Information arrival, jumps and cojumps in European financial markets: Evidence using tick by tick data

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Abstract

This paper investigates jumps and cojumps in European financial markets around the major U.S macroeconomic news announcements employing more than six years of high frequency data on stock indices, currency and interest rate futures. The findings show that while the U.S macroeconomic announcements cause significant jumps on all asset classes, European equity markets are found to be more responsive. Moreover, there is a strong correlation between the type of news and direction of the jumps. Significant cojumps caused by the U.S macroeconomic surprises across European stock indices futures are also reported. The time series analyses show that the European financial markets experienced more frequent and sizeable jumps during the recent global financial crisis. Similarly, more frequent cojumps are also reported across European equity markets during the same period.

JEL classification: G13; G14

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1. Introduction

The idea that macroeconomic fundamentals may affect financial markets is by now well established. More recent papers have focused on the information arrival and price discovery process using high frequency intraday data [e.g., Andersen et al. (2003, 2007), Gürkaynak and Wolfers (2006)]. The findings in those papers suggest that macroeconomic news announcements may be responsible for generating jumps and cojumps in financial markets.[1] Jumps are defined as sudden and large discontinuities in the pricing process of financial markets. Cojumps arise when jumps occur contemporaneously in multiple markets. Understanding the characterization and causes of jumps is central to asset pricing and financial management.[2] It is also important to consider the extent to which jumps occur simultaneously across different asset classes, such as stock indices, interest rate and currency market futures. Beine, Candelon and Piplack. (2009) argue that investors and speculators who follow real time trading strategies are interested in high-frequency interrelations of asset markets to optimally time their portfolio rebalancing. Therefore, common sources of news and relation of different asset classes to fundamentals help us understand jump characteristics across markets [Lahaye, Laurent and Neely (2011)].

The objective of this paper is to investigate the intraday jumps and cojumps in European financial markets around key U.S macroeconomic news announcements. We use very high frequency data on stock indices futures, i.e., Euro Stoxx50, CAC40, SMI, and DAX30 as well as the 3-month EURIBOR and EUR/USD futures. The idea that U.S macroeconomic news announcements significantly affect volatility in European financial markets is essentially motivated by the recent empirical findings in Harju and Hussain (2011), Hussain (2011) and Andersson (2010) etc., indicating that the U.S macroeconomic news announcements are clearly associated with the volatility spikes in the European financial markets. Moreover, Nikkinen and Sahlström (2004) show that while the U.S scheduled macroeconomic news announcements have a significant impact on the implied volatility in European stock markets, domestic news releases are found to be unimportant. Wongswan (2006) documents a large and significant response of global equity indices including European markets to the U.S monetary policy announcement surprises at short time horizons. Therefore, given the recent

empirical findings, we mainly focus on analyzing the role of U.S macroeconomic announcements in creating jumps and cojumps across European financial markets.[3]

We utilize the non-parametric statistic of Lee and Mykland (2008) to detect jumps on high frequency data spanning more than six years. The Lee-Mykland technique to identify intraday jumps allows us to study the role of scheduled macroeconomic announcements in creating jumps. In the spirit of Lahaye, Laurent and Neely (2011), we also use this statistic to investigate multivariate issues and test whether U.S macro announcements cause cojumps across multiple European financial markets. The results show that while the U.S macroeconomic announcements cause significant jumps on all asset classes, European equity markets are found to be the more responsive. Moreover, there is a strong correlation between the type of news and direction of the jumps. Significant cojumps caused by the U.S macroeconomic surprises across European stock indices futures are also reported. The time series analysis suggests that both the frequency and the size of jumps in European financial markets have increased since the start of the global credit crisis in 2007. Accordingly, more frequent cojumps are reported across European equity markets after the recent financial slowdown.

The recent literature on the relationship between economic fundamentals and financial markets can be divided into two main categories. The first strand of literature has analyzed the impact of macroeconomic news announcements on intraday returns and volatilities in financial markets.[4] The second thread has linked scheduled macro announcements to jumps and cojumps in financial markets. For example, Huang (2007) estimates daily jumps with bi-power variation on 10 years of S&P 500 and U.S T-bonds data. The author finds that major jumps are associated with news days compared to the non-news days, and that the fixed-income market is more responsive to the macroeconomic news announcements. Han (2008) analyzes the intraday effects of the U.S and the European Monetary Union (EMU) macroeconomic shocks on both the conditional means and the conditional variances of the high frequency Dollar–Euro returns. The author argues that macroeconomic shocks may have significant effects on exchange rates when examined at the high frequency that are not visible at lower frequency levels.[5]

Our paper extends the second strand of literature in the following directions. Firstly, we analyze jumps and cojumps around key U.S macroeconomic releases in several European financial markets and across different asset classes. Some earlier papers, such as Andersson (2010) and Harju and Hussain (2011) have analyzed the impact of U.S macroeconomic policy releases on the intraday returns and volatilities in European financial markets. But to the best of our knowledge, no study links jumps and cojumps in multiple European financial markets to the U.S macroeconomic indicators. Secondly, we estimate jumps at a very high frequency using intraday 5-minute data.[6] Lahaye, Laurent and Neely (2011) argue that these intraday estimates which are much more precise than daily or even lower frequency intraday jump measures enable us to describe jumps and cojumps and to carefully link them to macroeconomic indicators. Thirdly, The magnitude and the direction of jumps and co-jumps for each relevant U.S macroeconomic indicator is reported. Finally, we also examines whether the global credit crisis started in 2007 has significantly changed the jump dynamics in European financial markets. Overall, contrary to the majority of earlier studies which mainly focused on the U.S markets, this paper presents new empirical evidence on the European financial markets.

The rest of the paper is structured as follows: The data are described in section two. The methodology is presented in section three. Section four describes the empirical findings and a summary and conclusions follow in section five.

2. Data

2.1. Financial markets data

We use tick by tick level 1 quote prices to construct 5 minute data for the four main European equity indices futures, i.e. the FESX (Euro Stoxx50), FCE (CAC40 of French), FSMI (SMI of Switzerland) and FDAX (DAX30 of Germany) as well as the 3-month EURIBOR and EUR/USD futures, covering the period from 26 May 2003 until 31 January 2010.[7]

The description of the acquired dataset is given in Table 1. FDAX, FCE, FSMI and FESX, are futures on DAX30 (German), CAC40 (French), SMI (Swiss) and Euro stoxx50 index, respectively. The Euro Stoxx50 index includes the 50 largest companies of the Euro zone. It contains 35% of French stocks,

covered by the CAC40 index and 33% of German stock, included in the DAX30. Euro Stoxx50, SMI and DAX30 index futures, traded on the EUREX, are constituted of 4 yearly contracts, which expire in the third week of March, June, September and December. CAC40 index futures are traded on EURONEXT with a monthly expiry, while the EUR/USD futures, traded on the Chicago Mercantile Exchange (CME), consist of 4 yearly contracts expiring on the third Friday of March, June, September and December. Three month Euro (EURIBOR) interest rate futures contracts (hereafter "Euribor Futures") are based on 3 month euro interbank deposit rates. For Euribor futures, 28 delivery months are available for trading, with the nearest six delivery months being consecutive calendar months. They are quoted as 100 minus the 3-month rate of interest.

Insert Table 1 about here

To limit the detection of spurious jumps due to market microstructure issues, we filter out mid-quote prices where the bid-ask spread exceeds 4 ticks. This technique eliminates all tick by tick quotes marked as potentially invalid by the data provider and faulty quotes outside of trading hours. For similar reasons, the first quote after each auction state resulting from technical problems on an exchange has also been removed. We then follow the same procedure as in Lee and Mykland (2008) and sample the mid-quote prices at fixed time intervals of 5 minutes in order to limit the market microstructure noise. The descriptive statistics of 5-minute returns are shown in Table 2.

Insert Table 2 about here

2.2. U.S macroeconomic announcements data

The announcement data consist of scheduled U.S macroeconomic news announcements for the period May 26, 2003 through January 31, 2010. These data contain date, time, actual release and the mean forecast for each macroeconomic indicator in our sample. The surprise is calculated as the difference between the actual value of the announced indicator and its mean forecast provided by the Bloomberg World Economic Calendar (WECO). Since units of measurements differ across economic variables, following Balduzzi, Elton, and Green (2001), we calculate standardized surprise. That is, we divide the surprise by its sample standard deviation to facilitate comparison of responses to different macro indicators.

The summary of the announcement data is given in Appendix A. There are total of 23 U.S macroeconomic news announcements in our sample.[8] Almost all the indicators are announced either at 14:30 Central European Time (CET) or 16:00 CET with the exception of Industrial production which is announced at 15:15 CET.[9]

3. Methodology

The methodology employed in this paper for detecting the jumps and cojumps in European financial markets around U.S macro-economic releases is based largely on the model proposed by Lee and Mykland (2008). The Lee-Mykland test statistic detects jumps by taking the ratio of the instantaneous volatility estimated with the realised bi-power variation on a fixed window K to the next realised return.

Let $r(t_i)$ be the log-return of stock S_i, i.e. $r(t_i) = \log\frac{S(t_i)}{S(t_{i-1})}$. The Lee-Mykland statistic, which detects if a jump occurred in the interval $(t_{i-1}; t_i]$, is given by $\mathcal{L}(i) = \frac{r(t_i)}{\widehat{\sigma(t_i)}}$.

The realised bi-power variation on a window K is estimated as

$$\widehat{\sigma(t_i)} = \sqrt{\frac{1}{K-2}\sum_{j=i-K+2}^{i-1} |r_j| \cdot |r_{j-1}|} \qquad (5)$$

Provided that the window size $K \in (\Delta t)^{\alpha}$ where $-1 < \alpha < -0.5$ and that the time between two observations $\Delta t = \max_i\{t_i - t_{i-1}\}$ is small, the null hypothesis of no jump at time t_i is rejected at 1% significant level if

$$\frac{|\mathcal{L}(i)| - C_n}{S_n} > 4.6001$$

where n is the number of observations, $c = \sqrt{\frac{2}{\pi}}$, $C_n = \frac{\sqrt{2\log n}}{c} - \frac{\log\pi + \log(\log n)}{2c\sqrt{2\log n}}$ and $S_n = \frac{1}{c\sqrt{2\log n}}$. We rely on Lee-Mykland (2008) test to detect jumps because it is more accurate and precise than the Barndorff-Nielsen and Shephard (2004) test. Lee-Mykland (2008) demonstrates that the likelihood of misclassification of jumps becomes negligible using high frequency data.

4. Empirical results

4.1. Descriptive Statistics of Jumps

Table 3 provides an overview of the identified jumps. The second panel in Table 3 [Jump day frequency] shows that number of days associated with jumps vary across asset classes. In accordance with the results reported by Lahaye, Laurent and Neely (2011), stock indices futures exhibit fewer jump days than on Euribor and EUR/USD Futures. European stock indices futures exhibit jumps on 15.72% to 27.67% of the sample days, while currency (EUR/USD) and interest rate (Euribor) futures jump on about 36% and 33% of the sample days, respectively. However, the number of jumps per day does not vary a great deal across different asset classes. While interest rate (Euribor) futures jump on average 3 times per jump day, the European equity and currency futures (EUR/USD) jump about 2 times on each jump day.

The number of jumps for each instrument is listed in the third panel of Table 3 [All jumps (absolute value)]. These descriptive statistics show that interest rate and currency futures jump more often than the European equity futures. For example, per observation, the EUR/USD and Euribor futures jump more than twice compared to the Euro Stoxx50 futures [P(jump (%)]. One explanation of such

phenomena for exchange rate, as suggested by Lahaye, Laurent and Neely (2011) is that they are subject to news from two countries, not just one, and probably because they experience more idiosyncratic liquidity shocks during slow trading in the 24-hour markets. The idiosyncratic liquidity shocks and other news items that are not part of our sample may also explain the relatively more frequent and larger jumps in 3-months Euribor futures.[10] Among the European stock indices futures, the French market exhibits highest number of jump days indicating higher volatility, confirming the findings of Harju and Hussain (2011).

Table 3 (panel 3) also shows that interest rate and currency futures exhibit relatively larger jumps compared to the stock indices futures. The average jump size [E(|jumpsize||jump)] for Euribor and EUR/USD Futures is 1.08 and 0.94, respectively, whereas the European equity indices experience comparatively moderate and similar jump size, ranging from 0.44 for FSMI (SMI) to 0.76 for FCE (CAC40). The coefficients of variation for absolute jumps [√(Var|jumpsize||jump)] also vary across markets, the highest being 0.82 for both Euribor and EUR/USD Futures, and the lowest, 0.32 for FSMI.

We now turn our attention to asymmetry in jumps frequency. The statistics reported in panel 4 and 5 of Table 3 suggest that there are about equal number of positive and negative jumps in interest rate and currency futures. However, European stock indices futures experience more negative jumps, indicating asymmetry. For example, as shown in the last panel of Table 3, 65% of all the observed jumps in FSMI are negative, while the corresponding number for the FDAX, FCE and FESX is 63 %, 57% and 59%, respectively.[11] Lahaye, Laurent and Neely (2011) note that equity markets tend to show more negative jumps than the Forex market. However, they find that the disparity between positive and negative jumps on equity markets is not statistically significant.

Insert table 3 about here

4.2. U.S Macroeconomic announcements and associated Jumps in European markets.

To measure the impacts of scheduled U.S macroeconomic surprises on European stock indices, interest rate and currency futures; we perform the Lee-Mykland (2008) test at 1% significance level on the 5-minute mid-quote prices from 26 May 2003 until 31 January 2010.[12] The descriptive results are depicted in Figure 1. These results suggest that as many as 19 out of 23 U.S macroeconomic indicators have statistically significant impact across all asset classes, including unemployment reports, the housing indicators, the two ISM reports and the consumer confidence. The U.S unemployment reports and house price index cause the highest percentage of jumps across European markets, the former being the most influential of all indicators.

Insert Figure 1 about here

Turning to the specific asset classes, numerous U.S macro indicators are found to have significant impact on European equity indices futures (Figure 2). The unemployment reports, net exports, price measures (e.g., CPI and PPI), initial jobless claims, and import price index are particularly more dominant in causing jumps in stock indices futures.[13] These results support the findings of Harju and Hussain (2011) indicating that the various U.S indicators including the unemployment reports have a significant impact across European equity markets.

Insert Figure 2 & 3 about here

Figure 3 displays the percentage of jumps in EUR/USD futures linked to the type of U.S macroeconomic news announcements. As seen in Figure 3, many U.S macro indicators cause significant jumps in EUR/USD futures. Particularly, forward looking measures, i.e., index of leading indicators and business inventories explain highest number of jumps in currency futures. However, the effect of U.S macro fundamentals on 3-month Euribor futures, is relatively subdued as illustrated in Figure 4. Only four macroeconomic indicators; gross domestic product (GDP), initial jobless

claims, factory orders and housing starts appear to be associated with significant jumps in Euribor futures.

Insert Figure 4 about here

We also look at the number of jumps linked to the time of U.S macroeconomic releases across all asset classes in our sample.[14] Our analysis reveals that 95.43% and 69.67% of all detected jumps in European equity futures are related to the U.S macroeconomic news announcements at 14:30 and 16:00 CET, respectively. For the Euribor and EUR/USD future, about 60 and 30 percent jumps occurring at 14:30 and 16:00 CET, respectively, are related to the release of U.S macroeconomic indicators. These results indicate greater responsiveness of European equity markets to the U.S fundamentals.

Another important observation is that there are differences in markets' response to different types of announcements. These results are consistent with some of the earlier findings indicating that asset classes respond differently to different announcements. Huang (2007), for example, found that the U.S fixed income markets are more responsive to the domestic macroeconomic announcements than equity markets. Lahaye, Laurent and Neely (2011) show that the propensity of macroeconomic surprises to create jumps differs across asset classes, i.e., exchanges rates, bonds and stock indices.

4.3. Size and sign of jumps associated with U.S macroeconomic announcements

In this section, we associate the direction and magnitude of jumps detected in all five markets with the type of macroeconomic surprises. Since we utilize the mean forecast for each macroeconomic announcement to calculate surprises, the magnitude and direction of jumps are related to the size and the sign of a given surprise, respectively. Appendix B reports the date and time of the jump, the market (product), the return computed as logarithm of the price ratio before and after the jump, the actual announcement along with its mean forecast value, and type of the news announced for each macroeconomic indicator causing a jump in European markets. We look at the direction of the jump based on news type, i.e., whether the surprise is a 'good news' or 'bad news'. Given the type of the

news, an announcement is classified as 'good news' (bad news) if the event is better (worse) than forecast and as 'bad news' (good news) otherwise.

Our results show that while most of the U.S macroeconomic events generally cause jumps in all markets in our sample, stock indices futures clearly dominate the picture. Interestingly, the larger the surprise, the greater impact it has on all four European stock indices futures. For example, U.S unemployment rate announcement on 6 June 2008, when the announced number was 0.4 worse than expected, caused a large negative jump in all four equity indices futures i.e., Euro Stoxx50, SMI, CAC40 and DAX30. There is also a strong correlation between the sign of the surprises and direction of the jumps implying that most of the time, investors may base their trades on the forecasted numbers and take a long position in the index if the indicator is better than expected and short it after a bad news. However, there are sometimes negative reactions to good news. One of the plausible reasons explaining this discrepancy is that there may be some other factors beyond macroeconomic announcements that can have a strong impact on the direction of the jump. Secondly, as the mean forecast is not always a good predictor of the market direction, the surprises may not serve as the true sentiment of the market.[15]

Another interesting finding is that all four equity markets repeatedly react to the announced indicator in a similar fashion. For instance, on 7 August 2009, all four equity indices futures reacted positively to a better than expected unemployment rate announcement. A unanimous response can also be seen on November 6, 2009 to the unemployment rate and on May 26, 2009 to the Consumer Confidence announcement, indicating existence of cojumps, particularly in European equity indices futures. This is consistent with the evidence reported by Harju and Hussain (2011) indicating that major European equity markets tend to react simultaneously to the U.S macroeconomic news announcements. These findings also indicate the presence of cojumps across European financial markets that we test in the following section.

4.4. U.S macro announcements and Cojumps in European markets

Table 4 reports the number of cojumps and associated probabilities in multiple markets. The results show that the highest probabilities of cojumps are found for the pairs of European equity markets,

confirming our earlier assertion. For example, there are about 177 common jumps in DAX30 and CAC40 futures, 200 between DAX30 and Euro stoxx50, and 184 between CAC40 and Euro stoxx50 futures. Moreover, three European equity indices futures, (DAX30, CAC40 and Euro Stoxx50) experience 155 simultaneous jumps (cojumps) in response to the U.S macroeconomic news announcements signifying a highly correlated structure of European stock markets. Similarly, there are 56 common jumps in DAX30, CAC40 and SMI.[16] However, there are negligible instances of cojumps across different asset classes. For example, a total of 10 cojumps are reported between DAX30 futures and EUR/USD with a probability of 0.92 percent for the occurrence of cojump across equity and currency rate futures. Similarly, there are only 9 cojumps for the pairs of FESX - EUR/USD and Euribor - EUR/USD.

Insert Table 4 about here

The lower panel of Table 4 reports the probability of cojumps conditional on jumps in other markets (P(coj|jump)%). The conditional probability in the first column indicates that 70.92% of all jumps on Euro Stoxx50 (FESX) are also cojumps on DAX30 futures (FDAX). Whereas, 62.50% of all jumps on SMI are cojumps on DAX30 futures. Similarly, 50% of the jumps observed in SMI futures are cojumps in DAX30 and CAC40 futures. These results are consistent with those reported by Harju and Hussain (2011) and Hussain (2011), who report remarkable similarities across all European equity markets, particularly in response to the U.S macroeconomic news announcements.

Next, we examine the conditional probability of cojump for every significant U.S macroeconomic news announcement. Table 5 reports the main results for 10 U.S macro indicators that emerge as influential candidates for causing cojumps across European equity markets. First panel shows that 93.33% of all the jumps on SMI futures that are linked with the U.S unemployment rate surprises at

14:30 CET cause cojumps in DAX30 futures as well. Likewise, 91.66% of all jumps in CAC40 futures create simultaneous jumps (cojumps) in German equity index futures.

Insert Table 5 about here

The second panel of Table 5 reports the probability of a cojump on the considered markets given a jump on the market shown in the corresponding column, in response to consumer price index announcements (CPI). Our results reveal that 100% of all jumps in SMI coincide with jumps in French stock index futures (CAC40). Moreover, 90.90% of jumps related to U.S Consumer Price Index in Euro Stoxx50 are cojumps across all three futures markets, i.e., German DAX, French CAC and Euro Stoxx50.

Overall, our findings indicate that the number of other U.S indicators, such as producer price index, Existing home sales, consumer confidence and ISM price index are strongly linked with cojumps in European equity indices futures. These results are supported by significant intraday patterns with sharp peaks in European equity markets at the time of U.S scheduled macroeconomic news announcements documented by Harju and Hussain (2011) and Andersson (2010).

4.5. Time series pattern of Jumps and cojumps

In this section, we intend to examine whether jump dynamics in European financial markets have changed over time. To that end, we analyze the time series pattern of jumps and cojumps in these markets. Some recent studies have suggested that the interdependence among the financial markets has increased during the recent financial crisis.[17] Our results also shed some light on whether European financial markets have experienced more frequent and sizeable jumps and cojumps since the subprime crisis that started in 2007. We divide our sample period into two sub periods; that is, before and after January 01, 2007. Figure 5 plots the time series of significant jumps in all three asset classes in our sample. The graphical representation of jumps in Figure 5 depicts that both the

frequency and magnitude of the jumps have increased after 2007 in all future indices. Appendix C1 and C2 present descriptive statistics on significant jumps before and after 2007 for all asset classes in our sample, respectively. The results show that the percentage of jump days has increased in all markets during the recession period. However, while there is a moderate increase in equity indices, the interest rate (Euribor) and currency (EUR/USD) futures have experienced large increases in percentage of jump days after 2007. For example, on 3-months interest rate (Euribor) futures, about 47.57% days are associated with jumps during the recession years compared to 19.67% days in the pre-recession period. Similarly, there are 41.62% jump days after 2007 on EUR/USD futures in comparison with 28.83% in the pre-crisis period indicating that currency markets experienced higher volatility during the global financial crisis. Baglioni and Monticini (2010) report similar results for Euribor showing huge jumps in European interbank interest rate at the outset of the financial turmoil in August 2007.

The third panel of Appendix C1 and C2 compares the absolute value of all jumps across all markets, during the pre and post-recession period, respectively. The statistics show that the probability of occurrence of jump (P(jump) and jump size (E(|jumpsize||jump) have increased across all markets during the financial crisis. The asymmetry parameters reported in Appendices (the last panel of Appendix C1 and C2) show that there is a slight increase in negative jumps on European stock indices and interest rate futures during the financial crisis period, while more positive jumps are reported for EUR/USD. One of the possible reasons for this phenomenon is that since there have been more frequent adverse economic shocks during the recent global recession, equity markets have experienced more negative jumps during this period as they have been found to be more responsive compared to the other asset classes.

Insert Figure 5 about here

Figure 6 depicts the time series graph of significant cojumps in European stock indices futures, revealing more frequent and larger cojumps after 2007.[18] This is an important finding in the context of financial markets interdependence as suggested by more frequent and sizeable simultaneous jumps

(cojumps) across equity markets during the financial crisis. This implies a higher risk caused by the low diversification across European stock indices futures in bad times.

Insert Figure 6 about here

5. Discussion and Conclusion

Despite the perceived implications of price discontinuities in financial markets, there are not many papers that have analyzed the cojumps across European markets. Accordingly, our paper presents new empirical evidence on jumps and cojumps in European financial markets around the key U.S macroeconomic news announcements. We use high frequency 5-minute interval data on four European stock indices futures (DAX30, SMI, CAC40 and Euro Stoxx50), interest rate futures (3-month Euribor) and currency futures (EUR/USD) from 26 May 2003 until 31 January 2010 along with the key U.S macroeconomic indicators. The results suggest that scheduled U.S macroeconomic announcements cause significant jumps on all asset classes. However, European equity markets are found to be more responsive to the U.S fundamentals than other asset classes. The results also indicate a strong correlation between the type of the news and direction of the jumps. Moreover, the frequency and size of jumps have considerably increased in European markets since the start of global credit crisis in 2007. There is a strong evidence of cojumps caused by the U.S macroeconomic surprises, particularly across European stock indices futures. The results also indicate that interdependence among European equity markets has increased since the start of global financial crisis in 2007.

These results may have important implications for finance practitioners and researchers alike. For example, as we show that there are differences in markets' responses to different types of announcements, linking the fundamental to different asset classes may allow us to develop hedging strategies suitable to a particular asset class. However, it would also be worthwhile to elaborate more on underlying economic linkages across different asset classes and their response to macroeconomic fundamentals.

Notes

[1] Andersen, Bollerslev and Diebold (2007), for example, show that many jumps in DM/$ exchange rate, S&P500 market index, and the 30-year U.S Treasury bond yield are directly associated with specific macroeconomic news announcements.

[2] See for example, Piazzesi (2005), Lee and Mykland (2008), and Tauchen and Zhou (2011), among others, for further details.

[3] In order to rule out any overlapping impact of the European macroeconomic surprises as suggested by Hussain (2011), we also analyze the jumps and cojumps in European financial markets around some major European monetary policy releases such as European Central Bank, Bank of England and Swiss National Bank interest rate announcements. However, we do not find any significant results.

[4] See, for example, Andersen et al. (2003, 2007), Flannery and Protopapadakis (2002), Boyd, Hu and Jagannathan (2005) and Harju and Hussain (2011).

[5] Some other papers analyzing jumps (cojumps) have mainly focused on the U.S treasury markets. See for example, Jiang, Lo, and Verdelhan (2011), McKenzie, and Smith (2008) and Dungey and Hvozdyk (2012).

[6] Many earlier studies, e.g., Huang (2007), have relied on daily or lower frequency data to investigate the relation between economic fundamentals and jumps and cojumps in financial markets.

[7] The data were obtained from Tick Data (http://www.tickdata.com).

[8] The selection of the U.S macro indicators is based on the availability of data and their occurrence during the European markets' trading hours.

[9] Thereafter, all times are given in Central European Time (CET).

[10] For example, Baglioni and Monticini (2010) show that the implicit hourly interest rate in the euro area money market jumped by more than ten times at the outset of sub-prime financial turmoil in August 2010. Authors argue that this evidence may be attributed to an increase of the liquidity premium and of the cost of collateral.

[11] The total numbers of surprises associated with jumps are 254. Out of which, 22 are zero, 125 are negative and 107 are positive surprises. As the surprises are more often negative than positive during

our sample period, it seems intuitive that the European stock indices futures experienced more negative jumps, resulting in an observed asymmetry.

[12] As noted earlier that almost all U.S macroeconomic indicators are announced either at 14:30 or 16:00 CET, we carry out the test between 13:00 and 22:00 CET.

[13] The percentages presented in Figure 2 have been calculated as the ratio of the jumps related to the specific U.S macroeconomic indicator in an intraday setting.

[14] The results are not shown here to save the space. However, these results can be obtained from authors upon request.

[15] Another possible explanation along the same line is that these forecasts are not unanimously adopted among all analysts. Major financial institutions typically compile their own forecasts. Moreover, it is also important to note that whenever there is an opposite response to the type of announcement, all six markets analysed in this study usually react uniformly to that particular news event.

[16] It is important to note that three European equity indices futures, i.e., DAX30, CAC40 and Euros Stoxx50 share relatively fewer jumps (cojumps) with SMI futures. One of the plausible reasons for this phenomenon is that SMI future index is less liquid compared to the other indices as shown by the relatively lower number of observations in Table 3.

[17] See, for example, Jones (2009).

[18] We do not report similar graphs for EURIBOR and EUR/USD futures here because there are too little cojumps to draw any conclusion for these instruments.

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Appendix A

US Announcements	Number of announcements	US time of announcement (EST)	Corresponding European Central time (CET)
Advance Durable Good	78	08:30	14:30
Business Inventories	79	10:00	16:00
CPI	77	08:30	14:30
Consumer Confidence	80	10:00	16:00
Existing Home Sale	59	10:00	16:00
Factory Orders	79	10:00	16:00
GNP	28	08:30	14:30
House Price Index	11	10:00	16:00
Housing Start	79	08:30	14:30
ISM Manufacturing	80	10:00	16:00
ISM Price	68	10:00	16:00
Import Price Index	78	08:30	14:30
Industrial Production	78	09:15	15:15
Initial Jobless Claims	346	08:30	14:30
Leading Price Indicator	78	10:00	16:00
New Home Sale	79	10:00	16:00
Non-Farm Productivity	23	08:30	14:30
Personal Income	77	08:30	14:30
Personal Spending	69	08:30	14:30
Producer Price Index	77	08:30	14:30
Retail Sales	79	08:30	14:30
Trade Balance	79	08:30	14:30
Unemployment	80	08:30	14:30

Notes: This table reports the US macroeconomic news announcements selected for this study. The number of announcements refers to the number of releases for each macroeconomic indicator during our sample period. The last two columns show the local US time of announcement in Eastern Standard Time (EST), and the corresponding European time in Central European Time (CET), respectively.

Appendix B

Date time	Product	Return	Actual	Forecast	News Type
Unemployment					
2003.09.05 14:30:00	FDAX	-0.0053	6.1	6.2	good news
2003.10.03 14:30:00	FDAX	0.0092	6.1	6.2	good news
2003.10.03 14:30:00	FSMI	0.0051	6.1	6.2	good news
2003.12.05 14:30:00	FDAX	-0.0056	5.9	6	good news
2004.01.09 14:30:00	FDAX	-0.0070	5.7	5.9	good news
2004.03.05 14:30:00	FDAX	-0.0059	5.6	5.6	as forecasted
2004.03.05 14:30:00	FSMI	-0.0035	5.6	5.6	as forecasted
2004.06.04 14:30:00	FDAX	0.0041	5.6	5.6	as forecasted
2004.08.06 14:30:00	FCE	-0.0052	5.5	5.6	good news
2004.08.06 14:30:00	FDAX	-0.0067	5.5	5.6	good news
2004.08.06 14:30:00	FESX	-0.0058	5.5	5.6	good news
2004.08.06 14:30:00	FSMI	-0.0027	5.5	5.6	good news
2004.09.03 14:30:00	FCE	0.0029	5.4	5.5	good news
2004.09.03 14:30:00	FESX	0.004	5.4	5.5	good news
2004.10.08 14:30:00	FCE	-0.0044	5.4	5.4	as forecasted
2004.10.08 14:30:00	FDAX	-0.0046	5.4	5.4	as forecasted
2004.10.08 14:30:00	FESX	-0.0046	5.4	5.4	as forecasted
2004.10.08 14:30:01	FSMI	-0.0030	5.4	5.4	as forecasted
2004.11.05 14:30:00	FCE	0.0047	5.5	5.4	bad news
2004.11.05 14:30:00	FESX	0.0049	5.5	5.4	bad news
2004.12.03 14:30:00	FCE	-0.0041	5.4	5.4	as forecasted
2004.12.03 14:30:00	FDAX	-0.0046	5.4	5.4	as forecasted
2004.12.03 14:30:01	FSMI	-0.0030	5.4	5.4	as forecasted
2005.02.04 14:30:00	FCE	-0.0022	5.2	5.4	good news
2005.02.04 14:30:00	FDAX	-0.0024	5.2	5.4	good news
2005.03.04 14:30:00	FCE	0.0029	5.4	5.2	bad news
2005.03.04 14:30:00	FDAX	0.0037	5.4	5.2	bad news
2005.03.04 14:30:00	FESX	0.0038	5.4	5.2	bad news
2005.05.06 14:30:00	FDAX	0.0033	5.2	5.2	as forecasted
2006.03.10 14:30:00	FCE	0.0039	4.8	4.7	bad news
2006.03.10 14:30:00	FDAX	0.0041	4.8	4.7	bad news
2006.08.04 14:30:00	FCE	0.0050	4.8	4.6	bad news
2006.08.04 14:30:00	FDAX	0.0048	4.8	4.6	bad news
2006.08.04 14:30:00	FESX	0.0051	4.8	4.6	bad news
2006.11.03 14:30:00	FCE	0.0031	4.4	4.6	good news
2006.11.03 14:30:00	FDAX	0.0028	4.4	4.6	good news
2006.11.03 14:30:00	FESX	0.0033	4.4	4.6	good news
2006.12.08 14:30:00	FDAX	0.0030	4.5	4.5	as forecasted
2007.02.02 14:30:00	FCE	0.0025	4.6	4.5	bad news
2007.02.02 14:30:00	FDAX	0.0025	4.6	4.5	bad news

2007.02.02 14:30:00	FSMI	0.0017	4.6	4.5	bad news
2007.03.09 14:30:00	FSMI	0.0046	4.5	4.6	good news
2007.07.06 14:30:00	FDAX	-0.0042	4.5	4.5	as forecasted
2007.09.07 14:30:00	FCE	-0.0059	4.6	4.6	as forecasted
2007.09.07 14:30:00	FDAX	-0.0057	4.6	4.6	as forecasted
2007.09.07 14:30:00	FESX	-0.0052	4.6	4.6	as forecasted
2007.10.05 14:30:00	FCE	0.0037	4.7	4.7	as forecasted
2007.10.05 14:30:00	FDAX	0.0032	4.7	4.7	as forecasted
2007.10.05 14:30:00	FESX	0.0044	4.7	4.7	as forecasted
2007.10.05 14:30:01	FSMI	0.0041	4.7	4.7	as forecasted
2008.01.04 14:30:00	FCE	-0.0079	5	4.8	bad news
2008.01.04 14:30:00	FDAX	-0.006	5	4.8	bad news
2008.01.04 14:30:00	FESX	-0.0066	5	4.8	bad news
2008.01.04 14:30:01	FSMI	-0.0060	5	4.8	bad news
2008.03.07 14:30:00	EUR/USD	-0.0062	4.8	5	good news
2008.03.07 14:30:00	FDAX	-0.0067	4.8	5	good news
2008.03.07 14:30:00	FESX	-0.0074	4.8	5	good news
2008.04.04 14:30:00	FSMI	-0.0061	5.1	5	bad news
2008.05.02 14:30:00	FCE	0.0104	5	5.2	good news
2008.05.02 14:30:00	FDAX	0.0085	5	5.2	good news
2008.05.02 14:30:00	FESX	0.0101	5	5.2	good news
2008.06.06 14:30:00	FCE	-0.0084	5.5	5.1	bad news
2008.06.06 14:30:00	FDAX	-0.0071	5.5	5.1	bad news
2008.06.06 14:30:00	FESX	-0.0094	5.5	5.1	bad news
2008.06.06 14:30:01	FSMI	-0.0066	5.5	5.1	bad news
2008.08.01 14:30:00	FDAX	0.0058	5.7	5.6	bad news
2008.09.05 14:30:00	FCE	-0.0081	6.1	5.7	bad news
2008.09.05 14:30:00	FDAX	-0.0079	6.1	5.7	bad news
2008.09.05 14:30:00	FESX	-0.0087	6.1	5.7	bad news
2009.01.09 14:30:00	FCE	0.0106	7.2	7	bad news
2009.01.09 14:30:00	FDAX	0.0093	7.2	7	bad news
2009.01.09 14:30:00	FESX	0.0105	7.2	7	bad news
2009.06.05 14:30:00	FCE	0.0101	9.4	9.2	bad news
2009.06.05 14:30:00	FDAX	0.0114	9.4	9.2	bad news
2009.06.05 14:30:00	FESX	0.0113	9.4	9.2	bad news
2009.06.05 14:30:00	FSMI	0.0065	9.4	9.2	bad news
2009.07.02 14:30:00	FSMI	-0.0038	9.5	9.6	good news
2009.08.07 14:30:00	FCE	0.0097	9.4	9.6	good news
2009.08.07 14:30:00	FDAX	0.0077	9.4	9.6	good news
2009.08.07 14:30:00	FESX	0.0096	9.4	9.6	good news
2009.08.07 14:30:00	FSMI	0.0048	9.4	9.6	good news
2009.09.04 14:30:00	Euribor	-0.0270	9.7	9.5	bad news
2009.10.02 14:30:00	FCE	-0.0055	9.8	9.8	as forecasted
2009.10.02 14:30:00	FDAX	-0.0064	9.8	9.8	as forecasted

2009.10.02 14:30:00	FESX	-0.0067	9.8	9.8	as forecasted
2009.11.06 14:30:00	FCE	-0.0120	10.2	9.9	bad news
2009.11.06 14:30:00	FDAX	-0.0124	10.2	9.9	bad news
2009.11.06 14:30:00	FESX	-0.0129	10.2	9.9	bad news
2009.11.06 14:30:00	FSMI	-0.0098	10.2	9.9	bad news
2009.12.04 14:30:00	FCE	0.0125	10	10.2	good news
2009.12.04 14:30:00	FDAX	0.0115	10	10.2	good news
2009.12.04 14:30:00	FESX	0.0135	10	10.2	good news
2009.12.04 14:30:00	FSMI	0.0055	10	10.2	good news
2010.01.08 14:30:00	FCE	-0.0036	10	10.1	good news
2010.01.08 14:30:00	FDAX	-0.0043	10	10.1	good news
2010.01.08 14:30:00	FESX	-0.0041	10	10.1	good news
2010.01.08 14:30:00	FSMI	-0.0022	10	10.1	good news

Date time	Product	Return	Actual	Forecast	News type
ISM Manufacturing					
2003.07.01 16:00:00	FDAX	-0.0116	49.8	51	bad news
2003.07.01 16:00:00	FSMI	-0.0052	49.8	51	bad news
2004.01.02 16:00:00	FDAX	0.0037	66.2	61	good news
2004.10.01 16:00:00	Euribor	0.0171	58.5	58.4	good news
2005.07.01 16:00:00	FCE	0.0029	53.8	51.4	good news
2005.07.01 16:00:00	FDAX	0.0024	53.8	51.4	good news
2005.07.01 16:00:00	FESX	0.0030	53.8	51.4	good news
2006.08.01 16:00:00	FCE	-0.0033	54.7	53.5	good news
2006.08.01 16:00:00	FDAX	-0.0035	54.7	53.5	good news
2006.08.01 16:00:00	FESX	-0.0033	54.7	53.5	good news
2006.09.01 16:00:00	FDAX	-0.0034	54.5	54.5	good news
2006.09.01 16:00:00	FESX	-0.0031	54.5	54.5	good news
2006.10.02 16:00:00	FCE	0.0028	52.9	53.5	bad news
2006.10.02 16:00:00	FDAX	0.0025	52.9	53.5	bad news
2006.10.02 16:00:00	FESX	0.0028	52.9	53.5	bad news
2006.12.01 16:00:00	FDAX	-0.0053	49.5	51.5	bad news
2006.12.01 16:00:00	FESX	-0.0043	49.5	51.5	bad news
2007.01.03 16:00:00	FCE	0.0030	51.4	50	good news
2007.01.03 16:00:00	FDAX	0.0024	51.4	50	good news
2007.01.03 16:00:00	FESX	0.0027	51.4	50	good news
2007.04.02 16:00:00	EUR/USD	0.0077	50.9	51.4	bad news
2007.09.04 16:00:00	EUR/USD	0.0044	52.9	53	bad news
2007.10.01 16:00:00	FESX	0.0034	52	52.6	bad news
2008.01.02 16:00:00	FCE	-0.0055	47.7	50.5	bad news
2008.01.02 16:00:00	FDAX	-0.0050	47.7	50.5	bad news
2008.01.02 16:00:00	FESX	-0.0051	47.7	50.5	bad news
2008.04.01 16:00:00	EUR/USD	0.0024	48.6	47.5	good news

2008.04.01 16:00:00	FESX	0.0053	48.6	47.5	good news
2008.07.01 16:00:00	EUR/USD	0.0039	50.2	48.5	good news
2008.07.01 16:00:00	FCE	0.0073	50.2	48.5	good news
2008.07.01 16:00:00	FDAX	0.0065	50.2	48.5	good news
2008.07.01 16:00:00	FESX	0.0075	50.2	48.5	good news
2008.09.02 16:00:00	EUR/USD	-0.0132	49.9	50	bad news
2008.10.01 16:00:00	EUR/USD	-0.0168	43.5	49.5	bad news
2008.12.01 16:00:00	EUR/USD	-0.0157	36.2	37	bad news
2009.07.01 16:00:00	FSMI	-0.0038	50	46.7	good news
2009.11.02 16:00:00	FSMI	0.0065	65	64	good news

Date time	Product	Return	Actual	Forecast	News type
ISM Price					
2003.07.01 16:00:00	FDAX	-0.0116	56.5	51	bad news
2003.07.01 16:00:00	FSMI	-0.0052	56.5	51	bad news
2004.01.02 16:00:00	FDAX	0.0037	66	63.5	bad news
2004.10.01 16:00:00	Euribor	0.0171	76	81	good news
2005.07.01 16:00:00	FCE	0.0029	50.5	55.3	good news
2005.07.01 16:00:00	FDAX	0.0024	50.5	55.3	good news
2005.07.01 16:00:00	FESX	0.0030	50.5	55.3	good news
2006.08.01 16:00:00	FCE	-0.0033	78.5	75.3	bad news
2006.08.01 16:00:00	FDAX	-0.0035	78.5	75.3	bad news
2006.08.01 16:00:00	FESX	-0.0033	78.5	75.3	bad news
2006.09.01 16:00:00	FDAX	-0.0034	73	76	good news
2006.09.01 16:00:00	FESX	-0.0031	73	76	good news
2006.10.02 16:00:00	FCE	0.0028	61	67.5	good news
2006.10.02 16:00:00	FDAX	0.0025	61	67.5	good news
2006.10.02 16:00:00	FESX	0.0028	61	67.5	good news
2006.12.01 16:00:00	FDAX	-0.0053	53.5	49.8	bad news
2006.12.01 16:00:00	FESX	-0.0043	53.5	49.8	bad news
2007.01.03 16:00:00	FCE	0.0030	47.5	54	good news
2007.01.03 16:00:00	FDAX	0.0024	47.5	54	good news
2007.01.03 16:00:00	FESX	0.0027	47.5	54	good news
2007.04.02 16:00:00	EUR/USD	0.0077	65.5	58.5	bad news
2007.09.04 16:00:00	EUR/USD	0.0044	63	63	good news
2007.10.01 16:00:00	FESX	0.0034	59	62	good news
2008.01.02 16:00:00	FCE	-0.0055	68	65	bad news
2008.01.02 16:00:00	FDAX	-0.0050	68	65	bad news
2008.01.02 16:00:00	FESX	-0.0051	68	65	bad news
2008.04.01 16:00:00	EUR/USD	0.0024	83.5	75	bad news
2008.04.01 16:00:00	FESX	0.0053	83.5	75	bad news
2008.07.01 16:00:00	EUR/USD	0.0039	91.5	87	bad news

2008.07.01 16:00:00	FCE	0.0073	91.5	87	bad news
2008.07.01 16:00:00	FDAX	0.0065	91.5	87	bad news
2008.07.01 16:00:00	FESX	0.0075	91.5	87	bad news
2008.09.02 16:00:00	EUR/USD	-0.0132	77	82	good news
2008.10.01 16:00:00	EUR/USD	-0.0168	53.5	73	good news
2008.12.01 16:00:00	EUR/USD	-0.0157	25.5	32	good news

Date time	Product	Return	Actual	Forecast	News Type
Consumer Confidence					
2003.07.29 16:00:00	FDAX	-0.0156	76.6	85	bad news
2003.07.29 16:00:00	FSMI	-0.0066	76.6	85	bad news
2003.09.30 16:00:00	FDAX	-0.0093	76.8	80.5	bad news
2004.02.24 16:00:00	FDAX	-0.0041	87.3	92.5	bad news
2004.08.31 16:00:00	FCE	-0.0022	98	103.5	bad news
2004.08.31 16:00:00	FDAX	-0.0034	98	103.5	bad news
2006.10.31 16:00:00	Euribor	0.0015	105.4	108	bad news
2008.12.30 16:00:00	EUR/USD	0.0046	38	45.5	bad news
2009.01.27 16:00:00	EUR/USD	0.0051	37.7	39	bad news
2009.02.24 16:00:00	EUR/USD	0.0140	25	35.5	bad news
2009.03.31 16:00:00	EUR/USD	0.0081	26	28	bad news
2009.05.26 16:00:00	FCE	0.0107	54.9	42	good news
2009.05.26 16:00:00	FDAX	0.0119	54.9	42	good news
2009.05.26 16:00:00	FESX	0.0110	54.9	42	good news
2009.05.26 16:00:00	FSMI	0.0059	54.9	42	good news
2009.06.30 16:00:00	FCE	-0.0059	49.3	55	bad news
2009.07.28 16:00:00	FCE	-0.0066	46.6	49	bad news
2009.07.28 16:00:00	FDAX	-0.0073	46.6	49	bad news
2009.07.28 16:00:00	FESX	-0.0069	46.6	49	bad news
2009.09.29 16:00:00	FCE	-0.0049	53.1	57	bad news
2009.09.29 16:00:00	FDAX	-0.0058	53.1	57	bad news
2009.09.29 16:00:00	FESX	-0.0049	53.1	57	bad news
2009.12.29 16:00:00	EUR/USD	-0.0349	52.9	52.5	good news

Date time	Product	Return	Actual	Forecast	News Type
Initial Jobless Claims					
2003.07.31 14:30:00	FDAX	0.0077	388	400	good news
2003.07.31 14:30:00	FSMI	0.0033	388	400	good news
2003.10.30 14:30:00	FSMI	0.0049	386	385	good news
2005.04.28 14:30:00	FCE	-0.0053	320	320	bad news
2005.04.28 14:30:00	FDAX	-0.0050	320	320	bad news
2005.04.28 14:30:00	FESX	-0.0059	320	320	bad news
2005.07.14 14:30:00	FSMI	0.0017	336	322	good news
2005.07.21 14:30:00	FCE	-0.0040	303	325	good news

2005.07.21 14:30:00	FESX	-0.0049	303	325	good news
2005.11.03 14:30:00	FCE	0.0042	323	330	good news
2005.11.03 14:30:00	FDAX	0.0041	323	330	good news
2005.11.03 14:30:00	FESX	0.0048	323	330	good news
2006.09.21 14:30:00	Euribor	-0.0010	318	310	bad news
2006.11.02 14:30:00	FDAX	-0.0027	327	310	bad news
2006.11.02 14:30:00	FESX	-0.0030	327	310	bad news
2007.05.03 14:30:00	FCE	0.0031	305	325	good news
2007.05.03 14:30:00	FDAX	0.0033	305	325	good news
2007.05.03 14:30:00	FESX	0.0039	305	325	good news
2007.11.21 14:30:00	Euribor	0.0055	330	330	bad news
2007.12.27 14:30:00	FSMI	-0.0030	349	340	bad news
2008.07.31 14:30:00	FCE	-0.0096	448	392.5	bad news
2008.07.31 14:30:00	FDAX	-0.0089	448	392.5	bad news
2008.07.31 14:30:00	FESX	-0.0110	448	392.5	bad news
2008.07.31 14:30:00	FSMI	-0.0065	448	392.5	bad news
2008.08.14 14:30:00	FSMI	-0.0053	450	435	bad news
2009.04.02 14:30:00	FCE	0.0629	669	650	bad news
2009.07.02 14:30:00	FSMI	-0.0038	614	615	good news
2009.08.13 14:30:00	FSMI	-0.0051	558	545	bad news

Date time	Product	Return	Actual	Forecast	News Type
New Home Sale					
2005.02.28 16:00:00	EUR/USD	-0.0015	1106	1125	bad news
2006.07.27 16:00:00	EUR/USD	0.0050	1131	1150	bad news
2006.10.26 16:00:00	EUR/USD	0.0061	1075	1040	good news
2006.11.29 16:00:00	EUR/USD	0.0065	1004	1049	bad news
2007.01.26 16:00:00	FDAX	-0.0028	1120	1052	good news
2007.03.26 16:00:00	FCE	-0.0042	848	985	bad news
2007.03.26 16:00:00	FDAX	-0.0044	848	985	bad news
2007.03.26 16:00:00	FESX	-0.0043	848	985	bad news
2007.04.17 14:30:00	FSMI	0.0028	1518	1495	bad news
2007.05.24 16:00:00	EUR/USD	-0.0057	981	860	good news
2007.05.24 16:00:00	FDAX	0.0046	981	860	good news
2007.05.24 16:00:00	FESX	0.0029	981	860	good news
2007.08.24 16:00:00	FCE	0.0041	870	820	good news
2007.10.25 16:00:00	FCE	0.0039	770	770	bad news
2007.12.28 16:00:00	FCE	-0.0031	647	717	bad news
2008.04.24 16:00:00	EUR/USD	-0.0068	526	580	bad news
2008.04.24 16:00:00	FESX	-0.0062	526	580	bad news
2008.09.25 16:00:00	EUR/USD	0.0036	460	510	bad news
2009.08.26 16:00:00	EUR/USD	0.0096	433	390	good news

2009.12.23 16:00:00	EUR/USD	0.0035	355	440	bad news
2009.12.23 16:00:00	FDAX	-0.0037	355	440	bad news

Date time	Product	Return	Actual	Forecast	News type
Consumer Price Index					
2004.06.15 14:30:00	FDAX	0.0033	0.6	0.5	good news
2005.02.23 14:30:00	Euribor	0.0127	0.1	0.2	bad news
2005.04.20 14:30:00	FCE	-0.0025	0.6	0.5	good news
2005.05.18 14:30:00	FCE	0.0020	0.5	0.4	good news
2005.07.14 14:30:00	FSMI	0.0017	0	0.2	bad news
2006.06.14 14:30:00	FCE	-0.0082	0.4	0.4	bad news
2006.06.14 14:30:00	FDAX	-0.0089	0.4	0.4	bad news
2006.06.14 14:30:00	FESX	-0.0074	0.4	0.4	bad news
2006.12.15 14:30:00	FCE	0.0037	0	0.2	bad news
2006.12.15 14:30:00	FDAX	0.0034	0	0.2	bad news
2006.12.15 14:30:00	FESX	0.0034	0	0.2	bad news
2007.02.21 14:30:00	FCE	-0.0026	0.2	0.1	good news
2007.02.21 14:30:00	FDAX	-0.0031	0.2	0.1	good news
2007.02.21 14:30:00	FESX	-0.0029	0.2	0.1	good news
2007.04.17 14:30:00	FSMI	0.0028	0.6	0.6	as forecasted
2007.05.15 14:30:00	FCE	0.0072	0.4	0.5	bad news
2007.05.15 14:30:00	FDAX	0.0072	0.4	0.5	bad news
2007.05.15 14:30:00	FESX	0.0082	0.4	0.5	bad news
2007.05.15 14:30:00	FSMI	0.0038	0.4	0.5	bad news
2007.06.15 14:30:00	FCE	0.0060	0.7	0.6	good news
2007.06.15 14:30:00	FDAX	0.0067	0.7	0.6	good news
2007.06.15 14:30:00	FESX	0.0053	0.7	0.6	good news
2007.06.15 14:30:00	FSMI	0.0036	0.7	0.6	good news
2008.08.14 14:30:00	FSMI	-0.0053	0.8	0.4	good news

Date time	Product	Return	Actual	Forecast	News type
Advance Durable Goods					
2006.09.27 14:30:00	FCE	-0.0041	-0.5	0.5	bad news
2006.09.27 14:30:00	FDAX	-0.0043	-0.5	0.5	bad news
2006.09.27 14:30:00	FESX	-0.0041	-0.5	0.5	bad news
2007.02.27 14:30:00	FCE	-0.0042	-7.8	-3	bad news
2007.02.27 14:30:00	FDAX	-0.0038	-7.8	-3	bad news
2007.02.27 14:30:00	FESX	-0.0042	-7.8	-3	bad news
2007.03.28 14:30:00	FCE	-0.0038	2.5	3.5	bad news
2007.03.28 14:30:00	FDAX	-0.0044	2.5	3.5	bad news
2007.03.28 14:30:00	FESX	-0.0043	2.5	3.5	bad news
2007.03.28 14:30:00	FSMI	-0.0039	2.5	3.5	bad news
2007.12.27 14:30:00	FSMI	-0.0030	0.1	2	bad news

2008.05.28 14:30:00	FDAX	0.0043	-0.5	-1.5	good news
2008.05.28 14:30:00	FESX	0.0049	-0.5	-1.5	good news
2008.07.25 14:30:00	FCE	0.0069	0.8	-0.3	good news
2008.08.27 14:30:00	FDAX	0.0051	1.3	0	good news
2008.08.27 14:30:00	FESX	0.0052	1.3	0	good news
2009.09.25 14:30:00	FCE	-0.0062	-2.4	0.5	bad news
2009.09.25 14:30:00	FDAX	-0.0063	-2.4	0.5	bad news
2009.09.25 14:30:00	FESX	-0.0067	-2.4	0.5	bad news

Date time	Product	Return	Actual	Forecast	News type
Existing Home Sale					
2006.09.25 16:00:00	EUR/USD	-0.0033	6.3	6.2	good news
2006.10.25 16:00:00	EUR/USD	0.0018	6.18	6.23	bad news
2007.01.25 16:00:00	EUR/USD	-0.0023	6.22	6.25	bad news
2007.06.25 16:00:00	EUR/USD	0.0088	5.99	5.97	good news
2008.06.26 16:00:00	EUR/USD	0.0022	4.99	4.95	good news
2008.07.24 16:00:00	EUR/USD	-0.0075	4.86	4.94	bad news
2008.08.25 16:00:00	EUR/USD	-0.0053	5	4.91	good news
2008.11.24 16:00:00	EUR/USD	0.0155	4.98	5	bad news
2009.02.25 16:00:00	EUR/USD	0.0077	4.49	4.79	bad news
2009.06.23 16:00:00	EUR/USD	0.0122	4.77	4.81	bad news
2009.08.21 16:00:00	FCE	0.0071	5.24	5	good news
2009.08.21 16:00:00	FDAX	0.0074	5.24	5	good news
2009.08.21 16:00:00	FESX	0.0084	5.24	5	good news
2009.08.21 16:00:00	FSMI	0.0032	5.24	5	good news
2009.09.24 16:00:00	FCE	-0.0065	5.1	5.35	bad news
2009.09.24 16:00:00	FDAX	-0.0049	5.1	5.35	bad news
2009.09.24 16:00:00	FESX	-0.0053	5.1	5.35	bad news
2009.12.22 16:00:00	EUR/USD	0.0019	6.54	6.25	good news

Date time	Product	Return	Actual	Forecast	News type
Leading Price Indicator					
2004.07.22 16:00:00	EUR/USD	-0.0078	-0.2	0	bad news
2004.11.18 16:00:00	EUR/USD	-0.0016	-0.3	-0.1	bad news
2005.06.20 16:00:00	EUR/USD	-0.0022	-0.5	-0.3	bad news
2006.04.20 16:00:00	FDAX	0.0032	-0.1	0	bad news
2006.08.17 16:00:00	EUR/USD	-0.002	-0.1	0.1	bad news
2007.02.21 16:00:00	EUR/USD	0.0028	0.1	0.2	bad news
2007.04.19 16:00:00	EUR/USD	0.0017	0.1	0.1	as forecasted
2007.06.21 16:00:00	EUR/USD	0.0033	0.3	0.2	good news
2007.08.20 16:00:00	EUR/USD	0.0078	0.4	0.4	as forecasted
2008.04.17 16:00:00	EUR/USD	-0.0066	0.1	0.1	as forecasted
2009.06.18 16:00:00	EUR/USD	0.0065	1.2	0.9	good news

Date time	Product	Return	Actual	Forecast	News type
Producer Price Index					
2006.08.15 14:30:00	FCE	0.0054	0.1	0.4	good news
2006.08.15 14:30:00	FDAX	0.0069	0.1	0.4	good news
2006.08.15 14:30:00	FESX	0.0063	0.1	0.4	good news
2006.08.15 14:30:00	FSMI	0.0022	0.1	0.4	good news
2007.01.17 14:30:00	FCE	-0.0036	0.9	0.5	bad news
2007.01.17 14:30:00	FDAX	-0.0036	0.9	0.5	bad news
2007.01.17 14:30:00	FESX	-0.0035	0.9	0.5	bad news
2007.01.17 14:30:00	FSMI	-0.0024	0.9	0.5	bad news
2007.07.17 14:30:00	Euribor	0.0042	-0.2	0.2	good news
2007.04.13 14:30:00	FSMI	0.0027	1	0.7	bad news
2008.04.15 14:30:00	FCE	0.0045	1.1	0.6	bad news
2009.12.15 14:30:00	FCE	-0.0047	1.8	0.8	bad news
2009.12.15 14:30:00	FDAX	-0.0044	1.8	0.8	bad news
2009.12.15 14:30:00	FESX	-0.0046	1.8	0.8	bad news

Notes: This table reports the date and time of the jump, the market (product), the return computed as logarithm of the price ratio before and after the jump, actual announcement and its mean forecast value, and the type of the news announced for each macroeconomic indicator causing a jump in European markets. We look at the direction of the jump based on whether the surprise is a 'good news' or 'bad news'. An announcement is classified as 'good news' if the event is better than forecasted and as 'bad news' otherwise. FDAX, FESX, FCE and FSMI are futures indices of DAX30 (German), Euros Stoxx50, SMI (Swiss) and CAC40 (French) index, respectively.

Appendix C1

Descriptive statistics on significant jumps before 2007.01.01 from 13:00 until 22:00

	FDAX	FCE	FESX	FSMI	Euribor	EUR/USD
Nb. Obs	169623	170753	123687	93078	169565	134255
Nb. Days	922	641	639	924	803	770
Jump day frequency				Panel 2		
Nb. Jumpdays	132	156	87	46	158	222
P(Jumpdays) (in %)	14.3167	24.3370	13.6150	4.942	19.6762	28.8312
All jumps (absolute value)				Panel 3		
Nb. Jumps	291	391	194	51	391	392
P(jump) (in %)	0.1716	0.2290	0.1568	0.0548	0.2306	0.2920
E(|jumpsize||jump)	0.4456	0.5586	0.4363	0.3233	0.8559	0.6670
Sqrt Var(|jumpsize||jump)	0.3311	0.5744	0.3618	0.1253	0.5115	0.8747
Positive jumps				Panel 4		
Nb. Jumps>0	112	187	80	14	199	183
P(jump>0) (in %)	0.0660	0.1095	0.0647	0.015	0.1174	0.1363
E(jumpsize|jump>0)	0.4567	0.5980	0.4627	0.3396	0.8546	0.6885
Sqrt Var(jumpsize|jump>0)	0.4269	0.6291	0.5246	0.1399	0.5026	0.9282
Negative Jumps				Panel 5		
Nb. Jumps<0	179	204	114	37	192	209
P(jump<0) (in %)	0.1055	0.1195	0.0922	0.0398	0.1132	0.1557
E(jumpsize|jump<0)	0.4387	0.5235	0.4178	0.3172	0.8572	0.6486
Sqrt Var(jumpsize|jump<0)	0.2539	0.5183	0.1696	11.8721	0.5206	0.8260
Percentage of -ive jumps				Panel 6		
% of neg. jumps	61.5120	52.1739	58.7629	60.6557	49.1049	53.3163
Standard error	(2.8523)	(2.5262)	(3.5342)	(6.2489)	(2.5282)	(2.5198)

Notes: The first panel of the table displays, from top to bottom, the number of observations (Nb. obs) and the number of days in our sample (N. Days). The second panel shows the total number of jump days (Nb. Jumpdays), i.e. days with at least one jump), the probability (in %) of a jump day (P(jumpday)=100(Nb. jumpdays / Nb. Days)), and the number of jumps per jump day (E(nb. jumps|Nb.jumpdays). The third panel gives the total number jumps (Nb.jumps), their proportion (in %) over sample observations (P(jump) = 100(Nb.jumps/Nb.Obs.)), as well as their absolute mean size and standard deviation E(|jumpsize||jump) and Var(|jumpsize||jump)). The panel four and five split the jumps in two categories: positive and negative jumps. Proportions (P(jump > 0) and P(jump < 0)), mean (E(jumpsize|jump > 0) and E(jumpsize|jump < 0)) and std. dev. (Var(jumpsize|jump>0) and Var(jumpsize|jump < 0)) are reported, as for the full set of jumps in absolute value. Finally, the last panel reports the percentage of jumps that are negative (100(Nb. jumps<0/Nb.jumps) and the associated standard error. We use 1% significance level on the 5-minute mid-quote prices from 01 January 2007 until 31 January 2010. FDAX, FESX, FCE and FSMI are futures indices of DAX30 (German), Euros Stoxx50, CAC40 (French) and SMI (Swiss) index, respectively.

Appendix C2

Descriptive statistics on significant jumps after 2007.01.01 from 13:00 until 22:00

	FDAX	FCE	FESX	FSMI	Euribor	EUR/USD
Nb. Obs	185231	218462	175235	83102	233173	192909
Nb. Days	780	776	780	771	784	949
Jump day frequency				Panel 2		
Nb. Jumpdays	153	236	136	54	373	395
P(Jumpdays) (in %)	19.6154	30.4124	17.4359	7.004	47.5765	41.6228
All jumps (absolute value)				Panel 3		
Nb. Jumps	419	568	323	61	1355	968
P(jump) (in %)	0.2262	0.2600	0.1843	0.0734	0.5811	0.5018
E(|jumpsize||jump)	0.6638	0.9083	0.7567	0.5500	1.1520	1.0520
Sqrt Var(|jumpsize||jump)	0.5248	0.8196	0.5600	0.6813	0.8838	0.7804
Positive Jumps				Panel 4		
Nb. Jumps>0	145	227	131	25	670	532
P(jump>0) (in %)	0.0783	0.1039	0.0748	0.0301	0.2873	0.2758
E(jumpsize|jump>0)	0.7666	1.0379	0.8727	0.6411	1.1472	1.0938
Sqrt Var(jumpsize|jump>0)	0.6597	0.8972	0.7028	0.5425	0.8913	0.7819
Negative Jumps				Panel 5		
Nb. Jumps<0	274	341	192	36	685	436
P(jump<0) (in %)	0.1479	0.1561	0.1096	0.0433	0.2938	0.2260
E(jumpsize|jump<0)	0.6115	0.8230	0.6782	0.4867	1.1570	1.0011
Sqrt Var(jumpsize|jump<0)	0.4312	0.7522	0.4198	0.2466	0.8758	0.7755
Percentage of -ive jumps				Panel 6		
% of neg. jumps	65.3938	60.0352	59.4427	59.016	50.5535	45.0413
Standard error	(2.3240)	(2.0553)	(2.7320)	(6.2969)	(1.3582)	(1.5991)

Notes: The first panel of the table displays, from top to bottom, the number of observations (Nb. obs.) and the number of days in our sample (N. Days). The second panel shows the total number of jump days (Nb. Jumpdays), i.e. days with at least one jump), the probability (in %) of a jump day (P(jumpday)=100(Nb. jumpdays / Nb. Days)), and the number of jumps per jump day (E(nb. jumps|Nb.jumpdays). The third panel gives the total number jumps (Nb.jumps), their proportion (in %) over sample observations (P(jump) = 100(Nb.jumps/Nb.Obs.)), as well as their absolute mean size and standard deviation E(|jumpsize||jump) and Var(|jumpsize||jump)). The panel four and five split the jumps in two categories: positive and negative jumps. Proportions (P(jump > 0) and P(jump < 0)), mean (E(jumpsize|jump > 0) and E(jumpsize|jump < 0)) and std. dev. (Var(jumpsize|jump>0) and Var(jumpsize|jump < 0)) are reported, as for the full set of jumps in absolute value. Finally, the last panel reports the percentage of jumps that are negative (100(Nb. jumps<0/Nb.jumps) and the associated standard error. We use 1% significance level on the 5-minute mid-quote prices from 26 May 2003 until 31 December 2006. FDAX, FESX, FCE and FSMI are futures indices of DAX30 (German), Euros Stoxx50, CAC40 (French) and SMI (Swiss) index, respectively.

Table 1

Description of the raw original series

Asset	Exchange	Trading Months	Trading Unit	Trading Hours	Tick size
FDAX	EUREX	H,M,U,Z	€ 25	07:50 - 22:00	0.5
FCE	NYSE LIFFE Paris	F,G,H,J,K,M,N,Q ,U,V,X,Z	€ 5	08:00 - 22:00	0.5
FESX	EUREX	H,M,U,Z	€ 10	07:50 - 22:00	1
FSMI	EUREX	H,M,U,Z	CHF10	07:50 - 22:00	1
Euribor	NYSE LIFFE London	F,G,H,J,K,M,N,Q ,U,V,X,Z	€ 12.50	01:00 - 06:00	0.005
E-mini EUR/USD futures	CME Globex Electr.	H,M,U,Z	$6.25	07:00 - 21:00	0.0001

Notes: All times are given in Central European Time (CET). FDAX, FCE, FESX and FSMI are futures on DAX30 (German), CAC40 (French) Euro stoxx50, and SMI (Switzerland) index, respectively. The letters, F,G,H,J,K,M,N,Q,U,V,X,Z denote expiries in January, February, March, April, May, June July, August, September, October, November and December, respectively. FDAX, FESX, FSMI and EUR/USD have four expiries in March, June, September and December, while French equity indices and 3-month Euribor interest rates futures have monthly expiries.

Table 2

Descriptive statistics of log 5-minute returns

	Min	Max	Mean	Volatility	Skewness	Kurtosis
FESX						
H	-0.0077	0.0185	0.0000	0.0044 (0.0544)	1.39	99.20
M	-0.0079	0.0088	0.0000	0.0044 (0.0540)	0.03	7.82
U	-0.0034	0.0088	0.0000	0.0044 (0.0541)	0.20	4.92
Z	-0.0077	0.0088	0.0000	0.0044 (0.0543)	0.19	10.50
FDAX						
H	-0.0098	0.0226	0.0000	0.00175 (0.0204)	46.60	10300.00
M	-0.0741	0.0207	0.0000	0.0046 (0.0399)	-222.00	76700.00
U	-0.0530	0.0516	0.0000	0.0050 (0.0577)	-73.20	19900.00
Z	-0.0408	0.0309	0.0000	0.0043 (0.0498)	-41.60	9530.00
FCE						
F	-0.0053	0.0054	0.0000	-	1.02	175.00
G	-0.0035	0.0045	0.0000	-	3.07	183.00
H	-0.0181	0.0100	0.0000	0.0023 (0.0225)	-10.20	2370.00
J	-0.0043	0.0087	0.0000	-	9.45	829.00
K	-0.0149	0.0096	0.0000	-	-31.40	3060.00
M	-0.0168	0.0261	0.0000	0.0075 (0.0470)	29.70	1990.00
N	-0.0088	0.0086	0.0000	-	-4.05	1690.00
Q	-0.0434	0.0396	0.0000	-	-43.50	3850.00
U	-0.0269	0.0102	0.0000	0.0020 (0.0236)	-66.70	10800.00
V	-0.0432	0.0621	0.0000	-	0.00	2420.00
X	-0.0070	0.0058	0.0000	-	-4.68	166.00
Z	-0.0322	0.0276	0.0000	0.0133 (0.0816)	-4.84	1300.00
FSMI						
H	-0.0023	0.0018	0.0000	0.0018 (0.0194)	-0.30	17.24
M	-0.0014	0.0025	0.0000	0.0018 (0.0194)	0.19	11.48
U	-0.0013	0.0010	0.0000	0.0017 (0.0178)	-0.15	4.90
Z	-0.0017	0.0019	0.0000	0.0018 (0.0189)	-0.03	9.77
EUR/USD						
H	-0.0390	0.0356	0.0000	0.0281 (0.1288)	-24.00	1200.00
M	-0.0677	0.0694	0.0000	0.0370 (0.2384)	8.82	1200.00

U	-0.0786	0.0701	0.0000	0.0302 (0.1831)	8.21	2740.00
Z	-0.0473	0.0437	0.0000	0.0256 (0.1843)	-27.90	1320.00
Euribor						
F	-0.0013	0.0008	0.0000	-	-4.20	99.10
G	-0.0005	0.0009	0.0000	-	2.24	45.50
H	-0.0286	0.0119	-0.0004	0.0254 (0.2745)	-5.76	46.90
J	-0.0011	0.0013	0.0000	-	-1.80	167.00
K	-0.0006	0.0031	0.0000	0.0000	25.80	796.00
M	-0.0282	0.0140	-0.0004	0.0250 (0.2721)	-5.64	44.10
N	-0.0004	0.0025	0.0000	-	26.10	860.00
Q	-0.0084	0.0081	0.0000	-	-1.31	398.00
U	-0.0311	0.0118	-0.0004	0.0252 (0.2750)	-5.75	47.90
V	-0.0046	0.0006	0.0000	-	-24.90	771.00
X	-0.0013	0.0015	0.0000	-	1.50	98.80
Z	-0.0302	0.0131	-0.0004	0.0255 (0.2743)	-5.70	47.20

Notes: This table reports the descriptive statistics of log 5-minute returns for each instrument and for different maturities. FDAX, FCE, FESX and FSMI are futures on DAX30 (German), CAC40 (French), Euros Stoxx50, and SMI (Swiss) index, respectively. The letters, F,G,H,J,K,M,N,Q,U,V,X,Z denote expiries in January, February, March, April, May, June July, August, September, October, November and December, respectively. FDAX, FESX, FSMI and EUR/USD have four expiries in March, June, September and December, while French equity indices and 3-month Euribor interest rates futures have monthly expiries. The volatility column reports the 5-minute annualized volatility, computed as $\frac{\sqrt{12}}{n}\sum_{i=1}^{n}\sqrt{\mathrm{var}(r_i)}$. Whereas the realized 5-minute volatility given in parenthesis is computed as $\frac{\sqrt{12}}{n}\sum_{i=1}^{n} r_i^2$, where r is the 5-minute log-return and n the number of observations.

Table 3

Descriptive statistics on significant jumps from 13:00 - 22:00 CET

	FDAX	FCE	FESX	FSMI	Euribor	EUR/USD
Nb. Obs.	354854	389215	298922	179798	402738	327164
Nb. Days	1702	1417	1419	1692	1587	1719
Jump day frequency				Panel 2		
Nb. Jumpdays	285	392	223	100	531	617
P(jumpday) (%)	16.7450	27.6641	15.7153	5.9101	33.4594	35.8930
E(nb. Jump| Jumpday)	2.4912	2.4464	2.3184	1.12	3.2881	2.2042
All jumps (absolute value)				Panel 3		
Nb. Jumps	710	959	517	112	1746	1360
P(jump) (%)	0.2001	0.2464	0.1730	0.0623	0.4335	0.4157
E(|jumpsize||jump)	0.5737	0.7625	0.6362	0.4468	1.0837	0.9446
√(Var|jumpsize||jump)	0.4674	0.7476	0.5186	0.3290	0.8227	0.8261
Positive jumps				Panel 4		
Nb. Jumps>0	257	414	211	39	869	715
P(jump>0) (%)	0.0724	0.1064	0.0706	0.0217	0.2158	0.2185
E(jumpsize|jump>0)	0.6290	0.8358	0.7165	0.5329	1.0802	0.9946
√(Var|jumpsize|jump>0)	0.5888	0.8155	0.6710	0.4654	0.8279	0.8384
Negative jumps				Panel 5		
Nb. Jumps<0	453	545	306	73	877	645
P(jump<0) (%)	0.1277	0.1400	0.1024	0.0406	0.2178	0.1971
E(jumpsize|jump<0)	-0.5431	-0.7077	-0.5811	-0.4008	-1.0874	-0.8895
√(Var|jumpsize|jump<0)	0.3808	0.6874	0.3703	0.2105	0.8172	0.8086
Percentage of -ive jumps				Panel 6		
% of neg. jumps	63.8028	56.8300	59.1876	65.1786	50.2291	47.4265
Standard error	(1.8035)	(1.5994)	(2.1616)	(4.5016)	(1.1966)	(1.3540)

Notes: The first panel of this table displays, from top to bottom, the number of observations (Nb. obs.) and the number of days in our sample (N. Days). The second panel shows the total number of jump days (Nb. Jumpdays), i.e. days with at least one jump), the probability (in %) of a jump day (P(jumpday)=100(Nb. jumpdays / Nb. Days)), and the number of jumps per jump day (E(nb. jumps|Nb.jumpdays). The third panel gives the total number of jumps (Nb.jumps), their proportion (in %) over sample observations (P(jump) = 100(Nb.jumps/Nb.Obs.)), as well as their absolute mean size and standard deviation E(|jumpsize||jump) and Var(|jumpsize||jump)). The panel four and five splits the jumps in two categories: positive and negative jumps. Proportions (P(jump > 0) and P(jump < 0)), mean (E(jumpsize|jump > 0) and E(jumpsize|jump < 0)) and std. dev. (Var(jumpsize|jump>0) and Var(jumpsize|jump < 0)) are reported, as for the full set of jumps in absolute value. Finally, the last panel reports the percentage of jumps that are negative (100(Nb. jumps<0/Nb.jumps) and the associated standard error. The sampling frequency is 5 minutes. We use 1% significance level on the 5-minute mid-quote prices from 26 May 2003 until 31 January 2010. FDAX, FCE, FESX and FSMI are futures on DAX30 (German), CAC40 (French), Euros Stoxx50 and, SMI (Swiss) index, respectively.

Table 4

Cojump probability

Assets	Nb. Obs	Nb. Cojumps	P(cojump) in %
FDAX - FCE	126966	177	0.1394
FDAX – FSMI	88565	70	0.0007
FDAX - FESX	140800	200	0.1420
FDAX - FCE - FESX	123457	155	0.1255
FDAX – FCE - FSMI	73598	56	0.0007
FDAX - Euribor	110145	1	0.0009
FDAX - EUR/USD	108185	10	0.0092
FCE - FESX	123803	184	0.1486
FCE-FSMI	73892	62	0.0008
FCE - Euribor	101285	3	0.0030
FCE - EUR/USD	94561	5	0.0053
FSMI – Euribor	80160	0	0
FSMI – EUR/USD	52427	1	1.907E-5
FESX - Euribor	99991	1	0.0010
FESX - EUR/USD	105358	9	0.0085
Euribor - EUR/USD	75090	9	0.0120

Panel 2: Probability of a cojump on the considered markets given a jump on the market given in the corresponding column.

P(cojump|jump) in %	FESX	FDAX	FCE	FSMI
FDAX-FCE	-	48.8950	32.2993	-
FDAX-FESX	70.9220	55.2486	-	-
FDAX-SMI		18.5674		62.5000
FCE-FESX	65.2482	-	33.5766	-
FCE-SMI	-		11.0320	55.3571
SMI-FESX	19.3772	-	-	50.0000
FDAX-FCE-FESX	54.9645	42.8177	28.2847	-
FDAX-FCE-SMI	-	14.8541	9.9644	50.0000
FDAX-FESX-SMI	19.3772	14.8541	-	50.0000
FCE-FESX-SMI	18.3391	-	9.4306	47.3214
FCE-FDAX-FESX-SMI	18.3391	14.0584	9.4306	47.3214

Notes: The first panel of this table depicts the number of observations, number of cojumps and their respective probabilities for different pairs of asset classes in our sample. The second panel shows the probability of a cojump on the considered markets given a jump on the market shown in the corresponding column. FDAX, FESX, FSMI and FCE are futures indices of DAX30 (German), Euros Stoxx50, SMI (Swiss) and French CAC40 index, respectively.

Table 5
Conditional probability of cojump for every significant U.S macro announcement

P(cojump|jump) in %	FESX	FDAX	FCE	FSMI
Unemployment				
FDAX-FCE	-	66.6667	91.6667	-
FDAX-FESX	90.4762	57.5758	-	-
FDAX-FSMI		42.4242		93.3333
FCE-FESX	95.2381	-	83.3333	
FESX-FSMI	47.6190	-	-	66.6666
FCE-FSMI	-		48	80
FDAX-FCE-FESX	85.7143	54.5455	75	-
CPI				
FDAX-FCE	-	76.9231	62.5	
FDAX-FESX	90.9091	76.9231	-	
FDAX-FSMI		33.3333		80
FCE-FESX	100	-	68.75	
FESX-FSMI	36.3636			80
FCE-FSMI	-	-	33.3333	100
FDAX-FCE-FESX	90.9091	76.9231	62.5	
ISM Price Index				
FDAX-FCE	-	60	100	
FDAX-FESX	80	80	-	
FDAX-FSMI		20		100
FCE-FESX	60	-	100	
FESX-FSMI	25			100
FCE-FSMI	-	-	16.6666	100
FDAX-FCE-FESX	60	60	100	
Factory Orders				
FDAX-FCE	-	100	40	
FDAX-FESX	66.6666	100	-	
FDAX-FSMI		0		0
FCE-FESX	100	-	60	
FESX-FSMI	0			0
FCE-FSMI	-		0	0
FDAX-FCE-FESX	66.6666	100	40	
Consumer Confidence				
FDAX-FCE	-	57.1429	66.6667	
FDAX-FESX	100	42.8571	-	
FDAX-FSMI		20		100
FCE-FESX	100	-	50	
FESX-FSMI	20			50
FCE-FSMI			12.5	50
FDAX-FCE-FESX	50	42.8571	50	
Initial Jobless Claims				

FDAX-FCE	-	71.4286	62.5	
FDAX-FESX	85.7143	85.7143	-	
FDAX-FSMI		40		100
FCE-FESX	85.7143	-	75	
FESX-FSMI	22.2222			50
FCE-FSMI			22.2222	50
FDAX-FCE-FESX	71.4286	71.4286	62.5	
New Home Sale				
FDAX-FCE	-	33.3333	25	
FDAX-FESX	50	33.3333		
FDAX-FSMI		0		0
FCE-FESX	50	-	25	
FESX-FSMI	0			0
FCE-FSMI			0	0
FDAX-FCE-FESX	50	33.3333	25	
Advance Durable Good				
FDAX-FCE	-	57.1429	66.6667	
FDAX-FESX	100	100	-	
FDAX-FSMI		14.2857		50
FCE-FESX	57.1429	-	66.6667	
FESX-FSMI	14.28571			50
FCE-FSMI			33.3333	100
FDAX-FCE-FESX	57.1429	57.1429	66.6667	
Producer Price Index				
FDAX-FCE	-	88.8889	88.8889	
FDAX-FESX	100	88.8889	-	
FDAX-FSMI		50		100
FCE-FESX	100	-	88.8889	
FESX-FSMI	50			100
FCE-FSMI			42.8571	100
FDAX-FCE-FESX	100	88.8889	88.8889	
Existing Home Sale				
FDAX-FCE	-	100	100	
FDAX-FESX	100	100	-	
FDAX-FSMI		50		100
FCE-FESX	100	-	100	
FESX-FSMI	50			100
FCE-FSMI			50	100
FDAX-FCE-FESX	100	100	100	

Notes: This table reports the conditional probability of cojump for every significant U.S macroeconomic news announcement in our sample. FDAX, FCE, FSMI and FESX, are futures on DAX30 (German), CAC40 (French), SMI (Swiss) and Euro stoxx50 index, respectively. P(cojump|jump) is computed as the probability of a simultaneous jump (cojump) in both markets conditional on the jump in a given market. For example, P(cojump FDAX-FCE | jump for FCE) = 91.667% for U.S unemployment announcement indicates that 91.667% of the times when a jump occurs in FCE, there is a simultaneous jumps in FDAX in response to the U.S unemployment rate surprise.

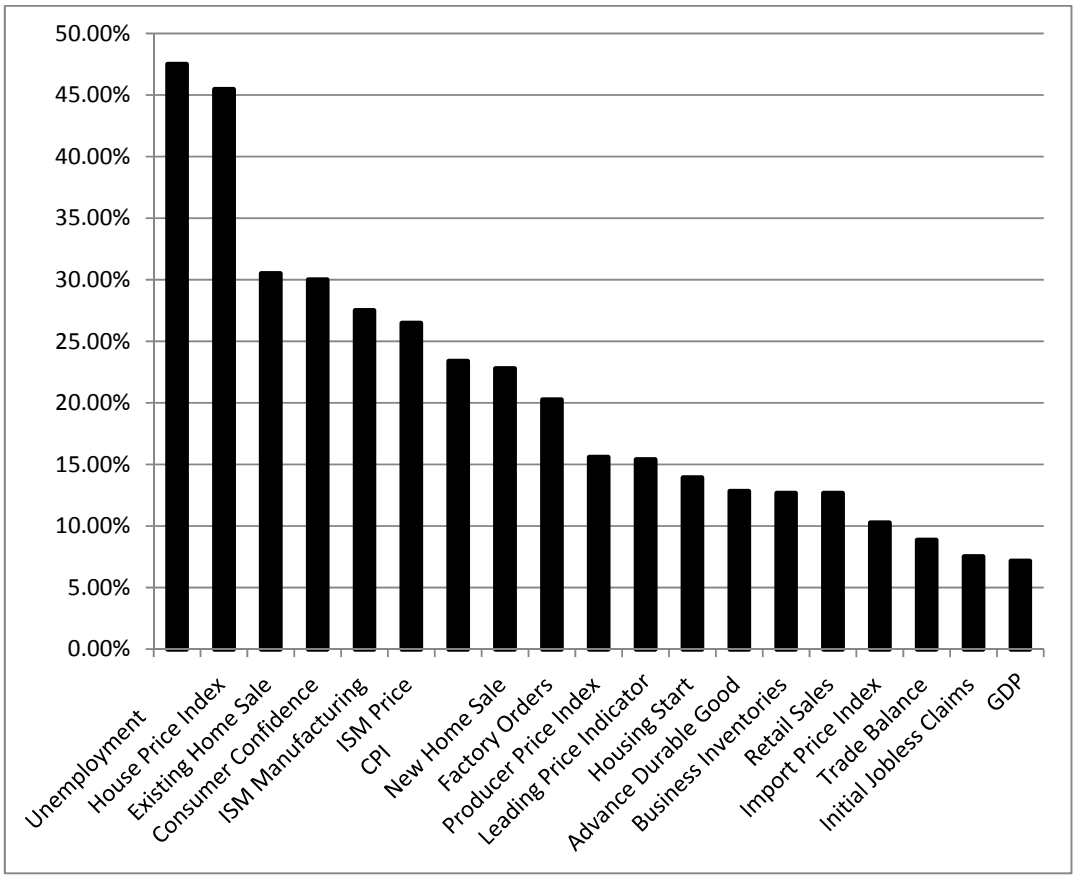

Fig. 1. Percentage of jumps by events for all markets

Notes: This figure shows the percentage of jumps caused by selected U.S macroeconomic indicators for all asset classes in our sample, namely FSMI, FDAX, FCE, FESX, 3-month Euribor interest rate, and EUR/USD futures. FSMI, FDAX, FCE and FESX are futures on SMI (Swiss), DAX30 (German), CAC40 (French) and Euro stoxx50 index, respectively.

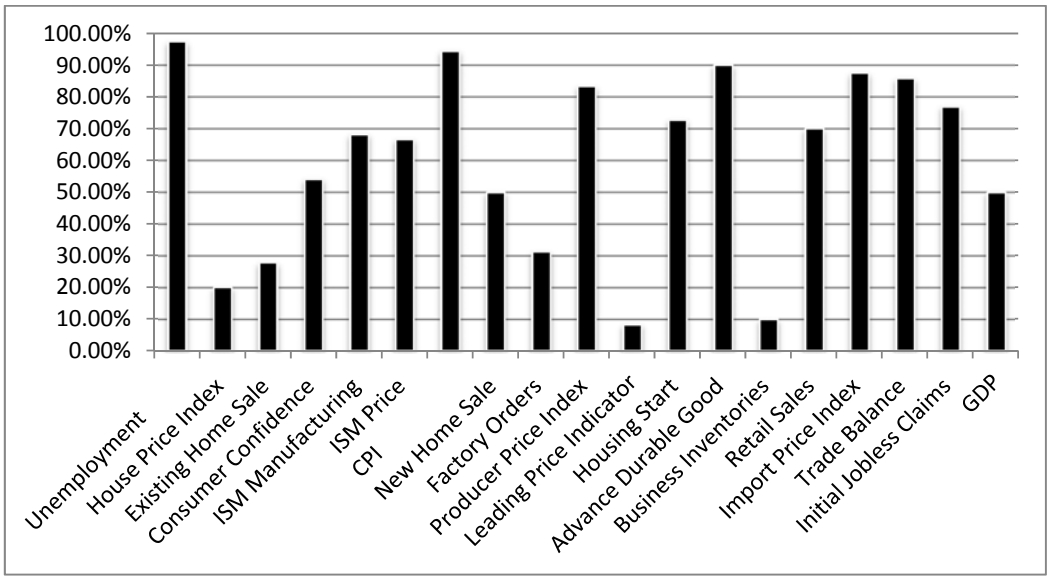

Fig. 2. Percentage of jumps by events for all Equity index futures
Notes: This figure shows the percentage of jumps caused by selected U.S macroeconomic indicators for all Equity markets futures in our sample, namely FSMI, FDAX, FCE and FESX. FSMI, FDAX, FCE and FESX are futures on SMI (Swiss), DAX30 (German), CAC40 (French) and Euro stoxx50 index, respectively.

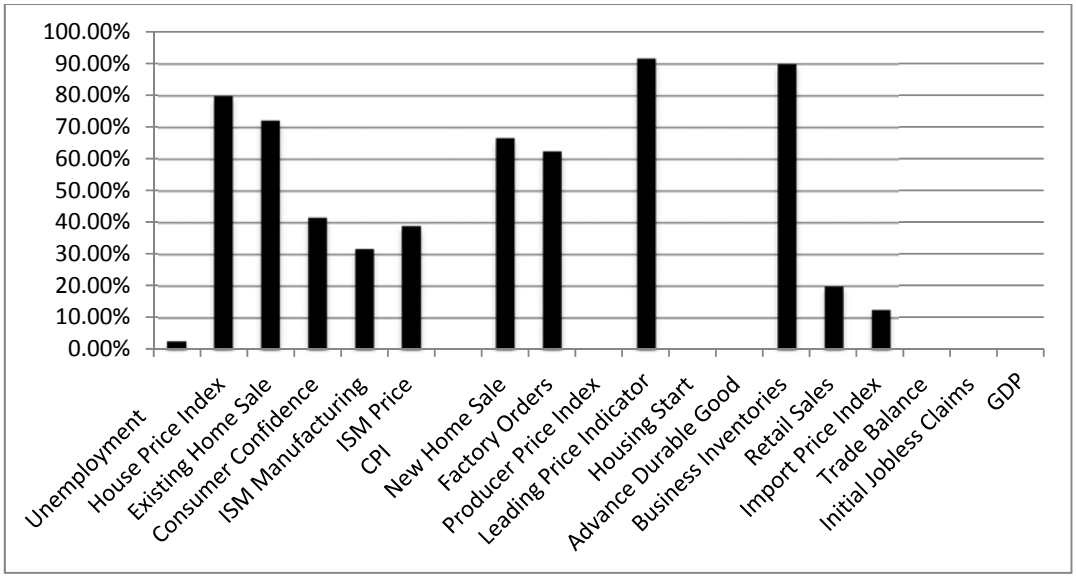

Fig. 3. Percentage of jumps by events for EUR/USD futures
Notes: This figure shows the percentage of jumps caused by selected U.S macroeconomic indicators for EUR/USD futures.

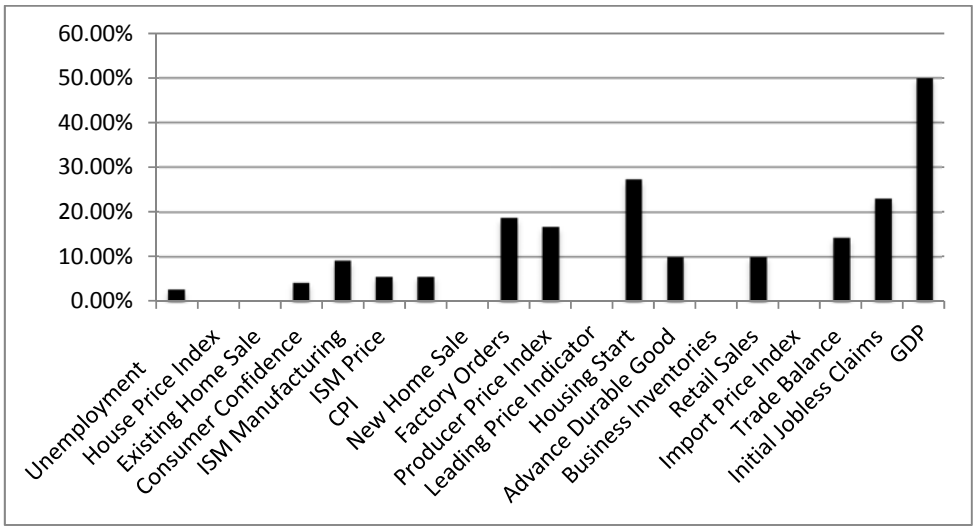

Fig. 4. Percentage of jumps by events for 3-month EURIBOR futures
Notes: This figure shows the percentage of jumps caused by selected U.S macroeconomic indicators for 3-month Euribor futures.

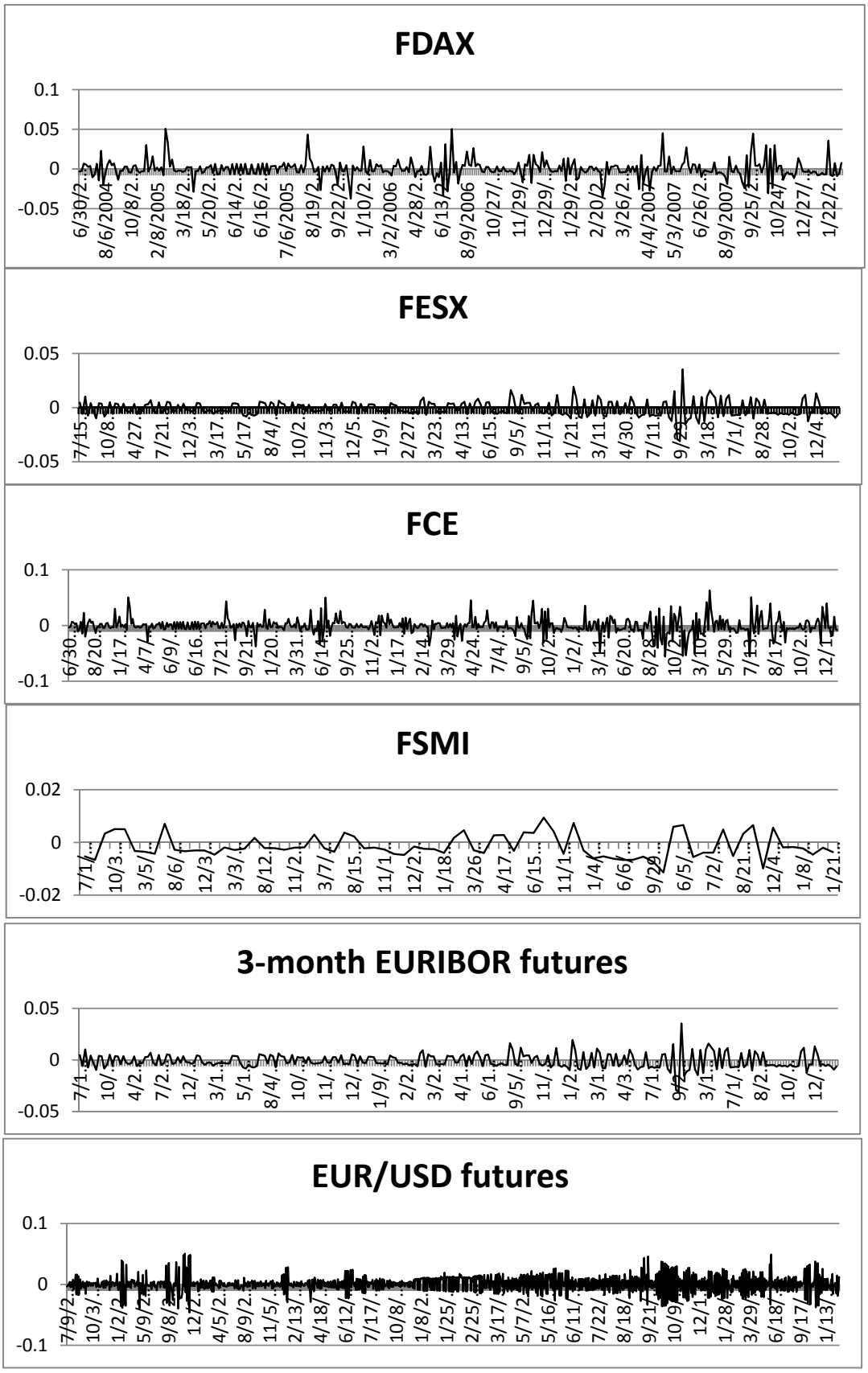

Fig. 5. Time series of jumps in all markets.

Notes: This Figure depicts the time series graph of significant jumps in five European financial markets. FSMI, FDAX, FESX, FCE, EURIBOR and EUR/USD are futures on SMI (Swiss), DAX30 (German), Euros Stoxx50, CAC40 (French), 3-month EURIBOR rate, and currency EUR/USD rates, respectively.

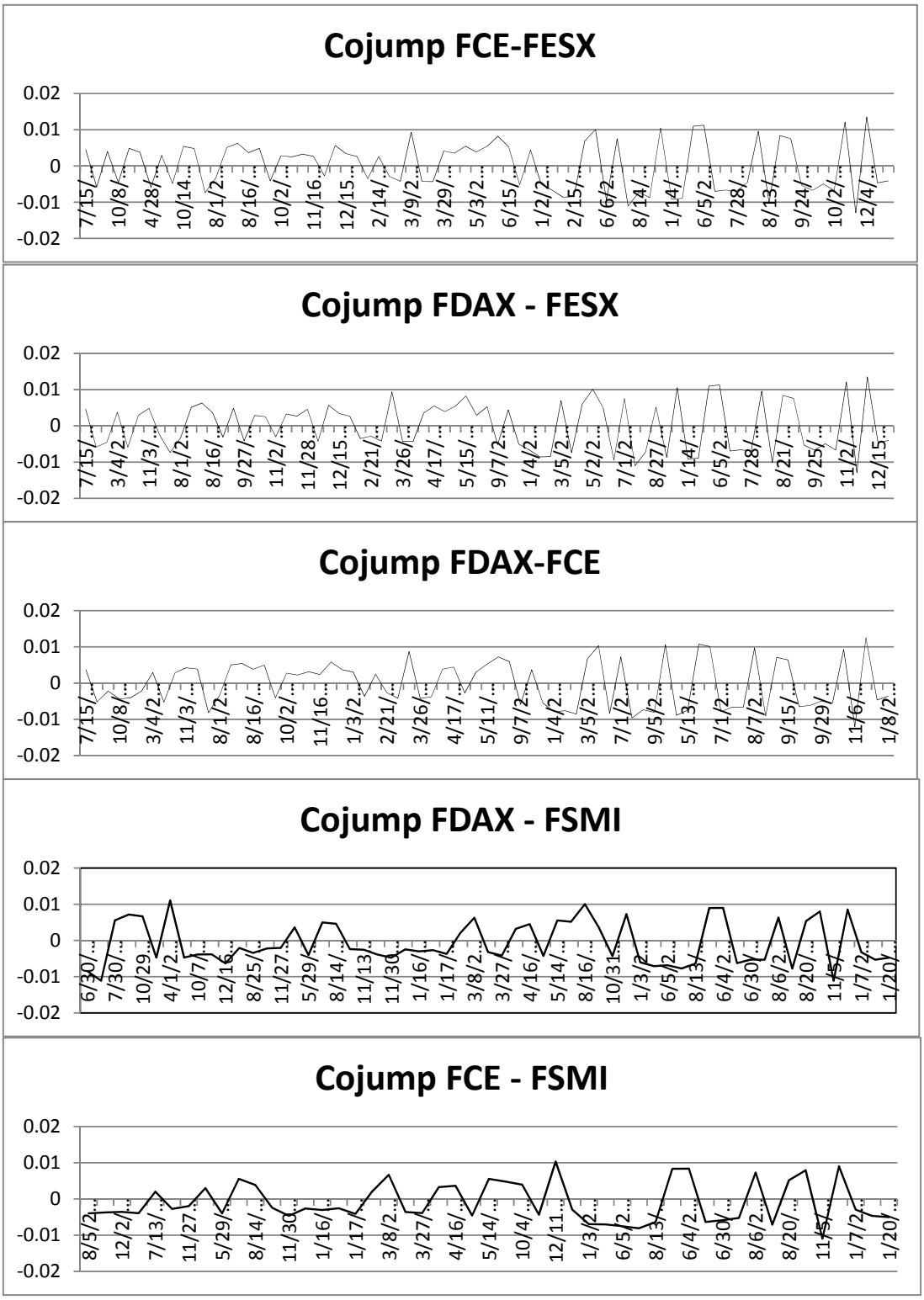

Fig. 6. Time series of cojumps in pairs of European equity indices futures

Notes: This Figure depicts the time series graph of significant cojumps in four European equity futures markets. FDAX, FESX, FSMI, and FCE are futures on DAX30 (German), Euros Stoxx50, SMI (Swiss) and CAC40 (French) index, respectively.