%	0.58%	28	0.05%	0.26%	1069	2.29
13:00	0.25%	0.33%	28	0.07%	0.25%	1066	2.88
14:00	0.37%	0.35%	28	0.09%	0.25%	1067	4.20
15:00	0.15%	0.26%	25	0.11%	0.27%	985	0.74
16:00	0.18%	0.21%	16	0.07%	0.18%	884	2.13

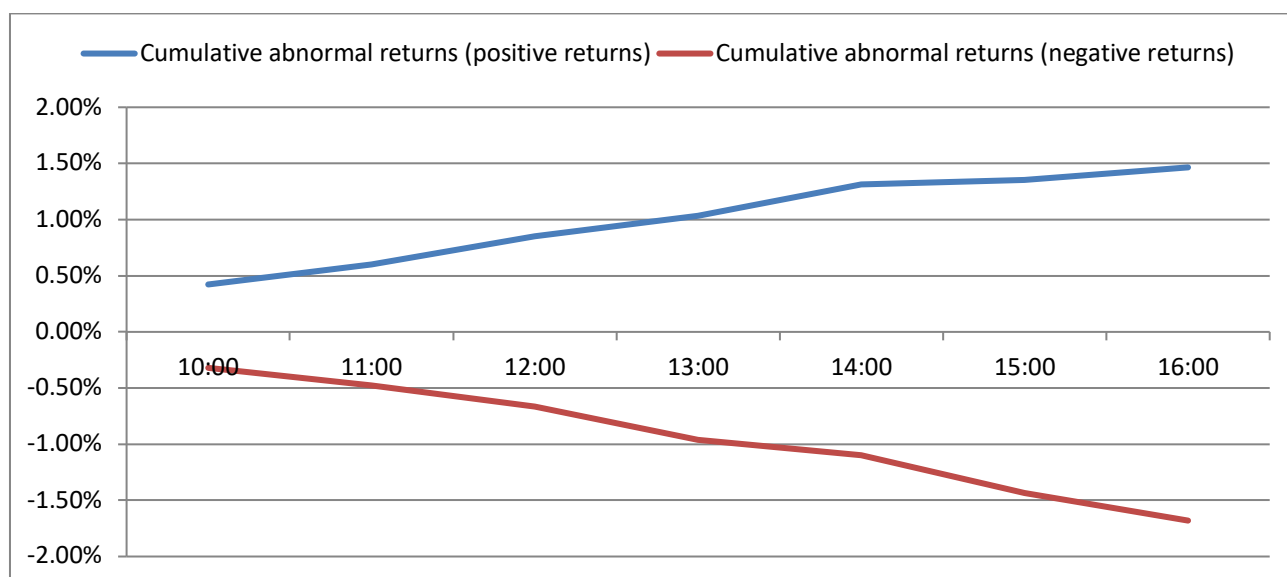
This table presents estimates from the t-tests of SENSEX hourly returns on abnormal and normal days for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on positive abnormal returns day and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table I.3: t-test of hourly returns on abnormal and normal days: the case of negative abnormal returns, SENSEX

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	-0.49%	0.57%	53	-0.17%	0.35%	1337	-4.08
11:00	-0.21%	0.34%	53	-0.06%	0.23%	1339	-3.26
12:00	-0.27%	0.39%	54	-0.08%	0.26%	1339	-3.52
13:00	-0.38%	0.88%	54	-0.08%	0.30%	1340	-2.47
14:00	-0.21%	0.66%	54	-0.07%	0.29%	1337	-1.58
15:00	-0.45%	0.57%	40	-0.12%	0.30%	1257	-3.74
16:00	-0.30%	0.34%	32	-0.06%	0.20%	1124	-3.99

This table presents estimates from the t-tests of SENSEX hourly returns on abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on negative abnormal returns day and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Figure I.3: Dynamics of cumulative abnormal returns: case of SENSEX



This figure displays the dynamics of cumulative abnormal returns in SENSEX prices for the case of negative and positive abnormal returns on the day of abnormal returns

Table I.4: Cumulative abnormal returns: the case of positive and negative abnormal returns, SENSEX

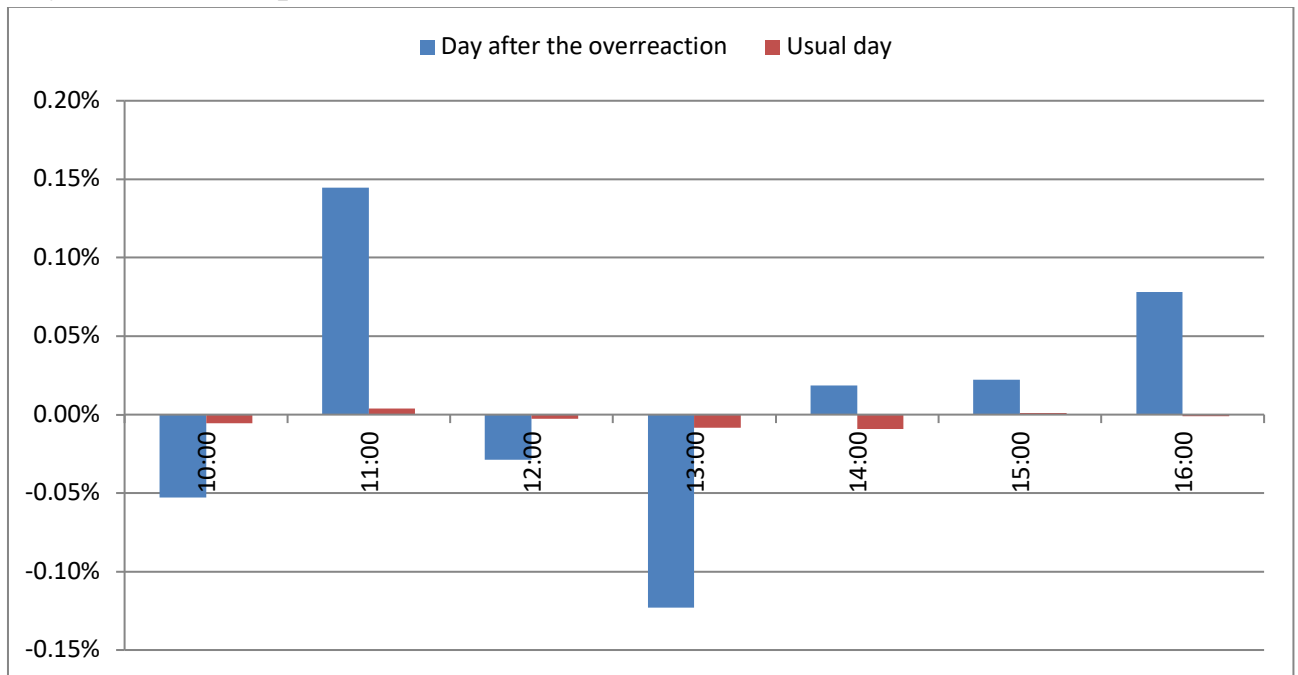
Hour	Positive abnormal returns			Negative abnormal returns		
	Abnormal returns	CAR	Abnormal returns cross	Abnormal returns	CAR	Abnormal returns cross
10:00	0.42%	0.42%	1.28%	-0.32%	-0.32%	-1.50%
11:00	0.18%	0.60%	1.05%	-0.15%	-0.47%	-1.28%
12:00	0.25%	0.85%	0.74%	-0.19%	-0.66%	-1.02%
13:00	0.18%	1.03%	0.49%	-0.30%	-0.96%	-0.64%
14:00	0.28%	1.31%	0.12%	-0.14%	-1.10%	-0.43%
15:00	0.04%	1.35%	-0.03%	-0.34%	-1.44%	0.02%
16:00	0.11%	1.46%	-0.21%	-0.24%	-1.68%	0.33%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns on abnormal days in SENSEX prices. The first column reports hours of the day, the second and fifth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and sixth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns; the fourth and seventh columns show respectively abnormal returns cross for the case of positive and negative abnormal returns;

Appendix K

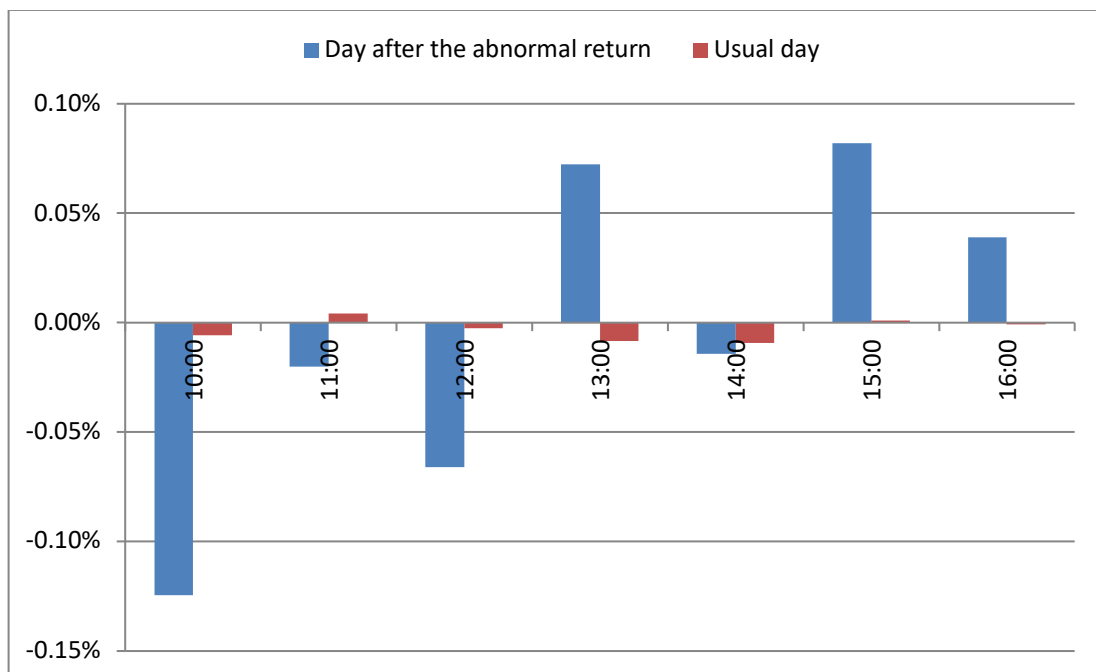
SENSEX: day after the abnormal returns

Figure K.1: Average hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, SENSEX



This figure presents estimates and comparison between average hourly SENSEX returns after the abnormal and normal days for the case of positive abnormal returns

Figure K.2: Average hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, SENSEX



This figure presents estimates and comparison between average hourly SENSEX returns after the abnormal and normal days for the case of negative abnormal returns

Table K.1: t-test of hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, SENSEX

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	-0.05%	0.37%	28	-0.01%	0.49%	1412	-0.67
11:00	0.14%	0.36%	28	0.00%	0.39%	1894	2.06
12:00	-0.03%	0.31%	28	0.00%	0.29%	1894	-0.45
13:00	-0.12%	0.45%	28	-0.01%	0.25%	1894	-1.35
14:00	0.02%	0.34%	28	-0.01%	0.29%	1894	0.43
15:00	0.02%	0.30%	26	0.00%	0.33%	1894	0.36
16:00	0.08%	0.25%	17	0.00%	0.29%	1894	1.28

This table presents estimates from the t-tests of SENSEX hourly returns on day after abnormal returns for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after positive abnormal returns and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on day after positive abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table K.2: t-test of hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, SENSEX

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	-0.12%	0.49%	55	-0.01%	0.49%	1412	-1.78
11:00	-0.02%	0.41%	55	0.00%	0.39%	1894	-0.43
12:00	-0.07%	0.37%	55	0.00%	0.29%	1894	-1.25
13:00	0.07%	0.51%	55	-0.01%	0.25%	1894	1.17
14:00	-0.01%	0.38%	55	-0.01%	0.29%	1894	-0.10
15:00	0.08%	0.38%	42	0.00%	0.33%	1894	1.35
16:00	0.04%	0.30%	33	0.00%	0.29%	1894	0.76

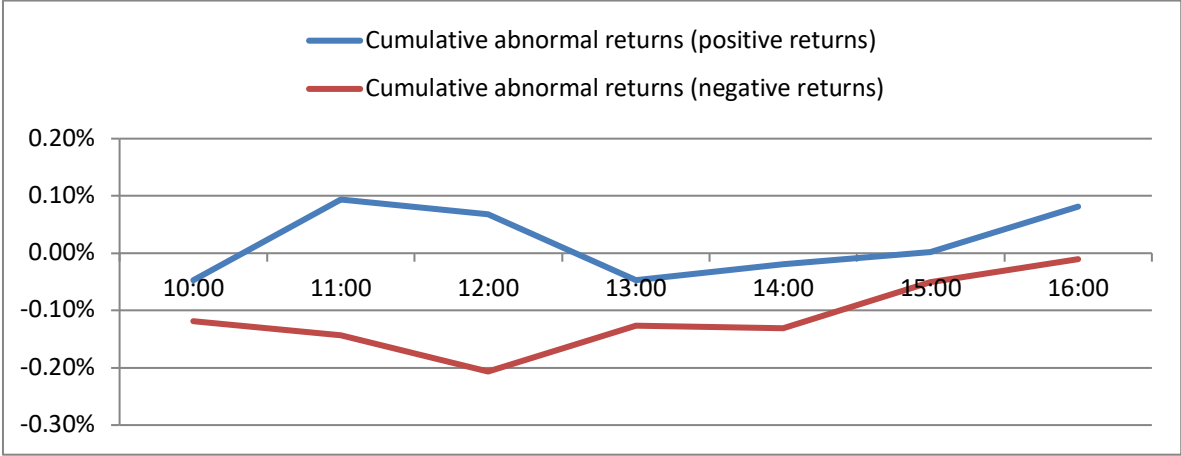
This table presents estimates from the t-tests of SENSEX hourly returns on the day after the abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after negative abnormal returns and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on day after negative abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table K.3: Cumulative abnormal returns: the case of positive and negative abnormal returns, SENSEX

Hour	Positive abnormal returns		Negative abnormal returns	
	Abnormal returns	Cumulative abnormal returns	Abnormal returns	Cumulative abnormal returns
10:00	-0.05%	-0.05%	-0.12%	-0.12%
11:00	0.14%	0.09%	-0.02%	-0.14%
12:00	-0.03%	0.07%	-0.06%	-0.21%
13:00	-0.11%	-0.05%	0.08%	-0.13%
14:00	0.03%	-0.02%	-0.01%	-0.13%
15:00	0.02%	0.00%	0.08%	-0.05%
16:00	0.08%	0.08%	0.04%	-0.01%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns after abnormal days in SENSEX prices. The first column reports hours of the day, the second and fourth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and fifth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns.

Figure K.3: Dynamics of cumulative abnormal returns, SENSEX

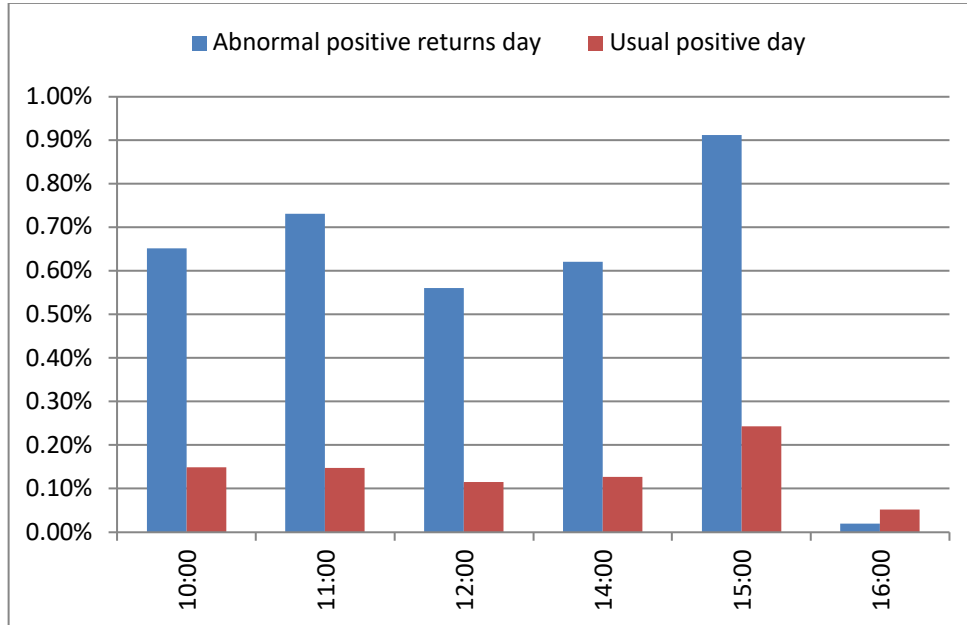


This figure displays the dynamics of cumulative abnormal returns in SENSEX prices for the case of negative and positive abnormal returns after the day of abnormal returns

Appendix L

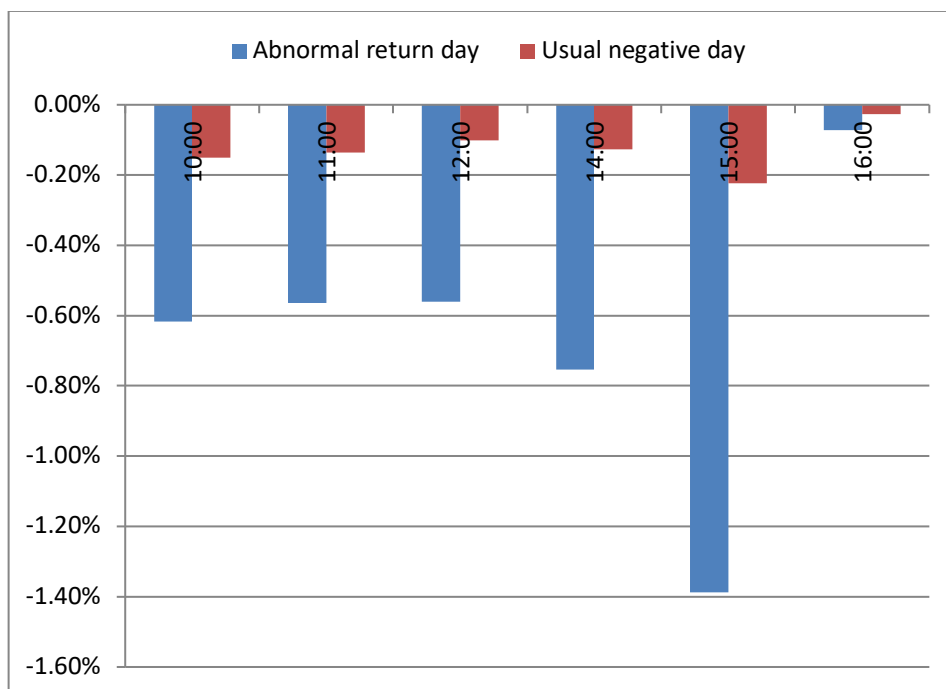
SSE COMPOSITE: day of abnormal returns

Figure L.1: Average hourly returns on abnormal and normal days: the case of positive abnormal returns, SSE COMPOSITE



This figure presents estimates and a comparison between average hourly SSE COMPOSITE returns on abnormal and normal days for the case of positive abnormal returns

Figure L.2: Average hourly returns on abnormal and normal days: the case of negative abnormal returns, SSE COMPOSITE



This figure presents estimates and a comparison between average hourly SSE COMPOSITE returns on abnormal and normal days for the case of negative abnormal returns

Table L.2: t-test of hourly returns on abnormal and normal days: the case of positive abnormal returns, SSE COMPOSITE

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	0.65%	0.87%	54	0.15%	0.43%	1316	4.21
11:00	0.73%	0.94%	55	0.15%	0.52%	1317	4.59
12:00	0.56%	0.89%	55	0.12%	0.45%	1315	3.71
14:00	0.62%	1.10%	55	0.13%	0.48%	1317	3.31
15:00	0.91%	1.06%	55	0.24%	0.52%	1321	4.63
16:00	0.02%	0.10%	53	0.05%	0.12%	1315	-2.37

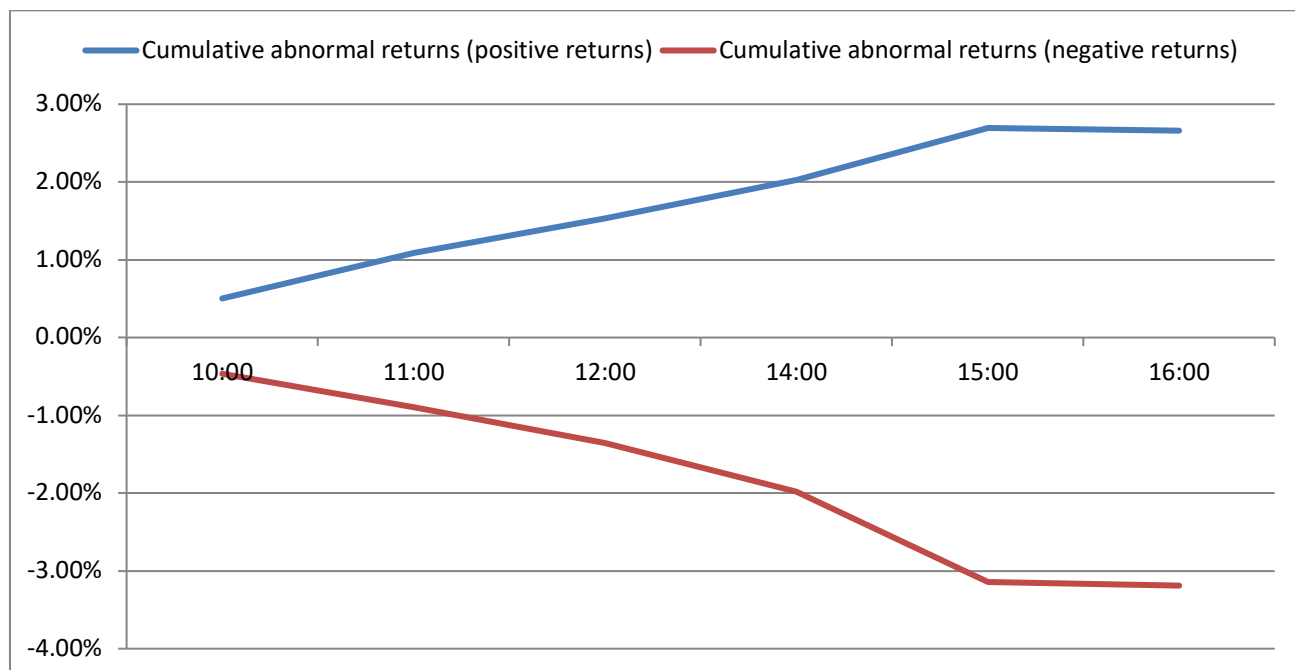
This table presents estimates from the t-tests of SSE COMPOSITE hourly returns on abnormal and normal days for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on positive abnormal returns day and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table L.3: t-test of hourly returns on abnormal and normal days: the case of negative abnormal returns, SSE COMPOSITE

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	-0.62%	1.19%	52	-0.15%	0.45%	1333	-2.82
11:00	-0.56%	0.70%	51	-0.14%	0.40%	1336	-4.34
12:00	-0.56%	0.90%	51	-0.10%	0.43%	1336	-3.64
14:00	-0.75%	0.87%	51	-0.13%	0.40%	1339	-5.10
15:00	-1.39%	1.51%	50	-0.22%	0.57%	1337	-5.44
16:00	-0.07%	0.31%	51	-0.03%	0.18%	1251	-1.03

This table presents estimates from the t-tests of SSE COMPOSITE hourly returns on abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on negative abnormal returns day and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on abnormal and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Figure L.3: Dynamics of cumulative abnormal returns: case of SSE COMPOSITE



This figure displays the dynamics of cumulative abnormal returns in SSE COMPOSITE prices for the case of negative and positive abnormal returns on the day of abnormal returns

Table L.4: Cumulative abnormal returns: the case of positive and negative abnormal returns, SSE COMPOSITE

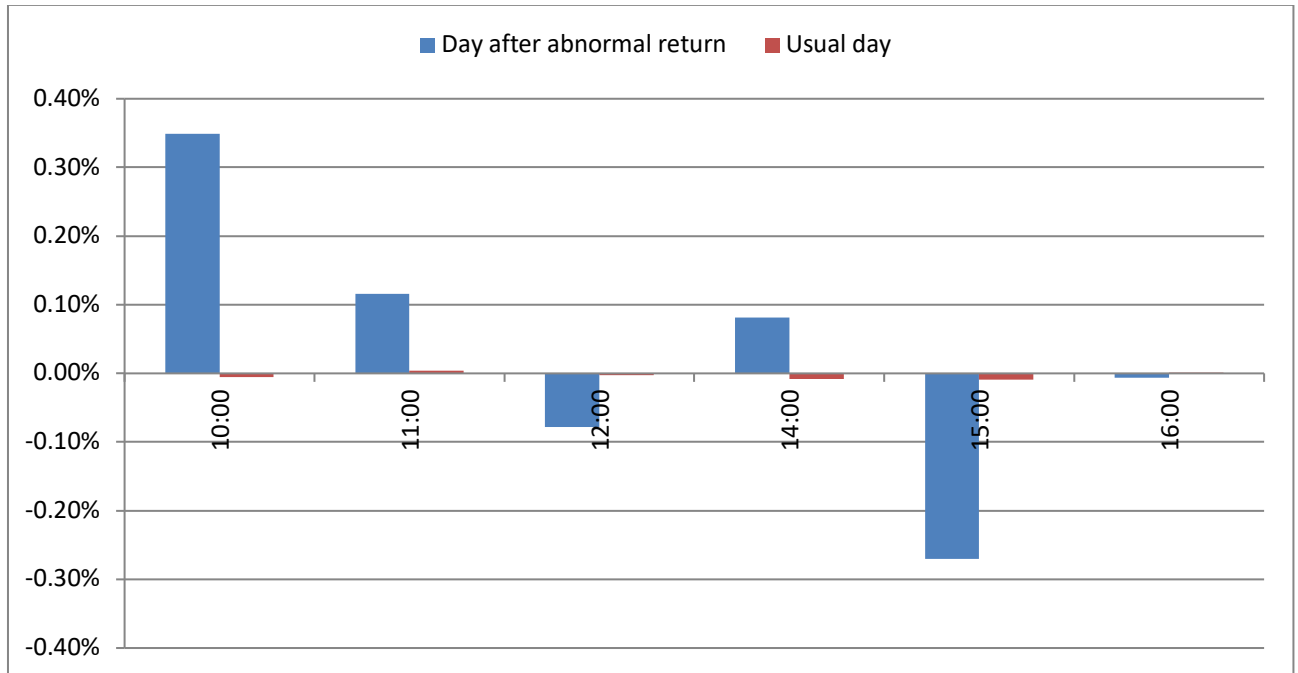
Hour	Positive abnormal returns			Negative abnormal returns		
	Abnormal returns	CAR	Abnormal returns cross	Abnormal returns	CAR	Abnormal returns cross
10:00	0.50%	0.50%	1.16%	-0.47%	-0.47%	-1.84%
11:00	0.58%	1.09%	0.43%	-0.43%	-0.89%	-1.27%
12:00	0.45%	1.53%	-0.13%	-0.46%	-1.35%	-0.71%
14:00	0.49%	2.03%	-0.75%	-0.63%	-1.98%	0.04%
15:00	0.67%	2.69%	-1.66%	-1.16%	-3.14%	1.43%
16:00	-0.03%	2.66%	-1.68%	-0.05%	-3.19%	1.50%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns on abnormal days in SSE COMPOSITE prices. The first column reports hours of the day, the second and fifth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and sixth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns; the fourth and seventh columns show respectively abnormal returns cross for the case of positive and negative abnormal returns;

Appendix M

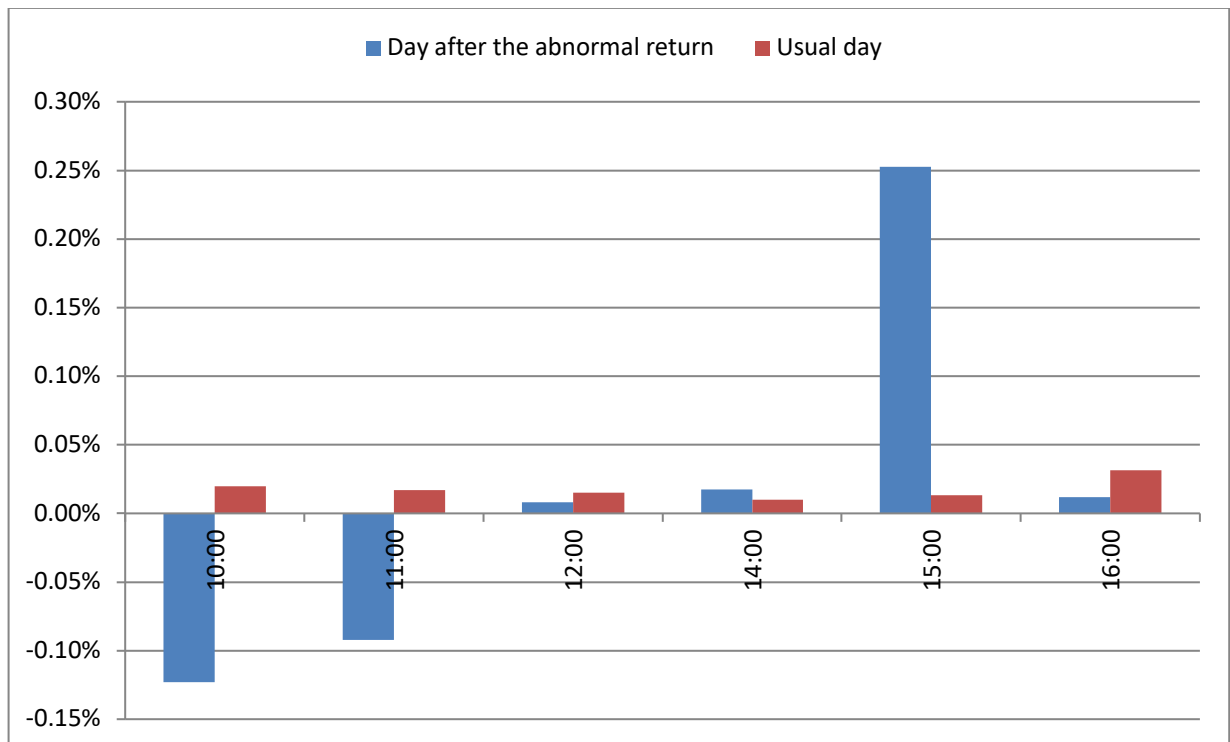
SSE COMPOSITE: day after the abnormal returns

Figure M.1: Average hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, SSE COMPOSITE



This figure presents estimates and comparison between average hourly SSE COMPOSITE returns after the abnormal and normal days for the case of positive abnormal returns

Figure M.2: Average hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, SSE COMPOSITE



This figure presents estimates and comparison between average hourly SSE COMPOSITE returns after the abnormal and normal days for the case of negative abnormal returns

Table M.1: t-test of hourly returns on the day after the abnormal and normal days: the case of positive abnormal returns, SSE COMPOSITE

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	0.35%	0.77%	56	-0.01%	0.49%	1412	3.43
11:00	0.12%	0.77%	56	0.00%	0.39%	1894	1.09
12:00	-0.08%	0.57%	56	0.00%	0.29%	1894	-0.99
14:00	0.08%	0.65%	56	-0.01%	0.25%	1894	1.03
15:00	-0.27%	1.17%	56	-0.01%	0.29%	1894	-1.67
16:00	-0.01%	0.29%	55	0.00%	0.33%	1894	-0.19

This table presents estimates from the t-tests of SSE COMPOSITE hourly returns on day after abnormal returns for the case of positive abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after positive abnormal returns and on usual day with positive returns; the third and sixth columns show respectively standard deviation estimates for returns on day after positive abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table M.2: t-test of hourly returns on the day after the abnormal and normal days: the case of negative abnormal returns, SSE COMPOSITE

Hour	Average return on day after positive abnormal returns (OD)	Standard deviation (OD)	Number of observations (OD)	Average return on usual day (UD)	Standard deviation (UD)	Number of observation (UD)	t criterion
10:00	-0.12%	1.25%	53	0.02%	0.49%	1894	-0.83
11:00	-0.09%	1.28%	53	0.02%	0.52%	1894	-0.62
12:00	0.01%	1.10%	53	0.01%	0.50%	1894	-0.04
14:00	0.02%	1.23%	53	0.01%	0.50%	1894	0.04
15:00	0.25%	1.31%	53	0.01%	0.66%	1894	1.33
16:00	0.01%	0.15%	52	0.03%	0.15%	1894	-0.91

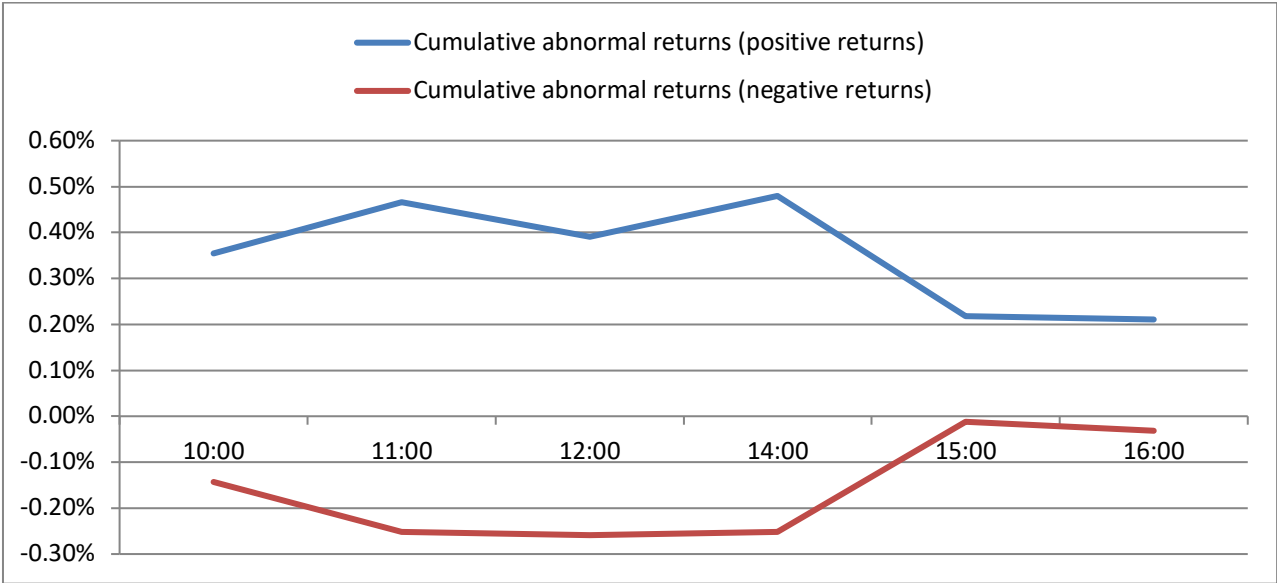
This table presents estimates from the t-tests of SSE COMPOSITE hourly returns on the day after the abnormal and normal days for the case of negative abnormal returns. The first column reports hours of the day, the second and fifth columns show respectively average returns on day after negative abnormal returns and on usual day with negative returns; the third and sixth columns show respectively standard deviation estimates for returns on day after negative abnormal returns and normal days; the fourth and seventh columns show respectively number of observation values for abnormal and normal days; the eighth column shows the t-statistics.

Table M.3: Cumulative abnormal returns: the case of positive and negative abnormal returns, SSE COMPOSITE

Hour	Positive abnormal returns		Negative abnormal returns	
	Abnormal returns	Cumulative abnormal returns	Abnormal returns	Cumulative abnormal returns
10:00	0.35%	0.35%	-0.14%	-0.14%
11:00	0.11%	0.47%	-0.11%	-0.25%
12:00	-0.08%	0.39%	-0.01%	-0.26%
13:00	0.09%	0.48%	0.01%	-0.25%
14:00	-0.26%	0.22%	0.24%	-0.01%
15:00	-0.01%	0.21%	-0.02%	-0.03%
16:00	0.35%	0.35%	-0.14%	-0.14%

This table presents estimates of cumulative abnormal returns for the case of positive and negative abnormal returns after abnormal days in SSE COMPOSITE prices. The first column reports hours of the day, the second and fourth columns show respectively abnormal returns for the case of positive and negative abnormal returns; the third and fifth columns show respectively cumulative abnormal returns for the case of positive and negative abnormal returns.

Figure M.3: Dynamics of cumulative abnormal returns, SSE COMPOSITE



This figure displays the dynamics of cumulative abnormal returns in SSE COMPOSITE prices for the case of negative and positive abnormal returns after the day of abnormal returns