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## Price Overreactions in The Forex and Trading Strategies

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# PRICE OVERREACTIONS IN THE FOREX AND TRADING STRATEGIES

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## **Abstract**

This paper explores price overreactions in the FOREX by using both daily and intraday data on the EURUSD, USDJPY, USDCAD, AUDUSD and EURJPY exchange rates over the period 01.01.2008-31.12.2018. It applies a dynamic trigger approach to detect overreactions and then various statistical methods, including cumulative abnormal returns analysis, to test the following hypotheses: the intraday behaviour of hourly returns on overreaction days is different from that on normal days (H1), there are detectable patterns in intraday price dynamics on overreaction days (H2) and on the following days (H3). The results suggest that there are statistically significant differences between intraday dynamics on overreaction and normal days respectively; also, prices tend to change in the direction of the overreaction during the overreaction day, but move in the opposite direction on the following day. Finally, there exist trading strategies that generate abnormal profits by exploiting the detected anomalies, which can be seen as evidence of market inefficiency.

**Keywords:** *FOREX, anomalies, overreactions, abnormal returns, patterns*

**JEL classification:** G12, G17, C63

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## **1. Introduction**

Abnormal price changes in financial markets are of interest to both academics and practitioners. The former aim to gain a deeper understanding of such anomalies by analysing their drivers (Mynhardt and Plastun, 2013;), the existence of market overreactions (De Bondt and Thaler, 1985;), possible patterns in price behaviour resulting from them (Bremer and Sweeney, 1991; Ferri and C. Min, 1996; Caporale et al., 2018) and their effects on market participants (Savor, 2012; Feldman et al., 2012). The latter seek to exploit them by developing profitable trading strategies (Lehmann, 1990; Jegadeesh and Titman, 1993; Pritamani and Singhal, 2001, Caporale et al., 2018).

The aim of the present paper is to examine whether overreactions exist and are exploitable by means of suitable trading strategies in the case of the Foreign Exchange market (FOREX), focusing in particular on the EURUSD, USDJPY, USDCAD, AUDUSD and EURJPY exchange rates over the period 01.01.2008-31.12.2018 and using both daily and intraday data. Overreactions are defined by using a dynamic trigger approach (Wong, 1997) and are classified as positive and negative. Then various hypotheses of interest are tested to establish whether or not the intraday behaviour of hourly returns on overreaction days differs from that on normal days, and whether or not there are detectable patterns in intraday price dynamics on overreaction days and on the following days. For this purpose a variety of statistical methods are used, including cumulative abnormal returns. Finally, a trading simulation approach is used to establish whether or not any detected anomalies can be exploited to generate profits by designing appropriate trading strategies. This type of analysis recognises that trading is an integral part of the process through which exchange rates are determined and evolve, and provides crucial information for understanding asset price dynamics and the degree of market efficiency.

The remainder of the paper is organised as follows. Section 2 contains a brief review of the literature on price overreactions in financial markets. Section 3 describes the methodology. Section 4 discusses the empirical results. Section 5 provides some concluding remarks.

## **2. Literature Review**

Abnormal price changes in financial markets were first examined by De Bondt and Thaler (1985), who showed that the best (worst) performing portfolios in the NYSE over a three-year period tended to under(over)-perform in the following three years. Subsequently, numerous papers have analysed overreactions in different markets (stock market, FOREX, commodities etc.) and different countries (both developed

and emerging), at different frequencies (daily, weekly, monthly etc.) and for different assets (exchange rates, stocks, oil, gold and many others). This led to developing the so-called overreaction hypothesis according to which if investors overreact in a given period, they will move in the opposite direction in the following period. A lot of empirical evidence supports this view – see, for instance, Brown et al. (1988), Atkins and Dyl (1990), and Ferri and Min (1996) for the US stock market, and Fung (1999) for the Hong Kong stock market. Gunaratne and Yonesawa (1997) analysed return reversals after overreactions in the Tokyo stock exchange; Lobe and Rieks (2011) found evidence of overreaction in the Frankfurt stock exchange; Maher and Parikh (2011) detected abnormal volatility patterns in the Indian stock market; Lerskullawat and Ungphakorn (2018) reported evidence of stock price overreaction in the Thai stock market; Cutler et al. (1991) found overreactions in the Gold market; and Larson and Madura (2003) in the case of the FOREX.

Possible reasons for overreactions include emotions and the herd effects (Griffin and Tversky, 1992; Madura and Richie, 2004), the existence of "noise" traders (Aiyagari and Gertler, 1999; Hong and Stein, 1999), overconfidence and other behavioural patterns (Barberis, Shleifer and Vishny, 1998; Daniel et al., 1998), the use of technical and fundamental analysis by investors in making decisions (Duran and Caginalp, 2007), the degree of liquidity in the market (Jegadeesh and Titman, 1993) and others.

Lehmann (1990), Jegadeesh and Titman (1993), Pritamani and Singhal (2001), and Caporale et al. (2018) showed that it is possible to generate abnormal returns adopting trading strategies based on overreactions. Further, overreactions can be used as a crisis identifier and a price predictor (Sandoval and Franca, 2012; Plastun et al., 2018).

However, none of the existing studies investigates intraday market behaviour during overreaction days and the following ones, and the related issue of whether detected anomalies can be exploited to generate profits in the specific case of the FOREX. This is the aim of the present contribution.

### **3. Methodology**

Our sample includes daily and hourly data from the FOREX for the following exchange rates: EURUSD, USDJPY, USDCAD, AUDUSD and EURJPY; the sample period is 01.01.2008-31.12.2018, and the data source is MetaQuotes Software Corp.

To detect overreactions we use a dynamic trigger approach (Wong, 1997; Caporale et al., 2018) and define overreactions on the basis of the number of standard deviations to be added to the average return.

In order to avoid distortions caused by price gaps, 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 in %;

$\text{Open}_i$  – open price on the  $i$ -th day;

$\text{Close}_i$  – close price on the  $i$ -th day.

Having calculated returns as in (1), a positive overreaction is defined by the following inequality:

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

and a negative overreaction is defined as:

$$R_i < (\bar{R}_n - k \times \delta_n) \quad (3)$$

where  $k$  is the number of standard deviations used to identify the overreaction (specifically,  $k=2$ );  $\bar{R}_n$  is the average size of daily returns for period  $n$ .

$$\bar{R}_n = \sum_{i=1}^n R_i / n \quad (4)$$

and  $\delta_n$  is the standard deviation of daily returns for period  $n$

$$\delta_n = \sqrt{\frac{1}{n} \sum_{i=1}^n (R_i - \bar{R})^2} \quad (5)$$

Then the following hypotheses are tested:

*Hypothesis 1 (H1): The intraday behaviour of hourly returns is different on overreaction days from that on normal days.*

*Hypothesis 2 (H2): There are detectable patterns in intraday price dynamics on overreaction days.*

*Hypothesis 3 (H3): There are detectable patterns in intraday price dynamics on the days following an overreaction.*

To test these hypotheses we use the following methods:

- Visual inspection and average analysis;

- Student's t-tests;
- A cumulative abnormal returns approach;
- A trading simulation approach.

The cumulative abnormal returns approach is based on MacKinlay (1997) and is standard for event studies. Abnormal returns are defined as follows:

$$AR_t = R_t - E(R_t) \quad (6)$$

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:

$$E(R_t) = \left(\frac{1}{T}\right) \sum_{i=1}^T R_i \quad (7)$$

where  $T$  is the sample size.

The cumulative abnormal return denoted as  $CAR_i$  is simply the sum of the abnormal returns:

$$CAR_i = \sum_{i=1}^{24} AR_i \quad (8)$$

Parametric t-tests are also carried out for Hypothesis 1. The Null Hypothesis ( $H_0$ ) is that the data (hourly returns on the overreaction day and in the full sample) belong to the same population, a rejection of the null suggesting the presence of a statistical anomaly in the price behaviour on the overreaction day. The test is carried out at the 95% confidence level, and the degrees of freedom are  $N - 1$  ( $N$  being equal to  $N_1 + N_2$ ).

#### 4. Empirical Results

We start with the EURUSD series. The results are presented in Appendix A. Figures A.1 and A.2 show that returns on overreaction days differ from those on normal days; the t-test statistics confirm that these differences are statistically significant. This holds in the case of positive overreactions for almost all the European and US trading sessions and half of the Asian session (the t-statistic is higher than the relevant critical value (Table A.2). As for negative overreactions, the US session appears to be the most volatile (Table A.3).

The cumulative abnormal returns analysis (Table A.4 and Figure A.2) indicates a stable pattern during the entire day of the overreaction, since returns increase till 11.00pm. We also identify the average timing of the overreactions (when the current

daily return can be seen as an overreaction according to our definition): it is 7.00pm in the case of positive overreactions and 5.00pm in the case of negative ones.

Concerning price behaviour on the day after the overreaction, average hourly returns after a positive overreaction are much lower than on normal days during the first hours of the following day (Figure B.1), and these differences are statistically significant (Table B.1); the negative overreaction results also provide evidence of contrarian movement (Figure B.2 and Table B.2).

The cumulative abnormal returns analysis suggests contrarian movements at specific times, namely from the start of the day till the beginning of the European session (Table B.3). This is true for the both positive and negative overreactions (see Figure B.3).

The same type of analysis is carried out for USDJPY (Appendices C and D), USDCAD (Appendices E and F), AUDUSD (Appendices G and H) and EURJPY (Appendices I and J). These results are summarised in Table 1 (for positive overreactions) and Table 2 (for negative overreactions).

**Table 1: Overall results for the case of positive overreactions**

| Parameter/Exchange rate                                                       | EURUSD                                                                                             | USDJPY                                                               | USDCAD                                                                                             | AUDUSD                                                                   | EURJPY                                                                                             |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <b>Day of the overreaction</b>                                                |                                                                                                    |                                                                      |                                                                                                    |                                                                          |                                                                                                    |
| Are there significant differences in returns (overreaction day vs usual day)? | Yes                                                                                                | Yes                                                                  | Yes                                                                                                | Yes                                                                      | Yes                                                                                                |
| Are these differences statistically significant?                              | Yes. Observed during almost all the European and US trading sessions and half of the Asian session | Yes. Observed during almost the whole day.                           | Yes. Observed during almost all the European and US trading sessions and half of the Asian session | Yes. Observed during almost the whole day.                               | Yes. Observed during almost all the European and US trading sessions and half of the Asian session |
| Any patterns in cumulative abnormal returns dynamics?                         | Yes. CAR increase till the end of the day                                                          | Yes. CAR increase till the end of the day                            | Yes. CAR increase till the end of the day                                                          | Yes. CAR increase till the end of the day                                | Yes. CAR increase till the end of the day                                                          |
| Timing of overreaction                                                        | 19:00                                                                                              | 16:00                                                                | 17:00                                                                                              | 17:00                                                                    | 16:00                                                                                              |
| <b>Day after the overreaction</b>                                             |                                                                                                    |                                                                      |                                                                                                    |                                                                          |                                                                                                    |
| Are there contrarian price movement on the day after the overreaction?        | Yes                                                                                                | Yes                                                                  | No                                                                                                 | Yes                                                                      | Yes                                                                                                |
| Are these differences statistically significant?                              | Yes. At 00:00 and 2:00.                                                                            | Yes. At 01:00 and 4:00.                                              | No                                                                                                 | Yes. At 0:00, 1:00 and 3:00.                                             | Yes. At 1:00, 2:00.                                                                                |
| Timing parameters of contrarian movements                                     | Since the start of the day till the start of the European session (9:00)                           | Since the start of the day till the start of European session (7:00) | Not detected                                                                                       | Since the start of the day till the start of the European session (9:00) | CAR reaches maximum at the start of the European session (7:00), but stay there for the whole day  |

**Table 2: Overall results for the case of negative overreactions**

| Parameter/ Exchange rate                                                      | EURUSD                                                                                               | USDJPY                                     | USDCAD                                                               | AUDUSD                                                               | EURJPY                                                                                               |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <b>Day of the overreaction</b>                                                |                                                                                                      |                                            |                                                                      |                                                                      |                                                                                                      |
| Are there significant differences in returns (overreaction day vs usual day)? | Yes                                                                                                  | Yes                                        | Yes                                                                  | Yes                                                                  | Yes                                                                                                  |
| Do these differences statistically significant?                               | Yes. Observed during almost all the European and US trading sessions and a half of the Asian session | Yes. Observed during almost the whole day. | Yes. Observed during almost all the European and US trading sessions | Yes. Observed during almost all the Asian trading session            | Yes. Observed during almost all the European and US trading sessions and a half of the Asian session |
| Any patterns in cumulative abnormal returns dynamics?                         | Yes. CAR increase till the end of the day                                                            | Yes. CAR increase till the end of the day  | Yes. CAR increase till the end of the day                            | Yes. CAR increase till the end of the day                            | Yes. CAR increase till the end of the day                                                            |
| Timing of overreaction                                                        | 17:00                                                                                                | 17:00                                      | 19:00                                                                | 16:00                                                                | 16:00                                                                                                |
| <b>Day after the overreaction</b>                                             |                                                                                                      |                                            |                                                                      |                                                                      |                                                                                                      |
| Are the contrarian price movement on the day after the overreaction?          | Yes                                                                                                  | Yes                                        | Yes                                                                  | Yes                                                                  | Yes                                                                                                  |
| Do these differences statistically significant?                               | Yes. At 00:00.                                                                                       | Yes. At 00:00, 1:00, 3:00 and 14:00.       | Yes. At 00:00 and 6:00                                               | No                                                                   | No                                                                                                   |
| Timing parameters of contrarian movements                                     | Since the start of the day till the start of the European session (8:00)                             | CAR increase till the end of the day       | Since the start of the day till the start of European session (9:00) | Since the start of the day till the start of European session (8:00) | CAR increase till the end of the day                                                                 |

As can be seen, the results for the other exchange rates are generally very similar to those for EURUSD.

To establish whether the detected anomalies can be exploited to generate abnormal profits a trading simulation approach is used which replicates the actions of a representative trader according to a given algorithm determining when a buy/sell position should be opened and then closed. It should be mentioned that the approach used here does not incorporate transaction costs (spread, fees to the broker or bank, swaps etc.) and is only a proxy for actual trading.

The percentage result of the individual deal is computed as follows:

$$\% \text{ result} = \frac{100\% \times P_{close}}{P_{open}} \quad (9)$$

where  $P_{open}$  – opening price for the trade

$P_{close}$  – closing price for the trade



The sum of the results from each trade is the total financial result of trading. A strategy producing positive total profits implies that there exists an exploitable market anomaly.

Another important indicator of the degree of success of the trading strategy is the percentage of successful trades:

$$\% \text{ successful trades} = \frac{100\% \times \text{number of successful trades}}{\text{overall number of trades}} \quad (10)$$

On the basis of the results presented in Tables 1 and 2 the following strategies are developed:

Strategy 1: when it becomes clear that the current day is an overreaction day (see the timing of overreaction parameter in Tables 1 and 2) a position in the direction of overreaction should be opened. This position should then be closed at the end of the day.

Strategy 2: at the beginning of the day after the overreaction a position in the opposite direction to the overreaction should be opened. This position should then be closed according to the timing displayed in the Tables 1 and 2 (see the timing parameters for the contrarian movements).

To establish whether or not the results obtained are statistically different from the random trading ones t-tests are carried out. They compare the means from two samples to see whether or not they come from the same population. The first sample consists of the trading results from the trading strategy, and the second one of random trading results. The null hypothesis ( $H_0$ ) is that the mean is the same in both samples, and the alternative ( $H_1$ ) that it is not. The computed values of the t-test are compared with the critical ones at the 5% significance level. Failure to reject  $H_0$  implies that there are no advantages from exploiting the trading strategy being considered since the trading results do not differ from the random ones, whilst a rejection suggests that the adopted strategy can generate abnormal profits since the trading results are not random and therefore it is possible to “beat the market”. As an example, the t-test results for EURJPY in the case of Strategy 1 are shown in Table 3.

**Table 3: t-test for evaluating the success of the trading strategy: EURJPY, positive overreactions, Strategy 1**

| Parameter                | Value    |
|--------------------------|----------|
| Number of the trades     | 59       |
| Total profit             | 45.50%   |
| Average profit per trade | 0.77%    |
| Standard deviation       | 1.02%    |
| t-test                   | 5.81     |
| t critical value (0.95%) | 1.78     |
| Null hypothesis          | rejected |

The trading simulation results for the two strategies are presented in Tables 4 (for positive overreactions) and 5 (for negative overreactions).

**Table 4: Trading simulation results for the case of positive overreactions**

| Instrument | Number of trades. units | Number of successful trades. units | Number of successful trades. % | Profit. % | Profit % per year | t-test calculated value | t-test status |
|------------|-------------------------|------------------------------------|--------------------------------|-----------|-------------------|-------------------------|---------------|
| Strategy 1 |                         |                                    |                                |           |                   |                         |               |
| EURUSD     | 67                      | 47                                 | 70%                            | 31.59%    | 3.16%             | 5.87                    | passed        |
| USDJPY     | 58                      | 54                                 | 93%                            | 35.07%    | 3.51%             | 7.62                    | passed        |
| USDCAD     | 76                      | 49                                 | 64%                            | 42.71%    | 4.27%             | 9.17                    | passed        |
| AUDUSD     | 55                      | 48                                 | 87%                            | 47.83%    | 4.78%             | 5.63                    | passed        |
| EURJPY     | 59                      | 53                                 | 90%                            | 45.50%    | 4.55%             | 5.81                    | passed        |
| Strategy 2 |                         |                                    |                                |           |                   |                         |               |
| EURUSD     | 67                      | 44                                 | 66%                            | 7.74%     | 0.77%             | 2.45                    | passed        |
| USDJPY     | 58                      | 38                                 | 66%                            | 13.70%    | 1.37%             | 2.60                    | passed        |
| USDCAD     | -                       | -                                  | -                              | -         | -                 | -                       | -             |
| AUDUSD     | 55                      | 37                                 | 67%                            | 22.95%    | 2.29%             | 3.03                    | passed        |
| EURJPY     | 59                      | 37                                 | 63%                            | 21.14%    | 2.11%             | 2.39                    | passed        |

**Table 5: Trading simulation results for the case of negative overreactions**

| Instrument | Number of trades. units | Number of successful trades. units | Number of successful trades. % | Profit. % | Profit % per year | t-test calculated value | t-test status |
|------------|-------------------------|------------------------------------|--------------------------------|-----------|-------------------|-------------------------|---------------|
| Strategy 1 |                         |                                    |                                |           |                   |                         |               |
| EURUSD     | 79                      | 68                                 | 86%                            | 30.83%    | 3.08%             | 8.98                    | passed        |
| USDJPY     | 63                      | 56                                 | 89%                            | 42.91%    | 4.29%             | 7.53                    | passed        |
| USDCAD     | 61                      | 51                                 | 84%                            | 26.84%    | 2.68%             | 5.17                    | passed        |
| AUDUSD     | 66                      | 60                                 | 91%                            | 73.83%    | 7.38%             | 8.54                    | passed        |
| EURJPY     | 77                      | 64                                 | 83%                            | 54.76%    | 5.48%             | 7.38                    | passed        |
| Strategy 2 |                         |                                    |                                |           |                   |                         |               |
| EURUSD     | 79                      | 40                                 | 50.6%                          | 5.1%      | 0.5%              | 1.23                    | failed        |
| USDJPY     | 62                      | 38                                 | 61.3%                          | 20.2%     | 2.0%              | 2.49                    | passed        |
| USDCAD     | 61                      | 37                                 | 60.7%                          | 5.6%      | 0.6%              | 1.25                    | failed        |
| AUDUSD     | 66                      | 36                                 | 54.5%                          | 16.9%     | 1.7%              | 2.12                    | passed        |
| EURJPY     | 62                      | 36                                 | 58.1%                          | 18.0%     | 1.8%              | 1.37                    | failed        |

As can be seen, the detected anomalies in most of cases can be exploited to generate abnormal profits from trading and “beat the market”.

## **5. Conclusions**

This paper examines price overreactions in the FOREX using daily and intraday data on the EURUSD, USDJPY, USDCAD, AUDUSD and EURJPY exchange rates over the period 01.01.2008-31.12.2018. Positive and negative overreactions are detected by means of a dynamic trigger approach. Intraday price behaviour during overreaction days and the following one is analysed applying various statistical methods such as cumulative abnormal returns analysis; market efficiency is then investigated applying a trading simulation approach. The intraday dimension of our analysis as well as the microstructure aspect of our trading analysis are both original contributions to this area of the literature.

To sum up, there are (in most cases statistically significant) differences between intraday dynamics on normal and overreactions days respectively. In particular, there is a strong momentum effect on overreaction days, i.e. prices tend to change only in the direction of the overreaction during the whole day; in addition, usually the presence of an overreaction becomes clear at the start of the US trading session. The overreaction hypothesis is supported by the evidence produced by our analysis: during the Asian trading session a strong contrarian pattern is present (i.e., on the day after the overreaction prices tend to go in the opposite direction). Contrarian movement is limited in time, since usually it lasts only till the start of the European session. Finally, there exist profitable trading strategies based on these anomalies, which represents evidence against market efficiency.

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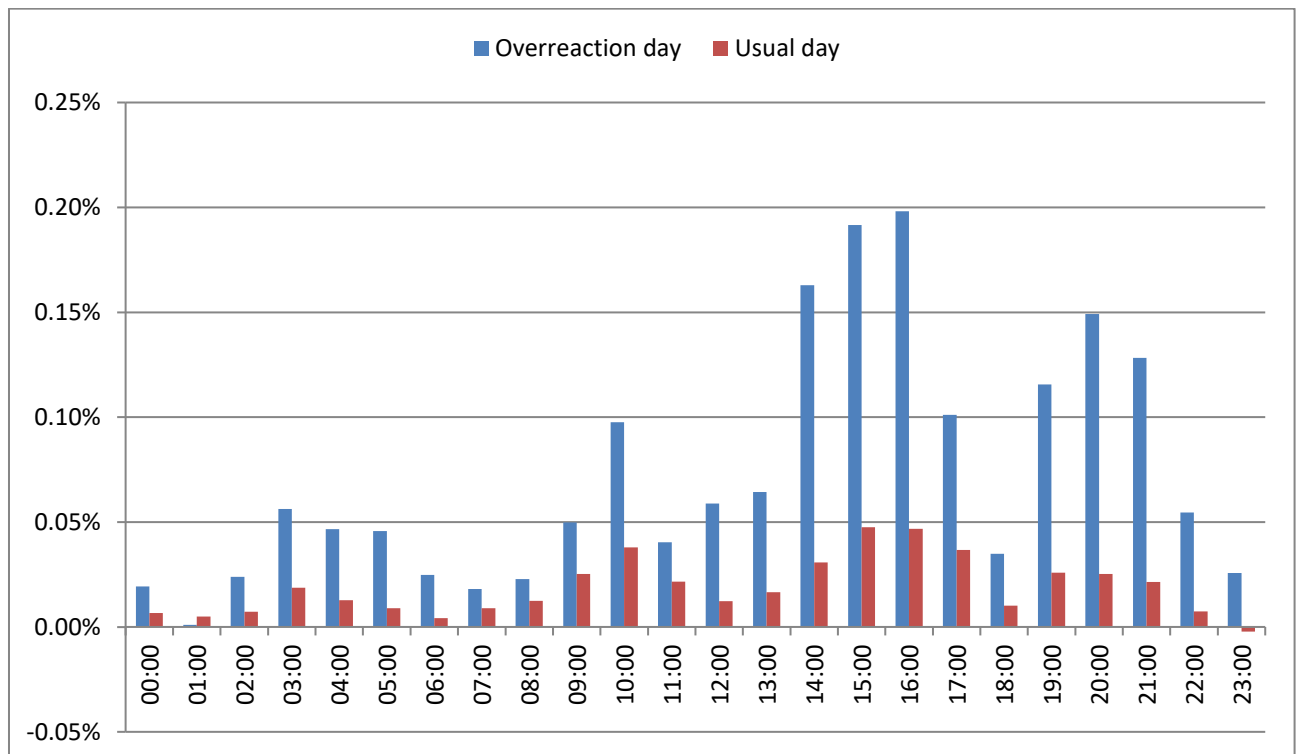
## Appendix A

### EURUSD: day of overreaction

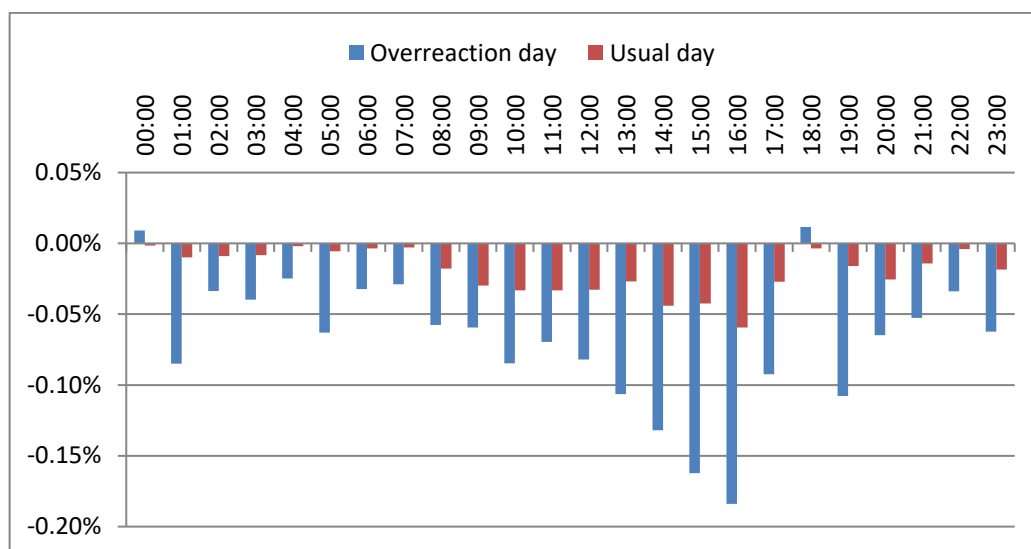
**Table A.1: Descriptive statistics for EURUSD data: daily, hourly, days with positive and negative returns**

| Parameter      | Daily data | Positive days | Negative days | Hourly data | Positive days (hourly data) | Negative days (hourly data) |
|----------------|------------|---------------|---------------|-------------|-----------------------------|-----------------------------|
| Mean           | -0.0001    | 0.0045        | -0.0048       | 0.0000      | 0.0002                      | -0.0002                     |
| Standard error | 0.0001     | 0.0001        | 0.0001        | 0.0000      | 0.0000                      | 0.0000                      |
| Median         | 0.0001     | 0.0033        | -0.0037       | 0.0000      | 0.0001                      | -0.0001                     |
| Mode           | 0          | 0             | 0             | 0           | 0                           | 0                           |
| Std. Dev.      | 0.0063     | 0.0043        | 0.0042        | 0.0013      | 0.0013                      | 0.0013                      |
| Variance       | 0.0000     | 0.0000        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Kurtosis       | 2.2121     | 7.2611        | 3.1314        | 12.8767     | 13.4662                     | 11.9229                     |
| Skewness       | 0.1424     | 2.1538        | -1.5873       | 0.0533      | 1.3152                      | -1.2367                     |
| Minimum        | -0.0266    | 0.0000        | -0.0266       | -0.0203     | -0.0117                     | -0.0203                     |
| Maximum        | 0.0349     | 0.0349        | 0.0000        | 0.0230      | 0.0230                      | 0.0114                      |
| Sum            | -0.2050    | 6.6299        | -6.8349       | -0.1479     | 6.1634                      | -6.3113                     |
| Observations   | 2883       | 1459          | 1426          | 64992       | 32891                       | 32125                       |

**Figure A.1: Average hourly returns on overreaction and normal days: the case of positive overreactions**



**Figure A.2: Average hourly returns on overreaction and normal days: the case of negative overreactions**



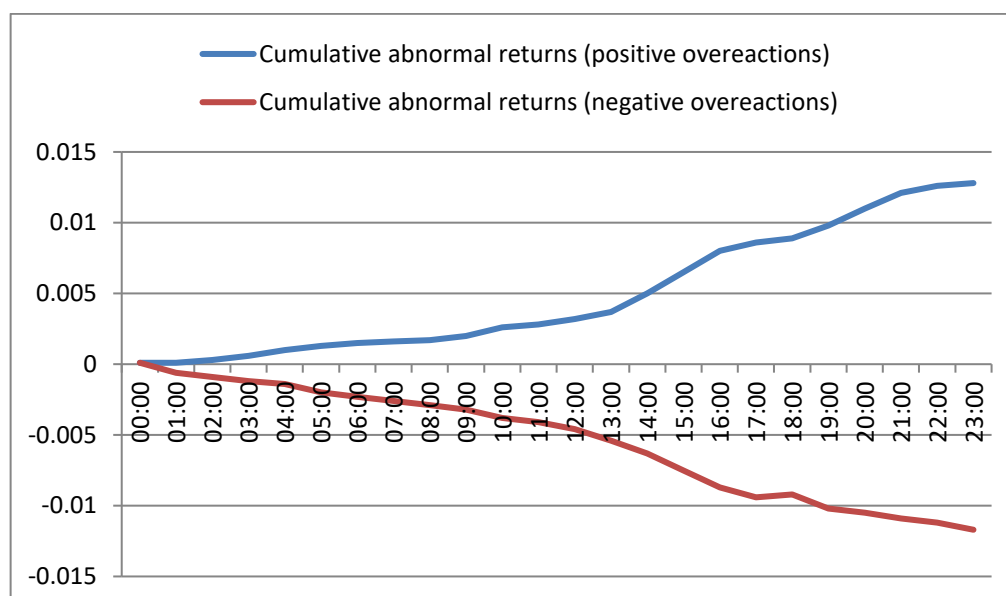
**Table A.2: t-test of hourly returns on overreaction and normal days: the case of positive overreactions**

| Hour         | Average return on positive overreaction 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 criterion |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|-------------|
| 0:00         | 0.0002                                           | 0.0012                  | 67                          | 0.0001                                                 | 0.0008                  | 1400                       | 0.84        |
| 1:00         | 0.0000                                           | 0.0014                  | 67                          | 0.0000                                                 | 0.0009                  | 1400                       | -0.23       |
| 2:00         | 0.0002                                           | 0.0013                  | 67                          | 0.0001                                                 | 0.0010                  | 1400                       | 1.02        |
| <b>3:00</b>  | <b>0.0006</b>                                    | <b>0.0014</b>           | <b>67</b>                   | <b>0.0002</b>                                          | <b>0.0009</b>           | <b>1400</b>                | <b>2.24</b> |
| <b>4:00</b>  | <b>0.0005</b>                                    | <b>0.0015</b>           | <b>67</b>                   | <b>0.0001</b>                                          | <b>0.0009</b>           | <b>1400</b>                | <b>1.82</b> |
| <b>5:00</b>  | <b>0.0005</b>                                    | <b>0.0015</b>           | <b>67</b>                   | <b>0.0001</b>                                          | <b>0.0008</b>           | <b>1400</b>                | <b>1.97</b> |
| 6:00         | 0.0002                                           | 0.0015                  | 67                          | 0.0000                                                 | 0.0008                  | 1400                       | 1.12        |
| 7:00         | 0.0002                                           | 0.0014                  | 67                          | 0.0001                                                 | 0.0009                  | 1400                       | 0.51        |
| 8:00         | 0.0002                                           | 0.0022                  | 67                          | 0.0001                                                 | 0.0012                  | 1400                       | 0.38        |
| 9:00         | 0.0005                                           | 0.0021                  | 67                          | 0.0003                                                 | 0.0015                  | 1400                       | 0.97        |
| <b>10:00</b> | <b>0.0010</b>                                    | <b>0.0020</b>           | <b>67</b>                   | <b>0.0004</b>                                          | <b>0.0015</b>           | <b>1400</b>                | <b>2.38</b> |
| 11:00        | 0.0004                                           | 0.0018                  | 67                          | 0.0002                                                 | 0.0014                  | 1400                       | 0.82        |
| <b>12:00</b> | <b>0.0006</b>                                    | <b>0.0016</b>           | <b>67</b>                   | <b>0.0001</b>                                          | <b>0.0012</b>           | <b>1400</b>                | <b>2.35</b> |
| <b>13:00</b> | <b>0.0006</b>                                    | <b>0.0020</b>           | <b>67</b>                   | <b>0.0002</b>                                          | <b>0.0013</b>           | <b>1400</b>                | <b>1.98</b> |
| <b>14:00</b> | <b>0.0016</b>                                    | <b>0.0034</b>           | <b>67</b>                   | <b>0.0003</b>                                          | <b>0.0018</b>           | <b>1400</b>                | <b>3.18</b> |
| <b>15:00</b> | <b>0.0019</b>                                    | <b>0.0036</b>           | <b>67</b>                   | <b>0.0005</b>                                          | <b>0.0020</b>           | <b>1400</b>                | <b>3.28</b> |
| <b>16:00</b> | <b>0.0020</b>                                    | <b>0.0030</b>           | <b>67</b>                   | <b>0.0005</b>                                          | <b>0.0018</b>           | <b>1400</b>                | <b>4.09</b> |
| <b>17:00</b> | <b>0.0010</b>                                    | <b>0.0028</b>           | <b>67</b>                   | <b>0.0004</b>                                          | <b>0.0017</b>           | <b>1400</b>                | <b>1.84</b> |
| 18:00        | 0.0003                                           | 0.0024                  | 67                          | 0.0001                                                 | 0.0013                  | 1400                       | 0.82        |
| <b>19:00</b> | <b>0.0012</b>                                    | <b>0.0036</b>           | <b>67</b>                   | <b>0.0003</b>                                          | <b>0.0014</b>           | <b>1400</b>                | <b>2.03</b> |
| <b>20:00</b> | <b>0.0015</b>                                    | <b>0.0031</b>           | <b>67</b>                   | <b>0.0003</b>                                          | <b>0.0014</b>           | <b>1400</b>                | <b>3.27</b> |
| <b>21:00</b> | <b>0.0013</b>                                    | <b>0.0029</b>           | <b>67</b>                   | <b>0.0002</b>                                          | <b>0.0013</b>           | <b>1400</b>                | <b>3.01</b> |
| 22:00        | 0.0005                                           | 0.0024                  | 67                          | 0.0001                                                 | 0.0009                  | 1400                       | 1.63        |
| 23:00        | 0.0003                                           | 0.0014                  | 67                          | 0.0000                                                 | 0.0006                  | 1400                       | 1.60        |

**Table A.3: t-test of hourly returns on overreaction and normal days: the case of negative overreactions**

| Hour         | Average return on positive overreaction 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 criterion  |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|--------------|
| 0:00         | 0.0001                                           | 0.0012                  | 67                          | 0.0000                                                 | 0.0008                  | 2700                       | 0.70         |
| <b>1:00</b>  | <b>-0.0008</b>                                   | <b>0.0017</b>           | <b>67</b>                   | <b>-0.0001</b>                                         | <b>0.0010</b>           | <b>2700</b>                | <b>-3.67</b> |
| 2:00         | -0.0003                                          | 0.0017                  | 67                          | -0.0001                                                | 0.0011                  | 2700                       | -1.17        |
| <b>3:00</b>  | <b>-0.0004</b>                                   | <b>0.0014</b>           | <b>67</b>                   | <b>-0.0001</b>                                         | <b>0.0009</b>           | <b>2700</b>                | <b>-1.80</b> |
| 4:00         | -0.0002                                          | 0.0013                  | 67                          | 0.0000                                                 | 0.0008                  | 2700                       | -1.43        |
| <b>5:00</b>  | <b>-0.0006</b>                                   | <b>0.0026</b>           | <b>67</b>                   | <b>-0.0001</b>                                         | <b>0.0009</b>           | <b>2700</b>                | <b>-1.83</b> |
| 6:00         | -0.0003                                          | 0.0016                  | 67                          | 0.0000                                                 | 0.0007                  | 2700                       | -1.51        |
| 7:00         | -0.0003                                          | 0.0014                  | 67                          | 0.0000                                                 | 0.0009                  | 2700                       | -1.54        |
| 8:00         | -0.0006                                          | 0.0022                  | 67                          | -0.0002                                                | 0.0013                  | 2700                       | -1.45        |
| 9:00         | -0.0006                                          | 0.0032                  | 67                          | -0.0003                                                | 0.0016                  | 2700                       | -0.76        |
| 10:00        | -0.0008                                          | 0.0030                  | 67                          | -0.0003                                                | 0.0016                  | 2700                       | -1.38        |
| 11:00        | -0.0007                                          | 0.0019                  | 67                          | -0.0003                                                | 0.0014                  | 2700                       | -1.58        |
| <b>12:00</b> | <b>-0.0008</b>                                   | <b>0.0018</b>           | <b>67</b>                   | <b>-0.0003</b>                                         | <b>0.0012</b>           | <b>2700</b>                | <b>-2.21</b> |
| <b>13:00</b> | <b>-0.0011</b>                                   | <b>0.0024</b>           | <b>67</b>                   | <b>-0.0003</b>                                         | <b>0.0013</b>           | <b>2700</b>                | <b>-2.70</b> |
| <b>14:00</b> | <b>-0.0013</b>                                   | <b>0.0030</b>           | <b>67</b>                   | <b>-0.0004</b>                                         | <b>0.0016</b>           | <b>2700</b>                | <b>-2.41</b> |
| <b>15:00</b> | <b>-0.0016</b>                                   | <b>0.0033</b>           | <b>67</b>                   | <b>-0.0004</b>                                         | <b>0.0019</b>           | <b>2700</b>                | <b>-2.92</b> |
| <b>16:00</b> | <b>-0.0018</b>                                   | <b>0.0026</b>           | <b>67</b>                   | <b>-0.0006</b>                                         | <b>0.0018</b>           | <b>2700</b>                | <b>-3.91</b> |
| <b>17:00</b> | <b>-0.0009</b>                                   | <b>0.0028</b>           | <b>67</b>                   | <b>-0.0003</b>                                         | <b>0.0017</b>           | <b>2700</b>                | <b>-1.89</b> |
| 18:00        | 0.0001                                           | 0.0016                  | 67                          | 0.0000                                                 | 0.0013                  | 2700                       | 0.76         |
| <b>19:00</b> | <b>-0.0011</b>                                   | <b>0.0019</b>           | <b>67</b>                   | <b>-0.0002</b>                                         | <b>0.0012</b>           | <b>2700</b>                | <b>-3.86</b> |
| <b>20:00</b> | <b>-0.0006</b>                                   | <b>0.0018</b>           | <b>67</b>                   | <b>-0.0003</b>                                         | <b>0.0013</b>           | <b>2700</b>                | <b>-1.80</b> |
| 21:00        | -0.0005                                          | 0.0022                  | 67                          | -0.0001                                                | 0.0012                  | 2700                       | -1.44        |
| 22:00        | -0.0003                                          | 0.0015                  | 67                          | 0.0000                                                 | 0.0009                  | 2700                       | -1.59        |
| <b>23:00</b> | <b>-0.0006</b>                                   | <b>0.0013</b>           | <b>67</b>                   | <b>-0.0002</b>                                         | <b>0.0007</b>           | <b>2700</b>                | <b>-2.77</b> |

**Figure A.2: Dynamics of cumulative abnormal returns**





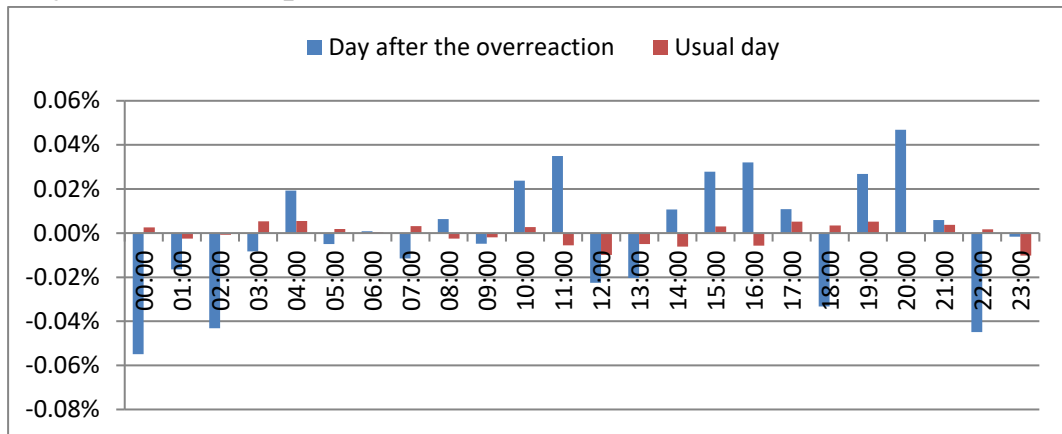
**Table A.4: Cumulative abnormal returns: the case of positive and negative overreactions**

| Hour         | Positive overreactions |               |                    | Positive overreactions |                |                    |
|--------------|------------------------|---------------|--------------------|------------------------|----------------|--------------------|
|              | Abnormal returns       | CAR           | Overreaction cross | Abnormal returns       | CAR            | Overreaction cross |
| 0:00         | 0.0001                 | 0.0001        | 0.0124             | 0.0001                 | 0.0001         | -0.0128            |
| 1:00         | 0.0000                 | 0.0001        | 0.0124             | -0.0008                | -0.0006        | -0.0120            |
| 2:00         | 0.0002                 | 0.0003        | 0.0122             | -0.0002                | -0.0009        | -0.0116            |
| 3:00         | 0.0004                 | 0.0006        | 0.0116             | -0.0003                | -0.0012        | -0.0112            |
| 4:00         | 0.0003                 | 0.0010        | 0.0111             | -0.0002                | -0.0014        | -0.0110            |
| 5:00         | 0.0004                 | 0.0013        | 0.0107             | -0.0006                | -0.0020        | -0.0104            |
| 6:00         | 0.0002                 | 0.0015        | 0.0104             | -0.0003                | -0.0023        | -0.0100            |
| 7:00         | 0.0001                 | 0.0016        | 0.0102             | -0.0003                | -0.0026        | -0.0097            |
| 8:00         | 0.0001                 | 0.0017        | 0.0100             | -0.0004                | -0.0029        | -0.0092            |
| 9:00         | 0.0002                 | 0.0020        | 0.0095             | -0.0003                | -0.0032        | -0.0086            |
| 10:00        | 0.0006                 | 0.0026        | 0.0085             | -0.0005                | -0.0038        | -0.0077            |
| 11:00        | 0.0002                 | 0.0028        | 0.0081             | -0.0004                | -0.0041        | -0.0070            |
| 12:00        | 0.0005                 | 0.0032        | 0.0075             | -0.0005                | -0.0046        | -0.0062            |
| 13:00        | 0.0005                 | 0.0037        | 0.0069             | -0.0008                | -0.0054        | -0.0051            |
| 14:00        | 0.0013                 | 0.0050        | 0.0053             | -0.0009                | -0.0063        | -0.0038            |
| 15:00        | 0.0014                 | 0.0065        | 0.0034             | -0.0012                | -0.0075        | -0.0022            |
| 16:00        | 0.0015                 | 0.0080        | 0.0014             | -0.0012                | -0.0087        | -0.0004            |
| <b>17:00</b> | 0.0006                 | 0.0086        | 0.0004             | <b>-0.0007</b>         | <b>-0.0094</b> | <b>0.0006</b>      |
| 18:00        | 0.0002                 | 0.0089        | 0.0000             | 0.0002                 | -0.0092        | 0.0004             |
| <b>19:00</b> | <b>0.0009</b>          | <b>0.0098</b> | <b>-0.0011</b>     | -0.0009                | -0.0102        | 0.0015             |
| 20:00        | 0.0012                 | 0.0110        | -0.0026            | -0.0004                | -0.0105        | 0.0022             |
| 21:00        | 0.0011                 | 0.0121        | -0.0039            | -0.0004                | -0.0109        | 0.0027             |
| 22:00        | 0.0005                 | 0.0126        | -0.0045            | -0.0003                | -0.0112        | 0.0030             |
| 23:00        | 0.0003                 | 0.0128        | -0.0047            | -0.0004                | -0.0117        | 0.0037             |

## Appendix B

### EURUSD: day after the overreaction

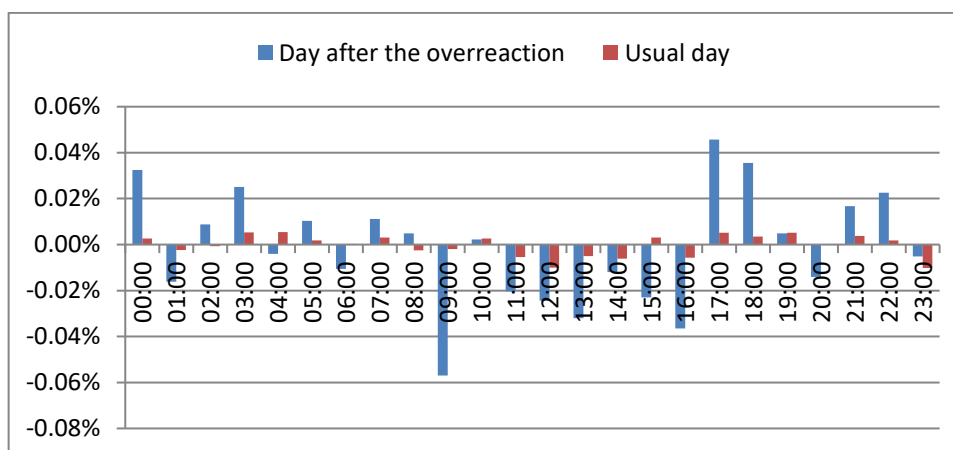
**Figure B.1: Average hourly returns on the day after the overreaction and normal days: the case of positive overreactions**



**Table B.1: t-test of hourly returns on the day after the overreaction and normal days: the case of positive overreactions**

| Hour        | Average return on day after positive overreaction (OD) | Standard deviation (OD) | Number of observations (OD) | Average return on usual day (UD) | Standard deviation (UD) | Number of observation (UD) | t criterion  |
|-------------|--------------------------------------------------------|-------------------------|-----------------------------|----------------------------------|-------------------------|----------------------------|--------------|
| <b>0:00</b> | <b>-0.0005</b>                                         | <b>0.0020</b>           | <b>67</b>                   | <b>0.0000</b>                    | <b>0.0008</b>           | <b>2700</b>                | <b>-2.41</b> |
| 1:00        | -0.0002                                                | 0.0017                  | 67                          | 0.0000                           | 0.0009                  | 2700                       | -0.68        |
| <b>2:00</b> | <b>-0.0004</b>                                         | <b>0.0014</b>           | <b>67</b>                   | <b>0.0000</b>                    | <b>0.0010</b>           | <b>2700</b>                | <b>-2.39</b> |
| 3:00        | -0.0001                                                | 0.0015                  | 67                          | 0.0001                           | 0.0009                  | 2700                       | -0.76        |
| 4:00        | 0.0002                                                 | 0.0017                  | 67                          | 0.0001                           | 0.0008                  | 2700                       | 0.66         |
| 5:00        | 0.0000                                                 | 0.0017                  | 67                          | 0.0000                           | 0.0009                  | 2700                       | -0.33        |
| 6:00        | 0.0000                                                 | 0.0012                  | 67                          | 0.0000                           | 0.0008                  | 2700                       | 0.04         |
| 7:00        | -0.0001                                                | 0.0013                  | 67                          | 0.0000                           | 0.0009                  | 2700                       | -0.90        |
| 8:00        | 0.0001                                                 | 0.0024                  | 67                          | 0.0000                           | 0.0013                  | 2700                       | 0.30         |
| 9:00        | 0.0000                                                 | 0.0022                  | 67                          | 0.0000                           | 0.0016                  | 2700                       | -0.11        |
| 10:00       | 0.0002                                                 | 0.0028                  | 67                          | 0.0000                           | 0.0016                  | 2700                       | 0.62         |
| 11:00       | 0.0004                                                 | 0.0023                  | 67                          | -0.0001                          | 0.0014                  | 2700                       | 1.45         |
| 12:00       | -0.0002                                                | 0.0023                  | 67                          | -0.0001                          | 0.0012                  | 2700                       | -0.44        |
| 13:00       | -0.0002                                                | 0.0017                  | 67                          | 0.0000                           | 0.0013                  | 2700                       | -0.73        |
| 14:00       | 0.0001                                                 | 0.0029                  | 67                          | -0.0001                          | 0.0018                  | 2700                       | 0.48         |
| 15:00       | 0.0003                                                 | 0.0032                  | 67                          | 0.0000                           | 0.0020                  | 2700                       | 0.62         |
| 16:00       | 0.0003                                                 | 0.0033                  | 67                          | -0.0001                          | 0.0019                  | 2700                       | 0.94         |
| 17:00       | 0.0001                                                 | 0.0030                  | 67                          | 0.0001                           | 0.0017                  | 2700                       | 0.16         |
| 18:00       | -0.0003                                                | 0.0017                  | 67                          | 0.0000                           | 0.0013                  | 2700                       | -1.74        |
| 19:00       | 0.0003                                                 | 0.0022                  | 67                          | 0.0001                           | 0.0014                  | 2700                       | 0.80         |
| 20:00       | 0.0005                                                 | 0.0024                  | 67                          | 0.0000                           | 0.0014                  | 2700                       | 1.56         |
| 21:00       | 0.0001                                                 | 0.0026                  | 67                          | 0.0000                           | 0.0012                  | 2700                       | 0.07         |
| 22:00       | -0.0004                                                | 0.0021                  | 67                          | 0.0000                           | 0.0009                  | 2700                       | -1.79        |
| 23:00       | 0.0000                                                 | 0.0010                  | 67                          | -0.0001                          | 0.0007                  | 2700                       | 0.73         |

**Figure B.2: Average hourly returns on the day after the overreaction and normal days: the case of negative overreactions**



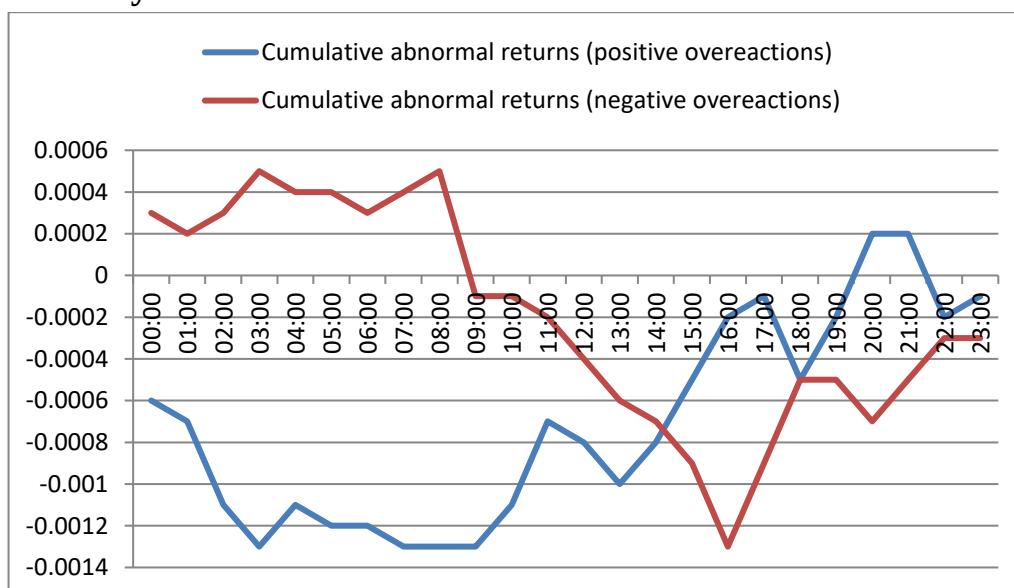
**Table B.2: t-test of hourly returns on the day after the overreaction and normal days: the case of negative overreactions**

| Hour        | Average return on day after negative overreaction (OD) | Standard deviation (OD) | Number of observations (OD) | Average return on usual day (UD) | Standard deviation (UD) | Number of observation (UD) | t criterion |
|-------------|--------------------------------------------------------|-------------------------|-----------------------------|----------------------------------|-------------------------|----------------------------|-------------|
| <b>0:00</b> | <b>0.0003</b>                                          | <b>0.0013</b>           | <b>67</b>                   | <b>0.0000</b>                    | <b>0.0008</b>           | <b>2700</b>                | <b>1.84</b> |
| 1:00        | -0.0002                                                | 0.0018                  | 67                          | 0.0000                           | 0.0009                  | 2700                       | -0.64       |
| 2:00        | 0.0001                                                 | 0.0017                  | 67                          | 0.0000                           | 0.0010                  | 2700                       | 0.44        |
| 3:00        | 0.0003                                                 | 0.0014                  | 67                          | 0.0001                           | 0.0009                  | 2700                       | 1.16        |
| 4:00        | 0.0000                                                 | 0.0017                  | 67                          | 0.0001                           | 0.0008                  | 2700                       | -0.46       |
| 5:00        | 0.0001                                                 | 0.0014                  | 67                          | 0.0000                           | 0.0009                  | 2700                       | 0.51        |
| 6:00        | -0.0001                                                | 0.0019                  | 67                          | 0.0000                           | 0.0008                  | 2700                       | -0.47       |
| 7:00        | 0.0001                                                 | 0.0015                  | 67                          | 0.0000                           | 0.0009                  | 2700                       | 0.44        |
| 8:00        | 0.0000                                                 | 0.0023                  | 67                          | 0.0000                           | 0.0013                  | 2700                       | 0.26        |
| 9:00        | -0.0006                                                | 0.0026                  | 67                          | 0.0000                           | 0.0016                  | 2700                       | -1.70       |
| 10:00       | 0.0000                                                 | 0.0021                  | 67                          | 0.0000                           | 0.0016                  | 2700                       | -0.02       |
| 11:00       | -0.0002                                                | 0.0022                  | 67                          | -0.0001                          | 0.0014                  | 2700                       | -0.56       |
| 12:00       | -0.0002                                                | 0.0018                  | 67                          | -0.0001                          | 0.0012                  | 2700                       | -0.65       |
| 13:00       | -0.0003                                                | 0.0020                  | 67                          | 0.0000                           | 0.0013                  | 2700                       | -1.08       |
| 14:00       | -0.0001                                                | 0.0026                  | 67                          | -0.0001                          | 0.0018                  | 2700                       | -0.18       |
| 15:00       | -0.0002                                                | 0.0026                  | 67                          | 0.0000                           | 0.0020                  | 2700                       | -0.82       |
| 16:00       | -0.0004                                                | 0.0030                  | 67                          | -0.0001                          | 0.0019                  | 2700                       | -0.83       |
| 17:00       | 0.0005                                                 | 0.0026                  | 67                          | 0.0001                           | 0.0017                  | 2700                       | 1.28        |
| 18:00       | 0.0004                                                 | 0.0021                  | 67                          | 0.0000                           | 0.0013                  | 2700                       | 1.27        |
| 19:00       | 0.0000                                                 | 0.0022                  | 67                          | 0.0001                           | 0.0014                  | 2700                       | -0.01       |
| 20:00       | -0.0001                                                | 0.0020                  | 67                          | 0.0000                           | 0.0014                  | 2700                       | -0.58       |
| 21:00       | 0.0002                                                 | 0.0021                  | 67                          | 0.0000                           | 0.0012                  | 2700                       | 0.50        |
| 22:00       | 0.0002                                                 | 0.0016                  | 67                          | 0.0000                           | 0.0009                  | 2700                       | 1.05        |
| 23:00       | -0.0001                                                | 0.0013                  | 67                          | -0.0001                          | 0.0007                  | 2700                       | 0.32        |

**Table B.3: Cumulative abnormal returns: the case of positive and negative overreactions**

| Hour  | Positive overreactions |                             | Negative overreactions |                             |
|-------|------------------------|-----------------------------|------------------------|-----------------------------|
|       | Abnormal returns       | Cumulative abnormal returns | Abnormal returns       | Cumulative abnormal returns |
| 0:00  | -0.0006                | -0.0006                     | 0.0003                 | 0.0003                      |
| 1:00  | -0.0001                | -0.0007                     | -0.0001                | 0.0002                      |
| 2:00  | -0.0004                | -0.0011                     | 0.0001                 | 0.0003                      |
| 3:00  | -0.0001                | -0.0013                     | 0.0002                 | 0.0005                      |
| 4:00  | 0.0001                 | -0.0011                     | -0.0001                | 0.0004                      |
| 5:00  | -0.0001                | -0.0012                     | 0.0001                 | 0.0004                      |
| 6:00  | 0.0000                 | -0.0012                     | -0.0001                | 0.0003                      |
| 7:00  | -0.0001                | -0.0013                     | 0.0001                 | 0.0004                      |
| 8:00  | 0.0001                 | -0.0013                     | 0.0001                 | 0.0005                      |
| 9:00  | 0.0000                 | -0.0013                     | -0.0006                | -0.0001                     |
| 10:00 | 0.0002                 | -0.0011                     | 0.0000                 | -0.0001                     |
| 11:00 | 0.0004                 | -0.0007                     | -0.0001                | -0.0002                     |
| 12:00 | -0.0001                | -0.0008                     | -0.0001                | -0.0004                     |
| 13:00 | -0.0002                | -0.0010                     | -0.0003                | -0.0006                     |
| 14:00 | 0.0002                 | -0.0008                     | -0.0001                | -0.0007                     |
| 15:00 | 0.0002                 | -0.0005                     | -0.0003                | -0.0009                     |
| 16:00 | 0.0004                 | -0.0002                     | -0.0003                | -0.0013                     |
| 17:00 | 0.0001                 | -0.0001                     | 0.0004                 | -0.0009                     |
| 18:00 | -0.0004                | -0.0005                     | 0.0003                 | -0.0005                     |
| 19:00 | 0.0002                 | -0.0002                     | 0.0000                 | -0.0005                     |
| 20:00 | 0.0005                 | 0.0002                      | -0.0001                | -0.0007                     |
| 21:00 | 0.0000                 | 0.0002                      | 0.0001                 | -0.0005                     |
| 22:00 | -0.0005                | -0.0002                     | 0.0002                 | -0.0003                     |
| 23:00 | 0.0001                 | -0.0001                     | 0.0001                 | -0.0003                     |

**Figure B.3: Dynamics of cumulative abnormal returns**



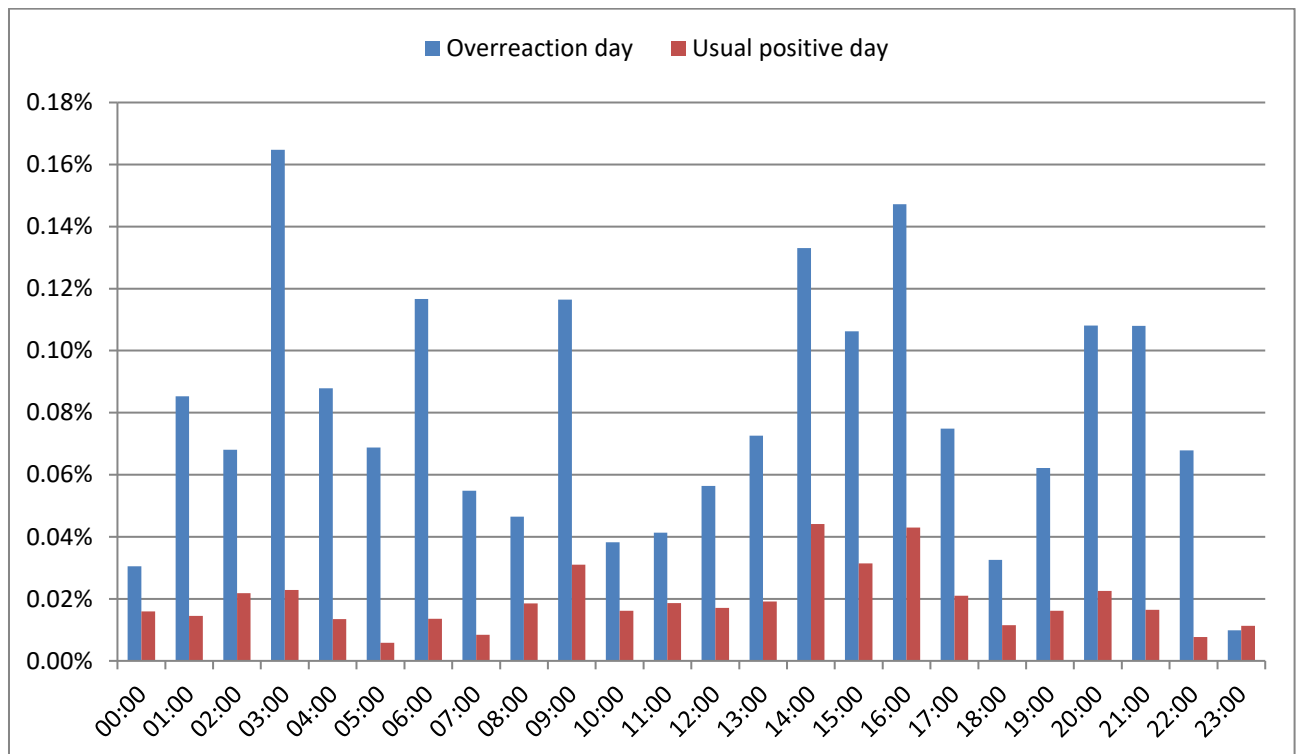
## Appendix C

### USDJPY: day of overreaction

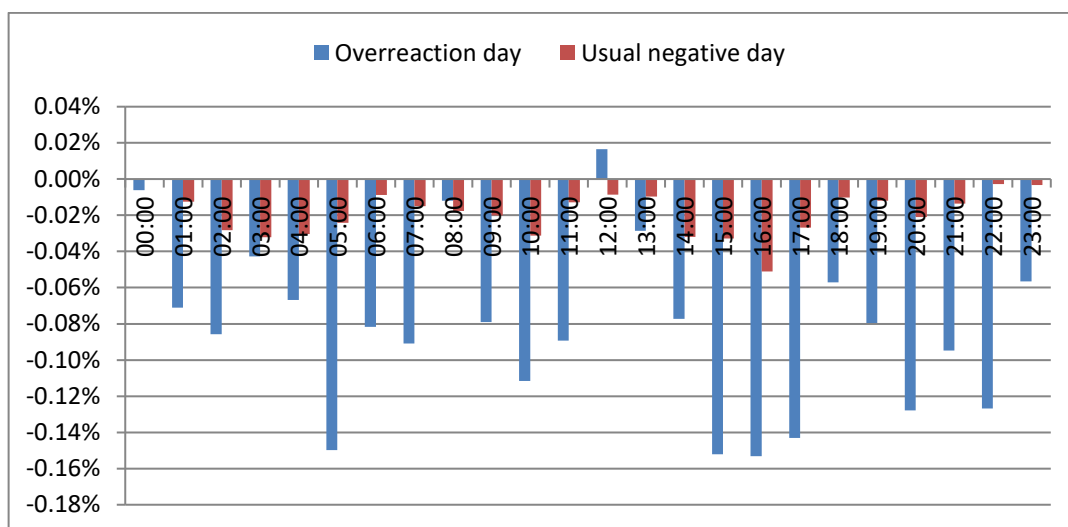
**Table C.1: Descriptive statistics for USDJPY data: daily, hourly, days with positive and negative returns**

| Parameter      | Daily data | Positive days | Negative days | Hourly data | Positive days (hourly data) | Negative days (hourly data) |
|----------------|------------|---------------|---------------|-------------|-----------------------------|-----------------------------|
| Mean           | 0.0000     | 0.0048        | -0.0047       | 0.0000      | 0.0002                      | -0.0002                     |
| Standard error | 0.0001     | 0.0001        | 0.0001        | 0.0000      | 0.0000                      | 0.0000                      |
| Median         | 0.0000     | 0.0035        | -0.0034       | 0.0000      | 0.0001                      | -0.0001                     |
| Mode           | 0.0000     | 0.0000        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Std. Dev.      | 0.0067     | 0.0047        | 0.0048        | 0.0014      | 0.0013                      | 0.0014                      |
| Variance       | 0.0000     | 0.0000        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Kurtosis       | 5.0065     | 13.9334       | 9.7566        | 35.9994     | 30.9203                     | 39.6193                     |
| Skewness       | -0.0230    | 2.6508        | -2.5004       | -0.6223     | 1.7519                      | -2.4414                     |
| Minimum        | -0.0377    | 0.0000        | -0.0377       | -0.0303     | -0.0145                     | -0.0303                     |
| Maximum        | 0.0535     | 0.0535        | 0.0000        | 0.0349      | 0.0349                      | 0.0166                      |
| Sum            | 0.0632     | 6.7060        | -6.6428       | 0.0539      | 6.2795                      | -6.2222                     |
| Observations   | 2822       | 1410          | 1417          | 64992       | 32543                       | 32576                       |

**Figure C.1: Average hourly returns on overreaction and normal days: the case of positive overreactions, USDJPY**



**Figure C.2: Average hourly returns on overreaction and normal days: the case of negative overreactions, USDJPY**



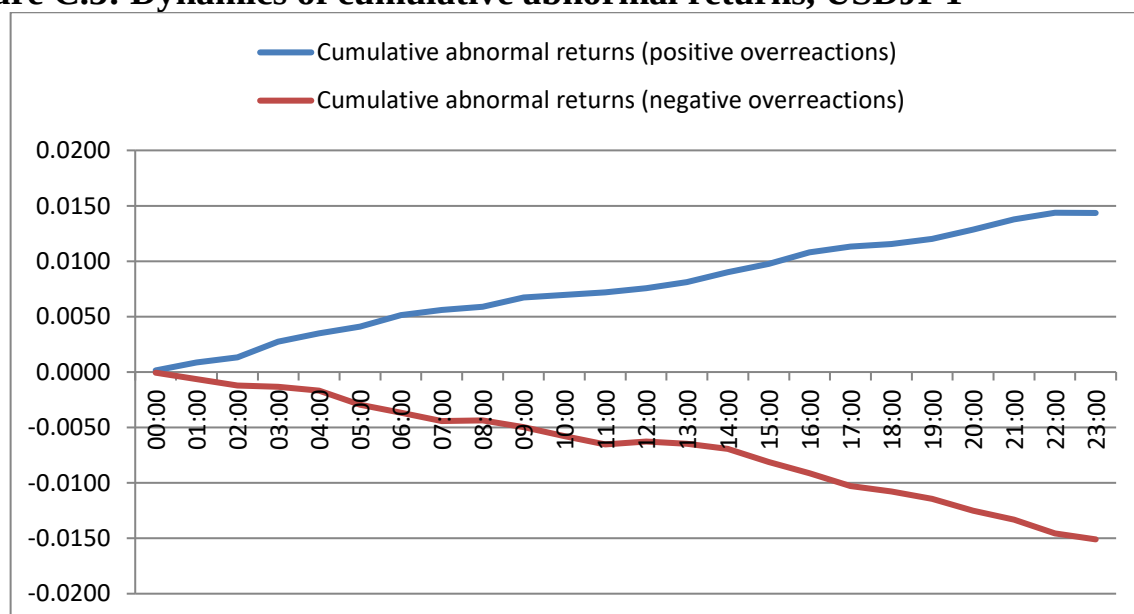
**Table C.2: t-test of hourly returns on overreaction and normal days: the case of positive overreactions, USDJPY**

| Hour  | Average return on positive overreaction 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 criterion |
|-------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|-------------|
| 0:00  | 0.0003                                           | 0.0015                  | 58                          | 0.0002                                                 | 0.0010                  | 2500                       | 0.75        |
| 1:00  | 0.0009                                           | 0.0033                  | 58                          | 0.0001                                                 | 0.0014                  | 2500                       | 1.63        |
| 2:00  | <b>0.0007</b>                                    | <b>0.0020</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0013</b>           | <b>2500</b>                | <b>1.78</b> |
| 3:00  | <b>0.0016</b>                                    | <b>0.0054</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0017</b>           | <b>2500</b>                | <b>2.01</b> |
| 4:00  | <b>0.0009</b>                                    | <b>0.0022</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0012</b>           | <b>2500</b>                | <b>2.62</b> |
| 5:00  | <b>0.0007</b>                                    | <b>0.0024</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0011</b>           | <b>2500</b>                | <b>2.00</b> |
| 6:00  | <b>0.0012</b>                                    | <b>0.0031</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0011</b>           | <b>2500</b>                | <b>2.52</b> |
| 7:00  | <b>0.0005</b>                                    | <b>0.0018</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0010</b>           | <b>2500</b>                | <b>1.92</b> |
| 8:00  | 0.0005                                           | 0.0024                  | 58                          | 0.0002                                                 | 0.0013                  | 2500                       | 0.90        |
| 9:00  | <b>0.0012</b>                                    | <b>0.0024</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0015</b>           | <b>2500</b>                | <b>2.65</b> |
| 10:00 | 0.0004                                           | 0.0022                  | 58                          | 0.0002                                                 | 0.0012                  | 2500                       | 0.75        |
| 11:00 | 0.0004                                           | 0.0024                  | 58                          | 0.0002                                                 | 0.0012                  | 2500                       | 0.71        |
| 12:00 | 0.0006                                           | 0.0018                  | 58                          | 0.0002                                                 | 0.0010                  | 2500                       | 1.69        |
| 13:00 | <b>0.0007</b>                                    | <b>0.0020</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0011</b>           | <b>2500</b>                | <b>2.06</b> |
| 14:00 | <b>0.0013</b>                                    | <b>0.0035</b>           | <b>58</b>                   | <b>0.0004</b>                                          | <b>0.0017</b>           | <b>2500</b>                | <b>1.92</b> |
| 15:00 | <b>0.0011</b>                                    | <b>0.0028</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0016</b>           | <b>2500</b>                | <b>2.02</b> |
| 16:00 | <b>0.0015</b>                                    | <b>0.0029</b>           | <b>58</b>                   | <b>0.0004</b>                                          | <b>0.0017</b>           | <b>2500</b>                | <b>2.74</b> |
| 17:00 | <b>0.0007</b>                                    | <b>0.0022</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0015</b>           | <b>2500</b>                | <b>1.83</b> |
| 18:00 | 0.0003                                           | 0.0020                  | 58                          | 0.0001                                                 | 0.0012                  | 2500                       | 0.80        |
| 19:00 | 0.0006                                           | 0.0028                  | 58                          | 0.0002                                                 | 0.0013                  | 2500                       | 1.26        |
| 20:00 | <b>0.0011</b>                                    | <b>0.0019</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0012</b>           | <b>2500</b>                | <b>3.39</b> |
| 21:00 | <b>0.0011</b>                                    | <b>0.0033</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0012</b>           | <b>2500</b>                | <b>2.13</b> |
| 22:00 | <b>0.0007</b>                                    | <b>0.0025</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0010</b>           | <b>2500</b>                | <b>1.84</b> |
| 23:00 | 0.0001                                           | 0.0022                  | 58                          | 0.0001                                                 | 0.0008                  | 2500                       | -0.05       |

**Table C.3: t-test of hourly returns on overreaction and normal days: the case of negative overreactions, USDJPY**

| Hour         | Average return on positive overreaction 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 criterion  |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|--------------|
| 0:00         | -0.0001                                          | 0.0016                  | 58                          | 0.0000                                                 | 0.0011                  | 2500                       | -0.28        |
| <b>1:00</b>  | <b>-0.0007</b>                                   | <b>0.0019</b>           | <b>58</b>                   | <b>-0.0001</b>                                         | <b>0.0012</b>           | <b>2500</b>                | <b>-2.40</b> |
| <b>2:00</b>  | <b>-0.0009</b>                                   | <b>0.0026</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0014</b>           | <b>2500</b>                | <b>-1.70</b> |
| 3:00         | -0.0004                                          | 0.0017                  | 58                          | -0.0003                                                | 0.0012                  | 2500                       | -0.49        |
| <b>4:00</b>  | <b>-0.0007</b>                                   | <b>0.0016</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0011</b>           | <b>2500</b>                | <b>-1.68</b> |
| <b>5:00</b>  | <b>-0.0015</b>                                   | <b>0.0042</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0014</b>           | <b>2500</b>                | <b>-2.27</b> |
| 6:00         | -0.0008                                          | 0.0036                  | 58                          | -0.0001                                                | 0.0012                  | 2500                       | -1.55        |
| <b>7:00</b>  | <b>-0.0009</b>                                   | <b>0.0030</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0012</b>           | <b>2500</b>                | <b>-1.91</b> |
| 8:00         | -0.0001                                          | 0.0021                  | 58                          | -0.0002                                                | 0.0012                  | 2500                       | 0.20         |
| <b>9:00</b>  | <b>-0.0008</b>                                   | <b>0.0022</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0014</b>           | <b>2500</b>                | <b>-2.03</b> |
| 10:00        | -0.0011                                          | 0.0037                  | 58                          | -0.0003                                                | 0.0015                  | 2500                       | -1.66        |
| <b>11:00</b> | <b>-0.0009</b>                                   | <b>0.0033</b>           | <b>58</b>                   | <b>-0.0001</b>                                         | <b>0.0013</b>           | <b>2500</b>                | <b>-1.77</b> |
| 12:00        | 0.0002                                           | 0.0026                  | 58                          | -0.0001                                                | 0.0012                  | 2500                       | 0.73         |
| 13:00        | -0.0003                                          | 0.0022                  | 58                          | -0.0001                                                | 0.0012                  | 2500                       | -0.65        |
| 14:00        | -0.0008                                          | 0.0029                  | 58                          | -0.0003                                                | 0.0017                  | 2500                       | -1.18        |
| <b>15:00</b> | <b>-0.0015</b>                                   | <b>0.0030</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0017</b>           | <b>2500</b>                | <b>-2.98</b> |
| <b>16:00</b> | <b>-0.0015</b>                                   | <b>0.0037</b>           | <b>58</b>                   | <b>-0.0005</b>                                         | <b>0.0020</b>           | <b>2500</b>                | <b>-2.08</b> |
| <b>17:00</b> | <b>-0.0014</b>                                   | <b>0.0043</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0018</b>           | <b>2500</b>                | <b>-2.06</b> |
| 18:00        | -0.0006                                          | 0.0028                  | 58                          | -0.0001                                                | 0.0013                  | 2500                       | -1.29        |
| 19:00        | -0.0008                                          | 0.0036                  | 58                          | -0.0001                                                | 0.0014                  | 2500                       | -1.41        |
| <b>20:00</b> | <b>-0.0013</b>                                   | <b>0.0047</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0016</b>           | <b>2500</b>                | <b>-1.72</b> |
| <b>21:00</b> | <b>-0.0009</b>                                   | <b>0.0036</b>           | <b>58</b>                   | <b>-0.0001</b>                                         | <b>0.0014</b>           | <b>2500</b>                | <b>-1.70</b> |
| <b>22:00</b> | <b>-0.0013</b>                                   | <b>0.0042</b>           | <b>58</b>                   | <b>0.0000</b>                                          | <b>0.0013</b>           | <b>2500</b>                | <b>-2.25</b> |
| 23:00        | -0.0006                                          | 0.0039                  | 58                          | 0.0000                                                 | 0.0012                  | 2500                       | -1.03        |

**Figure C.3: Dynamics of cumulative abnormal returns, USDJPY**



**Table C.4: Cumulative abnormal returns: the case of positive and negative overreactions, USDJPY**

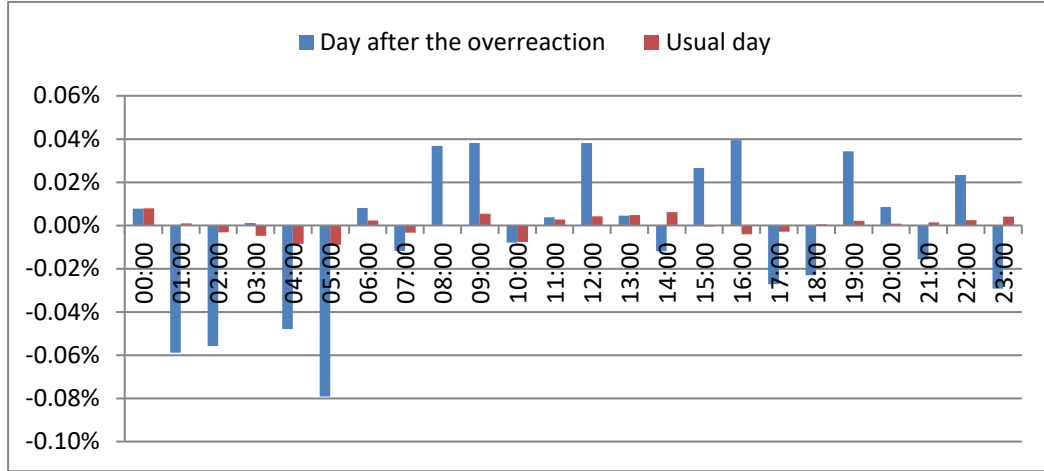
| Hour  | Positive overreactions |                             |                       | Positive overreactions |                             |                       |
|-------|------------------------|-----------------------------|-----------------------|------------------------|-----------------------------|-----------------------|
|       | Abnormal returns       | Cumulative abnormal returns | Overreaction cross    | Abnormal returns       | Cumulative abnormal returns | Overreaction cross    |
| 0:00  | 0.0001                 | 0.0001                      | 0.0131                | -0.0001                | -0.0001                     | -0.0133               |
| 1:00  | 0.0007                 | 0.0009                      | 0.0122                | -0.0006                | -0.0006                     | -0.0126               |
| 2:00  | 0.0005                 | 0.0013                      | 0.0116                | -0.0006                | -0.0012                     | -0.0118               |
| 3:00  | 0.0014                 | 0.0027                      | 0.0099                | -0.0001                | -0.0013                     | -0.0113               |
| 4:00  | 0.0007                 | 0.0035                      | 0.0090                | -0.0004                | -0.0017                     | -0.0107               |
| 5:00  | 0.0006                 | 0.0041                      | 0.0083                | -0.0013                | -0.0029                     | -0.0092               |
| 6:00  | 0.0010                 | 0.0051                      | 0.0072                | -0.0007                | -0.0037                     | -0.0084               |
| 7:00  | 0.0005                 | 0.0056                      | 0.0066                | -0.0008                | -0.0044                     | -0.0075               |
| 8:00  | 0.0003                 | 0.0059                      | 0.0062                | 0.0001                 | -0.0044                     | -0.0073               |
| 9:00  | 0.0009                 | 0.0067                      | 0.0050                | -0.0006                | -0.0050                     | -0.0065               |
| 10:00 | 0.0002                 | 0.0070                      | 0.0046                | -0.0008                | -0.0058                     | -0.0054               |
| 11:00 | 0.0002                 | 0.0072                      | 0.0042                | -0.0008                | -0.0065                     | -0.0045               |
| 12:00 | 0.0004                 | 0.0076                      | 0.0036                | 0.0003                 | -0.0063                     | -0.0047               |
| 13:00 | 0.0005                 | 0.0081                      | 0.0029                | -0.0002                | -0.0065                     | -0.0044               |
| 14:00 | 0.0009                 | 0.0090                      | 0.0016                | -0.0005                | -0.0069                     | -0.0036               |
| 15:00 | 0.0007                 | 0.0098                      | <b><u>0.0005</u></b>  | -0.0012                | -0.0081                     | -0.0021               |
| 16:00 | 0.0010                 | 0.0108                      | <b><u>-0.0009</u></b> | -0.0010                | -0.0091                     | <b><u>-0.0006</u></b> |
| 17:00 | 0.0005                 | 0.0113                      | -0.0017               | -0.0012                | -0.0103                     | <b><u>0.0008</u></b>  |
| 18:00 | 0.0002                 | 0.0115                      | -0.0020               | -0.0005                | -0.0108                     | 0.0014                |
| 19:00 | 0.0005                 | 0.0120                      | -0.0026               | -0.0007                | -0.0114                     | 0.0022                |
| 20:00 | 0.0009                 | 0.0129                      | -0.0037               | -0.0011                | -0.0125                     | 0.0035                |
| 21:00 | 0.0009                 | 0.0138                      | -0.0048               | -0.0008                | -0.0133                     | 0.0044                |
| 22:00 | 0.0006                 | 0.0144                      | -0.0055               | -0.0012                | -0.0146                     | 0.0057                |
| 23:00 | 0.0000                 | 0.0144                      | -0.0056               | -0.0005                | -0.0151                     | 0.0063                |



## Appendix D

### USDJPY: day after the overreaction

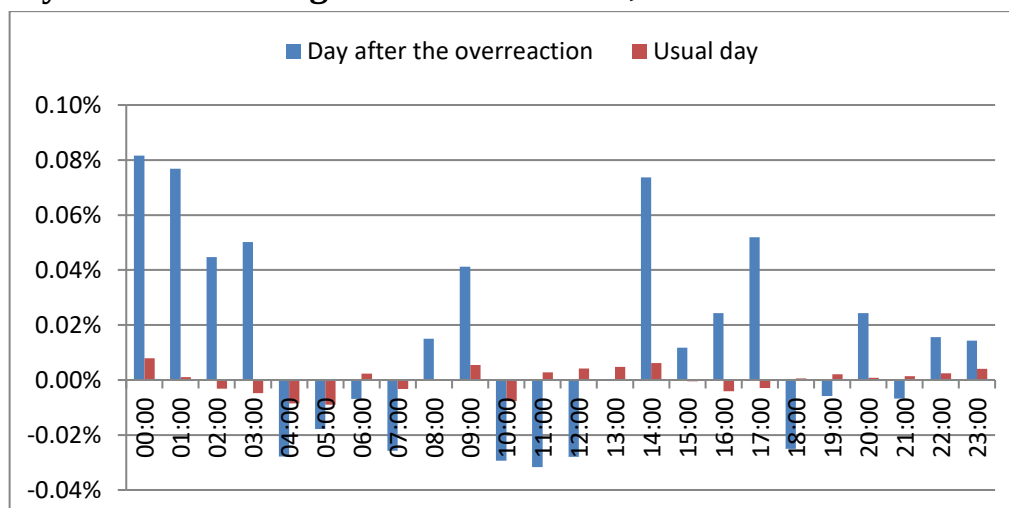
**Figure D.1: Average hourly returns on the day after the overreaction and normal days: the case of positive overreactions, USDJPY**



**Table D.1: t-test of hourly returns on the day after the overreaction and normal days: the case of positive overreactions, USDJPY**

| Hour         | Average return on day after positive overreaction (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         | 0.0001                                                 | 0.0014                  | 58                          | 0.0001                           | 0.0011                  | 2500                       | -0.01        |
| <b>1:00</b>  | <b>-0.0006</b>                                         | <b>0.0021</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0013</b>           | <b>2500</b>                | <b>-2.17</b> |
| 2:00         | -0.0006                                                | 0.0024                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | -1.65        |
| 3:00         | 0.0000                                                 | 0.0016                  | 58                          | 0.0000                           | 0.0015                  | 2500                       | 0.28         |
| <b>4:00</b>  | <b>-0.0005</b>                                         | <b>0.0015</b>           | <b>58</b>                   | <b>-0.0001</b>                   | <b>0.0012</b>           | <b>2500</b>                | <b>-2.05</b> |
| 5:00         | -0.0008                                                | 0.0041                  | 58                          | -0.0001                          | 0.0013                  | 2500                       | -1.31        |
| 6:00         | 0.0001                                                 | 0.0017                  | 58                          | 0.0000                           | 0.0012                  | 2500                       | 0.25         |
| 7:00         | -0.0001                                                | 0.0014                  | 58                          | 0.0000                           | 0.0011                  | 2500                       | -0.46        |
| 8:00         | 0.0004                                                 | 0.0021                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | 1.35         |
| 9:00         | 0.0004                                                 | 0.0020                  | 58                          | 0.0001                           | 0.0015                  | 2500                       | 1.25         |
| 10:00        | -0.0001                                                | 0.0018                  | 58                          | -0.0001                          | 0.0014                  | 2500                       | -0.01        |
| 11:00        | 0.0000                                                 | 0.0018                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | 0.04         |
| 12:00        | 0.0004                                                 | 0.0016                  | 58                          | 0.0000                           | 0.0011                  | 2500                       | 1.59         |
| 13:00        | 0.0000                                                 | 0.0020                  | 58                          | 0.0000                           | 0.0011                  | 2500                       | -0.01        |
| 14:00        | -0.0001                                                | 0.0026                  | 58                          | 0.0001                           | 0.0018                  | 2500                       | -0.54        |
| 15:00        | 0.0003                                                 | 0.0024                  | 58                          | 0.0000                           | 0.0017                  | 2500                       | 0.85         |
| 16:00        | 0.0004                                                 | 0.0024                  | 58                          | 0.0000                           | 0.0019                  | 2500                       | 1.36         |
| 17:00        | -0.0003                                                | 0.0020                  | 58                          | 0.0000                           | 0.0016                  | 2500                       | -0.93        |
| 18:00        | -0.0002                                                | 0.0017                  | 58                          | 0.0000                           | 0.0012                  | 2500                       | -1.05        |
| 19:00        | 0.0003                                                 | 0.0015                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | 1.63         |
| 20:00        | 0.0001                                                 | 0.0019                  | 58                          | 0.0000                           | 0.0015                  | 2500                       | 0.32         |
| 21:00        | -0.0002                                                | 0.0014                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | -0.90        |
| 22:00        | 0.0002                                                 | 0.0015                  | 58                          | 0.0000                           | 0.0011                  | 2500                       | 1.03         |
| <b>23:00</b> | <b>-0.0003</b>                                         | <b>0.0011</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0010</b>           | <b>2500</b>                | <b>-2.28</b> |

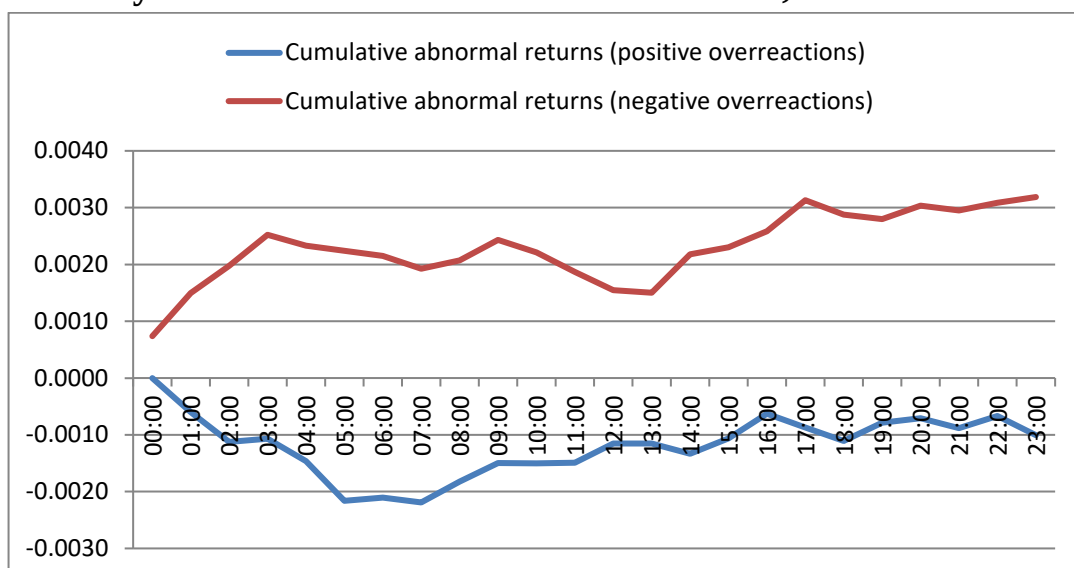
**Figure D.2: Average hourly returns on the day after the overreaction and normal days: the case of negative overreactions, USDJPY**



**Table D.2: t-test of hourly returns on the day after the overreaction and normal days: the case of negative overreactions, USDJPY**

| Hour         | Average return on day after negative overreaction (OD) | Standard deviation (OD) | Number of observations (OD) | Average return on usual day (UD) | Standard deviation (UD) | Number of observation (UD) | t criterion |
|--------------|--------------------------------------------------------|-------------------------|-----------------------------|----------------------------------|-------------------------|----------------------------|-------------|
| <b>0:00</b>  | <b>0.0008</b>                                          | <b>0.0024</b>           | <b>58</b>                   | <b>0.0001</b>                    | <b>0.0011</b>           | <b>2500</b>                | <b>2.31</b> |
| <b>1:00</b>  | <b>0.0008</b>                                          | <b>0.0029</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0013</b>           | <b>2500</b>                | <b>2.01</b> |
| 2:00         | 0.0004                                                 | 0.0025                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | 1.44        |
| <b>3:00</b>  | <b>0.0005</b>                                          | <b>0.0020</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0015</b>           | <b>2500</b>                | <b>2.05</b> |
| 4:00         | -0.0003                                                | 0.0029                  | 58                          | -0.0001                          | 0.0012                  | 2500                       | -0.51       |
| 5:00         | -0.0002                                                | 0.0027                  | 58                          | -0.0001                          | 0.0013                  | 2500                       | -0.25       |
| 6:00         | -0.0001                                                | 0.0022                  | 58                          | 0.0000                           | 0.0012                  | 2500                       | -0.32       |
| 7:00         | -0.0003                                                | 0.0019                  | 58                          | 0.0000                           | 0.0011                  | 2500                       | -0.88       |
| 8:00         | 0.0001                                                 | 0.0023                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | 0.49        |
| 9:00         | 0.0004                                                 | 0.0024                  | 58                          | 0.0001                           | 0.0015                  | 2500                       | 1.11        |
| 10:00        | -0.0003                                                | 0.0027                  | 58                          | -0.0001                          | 0.0014                  | 2500                       | -0.60       |
| 11:00        | -0.0003                                                | 0.0023                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | -1.15       |
| 12:00        | -0.0003                                                | 0.0024                  | 58                          | 0.0000                           | 0.0011                  | 2500                       | -1.01       |
| 13:00        | 0.0000                                                 | 0.0019                  | 58                          | 0.0000                           | 0.0011                  | 2500                       | -0.18       |
| <b>14:00</b> | <b>0.0007</b>                                          | <b>0.0023</b>           | <b>58</b>                   | <b>0.0001</b>                    | <b>0.0018</b>           | <b>2500</b>                | <b>2.25</b> |
| 15:00        | 0.0001                                                 | 0.0032                  | 58                          | 0.0000                           | 0.0017                  | 2500                       | 0.29        |
| 16:00        | 0.0002                                                 | 0.0038                  | 58                          | 0.0000                           | 0.0019                  | 2500                       | 0.57        |
| 17:00        | 0.0005                                                 | 0.0024                  | 58                          | 0.0000                           | 0.0016                  | 2500                       | 1.72        |
| 18:00        | -0.0003                                                | 0.0022                  | 58                          | 0.0000                           | 0.0012                  | 2500                       | -0.89       |
| 19:00        | -0.0001                                                | 0.0020                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | -0.30       |
| 20:00        | 0.0002                                                 | 0.0023                  | 58                          | 0.0000                           | 0.0015                  | 2500                       | 0.78        |
| 21:00        | -0.0001                                                | 0.0033                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | -0.19       |
| 22:00        | 0.0002                                                 | 0.0019                  | 58                          | 0.0000                           | 0.0011                  | 2500                       | 0.52        |
| 23:00        | 0.0001                                                 | 0.0018                  | 58                          | 0.0000                           | 0.0010                  | 2500                       | 0.44        |

**Figure D.3: Dynamics of cumulative abnormal returns, USDJPY**



**Table D.3: Cumulative abnormal returns: the case of positive and negative overreactions, USDJPY**

| Hour  | Positive overreactions |                             | Negative overreactions |                             |
|-------|------------------------|-----------------------------|------------------------|-----------------------------|
|       | Abnormal returns       | Cumulative abnormal returns | Abnormal returns       | Cumulative abnormal returns |
| 0:00  | 0.0000                 | 0.0000                      | 0.0007                 | 0.0007                      |
| 1:00  | -0.0006                | -0.0006                     | 0.0008                 | 0.0015                      |
| 2:00  | -0.0005                | -0.0011                     | 0.0005                 | 0.0020                      |
| 3:00  | 0.0001                 | -0.0011                     | 0.0005                 | 0.0025                      |
| 4:00  | -0.0004                | -0.0015                     | -0.0002                | 0.0023                      |
| 5:00  | -0.0007                | -0.0022                     | -0.0001                | 0.0022                      |
| 6:00  | 0.0001                 | -0.0021                     | -0.0001                | 0.0022                      |
| 7:00  | -0.0001                | -0.0022                     | -0.0002                | 0.0019                      |
| 8:00  | 0.0004                 | -0.0018                     | 0.0001                 | 0.0021                      |
| 9:00  | 0.0003                 | -0.0015                     | 0.0004                 | 0.0024                      |
| 10:00 | 0.0000                 | -0.0015                     | -0.0002                | 0.0022                      |
| 11:00 | 0.0000                 | -0.0015                     | -0.0003                | 0.0019                      |
| 12:00 | 0.0003                 | -0.0012                     | -0.0003                | 0.0015                      |
| 13:00 | 0.0000                 | -0.0012                     | 0.0000                 | 0.0015                      |
| 14:00 | -0.0002                | -0.0013                     | 0.0007                 | 0.0022                      |
| 15:00 | 0.0003                 | -0.0011                     | 0.0001                 | 0.0023                      |
| 16:00 | 0.0004                 | -0.0006                     | 0.0003                 | 0.0026                      |
| 17:00 | -0.0002                | -0.0009                     | 0.0005                 | 0.0031                      |
| 18:00 | -0.0002                | -0.0011                     | -0.0003                | 0.0029                      |
| 19:00 | 0.0003                 | -0.0008                     | -0.0001                | 0.0028                      |
| 20:00 | 0.0001                 | -0.0007                     | 0.0002                 | 0.0030                      |
| 21:00 | -0.0002                | -0.0009                     | -0.0001                | 0.0030                      |
| 22:00 | 0.0002                 | -0.0007                     | 0.0001                 | 0.0031                      |
| 23:00 | -0.0003                | -0.0010                     | 0.0001                 | 0.0032                      |

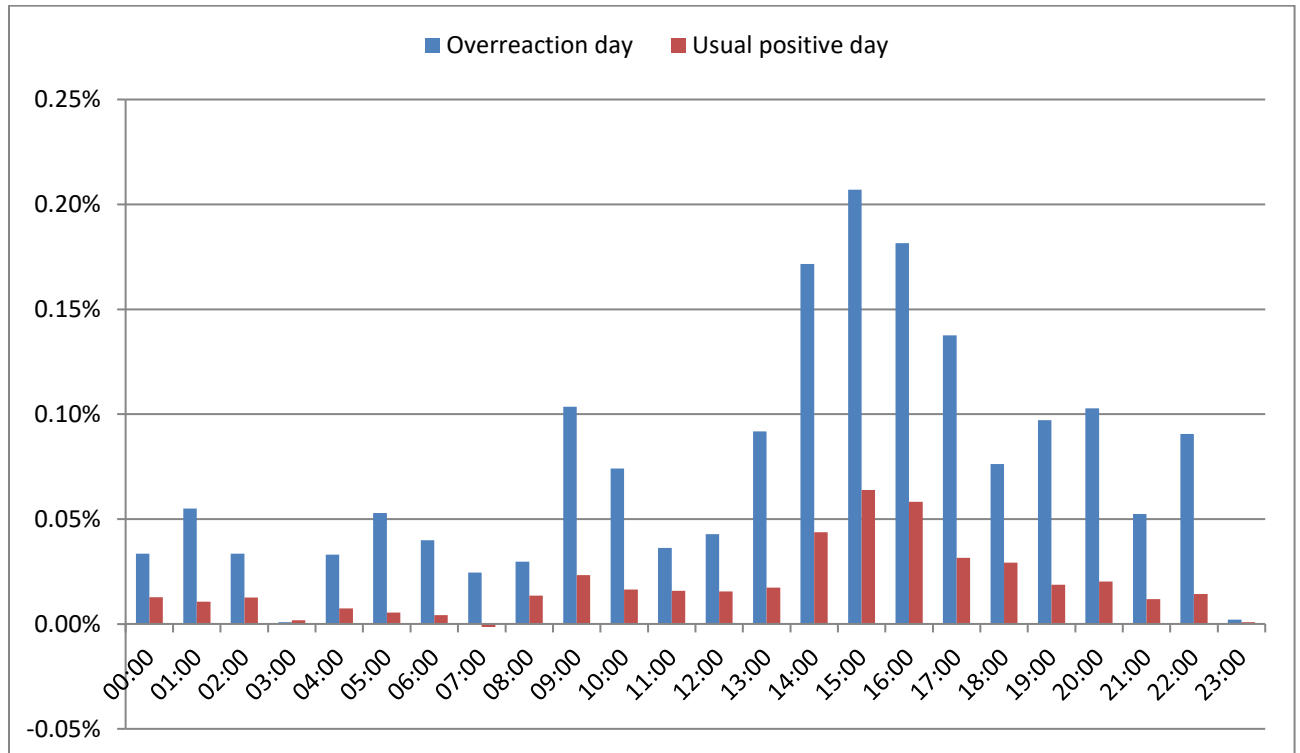
## Appendix E

### USDCAD: day of overreaction

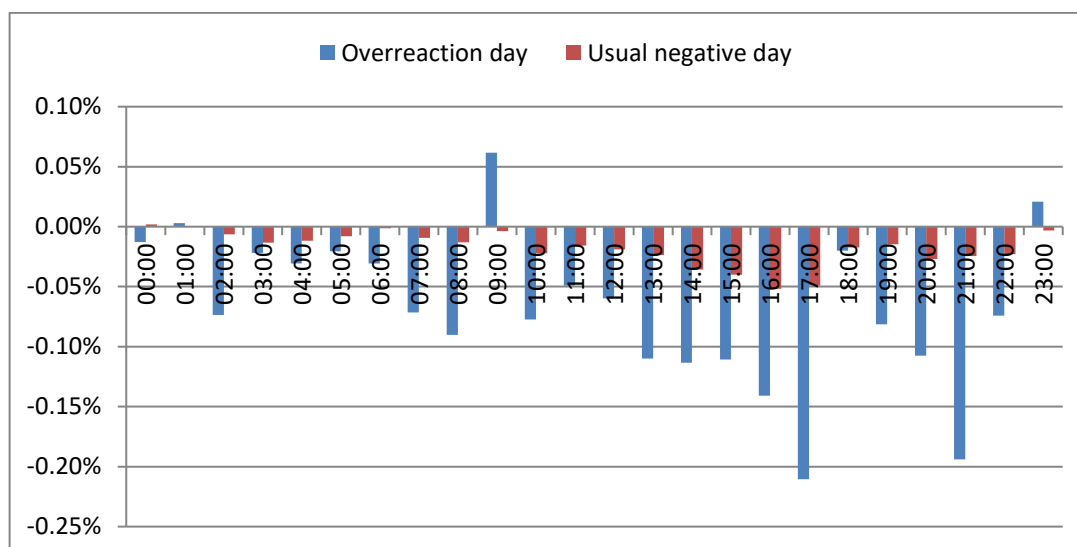
**Table E.1: Descriptive statistics for USDCAD data: daily, hourly, days with positive and negative returns**

| Parameter      | Daily data | Positive days | Negative days | Hourly data | Positive days (hourly data) | Negative days (hourly data) |
|----------------|------------|---------------|---------------|-------------|-----------------------------|-----------------------------|
| Mean           | 0.0001     | 0.0045        | -0.0044       | 0.0000      | 0.0002                      | -0.0002                     |
| Standard error | 0.0001     | 0.0001        | 0.0001        | 0.0000      | 0.0000                      | 0.0000                      |
| Median         | 0.0001     | 0.0033        | -0.0034       | 0.0000      | 0.0001                      | -0.0001                     |
| Mode           | 0.0000     | 0.0000        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Std. Dev.      | 0.0062     | 0.0044        | 0.0041        | 0.0013      | 0.0013                      | 0.0013                      |
| Variance       | 0.0000     | 0.0000        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Kurtosis       | 3.1043     | 7.2564        | 6.8753        | 14.0036     | 11.7443                     | 16.0283                     |
| Skewness       | 0.2055     | 2.2245        | -2.0031       | -0.1849     | 1.0196                      | -1.4095                     |
| Minimum        | -0.0379    | 0.0000        | -0.0379       | -0.0220     | -0.0171                     | -0.0220                     |
| Maximum        | 0.0349     | 0.0349        | 0.0000        | 0.0184      | 0.0184                      | 0.0117                      |
| Sum            | 0.3434     | 6.4674        | -6.1239       | 0.3585      | 6.1704                      | -5.8119                     |
| Observations   | 2808       | 1427          | 1389          | 65000       | 32920                       | 32223                       |

**Figure E.1: Average hourly returns on overreaction and normal days: the case of positive overreactions, USDCAD**



**Figure E.2: Average hourly returns on overreaction and normal days: the case of negative overreactions, USDCAD**



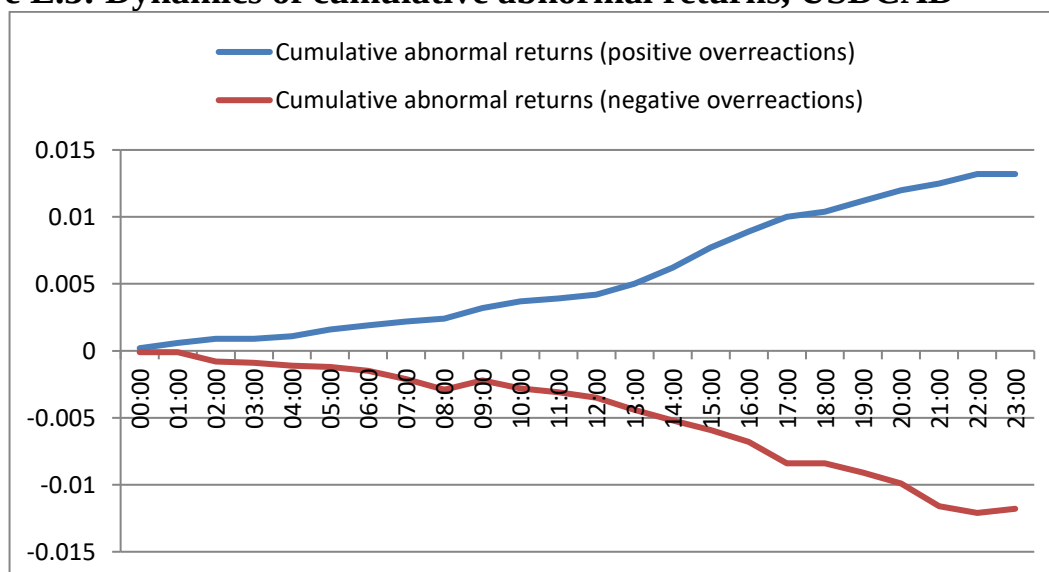
**Table E.2: t-test of hourly returns on overreaction and normal days: the case of positive overreactions, USDCAD**

| Hour         | Average return on positive overreaction 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 criterion |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|-------------|
| 0:00         | 0.0003                                           | 0.0010                  | 58                          | 0.0001                                                 | 0.0007                  | 2700                       | 1.56        |
| <b>1:00</b>  | <b>0.0005</b>                                    | <b>0.0014</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0009</b>           | <b>2700</b>                | <b>2.35</b> |
| 2:00         | 0.0003                                           | 0.0016                  | 58                          | 0.0001                                                 | 0.0009                  | 2700                       | 0.98        |
| 3:00         | 0.0000                                           | 0.0011                  | 58                          | 0.0000                                                 | 0.0008                  | 2700                       | -0.06       |
| <b>4:00</b>  | <b>0.0003</b>                                    | <b>0.0010</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0008</b>           | <b>2700</b>                | <b>1.85</b> |
| <b>5:00</b>  | <b>0.0005</b>                                    | <b>0.0017</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0008</b>           | <b>2700</b>                | <b>2.15</b> |
| <b>6:00</b>  | <b>0.0004</b>                                    | <b>0.0014</b>           | <b>58</b>                   | <b>0.0000</b>                                          | <b>0.0007</b>           | <b>2700</b>                | <b>1.93</b> |
| 7:00         | 0.0002                                           | 0.0013                  | 58                          | 0.0000                                                 | 0.0007                  | 2700                       | 1.55        |
| 8:00         | 0.0003                                           | 0.0021                  | 58                          | 0.0001                                                 | 0.0012                  | 2700                       | 0.58        |
| <b>9:00</b>  | <b>0.0010</b>                                    | <b>0.0021</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0013</b>           | <b>2700</b>                | <b>2.87</b> |
| <b>10:00</b> | <b>0.0007</b>                                    | <b>0.0022</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0013</b>           | <b>2700</b>                | <b>1.97</b> |
| 11:00        | 0.0004                                           | 0.0023                  | 58                          | 0.0002                                                 | 0.0012                  | 2700                       | 0.68        |
| 12:00        | 0.0004                                           | 0.0022                  | 58                          | 0.0002                                                 | 0.0012                  | 2700                       | 0.94        |
| <b>13:00</b> | <b>0.0009</b>                                    | <b>0.0024</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0014</b>           | <b>2700</b>                | <b>2.33</b> |
| <b>14:00</b> | <b>0.0017</b>                                    | <b>0.0029</b>           | <b>58</b>                   | <b>0.0004</b>                                          | <b>0.0018</b>           | <b>2700</b>                | <b>3.32</b> |
| <b>15:00</b> | <b>0.0021</b>                                    | <b>0.0031</b>           | <b>58</b>                   | <b>0.0006</b>                                          | <b>0.0021</b>           | <b>2700</b>                | <b>3.53</b> |
| <b>16:00</b> | <b>0.0018</b>                                    | <b>0.0038</b>           | <b>58</b>                   | <b>0.0006</b>                                          | <b>0.0020</b>           | <b>2700</b>                | <b>2.48</b> |
| <b>17:00</b> | <b>0.0014</b>                                    | <b>0.0042</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0020</b>           | <b>2700</b>                | <b>1.93</b> |
| 18:00        | 0.0008                                           | 0.0027                  | 58                          | 0.0003                                                 | 0.0014                  | 2700                       | 1.33        |
| <b>19:00</b> | <b>0.0010</b>                                    | <b>0.0021</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0013</b>           | <b>2700</b>                | <b>2.85</b> |
| <b>20:00</b> | <b>0.0010</b>                                    | <b>0.0028</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0014</b>           | <b>2700</b>                | <b>2.26</b> |
| 21:00        | 0.0005                                           | 0.0033                  | 58                          | 0.0001                                                 | 0.0014                  | 2700                       | 0.95        |
| <b>22:00</b> | <b>0.0009</b>                                    | <b>0.0020</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0011</b>           | <b>2700</b>                | <b>2.91</b> |
| 23:00        | 0.0000                                           | 0.0011                  | 58                          | 0.0000                                                 | 0.0007                  | 2700                       | 0.08        |

**Table E.3: t-test of hourly returns on overreaction and normal days: the case of negative overreactions, USDCAD**

| Hour         | Average return on negative overreaction day (OD) | Standard deviation (OD) | Number of observations (OD) | Average return on usual day with negative returns (UD) | Standard deviation (UD) | Number of observation (UD) | t criterion  |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|--------------|
| 0:00         | -0.0001                                          | 0.0011                  | 60                          | 0.0000                                                 | 0.0007                  | 2700                       | -1.04        |
| 1:00         | 0.0000                                           | 0.0016                  | 60                          | 0.0000                                                 | 0.0008                  | 2700                       | 0.12         |
| <b>2:00</b>  | <b>-0.0007</b>                                   | <b>0.0019</b>           | <b>60</b>                   | <b>-0.0001</b>                                         | <b>0.0009</b>           | <b>2700</b>                | <b>-2.79</b> |
| 3:00         | -0.0002                                          | 0.0014                  | 60                          | -0.0001                                                | 0.0008                  | 2700                       | -0.47        |
| 4:00         | -0.0003                                          | 0.0014                  | 60                          | -0.0001                                                | 0.0008                  | 2700                       | -1.05        |
| 5:00         | -0.0002                                          | 0.0015                  | 60                          | -0.0001                                                | 0.0007                  | 2700                       | -0.62        |
| 6:00         | -0.0003                                          | 0.0013                  | 60                          | 0.0000                                                 | 0.0007                  | 2700                       | -1.77        |
| <b>7:00</b>  | <b>-0.0007</b>                                   | <b>0.0017</b>           | <b>60</b>                   | <b>-0.0001</b>                                         | <b>0.0008</b>           | <b>2700</b>                | <b>-2.81</b> |
| <b>8:00</b>  | <b>-0.0009</b>                                   | <b>0.0018</b>           | <b>60</b>                   | <b>-0.0001</b>                                         | <b>0.0011</b>           | <b>2700</b>                | <b>-3.30</b> |
| <b>9:00</b>  | <b>0.0006</b>                                    | <b>0.0028</b>           | <b>60</b>                   | <b>0.0000</b>                                          | <b>0.0014</b>           | <b>2700</b>                | <b>1.79</b>  |
| <b>10:00</b> | <b>-0.0008</b>                                   | <b>0.0022</b>           | <b>60</b>                   | <b>-0.0002</b>                                         | <b>0.0013</b>           | <b>2700</b>                | <b>-1.93</b> |
| 11:00        | -0.0005                                          | 0.0023                  | 60                          | -0.0002                                                | 0.0012                  | 2700                       | -1.14        |
| 12:00        | -0.0006                                          | 0.0019                  | 60                          | -0.0002                                                | 0.0013                  | 2700                       | -1.64        |
| <b>13:00</b> | <b>-0.0011</b>                                   | <b>0.0026</b>           | <b>60</b>                   | <b>-0.0002</b>                                         | <b>0.0014</b>           | <b>2700</b>                | <b>-2.51</b> |
| <b>14:00</b> | <b>-0.0011</b>                                   | <b>0.0031</b>           | <b>60</b>                   | <b>-0.0004</b>                                         | <b>0.0019</b>           | <b>2700</b>                | <b>-1.91</b> |
| 15:00        | -0.0011                                          | 0.0038                  | 60                          | -0.0004                                                | 0.0020                  | 2700                       | -1.45        |
| 16:00        | -0.0014                                          | 0.0043                  | 60                          | -0.0005                                                | 0.0020                  | 2700                       | -1.59        |
| <b>17:00</b> | <b>-0.0021</b>                                   | <b>0.0034</b>           | <b>60</b>                   | <b>-0.0005</b>                                         | <b>0.0019</b>           | <b>2700</b>                | <b>-3.64</b> |
| 18:00        | -0.0002                                          | 0.0029                  | 60                          | -0.0002                                                | 0.0014                  | 2700                       | -0.07        |
| 19:00        | -0.0008                                          | 0.0035                  | 60                          | -0.0001                                                | 0.0013                  | 2700                       | -1.48        |
| <b>20:00</b> | <b>-0.0011</b>                                   | <b>0.0033</b>           | <b>60</b>                   | <b>-0.0003</b>                                         | <b>0.0014</b>           | <b>2700</b>                | <b>-1.88</b> |
| <b>21:00</b> | <b>-0.0019</b>                                   | <b>0.0039</b>           | <b>60</b>                   | <b>-0.0002</b>                                         | <b>0.0014</b>           | <b>2700</b>                | <b>-3.36</b> |
| <b>22:00</b> | <b>-0.0007</b>                                   | <b>0.0015</b>           | <b>60</b>                   | <b>-0.0002</b>                                         | <b>0.0010</b>           | <b>2700</b>                | <b>-2.69</b> |
| <b>23:00</b> | <b>0.0002</b>                                    | <b>0.0011</b>           | <b>60</b>                   | <b>0.0000</b>                                          | <b>0.0008</b>           | <b>2700</b>                | <b>1.68</b>  |

**Figure E.3: Dynamics of cumulative abnormal returns, USDCAD**



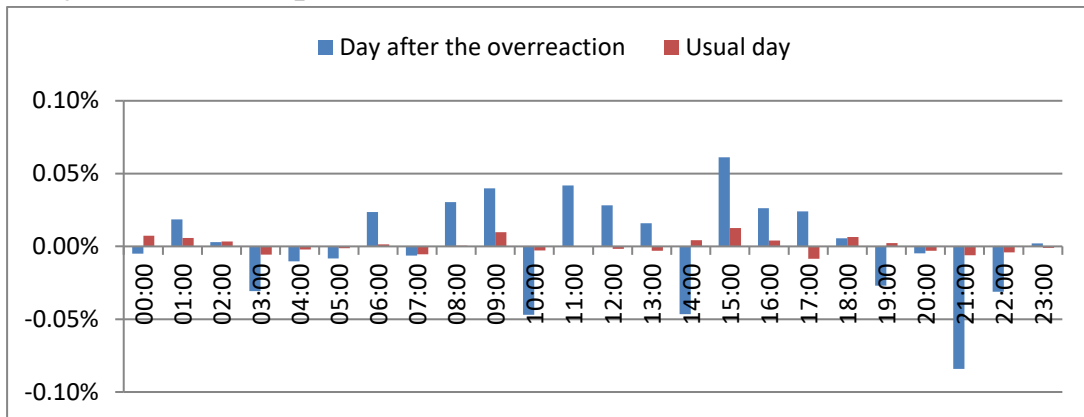
**Table E.4: Cumulative abnormal returns: the case of positive and negative overreactions, USDCAD**

| Hour  | Positive overreactions |        |                    | Positive overreactions |         |                    |
|-------|------------------------|--------|--------------------|------------------------|---------|--------------------|
|       | Abnormal returns       | CAR    | Overreaction cross | Abnormal returns       | CAR     | Overreaction cross |
| 0:00  | 0.0002                 | 0.0002 | 0.0122             | -0.0001                | -0.0001 | -0.0122            |
| 1:00  | 0.0004                 | 0.0006 | 0.0116             | 0.0000                 | -0.0001 | -0.0122            |
| 2:00  | 0.0002                 | 0.0009 | 0.0113             | -0.0007                | -0.0008 | -0.0115            |
| 3:00  | 0.0000                 | 0.0009 | 0.0113             | -0.0001                | -0.0009 | -0.0112            |
| 4:00  | 0.0003                 | 0.0011 | 0.0110             | -0.0002                | -0.0011 | -0.0109            |
| 5:00  | 0.0005                 | 0.0016 | 0.0104             | -0.0001                | -0.0012 | -0.0107            |
| 6:00  | 0.0004                 | 0.0019 | 0.0100             | -0.0003                | -0.0015 | -0.0104            |
| 7:00  | 0.0003                 | 0.0022 | 0.0098             | -0.0006                | -0.0021 | -0.0097            |
| 8:00  | 0.0002                 | 0.0024 | 0.0095             | -0.0008                | -0.0029 | -0.0088            |
| 9:00  | 0.0008                 | 0.0032 | 0.0085             | 0.0007                 | -0.0022 | -0.0094            |
| 10:00 | 0.0006                 | 0.0037 | 0.0077             | -0.0006                | -0.0028 | -0.0087            |
| 11:00 | 0.0002                 | 0.0039 | 0.0073             | -0.0003                | -0.0031 | -0.0082            |
| 12:00 | 0.0003                 | 0.0042 | 0.0069             | -0.0004                | -0.0035 | -0.0076            |
| 13:00 | 0.0007                 | 0.0050 | 0.0060             | -0.0009                | -0.0044 | -0.0065            |
| 14:00 | 0.0013                 | 0.0062 | 0.0043             | -0.0008                | -0.0052 | -0.0053            |
| 15:00 | 0.0014                 | 0.0077 | 0.0022             | -0.0007                | -0.0059 | -0.0042            |
| 16:00 | 0.0012                 | 0.0089 | <b>0.0004</b>      | -0.0009                | -0.0068 | -0.0028            |
| 17:00 | 0.0011                 | 0.0100 | <b>-0.0010</b>     | -0.0016                | -0.0084 | -0.0007            |
| 18:00 | 0.0005                 | 0.0104 | -0.0017            | 0.0000                 | -0.0084 | <b>-0.0005</b>     |
| 19:00 | 0.0008                 | 0.0112 | -0.0027            | -0.0007                | -0.0091 | <b>0.0003</b>      |
| 20:00 | 0.0008                 | 0.0120 | -0.0037            | -0.0008                | -0.0099 | 0.0014             |
| 21:00 | 0.0004                 | 0.0125 | -0.0043            | -0.0017                | -0.0116 | 0.0033             |
| 22:00 | 0.0008                 | 0.0132 | -0.0052            | -0.0005                | -0.0121 | 0.0041             |
| 23:00 | 0.0000                 | 0.0132 | -0.0052            | 0.0002                 | -0.0118 | 0.0038             |

## Appendix F

### USDCAD: day after the overreaction

**Figure F.1: Average hourly returns on the day after the overreaction and normal days: the case of positive overreactions, USDCAD**

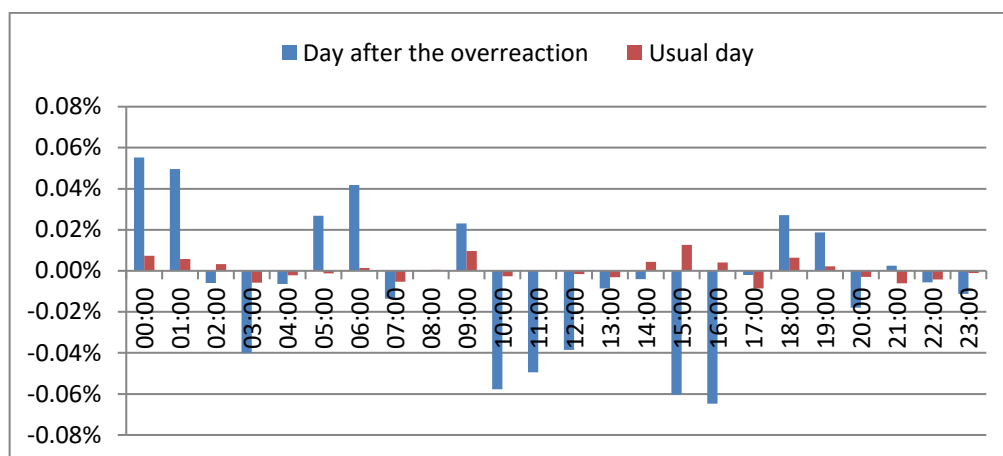


**Table F.1: t-test of hourly returns on the day after the overreaction and normal days: the case of positive overreactions, USDCAD**

| Hour  | Average return on day after positive overreaction (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  | -0.0001                                                | 0.0013                  | 58                          | 0.0001                           | 0.0007                  | 2700                       | -0.74       |
| 1:00  | 0.0002                                                 | 0.0013                  | 58                          | 0.0001                           | 0.0008                  | 2700                       | 0.74        |
| 2:00  | 0.0000                                                 | 0.0016                  | 58                          | 0.0000                           | 0.0009                  | 2700                       | -0.02       |
| 3:00  | -0.0003                                                | 0.0013                  | 58                          | -0.0001                          | 0.0008                  | 2700                       | -1.42       |
| 4:00  | -0.0001                                                | 0.0014                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | -0.43       |
| 5:00  | -0.0001                                                | 0.0014                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | -0.39       |
| 6:00  | 0.0002                                                 | 0.0015                  | 58                          | 0.0000                           | 0.0007                  | 2700                       | 1.14        |
| 7:00  | -0.0001                                                | 0.0014                  | 58                          | -0.0001                          | 0.0008                  | 2700                       | -0.05       |
| 8:00  | 0.0003                                                 | 0.0026                  | 58                          | 0.0000                           | 0.0011                  | 2700                       | 0.87        |
| 9:00  | 0.0004                                                 | 0.0027                  | 58                          | 0.0001                           | 0.0013                  | 2700                       | 0.86        |
| 10:00 | -0.0005                                                | 0.0021                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | -1.61       |
| 11:00 | 0.0004                                                 | 0.0022                  | 58                          | 0.0000                           | 0.0012                  | 2700                       | 1.46        |
| 12:00 | 0.0003                                                 | 0.0029                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | 0.77        |
| 13:00 | 0.0002                                                 | 0.0026                  | 58                          | 0.0000                           | 0.0014                  | 2700                       | 0.55        |
| 14:00 | -0.0005                                                | 0.0032                  | 58                          | 0.0000                           | 0.0019                  | 2700                       | -1.20       |
| 15:00 | 0.0006                                                 | 0.0033                  | 58                          | 0.0001                           | 0.0021                  | 2700                       | 1.11        |
| 16:00 | 0.0003                                                 | 0.0038                  | 58                          | 0.0000                           | 0.0021                  | 2700                       | 0.45        |
| 17:00 | 0.0002                                                 | 0.0039                  | 58                          | -0.0001                          | 0.0020                  | 2700                       | 0.64        |
| 18:00 | 0.0001                                                 | 0.0027                  | 58                          | 0.0001                           | 0.0014                  | 2700                       | -0.02       |
| 19:00 | -0.0003                                                | 0.0024                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | -0.93       |
| 20:00 | 0.0000                                                 | 0.0028                  | 58                          | 0.0000                           | 0.0014                  | 2700                       | -0.05       |
| 21:00 | -0.0008                                                | 0.0036                  | 58                          | -0.0001                          | 0.0015                  | 2700                       | -1.66       |
| 22:00 | -0.0003                                                | 0.0022                  | 58                          | 0.0000                           | 0.0010                  | 2700                       | -0.92       |
| 23:00 | 0.0000                                                 | 0.0010                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | 0.23        |



**Figure F.2: Average hourly returns on the day after the overreaction and normal days: the case of negative overreactions, USDCAD**



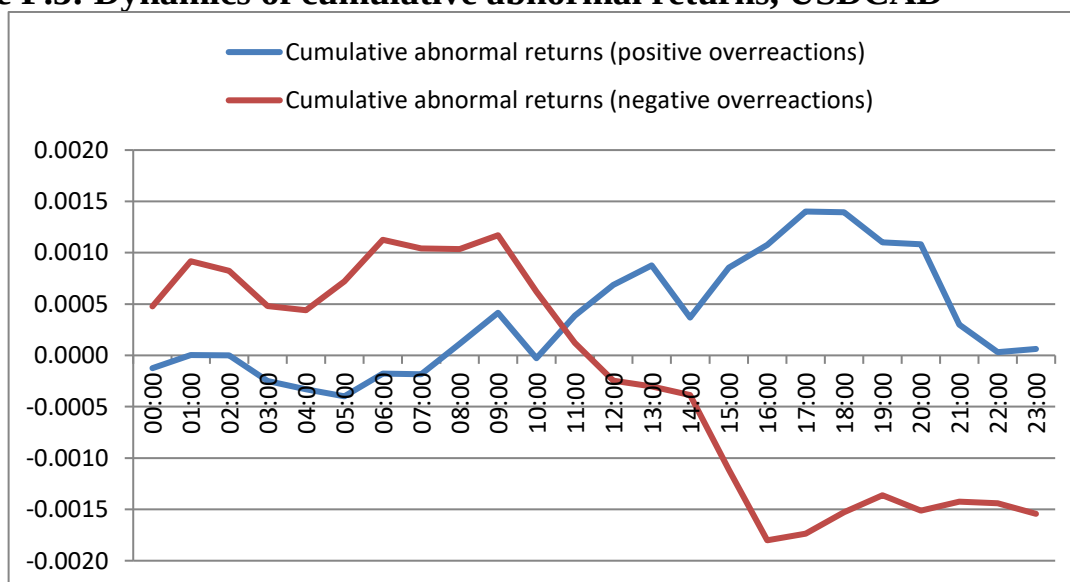
**Table F.1: t-test of hourly returns on the day after the overreaction and normal days: the case of positive overreactions, USDCAD**

| Hour  | Average return on day after positive overreaction (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  | -0.0001                                                | 0.0013                  | 58                          | 0.0001                           | 0.0007                  | 2700                       | -0.74       |
| 1:00  | 0.0002                                                 | 0.0013                  | 58                          | 0.0001                           | 0.0008                  | 2700                       | 0.74        |
| 2:00  | 0.0000                                                 | 0.0016                  | 58                          | 0.0000                           | 0.0009                  | 2700                       | -0.02       |
| 3:00  | -0.0003                                                | 0.0013                  | 58                          | -0.0001                          | 0.0008                  | 2700                       | -1.42       |
| 4:00  | -0.0001                                                | 0.0014                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | -0.43       |
| 5:00  | -0.0001                                                | 0.0014                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | -0.39       |
| 6:00  | 0.0002                                                 | 0.0015                  | 58                          | 0.0000                           | 0.0007                  | 2700                       | 1.14        |
| 7:00  | -0.0001                                                | 0.0014                  | 58                          | -0.0001                          | 0.0008                  | 2700                       | -0.05       |
| 8:00  | 0.0003                                                 | 0.0026                  | 58                          | 0.0000                           | 0.0011                  | 2700                       | 0.87        |
| 9:00  | 0.0004                                                 | 0.0027                  | 58                          | 0.0001                           | 0.0013                  | 2700                       | 0.86        |
| 10:00 | -0.0005                                                | 0.0021                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | -1.61       |
| 11:00 | 0.0004                                                 | 0.0022                  | 58                          | 0.0000                           | 0.0012                  | 2700                       | 1.46        |
| 12:00 | 0.0003                                                 | 0.0029                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | 0.77        |
| 13:00 | 0.0002                                                 | 0.0026                  | 58                          | 0.0000                           | 0.0014                  | 2700                       | 0.55        |
| 14:00 | -0.0005                                                | 0.0032                  | 58                          | 0.0000                           | 0.0019                  | 2700                       | -1.20       |
| 15:00 | 0.0006                                                 | 0.0033                  | 58                          | 0.0001                           | 0.0021                  | 2700                       | 1.11        |
| 16:00 | 0.0003                                                 | 0.0038                  | 58                          | 0.0000                           | 0.0021                  | 2700                       | 0.45        |
| 17:00 | 0.0002                                                 | 0.0039                  | 58                          | -0.0001                          | 0.0020                  | 2700                       | 0.64        |
| 18:00 | 0.0001                                                 | 0.0027                  | 58                          | 0.0001                           | 0.0014                  | 2700                       | -0.02       |
| 19:00 | -0.0003                                                | 0.0024                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | -0.93       |
| 20:00 | 0.0000                                                 | 0.0028                  | 58                          | 0.0000                           | 0.0014                  | 2700                       | -0.05       |
| 21:00 | -0.0008                                                | 0.0036                  | 58                          | -0.0001                          | 0.0015                  | 2700                       | -1.66       |
| 22:00 | -0.0003                                                | 0.0022                  | 58                          | 0.0000                           | 0.0010                  | 2700                       | -0.92       |
| 23:00 | 0.0000                                                 | 0.0010                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | 0.23        |

**Table F.2: t-test of hourly returns on the day after the overreaction and normal days: the case of negative overreactions, USDCAD**

| Hour         | Average return on day after negative overreaction (OD) | Standard deviation (OD) | Number of observations (OD) | Average return on usual day (UD) | Standard deviation (UD) | Number of observation (UD) | t criterion         |
|--------------|--------------------------------------------------------|-------------------------|-----------------------------|----------------------------------|-------------------------|----------------------------|---------------------|
| <b>0:00</b>  | <b><u>0.0006</u></b>                                   | <b><u>0.0013</u></b>    | <b><u>58</u></b>            | <b><u>0.0001</u></b>             | <b><u>0.0007</u></b>    | <b><u>2700</u></b>         | <b><u>2.76</u></b>  |
| 1:00         | 0.0005                                                 | 0.0022                  | 58                          | 0.0001                           | 0.0008                  | 2700                       | 1.49                |
| 2:00         | -0.0001                                                | 0.0015                  | 58                          | 0.0000                           | 0.0009                  | 2700                       | -0.47               |
| <b>3:00</b>  | <b><u>-0.0004</u></b>                                  | <b><u>0.0013</u></b>    | <b><u>58</u></b>            | <b><u>-0.0001</u></b>            | <b><u>0.0008</u></b>    | <b><u>2700</u></b>         | <b><u>-2.02</u></b> |
| 4:00         | -0.0001                                                | 0.0015                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | -0.21               |
| 5:00         | 0.0003                                                 | 0.0017                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | 1.28                |
| <b>6:00</b>  | <b><u>0.0004</u></b>                                   | <b><u>0.0012</u></b>    | <b><u>58</u></b>            | <b><u>0.0000</u></b>             | <b><u>0.0007</u></b>    | <b><u>2700</u></b>         | <b><u>2.50</u></b>  |
| 7:00         | -0.0001                                                | 0.0016                  | 58                          | -0.0001                          | 0.0008                  | 2700                       | -0.40               |
| 8:00         | 0.0000                                                 | 0.0022                  | 58                          | 0.0000                           | 0.0011                  | 2700                       | -0.02               |
| 9:00         | 0.0002                                                 | 0.0028                  | 58                          | 0.0001                           | 0.0013                  | 2700                       | 0.36                |
| 10:00        | -0.0006                                                | 0.0027                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | -1.57               |
| 11:00        | -0.0005                                                | 0.0022                  | 58                          | 0.0000                           | 0.0012                  | 2700                       | -1.70               |
| 12:00        | -0.0004                                                | 0.0024                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | -1.17               |
| 13:00        | -0.0001                                                | 0.0022                  | 58                          | 0.0000                           | 0.0014                  | 2700                       | -0.19               |
| 14:00        | 0.0000                                                 | 0.0038                  | 58                          | 0.0000                           | 0.0019                  | 2700                       | -0.17               |
| <b>15:00</b> | <b><u>-0.0006</u></b>                                  | <b><u>0.0029</u></b>    | <b><u>58</u></b>            | <b><u>0.0001</u></b>             | <b><u>0.0021</u></b>    | <b><u>2700</u></b>         | <b><u>-1.88</u></b> |
| 16:00        | -0.0006                                                | 0.0039                  | 58                          | 0.0000                           | 0.0021                  | 2700                       | -1.32               |
| 17:00        | 0.0000                                                 | 0.0032                  | 58                          | -0.0001                          | 0.0020                  | 2700                       | 0.15                |
| 18:00        | 0.0003                                                 | 0.0026                  | 58                          | 0.0001                           | 0.0014                  | 2700                       | 0.60                |
| 19:00        | 0.0002                                                 | 0.0018                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | 0.69                |
| 20:00        | -0.0002                                                | 0.0025                  | 58                          | 0.0000                           | 0.0014                  | 2700                       | -0.45               |
| 21:00        | 0.0000                                                 | 0.0030                  | 58                          | -0.0001                          | 0.0015                  | 2700                       | 0.21                |
| 22:00        | -0.0001                                                | 0.0018                  | 58                          | 0.0000                           | 0.0010                  | 2700                       | -0.06               |
| 23:00        | -0.0001                                                | 0.0012                  | 58                          | 0.0000                           | 0.0008                  | 2700                       | -0.63               |

**Figure F.3: Dynamics of cumulative abnormal returns, USDCAD**



**Table F.3: Cumulative abnormal returns: the case of positive and negative overreactions, USDCAD**

| Hour  | Positive overreactions |                             | Negative overreactions |                             |
|-------|------------------------|-----------------------------|------------------------|-----------------------------|
|       | Abnormal returns       | Cumulative abnormal returns | Abnormal returns       | Cumulative abnormal returns |
| 0:00  | -0.0001                | -0.0001                     | 0.0005                 | 0.0005                      |
| 1:00  | 0.0001                 | 0.0000                      | 0.0004                 | 0.0009                      |
| 2:00  | 0.0000                 | 0.0000                      | -0.0001                | 0.0008                      |
| 3:00  | -0.0002                | -0.0002                     | -0.0003                | 0.0005                      |
| 4:00  | -0.0001                | -0.0003                     | 0.0000                 | 0.0004                      |
| 5:00  | -0.0001                | -0.0004                     | 0.0003                 | 0.0007                      |
| 6:00  | 0.0002                 | -0.0002                     | 0.0004                 | 0.0011                      |
| 7:00  | 0.0000                 | -0.0002                     | -0.0001                | 0.0010                      |
| 8:00  | 0.0003                 | 0.0001                      | 0.0000                 | 0.0010                      |
| 9:00  | 0.0003                 | 0.0004                      | 0.0001                 | <b>0.0012</b>               |
| 10:00 | -0.0004                | 0.0000                      | -0.0006                | 0.0006                      |
| 11:00 | 0.0004                 | 0.0004                      | -0.0005                | 0.0001                      |
| 12:00 | 0.0003                 | 0.0007                      | -0.0004                | -0.0002                     |
| 13:00 | 0.0002                 | 0.0009                      | -0.0001                | -0.0003                     |
| 14:00 | -0.0005                | 0.0004                      | -0.0001                | -0.0004                     |
| 15:00 | 0.0005                 | 0.0009                      | -0.0007                | -0.0011                     |
| 16:00 | 0.0002                 | 0.0011                      | -0.0007                | -0.0018                     |
| 17:00 | 0.0003                 | <b>0.0014</b>               | 0.0001                 | -0.0017                     |
| 18:00 | 0.0000                 | <b>0.0014</b>               | 0.0002                 | -0.0015                     |
| 19:00 | -0.0003                | 0.0011                      | 0.0002                 | -0.0014                     |
| 20:00 | 0.0000                 | 0.0011                      | -0.0001                | -0.0015                     |
| 21:00 | -0.0008                | 0.0003                      | 0.0001                 | -0.0014                     |
| 22:00 | -0.0003                | 0.0000                      | 0.0000                 | -0.0014                     |
| 23:00 | 0.0000                 | 0.0001                      | -0.0001                | -0.0015                     |

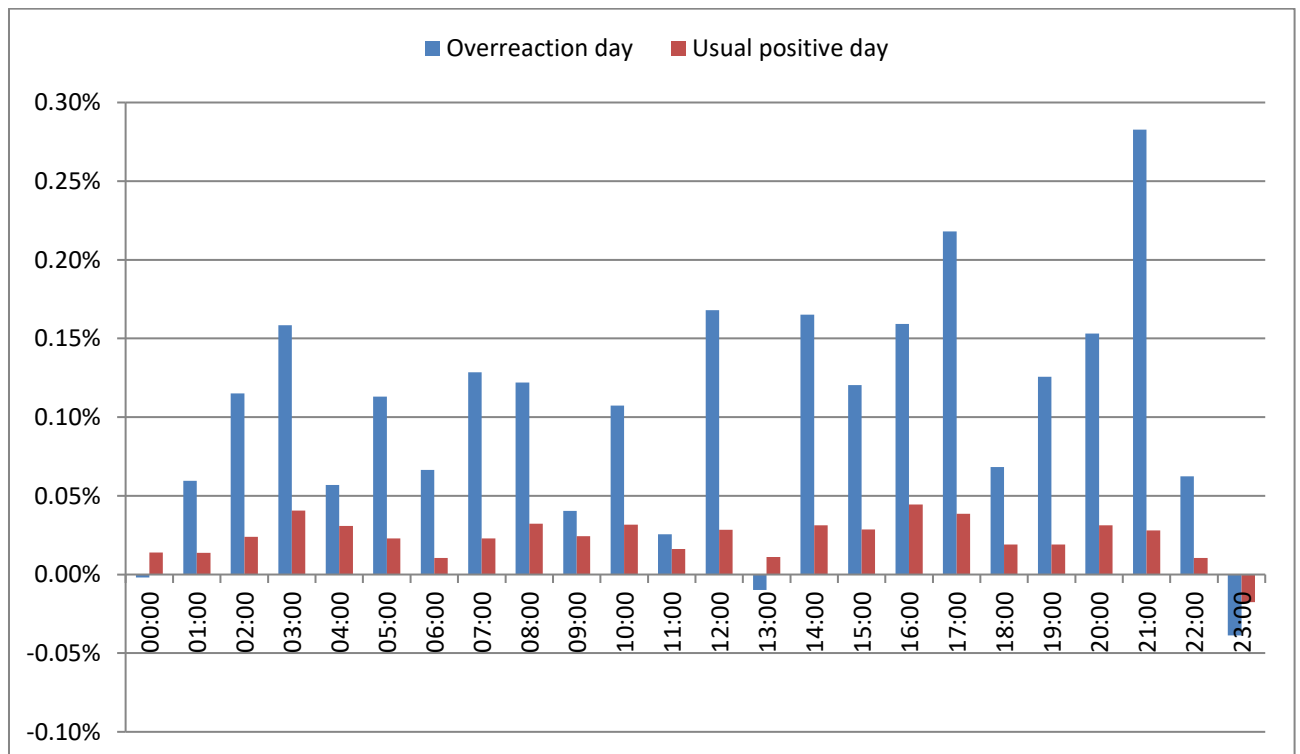
## Appendix G

### AUDUSD: day of overreaction

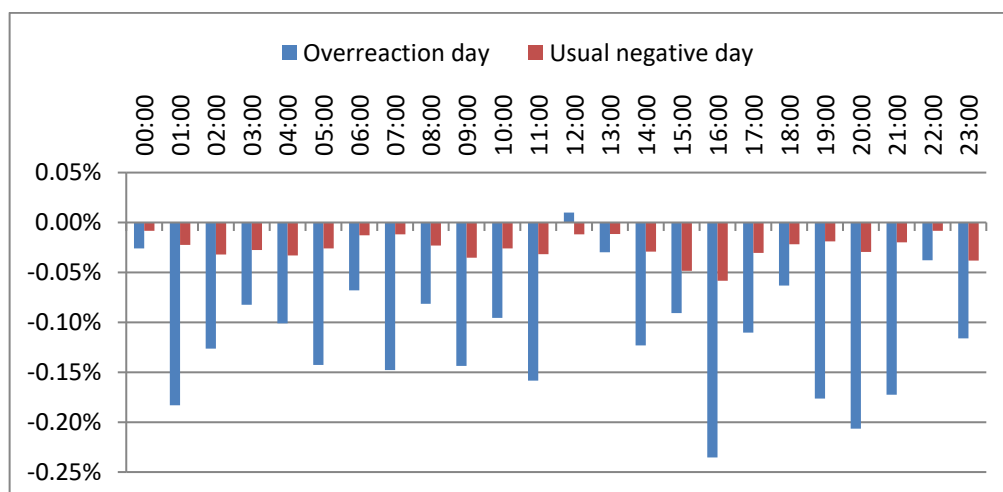
**Table G.1: Descriptive statistics for AUDUSD data: daily, hourly, days with positive and negative returns**

| Parameter      | Daily data | Positive days | Negative days | Hourly data | Positive days (hourly data) | Negative days (hourly data) |
|----------------|------------|---------------|---------------|-------------|-----------------------------|-----------------------------|
| Mean           | 0.0000     | 0.0057        | -0.0063       | 0.0000      | 0.0002                      | -0.0003                     |
| Standard error | 0.0002     | 0.0002        | 0.0002        | 0.0000      | 0.0000                      | 0.0000                      |
| Median         | 0.0002     | 0.0042        | -0.0044       | 0.0000      | 0.0001                      | -0.0001                     |
| Mode           | 0.0079     | 0.0079        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Std. Dev.      | 0.0089     | 0.0061        | 0.0069        | 0.0018      | 0.0017                      | 0.0018                      |
| Variance       | 0.0001     | 0.0000        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Kurtosis       | 13.7517    | 35.9662       | 30.0117       | 23.8962     | 18.8843                     | 28.3470                     |
| Skewness       | -0.3583    | 4.2355        | -4.0556       | -0.3232     | 1.1639                      | -1.6546                     |
| Minimum        | -0.0823    | 0.0000        | -0.0823       | -0.0371     | -0.0213                     | -0.0371                     |
| Maximum        | 0.0840     | 0.0840        | 0.0000        | 0.0284      | 0.0284                      | 0.0258                      |
| Sum            | -0.1063    | 8.3510        | -8.4573       | -0.1590     | 7.8791                      | -8.0374                     |
| Observations   | 2805       | 1461          | 1346          | 65000       | 33691                       | 31356                       |

**Figure G.1: Average hourly returns on overreaction and normal days: the case of positive overreactions, AUDUSD**



**Figure G.2: Average hourly returns on overreaction and normal days: the case of negative overreactions, AUDUSD**



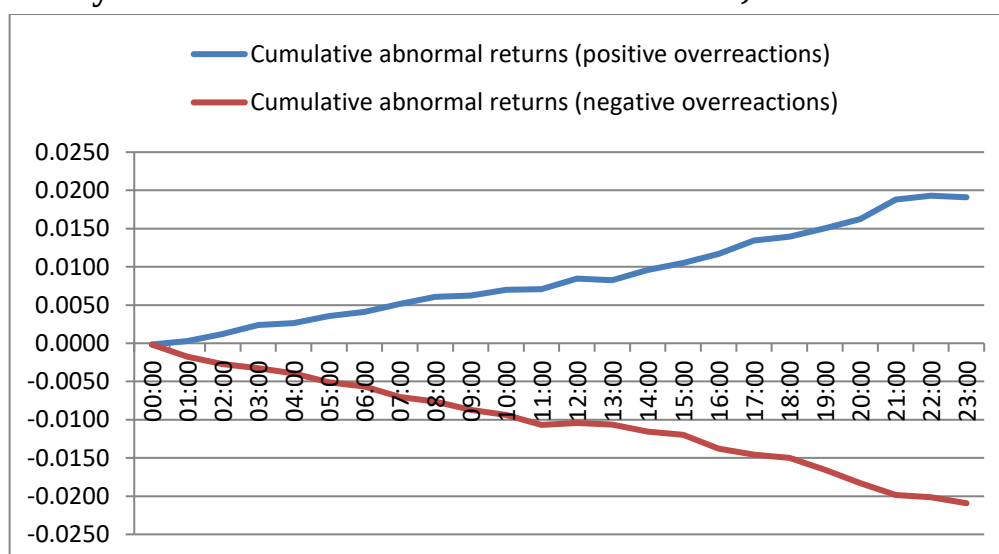
**Table G.2: t-test of hourly returns on overreaction and normal days: the case of positive overreactions, AUDUSD**

| Hour         | Average return on positive overreaction 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 criterion |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|-------------|
| 0:00         | 0.0000                                           | 0.0023                  | 58                          | 0.0001                                                 | 0.0013                  | 1300                       | -0.53       |
| 1:00         | 0.0006                                           | 0.0035                  | 58                          | 0.0001                                                 | 0.0016                  | 1300                       | 1.00        |
| <b>2:00</b>  | <b>0.0012</b>                                    | <b>0.0036</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0018</b>           | <b>1300</b>                | <b>1.91</b> |
| <b>3:00</b>  | <b>0.0016</b>                                    | <b>0.0047</b>           | <b>58</b>                   | <b>0.0004</b>                                          | <b>0.0018</b>           | <b>1300</b>                | <b>1.91</b> |
| 4:00         | 0.0006                                           | 0.0033                  | 58                          | 0.0003                                                 | 0.0017                  | 1300                       | 0.60        |
| <b>5:00</b>  | <b>0.0011</b>                                    | <b>0.0030</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0014</b>           | <b>1300</b>                | <b>2.28</b> |
| 6:00         | 0.0007                                           | 0.0030                  | 58                          | 0.0001                                                 | 0.0013                  | 1300                       | 1.44        |
| <b>7:00</b>  | <b>0.0013</b>                                    | <b>0.0030</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0014</b>           | <b>1300</b>                | <b>2.67</b> |
| <b>8:00</b>  | <b>0.0012</b>                                    | <b>0.0037</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0017</b>           | <b>1300</b>                | <b>1.86</b> |
| 9:00         | 0.0004                                           | 0.0040                  | 58                          | 0.0002                                                 | 0.0018                  | 1300                       | 0.30        |
| <b>10:00</b> | <b>0.0011</b>                                    | <b>0.0025</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0017</b>           | <b>1300</b>                | <b>2.24</b> |
| 11:00        | 0.0003                                           | 0.0033                  | 58                          | 0.0002                                                 | 0.0016                  | 1300                       | 0.21        |
| <b>12:00</b> | <b>0.0017</b>                                    | <b>0.0034</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0016</b>           | <b>1300</b>                | <b>3.11</b> |
| 13:00        | -0.0001                                          | 0.0033                  | 58                          | 0.0001                                                 | 0.0015                  | 1300                       | -0.47       |
| <b>14:00</b> | <b>0.0017</b>                                    | <b>0.0049</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0020</b>           | <b>1300</b>                | <b>2.05</b> |
| 15:00        | 0.0012                                           | 0.0046                  | 58                          | 0.0003                                                 | 0.0022                  | 1300                       | 1.52        |
| 16:00        | 0.0016                                           | 0.0055                  | 58                          | 0.0004                                                 | 0.0023                  | 1300                       | 1.59        |
| <b>17:00</b> | <b>0.0022</b>                                    | <b>0.0031</b>           | <b>58</b>                   | <b>0.0004</b>                                          | <b>0.0019</b>           | <b>1300</b>                | <b>4.43</b> |
| 18:00        | 0.0007                                           | 0.0033                  | 58                          | 0.0002                                                 | 0.0016                  | 1300                       | 1.13        |
| 19:00        | 0.0013                                           | 0.0057                  | 58                          | 0.0002                                                 | 0.0018                  | 1300                       | 1.43        |
| <b>20:00</b> | <b>0.0015</b>                                    | <b>0.0051</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0019</b>           | <b>1300</b>                | <b>1.82</b> |
| <b>21:00</b> | <b>0.0028</b>                                    | <b>0.0076</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0022</b>           | <b>1300</b>                | <b>2.56</b> |
| 22:00        | 0.0006                                           | 0.0030                  | 58                          | 0.0001                                                 | 0.0012                  | 1300                       | 1.33        |
| 23:00        | -0.0004                                          | 0.0018                  | 58                          | -0.0002                                                | 0.0010                  | 1300                       | -0.87       |

**Table G.3: t-test of hourly returns on overreaction and normal days: the case of negative overreactions, AUDUSD**

| Hour         | Average return on negative overreaction day (OD) | Standard deviation (OD) | Number of observations (OD) | Average return on usual day with negative returns (UD) | Standard deviation (UD) | Number of observation (UD) | t criterion  |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|--------------|
| 0:00         | -0.0003                                          | 0.0023                  | 58                          | -0.0001                                                | 0.0013                  | 1300                       | -0.58        |
| <b>1:00</b>  | <b>-0.0018</b>                                   | <b>0.0034</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0016</b>           | <b>1300</b>                | <b>-3.62</b> |
| <b>2:00</b>  | <b>-0.0013</b>                                   | <b>0.0031</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0018</b>           | <b>1300</b>                | <b>-2.30</b> |
| <b>3:00</b>  | <b>-0.0008</b>                                   | <b>0.0024</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0018</b>           | <b>1300</b>                | <b>-1.74</b> |
| <b>4:00</b>  | <b>-0.0010</b>                                   | <b>0.0029</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0017</b>           | <b>1300</b>                | <b>-1.77</b> |
| <b>5:00</b>  | <b>-0.0014</b>                                   | <b>0.0040</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0017</b>           | <b>1300</b>                | <b>-2.23</b> |
| 6:00         | -0.0007                                          | 0.0032                  | 58                          | -0.0001                                                | 0.0014                  | 1300                       | -1.32        |
| <b>7:00</b>  | <b>-0.0015</b>                                   | <b>0.0057</b>           | <b>58</b>                   | <b>-0.0001</b>                                         | <b>0.0018</b>           | <b>1300</b>                | <b>-1.82</b> |
| 8:00         | -0.0008                                          | 0.0033                  | 58                          | -0.0002                                                | 0.0017                  | 1300                       | -1.32        |
| <b>9:00</b>  | <b>-0.0014</b>                                   | <b>0.0035</b>           | <b>58</b>                   | <b>-0.0004</b>                                         | <b>0.0019</b>           | <b>1300</b>                | <b>-2.35</b> |
| 10:00        | -0.0010                                          | 0.0049                  | 58                          | -0.0003                                                | 0.0020                  | 1300                       | -1.09        |
| 11:00        | -0.0016                                          | 0.0057                  | 58                          | -0.0003                                                | 0.0020                  | 1300                       | -1.69        |
| 12:00        | 0.0001                                           | 0.0038                  | 58                          | -0.0001                                                | 0.0016                  | 1300                       | 0.43         |
| 13:00        | -0.0003                                          | 0.0039                  | 58                          | -0.0001                                                | 0.0016                  | 1300                       | -0.36        |
| 14:00        | -0.0012                                          | 0.0048                  | 58                          | -0.0003                                                | 0.0021                  | 1300                       | -1.48        |
| 15:00        | -0.0009                                          | 0.0048                  | 58                          | -0.0005                                                | 0.0022                  | 1300                       | -0.67        |
| <b>16:00</b> | <b>-0.0024</b>                                   | <b>0.0064</b>           | <b>58</b>                   | <b>-0.0006</b>                                         | <b>0.0024</b>           | <b>1300</b>                | <b>-2.08</b> |
| 17:00        | -0.0011                                          | 0.0044                  | 58                          | -0.0003                                                | 0.0022                  | 1300                       | -1.38        |
| 18:00        | -0.0006                                          | 0.0033                  | 58                          | -0.0002                                                | 0.0017                  | 1300                       | -0.94        |
| <b>19:00</b> | <b>-0.0018</b>                                   | <b>0.0053</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0019</b>           | <b>1300</b>                | <b>-2.27</b> |
| <b>20:00</b> | <b>-0.0021</b>                                   | <b>0.0047</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0019</b>           | <b>1300</b>                | <b>-2.88</b> |
| <b>21:00</b> | <b>-0.0017</b>                                   | <b>0.0065</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0022</b>           | <b>1300</b>                | <b>-1.78</b> |
| 22:00        | -0.0004                                          | 0.0033                  | 58                          | -0.0001                                                | 0.0014                  | 1300                       | -0.69        |
| 23:00        | -0.0012                                          | 0.0041                  | 58                          | -0.0004                                                | 0.0014                  | 1300                       | -1.46        |

**Figure G.3: Dynamics of cumulative abnormal returns, AUDUSD**



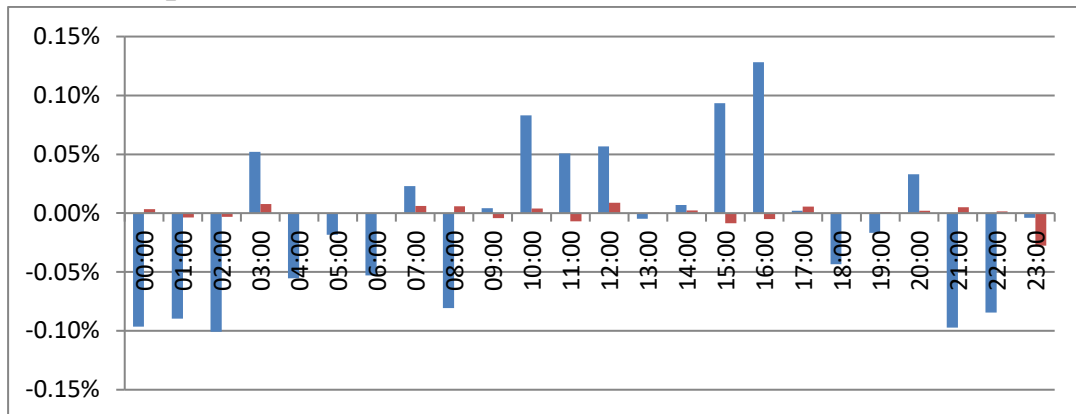
**Table G.4: Cumulative abnormal returns: the case of positive and negative overreactions, AUDUSD**

| Hour  | Positive overreactions |         |                    | Positive overreactions |         |                    |
|-------|------------------------|---------|--------------------|------------------------|---------|--------------------|
|       | Abnormal returns       | CAR     | Overreaction cross | Abnormal returns       | CAR     | Overreaction cross |
| 0:00  | -0.0002                | -0.0002 | 0.0177             | -0.0002                | -0.0002 | -0.0175            |
| 1:00  | 0.0005                 | 0.0003  | 0.0171             | -0.0016                | -0.0018 | -0.0157            |
| 2:00  | 0.0009                 | 0.0012  | 0.0160             | -0.0009                | -0.0027 | -0.0144            |
| 3:00  | 0.0012                 | 0.0024  | 0.0144             | -0.0006                | -0.0033 | -0.0136            |
| 4:00  | 0.0003                 | 0.0027  | 0.0138             | -0.0007                | -0.0040 | -0.0126            |
| 5:00  | 0.0009                 | 0.0036  | 0.0127             | -0.0012                | -0.0051 | -0.0111            |
| 6:00  | 0.0006                 | 0.0041  | 0.0120             | -0.0006                | -0.0057 | -0.0105            |
| 7:00  | 0.0011                 | 0.0052  | 0.0107             | -0.0014                | -0.0070 | -0.0090            |
| 8:00  | 0.0009                 | 0.0061  | 0.0095             | -0.0006                | -0.0076 | -0.0082            |
| 9:00  | 0.0002                 | 0.0062  | 0.0091             | -0.0011                | -0.0087 | -0.0067            |
| 10:00 | 0.0008                 | 0.0070  | 0.0080             | -0.0007                | -0.0094 | -0.0058            |
| 11:00 | 0.0001                 | 0.0071  | 0.0078             | -0.0013                | -0.0107 | -0.0042            |
| 12:00 | 0.0014                 | 0.0085  | 0.0061             | 0.0002                 | -0.0104 | -0.0043            |
| 13:00 | -0.0002                | 0.0083  | 0.0062             | -0.0002                | -0.0106 | -0.0040            |
| 14:00 | 0.0013                 | 0.0096  | 0.0046             | -0.0009                | -0.0116 | -0.0028            |
| 15:00 | 0.0009                 | 0.0105  | 0.0033             | -0.0004                | -0.0120 | <b>-0.0019</b>     |
| 16:00 | 0.0011                 | 0.0117  | <b>0.0018</b>      | -0.0018                | -0.0138 | <b>0.0005</b>      |
| 17:00 | 0.0018                 | 0.0135  | <b>-0.0004</b>     | -0.0008                | -0.0146 | 0.0016             |
| 18:00 | 0.0005                 | 0.0140  | -0.0011            | -0.0004                | -0.0150 | 0.0022             |
| 19:00 | 0.0011                 | 0.0150  | -0.0024            | -0.0016                | -0.0166 | 0.0040             |
| 20:00 | 0.0012                 | 0.0162  | -0.0039            | -0.0018                | -0.0183 | 0.0061             |
| 21:00 | 0.0025                 | 0.0188  | -0.0067            | -0.0015                | -0.0199 | 0.0078             |
| 22:00 | 0.0005                 | 0.0193  | -0.0073            | -0.0003                | -0.0201 | 0.0082             |
| 23:00 | -0.0002                | 0.0191  | -0.0070            | -0.0008                | -0.0209 | 0.0093             |

## Appendix H

### AUDUSD: day after the overreaction

**Figure H.1: Average hourly returns on day after the overreaction and normal days: the case of positive overreactions, AUDUSD**

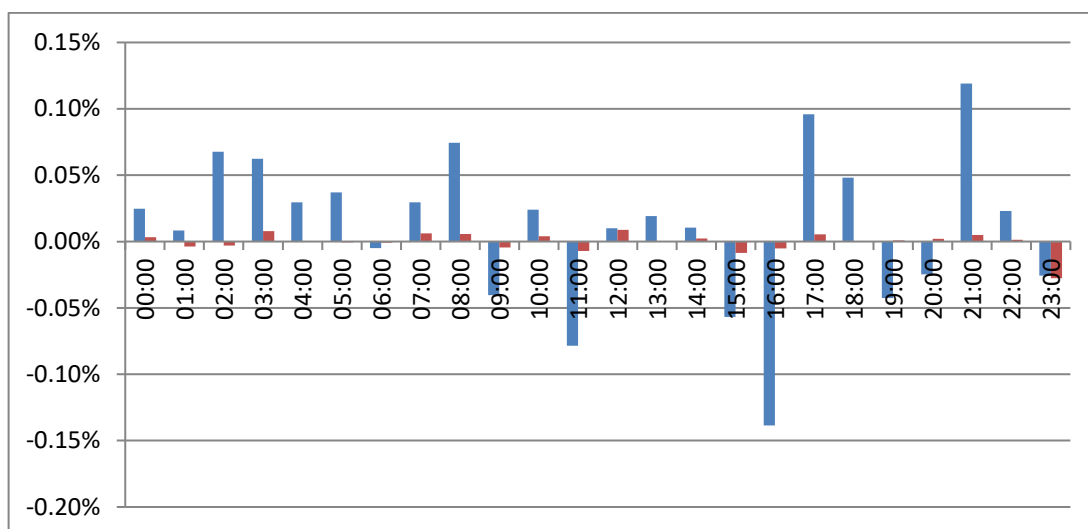


**Table H.1: t-test of hourly returns on the day after the overreaction and normal days: the case of positive overreactions, AUDUSD**

| Hour        | Average return on day after positive overreaction (OD) | Standard deviation (OD) | Number of observations (OD) | Average return on usual day (UD) | Standard deviation (UD) | Number of observation (UD) | t criterion  |
|-------------|--------------------------------------------------------|-------------------------|-----------------------------|----------------------------------|-------------------------|----------------------------|--------------|
| <b>0:00</b> | <b>-0.0010</b>                                         | <b>0.0030</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0013</b>           | <b>1300</b>                | <b>-2.49</b> |
| <b>1:00</b> | <b>-0.0009</b>                                         | <b>0.0039</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0016</b>           | <b>1300</b>                | <b>-1.66</b> |
| <b>2:00</b> | <b>-0.0010</b>                                         | <b>0.0031</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0018</b>           | <b>1300</b>                | <b>-2.40</b> |
| 3:00        | 0.0005                                                 | 0.0026                  | 58                          | 0.0001                           | 0.0018                  | 1300                       | 1.30         |
| 4:00        | -0.0006                                                | 0.0032                  | 58                          | 0.0000                           | 0.0017                  | 1300                       | -1.31        |
| 5:00        | -0.0002                                                | 0.0031                  | 58                          | 0.0000                           | 0.0016                  | 1300                       | -0.43        |
| 6:00        | -0.0005                                                | 0.0026                  | 58                          | 0.0000                           | 0.0013                  | 1300                       | -1.51        |
| 7:00        | 0.0002                                                 | 0.0028                  | 58                          | 0.0001                           | 0.0016                  | 1300                       | 0.46         |
| 8:00        | -0.0008                                                | 0.0042                  | 58                          | 0.0001                           | 0.0017                  | 1300                       | -1.56        |
| 9:00        | 0.0000                                                 | 0.0037                  | 58                          | 0.0000                           | 0.0019                  | 1300                       | 0.17         |
| 10:00       | 0.0008                                                 | 0.0033                  | 58                          | 0.0000                           | 0.0019                  | 1300                       | 1.84         |
| 11:00       | 0.0005                                                 | 0.0042                  | 58                          | -0.0001                          | 0.0018                  | 1300                       | 1.03         |
| 12:00       | 0.0006                                                 | 0.0031                  | 58                          | 0.0001                           | 0.0016                  | 1300                       | 1.17         |
| 13:00       | 0.0000                                                 | 0.0034                  | 58                          | 0.0000                           | 0.0016                  | 1300                       | -0.11        |
| 14:00       | 0.0001                                                 | 0.0045                  | 58                          | 0.0000                           | 0.0021                  | 1300                       | 0.08         |
| 15:00       | 0.0009                                                 | 0.0044                  | 58                          | -0.0001                          | 0.0022                  | 1300                       | 1.77         |
| 16:00       | 0.0013                                                 | 0.0057                  | 58                          | -0.0001                          | 0.0024                  | 1300                       | 1.78         |
| 17:00       | 0.0000                                                 | 0.0036                  | 58                          | 0.0001                           | 0.0021                  | 1300                       | -0.07        |
| 18:00       | -0.0004                                                | 0.0028                  | 58                          | 0.0000                           | 0.0017                  | 1300                       | -1.16        |
| 19:00       | -0.0002                                                | 0.0045                  | 58                          | 0.0000                           | 0.0019                  | 1300                       | -0.29        |
| 20:00       | 0.0003                                                 | 0.0037                  | 58                          | 0.0000                           | 0.0019                  | 1300                       | 0.62         |
| 21:00       | -0.0010                                                | 0.0056                  | 58                          | 0.0000                           | 0.0022                  | 1300                       | -1.38        |
| 22:00       | -0.0008                                                | 0.0032                  | 58                          | 0.0000                           | 0.0013                  | 1300                       | -2.06        |
| 23:00       | 0.0000                                                 | 0.0024                  | 58                          | -0.0003                          | 0.0012                  | 1300                       | 0.75         |



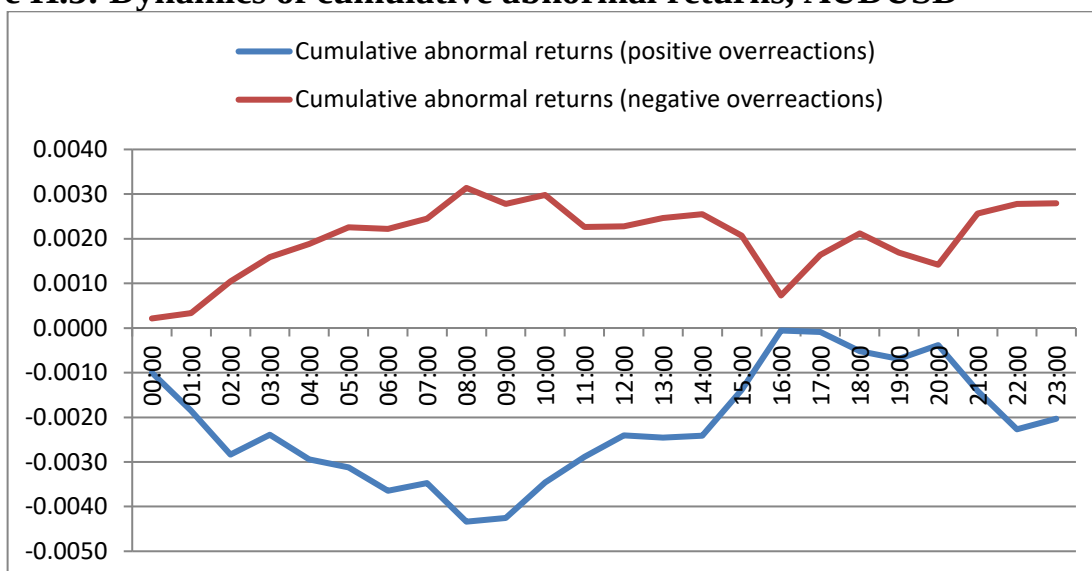
**Figure H.2: Average hourly returns on the day after the overreaction and normal days: the case of negative overreactions, AUDUSD**



**Table H.2: t-test of hourly returns on the day after the overreaction and normal days: the case of negative overreactions, AUDUSD**

| Hour  | Average return on day after negative overreaction (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  | 0.0002                                                 | 0.0038                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | 0.43        |
| 1:00  | 0.0001                                                 | 0.0025                  | 58                          | 0.0000                           | 0.0016                  | 2700                       | 0.36        |
| 2:00  | 0.0007                                                 | 0.0040                  | 58                          | 0.0000                           | 0.0018                  | 2700                       | 1.36        |
| 3:00  | 0.0006                                                 | 0.0045                  | 58                          | 0.0001                           | 0.0018                  | 2700                       | 0.93        |
| 4:00  | 0.0003                                                 | 0.0030                  | 58                          | 0.0000                           | 0.0017                  | 2700                       | 0.75        |
| 5:00  | 0.0004                                                 | 0.0030                  | 58                          | 0.0000                           | 0.0016                  | 2700                       | 0.94        |
| 6:00  | 0.0000                                                 | 0.0035                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | -0.09       |
| 7:00  | 0.0003                                                 | 0.0029                  | 58                          | 0.0001                           | 0.0016                  | 2700                       | 0.61        |
| 8:00  | 0.0007                                                 | 0.0036                  | 58                          | 0.0001                           | 0.0017                  | 2700                       | 1.45        |
| 9:00  | -0.0004                                                | 0.0044                  | 58                          | 0.0000                           | 0.0019                  | 2700                       | -0.62       |
| 10:00 | 0.0002                                                 | 0.0034                  | 58                          | 0.0000                           | 0.0019                  | 2700                       | 0.45        |
| 11:00 | -0.0008                                                | 0.0029                  | 58                          | -0.0001                          | 0.0018                  | 2700                       | -1.87       |
| 12:00 | 0.0001                                                 | 0.0037                  | 58                          | 0.0001                           | 0.0016                  | 2700                       | 0.02        |
| 13:00 | 0.0002                                                 | 0.0038                  | 58                          | 0.0000                           | 0.0016                  | 2700                       | 0.38        |
| 14:00 | 0.0001                                                 | 0.0041                  | 58                          | 0.0000                           | 0.0021                  | 2700                       | 0.15        |
| 15:00 | -0.0006                                                | 0.0044                  | 58                          | -0.0001                          | 0.0022                  | 2700                       | -0.82       |
| 16:00 | -0.0014                                                | 0.0050                  | 58                          | -0.0001                          | 0.0024                  | 2700                       | -2.04       |
| 17:00 | 0.0010                                                 | 0.0043                  | 58                          | 0.0001                           | 0.0021                  | 2700                       | 1.61        |
| 18:00 | 0.0005                                                 | 0.0038                  | 58                          | 0.0000                           | 0.0017                  | 2700                       | 0.97        |
| 19:00 | -0.0004                                                | 0.0048                  | 58                          | 0.0000                           | 0.0019                  | 2700                       | -0.69       |
| 20:00 | -0.0002                                                | 0.0042                  | 58                          | 0.0000                           | 0.0019                  | 2700                       | -0.49       |
| 21:00 | 0.0012                                                 | 0.0076                  | 58                          | 0.0000                           | 0.0022                  | 2700                       | 1.15        |
| 22:00 | 0.0002                                                 | 0.0034                  | 58                          | 0.0000                           | 0.0013                  | 2700                       | 0.48        |
| 23:00 | -0.0003                                                | 0.0027                  | 58                          | -0.0003                          | 0.0012                  | 2700                       | 0.06        |

**Figure H.3: Dynamics of cumulative abnormal returns, AUDUSD**



**Table H.3: Cumulative abnormal returns: the case of positive and negative overreactions, AUDUSD**

| Hour  | Positive overreactions |                             | Negative overreactions |                             |
|-------|------------------------|-----------------------------|------------------------|-----------------------------|
|       | Abnormal returns       | Cumulative abnormal returns | Abnormal returns       | Cumulative abnormal returns |
| 0:00  | -0.0010                | -0.0010                     | 0.0002                 | 0.0002                      |
| 1:00  | -0.0009                | -0.0019                     | 0.0001                 | 0.0003                      |
| 2:00  | -0.0010                | -0.0028                     | 0.0007                 | 0.0010                      |
| 3:00  | 0.0004                 | -0.0024                     | 0.0005                 | 0.0016                      |
| 4:00  | -0.0006                | -0.0029                     | 0.0003                 | 0.0019                      |
| 5:00  | -0.0002                | -0.0031                     | 0.0004                 | 0.0023                      |
| 6:00  | -0.0005                | -0.0036                     | 0.0000                 | 0.0022                      |
| 7:00  | 0.0002                 | -0.0035                     | 0.0002                 | 0.0025                      |
| 8:00  | -0.0009                | <b>-0.0043</b>              | 0.0007                 | <b>0.0031</b>               |
| 9:00  | 0.0001                 | <b>-0.0043</b>              | -0.0004                | 0.0028                      |
| 10:00 | 0.0008                 | -0.0035                     | 0.0002                 | 0.0030                      |
| 11:00 | 0.0006                 | -0.0029                     | -0.0007                | 0.0023                      |
| 12:00 | 0.0005                 | -0.0024                     | 0.0000                 | 0.0023                      |
| 13:00 | -0.0001                | -0.0025                     | 0.0002                 | 0.0025                      |
| 14:00 | 0.0000                 | -0.0024                     | 0.0001                 | 0.0025                      |
| 15:00 | 0.0010                 | -0.0014                     | -0.0005                | 0.0021                      |
| 16:00 | 0.0013                 | -0.0001                     | -0.0013                | 0.0007                      |
| 17:00 | 0.0000                 | -0.0001                     | 0.0009                 | 0.0016                      |
| 18:00 | -0.0004                | -0.0005                     | 0.0005                 | 0.0021                      |
| 19:00 | -0.0002                | -0.0007                     | -0.0004                | 0.0017                      |
| 20:00 | 0.0003                 | -0.0004                     | -0.0003                | 0.0014                      |
| 21:00 | -0.0010                | -0.0014                     | 0.0011                 | 0.0026                      |
| 22:00 | -0.0009                | -0.0023                     | 0.0002                 | 0.0028                      |
| 23:00 | 0.0002                 | -0.0020                     | 0.0000                 | 0.0028                      |

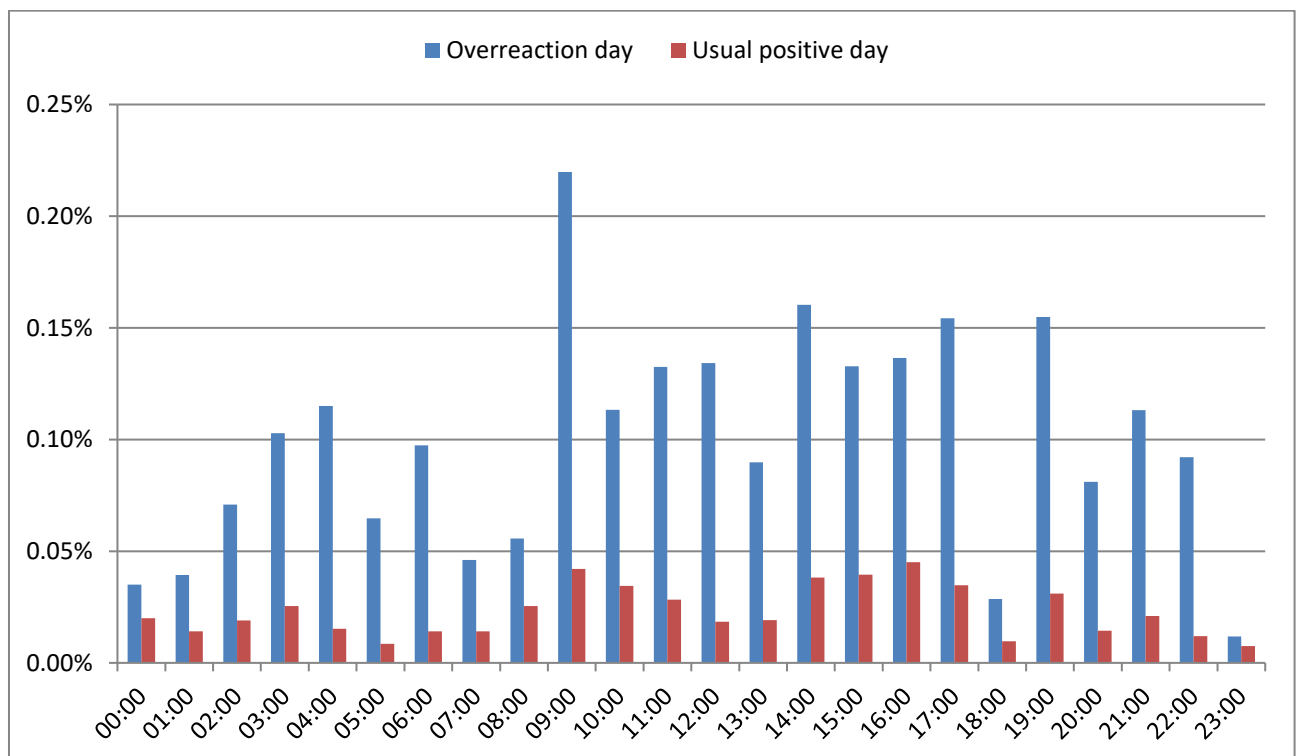
## Appendix I

### EURJPY: day of overreaction

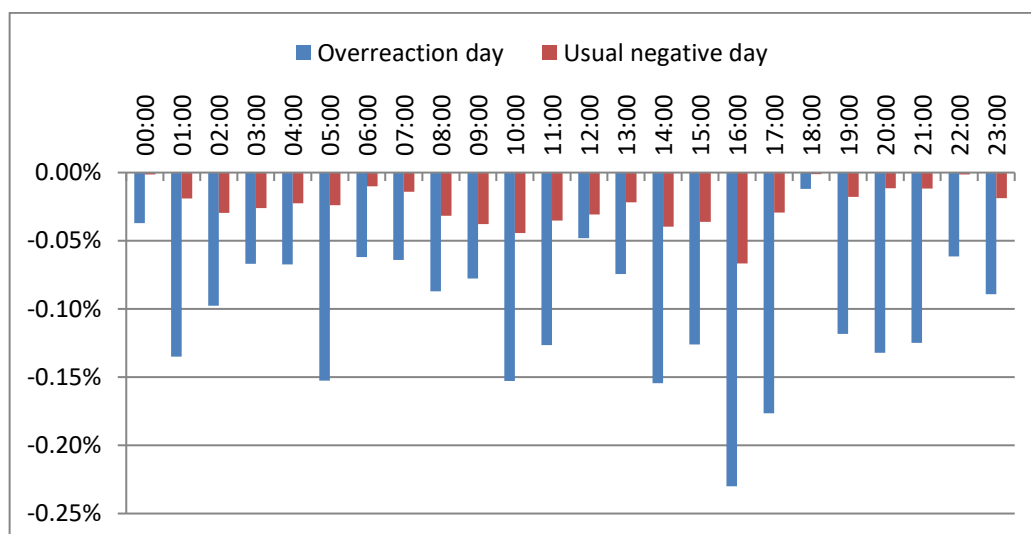
**Table I.1: Descriptive statistics for EURJPY data: daily, hourly, days with positive and negative returns**

| Parameter      | Daily data | Positive days | Negative days | Hourly data | Positive days (hourly data) | Negative days (hourly data) |
|----------------|------------|---------------|---------------|-------------|-----------------------------|-----------------------------|
| Mean           | 0.0000     | 0.0055        | -0.0059       | 0.0000      | 0.0002                      | -0.0002                     |
| Standard error | 0.0002     | 0.0002        | 0.0002        | 0.0000      | 0.0000                      | 0.0000                      |
| Median         | 0.0001     | 0.0039        | -0.0041       | 0.0000      | 0.0001                      | -0.0001                     |
| Mode           | 0.0000     | 0.0000        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Std. Dev.      | 0.0083     | 0.0058        | 0.0062        | 0.0017      | 0.0016                      | 0.0017                      |
| Variance       | 0.0001     | 0.0000        | 0.0000        | 0.0000      | 0.0000                      | 0.0000                      |
| Kurtosis       | 9.2115     | 31.7532       | 14.4825       | 32.8456     | 23.2972                     | 41.0261                     |
| Skewness       | -0.0355    | 3.7926        | -2.8803       | -0.5922     | 1.0958                      | -2.0210                     |
| Minimum        | -0.0638    | 0.0000        | -0.0638       | -0.0496     | -0.0318                     | -0.0496                     |
| Maximum        | 0.0832     | 0.0832        | 0.0000        | 0.0306      | 0.0306                      | 0.0196                      |
| Sum            | -0.1191    | 7.9224        | -8.0415       | -0.1324     | 7.6661                      | -7.7983                     |
| Observations   | 2809       | 1440          | 1374          | 64992       | 33246                       | 31843                       |

**Figure I.1: Average hourly returns on overreaction and normal days: the case of positive overreactions, EURJPY**



**Figure I.2: Average hourly returns on overreaction and normal days: the case of negative overreactions, EURJPY**



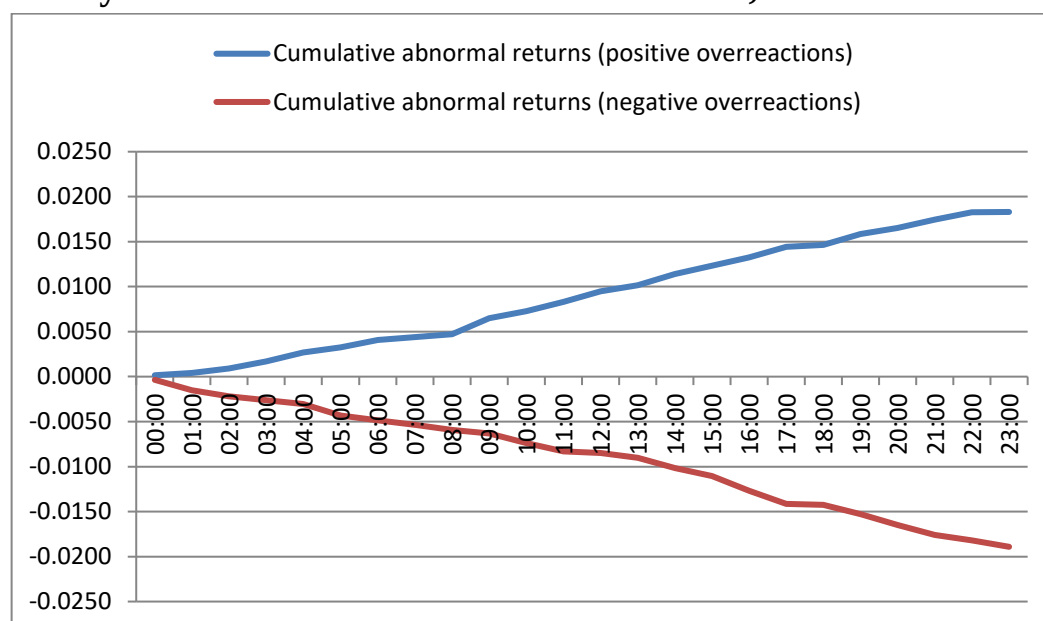
**Table I.2: t-test of hourly returns on overreaction and normal days: the case of positive overreactions, EURJPY**

| Hour         | Average return on positive overreaction 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 criterion |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|-------------|
| 0:00         | 0.0004                                           | 0.0024                  | 58                          | 0.0002                                                 | 0.0012                  | 2500                       | 0.49        |
| 1:00         | 0.0004                                           | 0.0041                  | 58                          | 0.0001                                                 | 0.0017                  | 2500                       | 0.47        |
| 2:00         | 0.0007                                           | 0.0026                  | 58                          | 0.0002                                                 | 0.0015                  | 2500                       | 1.50        |
| <b>3:00</b>  | <b>0.0010</b>                                    | <b>0.0025</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0016</b>           | <b>2500</b>                | <b>2.34</b> |
| <b>4:00</b>  | <b>0.0011</b>                                    | <b>0.0024</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0014</b>           | <b>2500</b>                | <b>3.19</b> |
| <b>5:00</b>  | <b>0.0006</b>                                    | <b>0.0021</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0013</b>           | <b>2500</b>                | <b>2.04</b> |
| 6:00         | 0.0010                                           | 0.0042                  | 58                          | 0.0001                                                 | 0.0014                  | 2500                       | 1.50        |
| 7:00         | 0.0005                                           | 0.0019                  | 58                          | 0.0001                                                 | 0.0012                  | 2500                       | 1.25        |
| 8:00         | 0.0006                                           | 0.0039                  | 58                          | 0.0003                                                 | 0.0017                  | 2500                       | 0.58        |
| <b>9:00</b>  | <b>0.0022</b>                                    | <b>0.0035</b>           | <b>58</b>                   | <b>0.0004</b>                                          | <b>0.0021</b>           | <b>2500</b>                | <b>3.82</b> |
| <b>10:00</b> | <b>0.0011</b>                                    | <b>0.0025</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0019</b>           | <b>2500</b>                | <b>2.38</b> |
| <b>11:00</b> | <b>0.0013</b>                                    | <b>0.0029</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0016</b>           | <b>2500</b>                | <b>2.68</b> |
| <b>12:00</b> | <b>0.0013</b>                                    | <b>0.0029</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0015</b>           | <b>2500</b>                | <b>3.00</b> |
| <b>13:00</b> | <b>0.0009</b>                                    | <b>0.0031</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0015</b>           | <b>2500</b>                | <b>1.71</b> |
| <b>14:00</b> | <b>0.0016</b>                                    | <b>0.0042</b>           | <b>58</b>                   | <b>0.0004</b>                                          | <b>0.0021</b>           | <b>2500</b>                | <b>2.19</b> |
| <b>15:00</b> | <b>0.0013</b>                                    | <b>0.0043</b>           | <b>58</b>                   | <b>0.0004</b>                                          | <b>0.0021</b>           | <b>2500</b>                | <b>1.66</b> |
| <b>16:00</b> | <b>0.0014</b>                                    | <b>0.0041</b>           | <b>58</b>                   | <b>0.0005</b>                                          | <b>0.0023</b>           | <b>2500</b>                | <b>1.70</b> |
| <b>17:00</b> | <b>0.0015</b>                                    | <b>0.0035</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0018</b>           | <b>2500</b>                | <b>2.63</b> |
| 18:00        | 0.0003                                           | 0.0028                  | 58                          | 0.0001                                                 | 0.0015                  | 2500                       | 0.51        |
| <b>19:00</b> | <b>0.0015</b>                                    | <b>0.0040</b>           | <b>58</b>                   | <b>0.0003</b>                                          | <b>0.0016</b>           | <b>2500</b>                | <b>2.34</b> |
| 20:00        | 0.0008                                           | 0.0034                  | 58                          | 0.0001                                                 | 0.0016                  | 2500                       | 1.49        |
| <b>21:00</b> | <b>0.0011</b>                                    | <b>0.0044</b>           | <b>58</b>                   | <b>0.0002</b>                                          | <b>0.0016</b>           | <b>2500</b>                | <b>1.60</b> |
| <b>22:00</b> | <b>0.0009</b>                                    | <b>0.0036</b>           | <b>58</b>                   | <b>0.0001</b>                                          | <b>0.0012</b>           | <b>2500</b>                | <b>1.69</b> |
| 23:00        | 0.0001                                           | 0.0019                  | 58                          | 0.0001                                                 | 0.0009                  | 2500                       | 0.17        |

**Table I.3: t-test of hourly returns on overreaction and normal days: the case of negative overreactions, EURJPY**

| Hour         | Average return on negative overreaction day (OD) | Standard deviation (OD) | Number of observations (OD) | Average return on usual day with negative returns (UD) | Standard deviation (UD) | Number of observation (UD) | t criterion  |
|--------------|--------------------------------------------------|-------------------------|-----------------------------|--------------------------------------------------------|-------------------------|----------------------------|--------------|
| 0:00         | -0.0004                                          | 0.0024                  | 58                          | 0.0000                                                 | 0.0014                  | 2500                       | -1.13        |
| <b>1:00</b>  | <b>-0.0013</b>                                   | <b>0.0028</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0015</b>           | <b>2500</b>                | <b>-3.17</b> |
| <b>2:00</b>  | <b>-0.0010</b>                                   | <b>0.0028</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0016</b>           | <b>2500</b>                | <b>-1.82</b> |
| <b>3:00</b>  | <b>-0.0007</b>                                   | <b>0.0019</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0014</b>           | <b>2500</b>                | <b>-1.61</b> |
| 4:00         | -0.0007                                          | 0.0023                  | 58                          | -0.0002                                                | 0.0013                  | 2500                       | -1.50        |
| 5:00         | -0.0015                                          | 0.0062                  | 58                          | -0.0002                                                | 0.0019                  | 2500                       | -1.58        |
| 6:00         | -0.0006                                          | 0.0035                  | 58                          | -0.0001                                                | 0.0014                  | 2500                       | -1.12        |
| 7:00         | -0.0006                                          | 0.0027                  | 58                          | -0.0001                                                | 0.0014                  | 2500                       | -1.41        |
| 8:00         | -0.0009                                          | 0.0037                  | 58                          | -0.0003                                                | 0.0018                  | 2500                       | -1.15        |
| 9:00         | -0.0008                                          | 0.0036                  | 58                          | -0.0004                                                | 0.0021                  | 2500                       | -0.83        |
| <b>10:00</b> | <b>-0.0015</b>                                   | <b>0.0050</b>           | <b>58</b>                   | <b>-0.0004</b>                                         | <b>0.0022</b>           | <b>2500</b>                | <b>-1.66</b> |
| <b>11:00</b> | <b>-0.0013</b>                                   | <b>0.0035</b>           | <b>58</b>                   | <b>-0.0004</b>                                         | <b>0.0018</b>           | <b>2500</b>                | <b>-1.96</b> |
| 12:00        | -0.0005                                          | 0.0035                  | 58                          | -0.0003                                                | 0.0016                  | 2500                       | -0.38        |
| 13:00        | -0.0007                                          | 0.0037                  | 58                          | -0.0002                                                | 0.0017                  | 2500                       | -1.08        |
| <b>14:00</b> | <b>-0.0015</b>                                   | <b>0.0036</b>           | <b>58</b>                   | <b>-0.0004</b>                                         | <b>0.0021</b>           | <b>2500</b>                | <b>-2.40</b> |
| <b>15:00</b> | <b>-0.0013</b>                                   | <b>0.0043</b>           | <b>58</b>                   | <b>-0.0004</b>                                         | <b>0.0021</b>           | <b>2500</b>                | <b>-1.59</b> |
| <b>16:00</b> | <b>-0.0023</b>                                   | <b>0.0046</b>           | <b>58</b>                   | <b>-0.0007</b>                                         | <b>0.0023</b>           | <b>2500</b>                | <b>-2.72</b> |
| <b>17:00</b> | <b>-0.0018</b>                                   | <b>0.0048</b>           | <b>58</b>                   | <b>-0.0003</b>                                         | <b>0.0021</b>           | <b>2500</b>                | <b>-2.34</b> |
| 18:00        | -0.0001                                          | 0.0030                  | 58                          | 0.0000                                                 | 0.0016                  | 2500                       | -0.28        |
| <b>19:00</b> | <b>-0.0012</b>                                   | <b>0.0045</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0017</b>           | <b>2500</b>                | <b>-1.69</b> |
| <b>20:00</b> | <b>-0.0013</b>                                   | <b>0.0053</b>           | <b>58</b>                   | <b>-0.0001</b>                                         | <b>0.0018</b>           | <b>2500</b>                | <b>-1.73</b> |
| <b>21:00</b> | <b>-0.0012</b>                                   | <b>0.0051</b>           | <b>58</b>                   | <b>-0.0001</b>                                         | <b>0.0017</b>           | <b>2500</b>                | <b>-1.69</b> |
| 22:00        | -0.0006                                          | 0.0038                  | 58                          | 0.0000                                                 | 0.0013                  | 2500                       | -1.20        |
| <b>23:00</b> | <b>-0.0009</b>                                   | <b>0.0032</b>           | <b>58</b>                   | <b>-0.0002</b>                                         | <b>0.0012</b>           | <b>2500</b>                | <b>-1.67</b> |

**Figure I.3: Dynamics of cumulative abnormal returns, EURJPY**



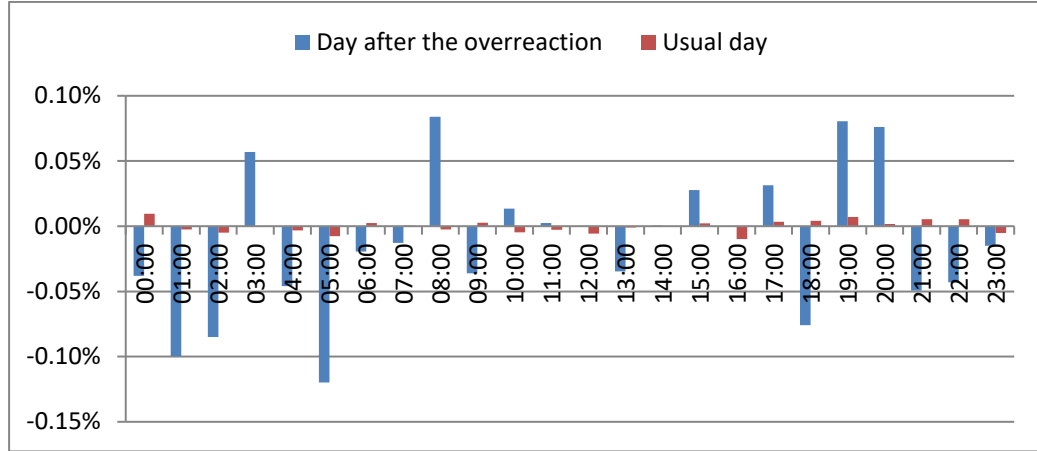
**Table I.4: Cumulative abnormal returns: the case of positive and negative overreactions, EURJPY**

| Hour  | Positive overreactions |        |                    | Positive overreactions |         |                    |
|-------|------------------------|--------|--------------------|------------------------|---------|--------------------|
|       | Abnormal returns       | CAR    | Overreaction cross | Abnormal returns       | CAR     | Overreaction cross |
| 0:00  | 0.0002                 | 0.0002 | 0.0161             | -0.0004                | -0.0004 | -0.0162            |
| 1:00  | 0.0003                 | 0.0004 | 0.0158             | -0.0012                | -0.0015 | -0.0149            |
| 2:00  | 0.0005                 | 0.0009 | 0.0150             | -0.0007                | -0.0022 | -0.0139            |
| 3:00  | 0.0008                 | 0.0017 | 0.0140             | -0.0004                | -0.0026 | -0.0132            |
| 4:00  | 0.0010                 | 0.0027 | 0.0129             | -0.0004                | -0.0031 | -0.0126            |
| 5:00  | 0.0006                 | 0.0033 | 0.0122             | -0.0013                | -0.0043 | -0.0110            |
| 6:00  | 0.0008                 | 0.0041 | 0.0113             | -0.0005                | -0.0049 | -0.0104            |
| 7:00  | 0.0003                 | 0.0044 | 0.0108             | -0.0005                | -0.0054 | -0.0098            |
| 8:00  | 0.0003                 | 0.0047 | 0.0102             | -0.0006                | -0.0059 | -0.0089            |
| 9:00  | 0.0018                 | 0.0065 | 0.0080             | -0.0004                | -0.0063 | -0.0081            |
| 10:00 | 0.0008                 | 0.0073 | 0.0069             | -0.0011                | -0.0074 | -0.0066            |
| 11:00 | 0.0010                 | 0.0083 | 0.0056             | -0.0009                | -0.0083 | -0.0053            |
| 12:00 | 0.0012                 | 0.0095 | 0.0042             | -0.0002                | -0.0085 | -0.0049            |
| 13:00 | 0.0007                 | 0.0102 | 0.0033             | -0.0005                | -0.0090 | -0.0041            |
| 14:00 | 0.0012                 | 0.0114 | 0.0017             | -0.0011                | -0.0102 | -0.0026            |
| 15:00 | 0.0009                 | 0.0123 | <b>0.0004</b>      | -0.0009                | -0.0111 | <b>-0.0013</b>     |
| 16:00 | 0.0009                 | 0.0132 | <b>-0.0010</b>     | -0.0016                | -0.0127 | <b>0.0010</b>      |
| 17:00 | 0.0012                 | 0.0144 | -0.0025            | -0.0015                | -0.0142 | 0.0028             |
| 18:00 | 0.0002                 | 0.0146 | -0.0028            | -0.0001                | -0.0143 | 0.0029             |
| 19:00 | 0.0012                 | 0.0159 | -0.0043            | -0.0010                | -0.0153 | 0.0041             |
| 20:00 | 0.0007                 | 0.0165 | -0.0051            | -0.0012                | -0.0165 | 0.0054             |
| 21:00 | 0.0009                 | 0.0175 | -0.0063            | -0.0011                | -0.0176 | 0.0066             |
| 22:00 | 0.0008                 | 0.0183 | -0.0072            | -0.0006                | -0.0182 | 0.0072             |
| 23:00 | 0.0000                 | 0.0183 | -0.0073            | -0.0007                | -0.0189 | 0.0081             |

## Appendix J

### EURJPY: day after the overreaction

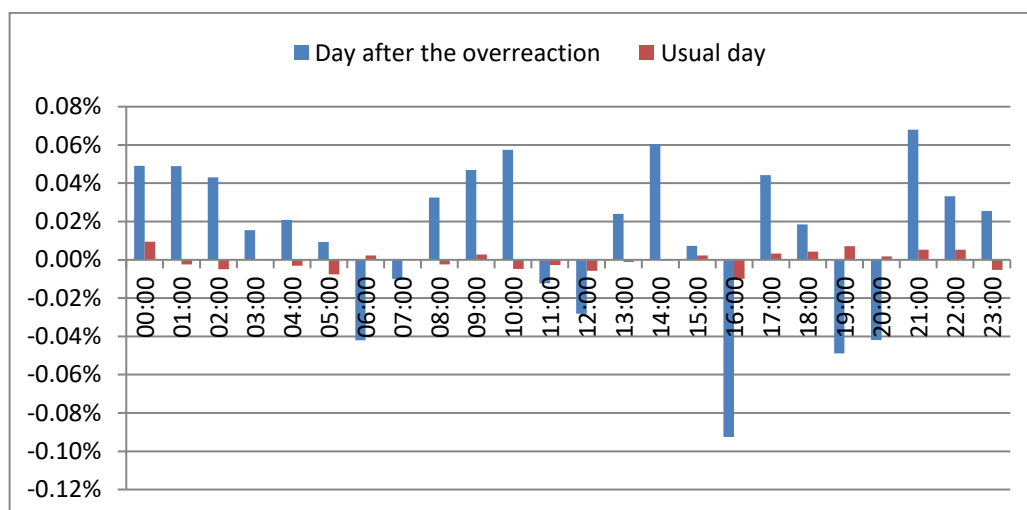
**Figure J.1: Average hourly returns on day after the overreaction and normal days: the case of positive overreactions, EURJPY**



**Table J.1: t-test of hourly returns on the day after the overreaction and normal days: the case of positive overreactions, EURJPY**

| Hour        | Average return on day after positive overreaction (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        | -0.0004                                                | 0.0027                  | 58                          | 0.0001                           | 0.0013                  | 2500                       | -1.36        |
| <b>1:00</b> | <b>-0.0010</b>                                         | <b>0.0031</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0016</b>           | <b>2500</b>                | <b>-2.40</b> |
| <b>2:00</b> | <b>-0.0009</b>                                         | <b>0.0032</b>           | <b>58</b>                   | <b>0.0000</b>                    | <b>0.0016</b>           | <b>2500</b>                | <b>-1.92</b> |
| 3:00        | 0.0006                                                 | 0.0026                  | 58                          | 0.0000                           | 0.0016                  | 2500                       | 1.64         |
| 4:00        | -0.0005                                                | 0.0021                  | 58                          | 0.0000                           | 0.0014                  | 2500                       | -1.51        |
| 5:00        | -0.0012                                                | 0.0067                  | 58                          | -0.0001                          | 0.0016                  | 2500                       | -1.27        |
| 6:00        | -0.0002                                                | 0.0026                  | 58                          | 0.0000                           | 0.0014                  | 2500                       | -0.65        |
| 7:00        | -0.0001                                                | 0.0018                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | -0.57        |
| 8:00        | 0.0008                                                 | 0.0039                  | 58                          | 0.0000                           | 0.0017                  | 2500                       | 1.70         |
| 9:00        | -0.0004                                                | 0.0034                  | 58                          | 0.0000                           | 0.0021                  | 2500                       | -0.88        |
| 10:00       | 0.0001                                                 | 0.0042                  | 58                          | 0.0000                           | 0.0021                  | 2500                       | 0.33         |
| 11:00       | 0.0000                                                 | 0.0028                  | 58                          | 0.0000                           | 0.0018                  | 2500                       | 0.13         |
| 12:00       | 0.0000                                                 | 0.0031                  | 58                          | -0.0001                          | 0.0016                  | 2500                       | 0.15         |
| 13:00       | -0.0003                                                | 0.0033                  | 58                          | 0.0000                           | 0.0016                  | 2500                       | -0.77        |
| 14:00       | 0.0000                                                 | 0.0036                  | 58                          | 0.0000                           | 0.0021                  | 2500                       | 0.01         |
| 15:00       | 0.0003                                                 | 0.0035                  | 58                          | 0.0000                           | 0.0022                  | 2500                       | 0.55         |
| 16:00       | 0.0000                                                 | 0.0042                  | 58                          | -0.0001                          | 0.0024                  | 2500                       | 0.18         |
| 17:00       | 0.0003                                                 | 0.0029                  | 58                          | 0.0000                           | 0.0020                  | 2500                       | 0.72         |
| 18:00       | -0.0008                                                | 0.0025                  | 58                          | 0.0000                           | 0.0015                  | 2500                       | -2.46        |
| 19:00       | 0.0008                                                 | 0.0031                  | 58                          | 0.0001                           | 0.0017                  | 2500                       | 1.78         |
| 20:00       | 0.0008                                                 | 0.0028                  | 58                          | 0.0000                           | 0.0017                  | 2500                       | 1.99         |
| 21:00       | -0.0005                                                | 0.0032                  | 58                          | 0.0001                           | 0.0016                  | 2500                       | -1.31        |
| 22:00       | -0.0004                                                | 0.0022                  | 58                          | 0.0001                           | 0.0013                  | 2500                       | -1.68        |
| 23:00       | -0.0001                                                | 0.0015                  | 58                          | -0.0001                          | 0.0011                  | 2500                       | -0.49        |

**Figure J.2: Average hourly returns on the day after the overreaction and normal days: the case of negative overreactions, EURJPY**

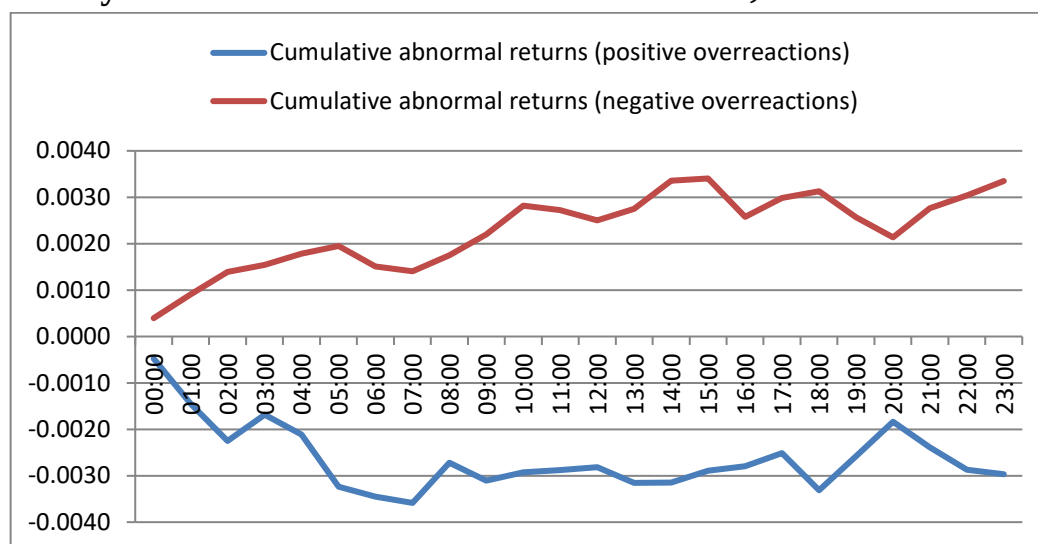


**Table J.2: t-test of hourly returns on the day after the overreaction and normal days: the case of negative overreactions, EURJPY**

| Hour  | Average return on day after negative overreaction (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  | 0.0005                                                 | 0.0032                  | 58                          | 0.0001                           | 0.0013                  | 2500                       | 0.95        |
| 1:00  | 0.0005                                                 | 0.0037                  | 58                          | 0.0000                           | 0.0016                  | 2500                       | 1.06        |
| 2:00  | 0.0004                                                 | 0.0032                  | 58                          | 0.0000                           | 0.0016                  | 2500                       | 1.14        |
| 3:00  | 0.0002                                                 | 0.0025                  | 58                          | 0.0000                           | 0.0016                  | 2500                       | 0.47        |
| 4:00  | 0.0002                                                 | 0.0028                  | 58                          | 0.0000                           | 0.0014                  | 2500                       | 0.65        |
| 5:00  | 0.0001                                                 | 0.0028                  | 58                          | -0.0001                          | 0.0016                  | 2500                       | 0.45        |
| 6:00  | -0.0004                                                | 0.0034                  | 58                          | 0.0000                           | 0.0014                  | 2500                       | -0.98       |
| 7:00  | -0.0001                                                | 0.0028                  | 58                          | 0.0000                           | 0.0013                  | 2500                       | -0.29       |
| 8:00  | 0.0003                                                 | 0.0033                  | 58                          | 0.0000                           | 0.0017                  | 2500                       | 0.80        |
| 9:00  | 0.0005                                                 | 0.0042                  | 58                          | 0.0000                           | 0.0021                  | 2500                       | 0.80        |
| 10:00 | 0.0006                                                 | 0.0033                  | 58                          | 0.0000                           | 0.0021                  | 2500                       | 1.42        |
| 11:00 | -0.0001                                                | 0.0027                  | 58                          | 0.0000                           | 0.0018                  | 2500                       | -0.26       |
| 12:00 | -0.0003                                                | 0.0027                  | 58                          | -0.0001                          | 0.0016                  | 2500                       | -0.62       |
| 13:00 | 0.0002                                                 | 0.0032                  | 58                          | 0.0000                           | 0.0016                  | 2500                       | 0.59        |
| 14:00 | 0.0006                                                 | 0.0037                  | 58                          | 0.0000                           | 0.0021                  | 2500                       | 1.23        |
| 15:00 | 0.0001                                                 | 0.0036                  | 58                          | 0.0000                           | 0.0022                  | 2500                       | 0.11        |
| 16:00 | -0.0009                                                | 0.0054                  | 58                          | -0.0001                          | 0.0024                  | 2500                       | -1.16       |
| 17:00 | 0.0004                                                 | 0.0041                  | 58                          | 0.0000                           | 0.0020                  | 2500                       | 0.75        |
| 18:00 | 0.0002                                                 | 0.0038                  | 58                          | 0.0000                           | 0.0015                  | 2500                       | 0.29        |
| 19:00 | -0.0005                                                | 0.0033                  | 58                          | 0.0001                           | 0.0017                  | 2500                       | -1.27       |
| 20:00 | -0.0004                                                | 0.0056                  | 58                          | 0.0000                           | 0.0017                  | 2500                       | -0.59       |
| 21:00 | 0.0007                                                 | 0.0055                  | 58                          | 0.0001                           | 0.0016                  | 2500                       | 0.86        |
| 22:00 | 0.0003                                                 | 0.0021                  | 58                          | 0.0001                           | 0.0013                  | 2500                       | 0.99        |
| 23:00 | 0.0003                                                 | 0.0024                  | 58                          | -0.0001                          | 0.0011                  | 2500                       | 0.97        |



**Figure J.3: Dynamics of cumulative abnormal returns, EURJPY**



**Table J.3: Cumulative abnormal returns: the case of positive and negative overreactions, EURJPY**

| Hour  | Positive overreactions |                             | Negative overreactions |                             |
|-------|------------------------|-----------------------------|------------------------|-----------------------------|
|       | Abnormal returns       | Cumulative abnormal returns | Abnormal returns       | Cumulative abnormal returns |
| 0:00  | -0.0005                | -0.0005                     | 0.0004                 | 0.0004                      |
| 1:00  | -0.0010                | -0.0014                     | 0.0005                 | 0.0009                      |
| 2:00  | -0.0008                | -0.0023                     | 0.0005                 | 0.0014                      |
| 3:00  | 0.0006                 | -0.0017                     | 0.0002                 | 0.0015                      |
| 4:00  | -0.0004                | -0.0021                     | 0.0002                 | 0.0018                      |
| 5:00  | -0.0011                | -0.0032                     | 0.0002                 | 0.0020                      |
| 6:00  | -0.0002                | -0.0035                     | -0.0004                | 0.0015                      |
| 7:00  | -0.0001                | <b>-0.0036</b>              | -0.0001                | 0.0014                      |
| 8:00  | 0.0009                 | -0.0027                     | 0.0004                 | 0.0018                      |
| 9:00  | -0.0004                | -0.0031                     | 0.0004                 | 0.0022                      |
| 10:00 | 0.0002                 | -0.0029                     | 0.0006                 | 0.0028                      |
| 11:00 | 0.0001                 | -0.0029                     | -0.0001                | 0.0027                      |
| 12:00 | 0.0001                 | -0.0028                     | -0.0002                | 0.0025                      |
| 13:00 | -0.0003                | -0.0032                     | 0.0003                 | 0.0027                      |
| 14:00 | 0.0000                 | -0.0031                     | 0.0006                 | 0.0034                      |
| 15:00 | 0.0003                 | -0.0029                     | 0.0001                 | <b>0.0034</b>               |
| 16:00 | 0.0001                 | -0.0028                     | -0.0008                | 0.0026                      |
| 17:00 | 0.0003                 | -0.0025                     | 0.0004                 | 0.0030                      |
| 18:00 | -0.0008                | -0.0033                     | 0.0001                 | 0.0031                      |
| 19:00 | 0.0007                 | -0.0026                     | -0.0006                | 0.0026                      |
| 20:00 | 0.0007                 | -0.0018                     | -0.0004                | 0.0021                      |
| 21:00 | -0.0005                | -0.0024                     | 0.0006                 | 0.0028                      |
| 22:00 | -0.0005                | -0.0029                     | 0.0003                 | 0.0030                      |
| 23:00 | -0.0001                | -0.0030                     | 0.0003                 | 0.0033                      |