Euro-Dollar exchange rate and news: Market behaviour before and after the 2007-2008 financial crisis

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ABSTRACT

This paper examines the determinants of the Euro/US Dollar exchange rate during the 2007-2008 period to investigate the possible effects of the financial crisis on dynamics of the Euro-Dollar rate. We use an EGARCH (3,1) news-type model with thrice-daily frequency data to represent three temporal trading zones with unscheduled news in addition to the traditional scheduled macroeconomic news. In line with some behavioral finance insights, we find that when comparing pre-crisis and post crisis periods there are noticeable differences in agents' attitudes across the three trading time zones in terms of asymmetric reactions, over/under-reactions to news, policies and fundamentals variables.

Keywords: exchange rate, macroeconomic announcements, unscheduled news, market reaction, behavioural finance

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1. Introduction

The Euro/US Dollar rate is the youngest and the most traded among the major currency pairs[1]: it started with a value of 1.17 on January 4, 1999, it reached a value of 0.82 on October 26, 2000, increased up to a maximum level of 1.59 on July 17, 2008, and fell back down below 1.20 in mid-2010. Values so far apart have pointed to a persistence of misalignment *vis-à-vis* the Dollar for long periods, and prompted alternative new theories to explain exchange rate fluctuations. Back in seventies and eighties, the dynamics of the exchange rate was traditionally investigated in terms of equilibrium relationships between currencies and their fundamentals, a group of macroeconomic variables such as economic activity, inflation, interest rates, monetary and financial aggregates. The break-through study by Meese and Rogoff (1983), casting serious doubts on the forecasting performance of these classes of models, generated a parallel reconsideration of equilibrium schemes in favor, among other schemes, of news models. The central idea of this latter approach, influenced by the efficiency market/rational expectation paradigm, is that the exchange rate dynamic is affected by the surprise in the fundamentals rather than by the fundamentals themselves, where the surprise is the unexpected *news*, i.e. the difference between published values and its expected values. The news approach has thus grown out of the empirical counterpart of the main macro-financial theories of exchange rate determination. In that initial phase, the lack (or the high cost) of data on market expectations led to generate macroeconomics and financial news by using econometric models, as in Edwards's (1982, 1983) pioneering work's. Later on Hoffman and Schlagenhauf (1985) made use of sampled forecasts to compute news and to estimate various versions of news-form equations. Since then, the foreign

[1] According to the 2010 Bank of International Settlements Eight Triennial Bank Survey of Foreign Exchange and Derivatives Market Activity (p.15, table B.6), at the end of 2010 the Euro-US Dollar exchange rate accounts for 28% of the global foreign exchange market turnover.

exchange market has become empirically richer and richer as various data providers started sampling the international financial market with tick data, while, at the same time, technology advances have enabled the main financial newswire services (e.g. Reuters, Bloomberg, Down Jones Newswires, etc.) to follow the market continuously and to produce reports of events with time stamps during the entire global trading day, becoming in this way the main source of news.

The developments in data collection and communication have enabled academics and practitioners to analyze the exchange rate market at various frequencies[2] and to estimate directly the impact of a news-event on exchange rates, typically quoted against the US Dollar. As a result, the news literature has progressively adopted a more microstructure perspective in looking at the Forex market (Sarno and Taylor, 2003), a perspective that focuses on the traders' behaviours and reactions and hence on very high frequency data and on the microscope. A vast body of literature has analyzed and explained intraday dynamics of the exchange rate. Ederington and Lee (1993, 1995) in their studies argue that most of the Dollar/Deutsche Mark (USD/DEM) intraday price adjustment to new information occurs within the first minute of macroeconomic variables release and that market reaction is resolved in the first 40 seconds. Also Andersen et al. (2003) find that announcements produce a very short-term effect reaction of news and the occurrence of quick jumps. They also point out to the market's asymmetric reaction to positive and negative surprises, with more pronounced reaction to negative than to positive news.

[2] With a focus, among other rates, on the USD/EUR(DEM) exchange rate returns, at daily frequencies by Hardouvelis (1988); Aggarwal and Schirm (1992, 1998); Galati and Ho (2003); Ehrmann and Fratzscher (2005); Evans and Lyons (2005). At infra-daily frequencies using: hourly data by Tanner (1997); Evans and Lyons (2002); five-minute data by: Ederington and Lee (1993); Almeida et al. (1998); Andersen et al. (2003, 2007); Faust et al. (2007); Pearce and Solakoglu (2007); Evans and Lyons (2008); Conrad and Lamia (2012); 1-minute data by: Fair (2003); Love and Payne (2008);10-second and tick-by-tick data by Ederington and Lee (1995); Carlson and Lo (2006).

Despite the abundance of empirical studies based on the news-based approach[3], we limit our description here only to the above two contributions, because they contend that the response of exchange rates to news is a very short-term phenomenon whereas our findings indicate that news have an impact that goes far beyond a few seconds and traders may over-react or under-react to news, indicating that old surprises can still influence the market beyond their immediate impact effect.

In the light of the past theoretical and empirical contributions of the news models, largely used to study high frequency fluctuations of the Euro-Dollar rate over periods of relatively calmness, this paper aims to investigate the determinants of lower frequency intra-daily fluctuations of the same rate during rather turbulent times marked by the occurrence of the most serious international financial crises of the past seventy years. Our goal is to assess if and to what extent trading behaviour may have been affected by the crises epitomized with the collapse of Lehman. To this end we extend the news approach to take into account other factors influencing the Euro-Dollar rate such as the role of unscheduled news and that of geographical "trading styles", hence providing some original contributions under different perspectives. Firstly, we employ an intra-day frequency that reflects a natural partition of the trading day into three geographical trading areas; secondly, the reactions of heterogeneous market participants is extended to qualitative surprises news and events; thirdly we include possible asymmetric effects (to positive and negative surprises) to stale news, that is the reactions to past events that occurred in previous trading areas and we interpret these over-reaction and under-reactions at the lights of some behavioural finance biases.[4]

[3] We refer the interested reader to Neely and Dey (2010) who provide an excellent review of all contributions in this field.

[4] Research in behavioral finance explains the presence of anomalies and price patterns that contrast with the standard EMH by investigating the relevance and the effects of investors' psychology on asset pricing. The field of behavioral finance thus combines methods originated in psychology with the more

Our results are consistent with earlier studies on news-approach: macroeconomic news and unscheduled news increased volatility significantly, and news on the United States are the most important. The hypothesis of bad news having a greater impact on volatility was also re-confirmed in this study. Similarly to Ehrmann and Fratzscher (2005), who used daily data from 1993-2003 to study the Euro/DEM-US Dollar fluctuations, we find that the exchange rate responds more strongly to news in periods of large market uncertainty and when negative or large shocks occur. In their study, the larger importance of US macroeconomic news was in part explained by the earlier release time compared to corresponding German and Euro-area news. Due to our partition of the trading day, we were able to pair more accurately news releases and trading areas and we found that although many Euro-area news are actually released before American news, still American news (scheduled and unscheduled) play a major role, particularly after the crisis. We also confirm Fatum et al.'s (2012) previous results in founding that the exchange rate reaction to macro news depends on the state of the business cycle, on the type of news and on their content (good versus and bad news). However in this study we were able to show that also the conditional volatility of the Euro-Dollar rate also depends on the state of the cycle and that it responds asymmetrically to positive and negative unexpected surprises especially after the financial crisis. As in Hayo and Neuenkirch (2012) we found that the Euro-Dollar exchange rate responds more to shocks originating from the real economy than to price shocks and monetary policy news (interest rate) and that macro news that originating from the United States dominates but we also found that unscheduled news, particularly

traditional finance research methods. In doing so, it offers an alternative theoretical approach to the study of financial markets, taking impetus from the prospect theory (Kahneman and Tversky, 1979). For an overall overview in the stock markets see, for example, Barberis and Thaler (2003) and Shiller (2005). In the foreign exchange markets, among others, Oberlechner and Hocking (2004), De Grauwe and Grimaldi, (2006) and Oberlechner and Osler (2012).

in the post financial crisis period are relevant. Finally, in line with Jansen and De Haan (2005), who used daily data of the Euro-Dollar rate from 1999 to 2002, we consider unscheduled news such as statements by European Central Bank and national central bank officials and comments on monetary policy to study the reaction of the conditional mean and volatility of the rate. In their study they highlight that the Bundesbank dominated the news coverage and that the ECB statements have mainly influenced conditional volatility and in some circumstances the conditional mean of the Euro–Dollar exchange rates. Our results point out that after the crisis the events and comments originating from the American trading zones are the most influential in affecting the conditional mean and that positive Euro and negative Dollar news have larger impact on conditional volatility. The rest of the paper is organized as follows: in Section 2 the econometric methodology is introduced and explained, then in Section 3 the data are presented, while in Section 4 the specification and estimations issues are discussed. In Section 5 the results and limitations are presented and commented. Finally Section 6 concludes and indicates directions for further research.

2. Methodology and econometric model

In our analysis we estimate a news equation of the Euro-Dollar exchange rate to assess the market reaction of investors following the release of different typologies of news (scheduled and unscheduled) at different times of the global trading day (GTD). Our econometric model captures the feature that the global trading day never stops and it runs through three main intervals or eight-hour time zones: Asian Time Zone (ASTZ), European Time Zone (ETZ), and an American Time Zone, (ATZ). The eight-hour time series have been built in the following order: the trading day starts in Asia (ASTZ), to continue in Europe (ETZ), and then in America (ATZ).

ASTZ goes from the closing of Wall Street at 4PM EST in the previous day (10PM in Central European Time, CET) to 6AM, CET. ETZ goes from 6AM to 2PM, CET, before the ECB Euro "fixing" and the publication of important macro news in the US (8:30AM EST, corresponding to 2:30PM, CET). The ATZ goes from 2PM, CET, to 10PM CET (4PM EST) of the current day. We thus see that our GTD does not correspond to the astronomical 24-hour day as it begins two hours before midnight CET, on the previous day, and ends two hours before midnight CET, on the current day. The three values of the exchange rates are then placed at 6AM, 2PM and 10PM, CET. All the explanatory variables in our empirical relationships are recorded and coded according to a thrice-daily frequency and are placed within the three time zones. Therefore they can explain the Euro-Dollar returns at the corresponding three hours defined above. It is worth mentioning that this tri-partition of the GTD into three equal parts of eight hours is an absolute novelty in empirical modelling of exchange rates. In the literature of more dated equilibrium models time frequencies ranges from quarterly, to monthly and daily data. The most recent models typically use much higher frequencies (from hourly to five, one minutes and tick by tick) as a way to integrate more closely finance and economics and to provide a more microstructural explanation of currency fluctuations. The thrice-daily choice allows a finer attribution of policy events and news to a more homogeneous set of market participants (belonging to the same trading zones) and to differentiate across heterogeneous traders (belonging to different trading areas), without being disturbed by noisy data (in the ultra-high frequency) and to overcome the scarce heuristics of the empirical results, stemming from their use. Experience and common sense (enriched by countless discussions with Forex traders) has suggested that in order to meaningfully connect exchange rate movements and news, it is necessary to allow for some time to go after the news (be it

scheduled or, most of all, unscheduled). The eight-hour time interval turned out to be heuristically and operationally the best, although some statistical purity is lost as in eight hours some other shock can hit the market.

[PLEASE INSERT FIGURE 1 HERE]

In order to shed some extra light on how news, expectations and market sentiment determines the wild swings of Euro-Dollar, this study uses – together with the traditional scheduled macro news - a relatively novel kind of news variables, called unscheduled news[5], consisting of political news, policy statements, market news, interventions by Central Banks, unexpected monetary policy decisions and other events, all occurring somewhat randomly overtime or, even though expected to occur at a known time, having an unknown content or an ex-ante unpredictable impact on exchange rates, because of time-inconsistent decoding by heterogeneous traders.[6]

The general specification of our model is as follows:

$$\begin{aligned}\Delta S_t \;=\; & \alpha + (\mu_1 L^1 + \mu_2 L^2 + \mu_3 L^3)\Delta S_t + (\boldsymbol{\vartheta}_0' L^0 + \boldsymbol{\vartheta}_1' L^1 + \boldsymbol{\vartheta}_2' L^2 + \boldsymbol{\vartheta}_3' L^3)\boldsymbol{Y_t} \\ & + (\boldsymbol{\beta}_0' L^0 + \boldsymbol{\beta}_1' L^1 + \boldsymbol{\beta}_2' L^2 + \boldsymbol{\beta}_3' L^3)[\boldsymbol{Z_t} - \boldsymbol{E(Z)_t}] \\ & + (\boldsymbol{\gamma}_0' L^0 + \boldsymbol{\gamma}_1' L^1 + \boldsymbol{\gamma}_2' L^2 + \boldsymbol{\gamma}_3' L^3)\boldsymbol{U_t} + \epsilon_t \qquad (1)\end{aligned}$$

Where $\Delta S_t = \log(S_t / S_{t-1})$ is the thrice-daily return between two consecutive time zone (*t* and *t-1)* sampled at the end of each relevant time zone. The symbols μ, $\boldsymbol{\vartheta}'$, $\boldsymbol{\beta}'$, and $\boldsymbol{\gamma}'$ are parameters or vectors of parameters to be estimated and ϵ_t is a stochastic error expected to be normally distributed with zero mean and constant variance.

[5] This definition is proposed by Ederington and Lee (1996), Fornari and Mele (2001) and Tivegna and Chiofi (2004).

[6] The same line of analysis is used by Fair (2002, 2003), Fatum and Hutchinson (2002), whose approach is probably the closest to the one in this paper. The most recent papers in this approach are by Fratzscher (2008a, 2008b).

The letter L is the lag operator, and its exponential index indicates the number of times that the associated variable has been lagged. A three lags structure would cover the length of one global trading day.[7] Lagged values of fundamentals and news variables should capture the reactions of traders operating in a specific trading area to past events and news originated in preceding trading areas meaning that an event can still exert some effect in a time zone different from the one when it occurred.

The letter **Y** indicates a vector of fundamentals, the letter **Z** is used to indicate the vector of macroeconomic indicators and **E(Z)** is the vector of their respective expected values, so that their difference, in brackets, is the news or surprise that would move the exchange rate. The letter **U** is used to indicate the unscheduled news, mentioned earlier on and explained more in detail in the next session of the paper.

We also consider asymmetries[8] in the Euro/Dollar exchange rate volatility produced by large swings of Euro-Dollar and unaccounted for in the mean part of the model using an exponential GARCH (EGARCH) specification (Nelson,1991). The conditional variance of error terms is modeled as:

$$\log(h_t) = \omega + \sum_{j=1}^{m} \theta_j \left[\frac{|\epsilon_{t-j}|}{\sqrt{h_{t-j}}} - E\left\{\frac{|\epsilon_{t-j}|}{\sqrt{h_{t-j}}}\right\}\right] + \sum_{j=1}^{m} \varphi_j \left(\frac{\epsilon_{t-j}}{\sqrt{h_{t-j}}}\right) + \sum_{l=1}^{k} \delta_l \log(h_{t-l}) \qquad (2.1)$$

where $\epsilon_t = \sqrt{h_t} z_t$ and $z_t = \epsilon_t / \sqrt{h_t} \sim N(0,1)$

assuming a Gaussian distribution for the innovation terms we obtain (Hamilton, 1994):

$$E\left\{\frac{|\epsilon_{t-j}|}{\sqrt{h_{t-j}}}\right\} = E\{|z_{t-j}|\} = \sqrt{\frac{2}{\pi}} \qquad (2.2)$$

and

[7] On estimation we also tried a fourth lag which represents the same time zone one day earlier. Lags longer than 3 periods were never statistically significant.

[8] Andersen et al. (2003) show evidence of asymmetries in the UDS foreign exchange market returns versus Euro, DM, UKP and JPY while Fatum et al. (2012) document asymmetric (different) market reactions on the JPY/USD exchange rate for negative and positive surprise.

$$\log(h_t) = \omega + \sum_{j=1}^{m} \theta_j \left[|z_{t-j}| - \sqrt{\frac{2}{\pi}} \right] + \sum_{j=1}^{m} \varphi_j z_{t-j} + \sum_{l=1}^{k} \delta_l \log(h_{t-l}) \quad (2.3)$$

The parameter φ is the asymmetry parameter. When φ_j =0, then a positive unaccounted surprise has the same effect on volatility as a negative surprise of the same magnitude; if -1 < φ_j < 0 a positive unaccounted surprise increases volatility less than an negative surprise (negative leverage). The parameter θ indicates the sensitivity of volatility to large unaccounted news. A positive value implies that the large surprises of both sign will increase the volatility.

3. Data

The construction of thrice-daily time series of exchange rates and of other fundamental financial variables (stock indexes and interest rates) was carried out paying meticulous attention to the alignment and correct attribution of each observation to its correct time zones[9], keeping also track of changes in Daylight-saving time between the ETZ and the ATZ. The same was true for the rest of the scheduled news and unscheduled news,

[9] The task of assigning the stock indexes to time zones was easy as they start and end trading well within their respective time zones. The time zone assignment of interest rates was a little trickier. Contacts with the help desk of Thomson Reuters Datastream allowed us to use those time series of 10-Year interest rates, traded within their respective time zones (or approximately so). Scheduled news fell very well in our time zones and great care was employed to do the same for unscheduled news, as mentioned in the previous paragraph. Daylight-saving time (DST) differences on the two sides of the Atlantic required some attention. Corrections were needed when the time difference between the countries in the Eurozone plus UK and the United States (East Coast) moved away from the normal 6 span, going to 7 or 5 hours, according to permanence in DST in one geographical block but not in the other and viceversa. That was all the most important because a large bunch of US scheduled news, those released at 2:30PM (CET, in regular times), move from ATZ to ETZ, when the US is in DST but Europe is not. Other scheduled news were also affected. From 2003 to 2006, the problem had limited dimensions (but corrections had to be made, anyway), from 2007 it was absolutely necessary to cope with this issue. In fact, between 2003 and 2006 Europe moved into DST in the last weekend of March and USA used to follow suit one week later in April. Between the same years above, Europe and USA used to go back in October to solar time on the same day (last Sunday of October). Starting from 2007, however, the US started moving into DST three weeks earlier, in March, and hence before the European change into DST, occurring during the last week of March. Changes occurred also in October, when the US goes back into solar time a week later than Europe.

attributing the news to the time zone interval (ASTZ, ETZ, ATZ) during which the news was released.

3.1. Data: Dependent Variable and Fundamentals

Thrice-daily data on exchange rates, for the set-up shown in Fig. 1, were extracted from an hourly time series of Euro/US Dollar obtained from CQG Data and maintained with data controls overtime. The S_t time series begins in ASTZ on January 1, 2003 and ends in ATZ, 6849 8-hour periods later, on August 31, 2011.

Traditional exchange rates empirics take into consideration also interest rates differentials and, in more recent times, also stock indexes. The same was done for the high frequency employed in this paper. Daily data for Dow Jones, DAX, Nikkei 225, FTSE All Shares, 10-Year Government bond yield for US, UK, Germany and Japan, were obtained from Thomson Reuters Datastream.[10] The variation in ten years government bond yield is measured as the 24 hours variation in the yield of public debt of the US, Germany, UK and Japan, computed on the end of day annualized yields of the 10–year bonds. Daily returns for stock market indexes assuming reinvestment of dividends are computed as 24 hours (logarithmic) change of the *cum*-dividends values of the indices for national stock market.

3.2. Data: Scheduled news

The next set of explanatory variables in equation (1), is about scheduled news. These variables are "unexpected" values of main macroeconomic announcements made by

[10] In this paper we use 10-Year rates instead of very short-term interest rates as we are dealing with intraday movements of Euro/US Dollar. We made this choice as long-term rates have a much higher signalling effect on the entire yield curve, which is what matters for most traders. Besides that, short-term interest did not explain anything, as being moved by occasional and unpredictable liquidity swings in their money markets.

Government statistical Agencies and Departments, Central Banks, Institutes or Centers of Economic Research, National or Supranational Institutions. Amongst the global area of the Euro-Dollar exchange rate, during our sample period, 2003–2011, United States, Euro-Area as a whole, Germany and United Kingdom have had a calendar of statistical releases of economic indicators made known well ahead (in fact at scheduled times), typically in the early hours of their respective trading zones, with a few exceptions, though.

The scheduled macroeconomic "surprises" are computed by taking the difference between the actual value of the macroeconomic release, announced by the statistical authorities, and its expected value, collected by specialized organizations. The set of macroeconomic announcements and market consensus we used is form Bloomberg News Service.[11] Because these surprises have different units of account, we followed the convention to standardize them using the standard deviations of the entire sample period according to the Balduzzi et al.'s, 2001 procedure.

Table 1 summarizes the main characteristics of the scheduled announcements we considered for our study. The total number of macroeconomic indicators is 68 (25 for the United States, 17 for the Euro-Area, 14 for the United Kingdom and 12 for Germany). For each country or area we first classify the announcements according to frequency of release (monthly, quarterly or weekly) and provide the unit of measure of the indicator. Echoing Andersen et al. (2003) and Ehrmann and Fratzscher (2005) each

[11] Bloomberg provides results of a market survey conducted usually 48-72 hours prior to the release of important economic indicators. The survey polls economists across the industry for their estimate of a particular statistic. These estimates are then averaged to provide the Bloomberg Survey mean and median estimates.

announcement is then ordered within its frequency group according to its temporal sequence in the calendar month of release.[12]

[PLEASE INSERT TABLE 1 HERE]

3.3. Data: Unscheduled News

The unscheduled news typology is less frequently used in the econometric estimation of exchange rates empirical models.[13] This is due to their nature: interpretation is necessary as their definition and perception by traders is quite idiosyncratic and time-varying. The decoding process by traders goes through non-homogeneous economic, financial, and policy evaluation models, including the way policy decisions are taken and implemented. That makes quite hard to propose an unambiguous taxonomy of unscheduled news. In principle, unscheduled news consists of an economic, an institutional or a policy event, a declaration or a disclosure, which can be either totally unexpected or - even though expected to occur - has an unknown timing, or an unknown content or both and frequently producing weird and ex-ante unpredictable reactions from financial markets. This news typology, therefore, implies a process of expectation formation very different from that of scheduled news and most likely to be variable overtime. An initial taxonomy of these events could be the following:

[12] For most US indicators data are generally released in the subsequent month. Forward-looking indicators (Consumer Confidence Index, Philadelphia Manufacturing Index) refer to the same month of release. US GDP data deserve special attention as there are three monthly readings of GDP releases: Advance (about 30 days after the previous quarter ends), Preliminary (about 60 days after the previous quarter ends) and Final (about 90 days after the previous quarter ends). Since the Advance version is the earliest release of GDP one would expect, *a priori*, that the advanced data surprise should have the major impact in term of market reaction. The same temporal pattern is usually followed by the macro announcements for United Kingdom, Germany and the Euro-Area (more casually for these latter two entities).

[13] For recent studies that used macroeconomic surprises and unscheduled news in stock and interest rates markets see, for example, Birz and Lott.(2011), Rosa (2011), Jiang et al. (2012) and Beetsmaa et al. (2013).

A) Scheduled policy statements, like the press conferences of ECB Governors or the Humphrey-Hawkins testimonies by US Fed Chiefs. These statements have generally an uncertain content on internationally sensitive arguments, frequently different from market expectations. In most recent times, the reactions to these generally unequivocal messages have become excessive, abnormal and highly volatile.

B) Unscheduled policy statements or simple opinions in interviews or in question and answer sessions at the end of formal press conferences (examples: the ECB and, in recent times, the Fed ones).

C) Terrorist events deemed to be influential on policy decisions, on commodity price developments (especially oil) or on international mobility of factors of production.

D) Institutional or personality events (Government or Parliamentarian) involving leading policy makers, potentially able to cause policy changes.

E) Public interventions by Central Banks in the foreign exchange market or statements announcing or threatening them (Japanese Authorities is a good example).

F) Low-ranking policy makers' comments to unexpected – or moderately so – monetary policy decisions and other authoritative comments on economic indicators in relation to macroeconomic or market trends;

G) Unexpected – or moderately so - upgrading or downgrading of creditworthiness (of entire countries, or of important financial Institutions, or of various asset typologies) or of previous forecasts by Rating Agencies or by domestic or international policy Institutions.

Examples of the above typologies of unscheduled news over a two-month time-span in 2003 are reported in Table 2. This table contains for each unscheduled news the date and the weekday of release, the text of the event, the time-zone of reference, the

expected sign on the Euro-Dollar rate, the news typology, referred to the A-G itemization above and the source of the news.

[PLEASE INSERT TABLE 2 HERE]

Once identified, unscheduled news were coded as qualitative variables attributing them the value of (+1) or (-1) according to the following convention: unscheduled news were given a value of (+1) if their *a priori* effect was likely to strengthen the Euro-Dollar exchange rate -either because they had a content directly favourable to the Euro or because they had a content directly unfavourable to the Dollar. Alternatively, the surprises were coded with a value of (-1) if it was more likely that they would produce a weakening of the Euro-Dollar rate. This coding convention allowed us to test for asymmetric effects by separating the unscheduled news according to their sign and using an interaction term for the strengthening news.

We stress again that every single unscheduled news was attributed to its own time zone[14], often using Bloomberg time stamps, and that, to avoid "double counting" effects and correlation issues between scheduled and unscheduled news, a consistent criterion of "non-overlapping" recording was used. According to this criterion – violated only in exceptional circumstances[15]- whenever a scheduled news was released in a specific time zone, any related or unrelated unscheduled news falling in the same time interval would not be recorded. Moreover, whenever several unscheduled news had occurred within the same time zone interval, only one would be recorded.

[14] The assignment of this single aggregate unscheduled news group to the three time and trading zones (e.g ASTZ, ETZ, ATZ) was carried out not on a nationality or area-pertinence basis but by the timing of the news.

[15] When, for instance, an unscheduled surprise had an opposite a priory sign effect of a scheduled surprise released in the same time zone interval.

Those unscheduled news that conformed to the A-G typology and to the above recording criteria were extracted from a large archive of daily events dating from 1998 (and before, see Tivegna and Chiofi, 2004) until today. This unique hand-collected archive of news – called informally *Newsmetrics* – contains, each day, on average between ten and fifteen daily articles and extended newsflashes from the Financial Times, the Wall Street Journal, Bloomberg News, Reuters and Dow Jones Newswires. Within this group, there have always been the daily articles on the foreign exchange market and on the US stock market.[16] The richness and completeness of *Newsmetrics* has helped to isolate the "main" news of each time zone (not "of the day").[17]

In this paper, for each time zone ASTZ, ETZ, ATZ, the A-G categories of unscheduled news have been aggregated into a single vector. This decision of aggregating different typologies was taken for two reasons: to reduce the number of explanatory variables and because some unscheduled news categories have somehow evolved.[18] Given their qualitative nature and trinary/binary representation, unscheduled surprises have not been standardized.

4. Estimates

Before proceeding to estimating our model all news were tested for normality and white noise[19] and tested for current and cross-correlations, to avoid - as best as possible –

[16] The above reliance mostly on newspaper articles deserves some extra speculation. In fact, the same idea of a tri-partition of the GTD is to a large extent due to the news search process employed in this and previous studies, Fornari et al. (2002), Tivegna and Chiofi (2004) and Cagliesi and Tivegna (2006).

[17] So, for instance, in recent times, the communication of ECB council decisions on interest rates to financial markets (at or a little before 1PM, CET, well within ETZ) does not move Euro-Dollar that much. The ECB press conference, generally at 2:30PM CET, is in ATZ and assigned to this area, even though it is the most European event for financial markets, after the beginning of the Euro era in 1999. And the real reaction occurs there.

[18] The process of news collection has been a daily process between 1998 and today. So it is quite likely that decisions to include unscheduled news in one category, or rather in another one, somehow changed most of all because communication to and within financial markets evolved quite rapidly over the years.

[19] Table A.1 in Appendix (Supplementary Data) reports the main statistical features of the entire sample

issues of collinearity and distortions. After this first statistical screening process, the initial phase of econometric procedure was carried out using a standard OLS estimates for the entire sample period -running from January 1th, 2003 and August 31st, 2011 - as a first exploration of the general specification of the news model and of the stability of coefficients. OLS estimates indicates that the relevant scheduled news were only a small subset of the originals ones (68) while all unscheduled were highly statistically relevant. We then began dealing with one of the main objective of our paper: to investigate the stability of the relationship between news and exchange rate dynamics, as determined by the unfolding of the financial crisis (subprime plus European sovereign debt) on policy-makers' and traders' behaviours. We divided our sample into two statistically determined sub-periods – before February 2008 and thereafter - to better catch the consequences on our equations originating from structural breaks due to the financial crisis.

We used the OLS specification reported in Table 3 to investigate the presence of a structural break around the financial crisis period. The table reports the value of the Hansen test and of the Chow test, while Figure 2 shows the analysis of recursive residuals. The Hansen test is a test for general parameter stability based on the behaviours of the partial sums of the regression's normal equations for the parameters and for the variance. We produce statistics and approximate *p*-values for the overall regression (coefficients and variance) as well as for each coefficient and for the variance individually. The test indicated the presence of a structural break in the parameter and in the variance. The Chow test, and historical hindsight, helped to position the structural break at the end of February 2008. Although the collapse of Lehman Brother on

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of news and the results of Jarque-Bera and Ljung-Box tests. In tables A.2 to A.9 of the Appendix (Supplementary Data) we show the results of the analyses for correlation between news and cross-correlation with lagged news.

September 15, 2008 might have appeared to be a natural choice, the subprime crisis in the US had been mounting up from early 2007, with the accelerated deflation of house prices and the market started showing level of anxieties already at the beginning for 2008, as showed by the graph of the recursive residuals.

[PLEASE INSERT TABLE 3 and FIGURE 2 HERE]

The indication in the Hansen test and the use of financial time series sampled in high frequency prompted us to take into account the possible issue of heteroschedasticity and to consider an ARCH-type of models. Given our research interests, we chose the exponential GARCH (EGARCH) models which enable to test for asymmetric response of the conditional volatility of the exchange rate to positive and negative values of the innovation term ϵ_t of the exchange rate equation, and to the order of magnitude of the innovation term itself. We quantify these effects in the analysis of the volatility curve which is presented in the final part of section 5. In addition to asymmetric reactions in volatility we also investigate, with the help of auxiliary variables, the presence of asymmetric reactions of the exchange rate to the scheduled or unscheduled news included in the linear part of the EGARCH. To distinguish between those (accounted for) news included in the mean and those (unaccounted for) news that are embedded in the innovation term and affect the conditional volatility, we shall refer to the latter ones as to "unaccounted surprises".

EGARCH estimations are carried out in using the Broyden–Fletcher–Goldfarb–Shanno (BFGS) optimization method. Given the explorative nature of our study, we did not run any test to evaluate higher order EGARCH and the specification and choice of the

models was based on criteria such as convergence, t-test values, and a parsimonious use of lags.

Many empirical studies use basic GARCH(1,1) to model daily conditional volatility.[20] Based on this practice, and because our daily volatility is composed by three time intervals, we propose to use EGARCH with up to 3 lags.[21] In discussing our results in the coming section we will generally make reference to the EGARCH(3,1) sub-period1 and sub-period2 to indicate the models we estimated prior and after the financial crisis.

5. Estimations Results

The econometric results of EGARCH equations, are reported in Table 4.[22] Before discussing results, we stress again the presence of lagged news. A statistically significant coefficient on a lagged news implies that a particular news produces its effect also in the following time zone(s). For instance, when American traders enter the market, they can still react to stale news that were released during the earlier European ETZ trading time, something which is frequently observed in practice. A reaction elicited by a past event can confirm or counteract the original reaction produced at the time when the news was released. In the case when subsequent traders reinforce the original under-reaction or over-reaction of previous traders, the exchange rate will trend. In the alternative case, when subsequent traders counteract the over-reaction or under-reaction of the previous traders, the exchange rate will revert back. Behavioural theories have provided several explanations for the occurrence of traders' under-

[20] See for example Andersen et al. (2000) who point out the use of daily GARCH (1,1) as benchmark model in exchange rates volatility determination.

[21] For both sub-periods –prior and post financial crisis- we also tried lower order EGARCH but they did either not converge (EGARCH 1,1) or converge too soon (iterations number lower than number of estimated parameters indicates inaccurate values of estimates) so we accepted our initial choice of an EGARCH(3,1) structure.

[22] Table A.10 in the Appendix (Supplementary Data) reports the results of the OLS regressions for the two sub-periods.

reaction and over-reaction to news ranging from loss aversion and disposition effect, to overconfidence. This will be discussed later. In what follows we discuss results of different categories of explanatory variables from fundamentals to scheduled news. We end this section with the discussion of the volatility curve.

[PLEASE INSERT TABLE 4 HERE]

5.1. Results: Lagged exchange rate and fundamentals

We, first of all, observe in all estimation techniques that the autoregressive component of the exchange rates includes three lags, (the equivalent of a one day dynamics of the adjustment). This lag structure was to a large extent expected given the convention that we use to split of the Global Trading Day into three trading zones and the fluctuating profile of exchange rates in high frequency domain produced by day-traders, who represent today a large share of world currency markets. The coefficients of the autoregressive process have all negative signs indicating the presence of mean reverting behaviour of the exchange rate. In accordance to the results of the Hansen test (Table 3) the coefficients of the autoregressive components differ significantly before and after the financial crises and this is particularly noticeable for the coefficient of the second lag. The change in value of this coefficient affects the shape of the lag profile and mean reversion in the following way: in the second sub-period the autoregressive component of the exchange rate shows a progressively declining profile, as it would be normal to expect. However, during the period prior the financial crisis the autoregressive component shows a quite unnatural humped shaped profile.[23]

[23] To study this result further, we introduced an interaction term to capture possible different asymmetric effects of appreciations and depreciations of the exchange rate and tested for asymmetric adjustments. This version of the model is reported in Table A.11 of the Appendix (Supplementary Data). We obtained

The sum of the lag coefficients indicates that, over a period of one day, the exchange rate is expected to revert back by about 20% (18% in the second sub period). The main differences between the period preceding and the period following the financial crisis is the time frame of the mean reversion which would occur mainly within the following 8 hours of trading (-0.128 after the 2008), rather than within the subsequent 16 hours of trading (-0.113 before the 2008) as shown in Table 4. One possible explanation of this phenomenon is that the uncertainty brought about by the financial crisis could have prompted day-traders having long positions to close them (and cash profits) more quickly than what they would have done prior to the crisis (16 hours)[24] when the Euro was appreciating and expected to keep strong.

Talking about mean reverting coefficients, a further remark can be made. Fluctuation is the standard movement in world Forex markets. In accordance to that, our analysis indicates that this can be clearly observed at jumps of 8 hours. Besides, periods of swinging appreciations, depreciations and flat trends certainly come to an end, but the fluctuations around trends are much more frequent than the trend reversions. Therefore mean reverting trading protocols can impose an oscillating profile to Euro-Dollar and yield great money for day-traders.

The relationship between interest rates and exchange rates is confirmed here with the expected signs in both sub-periods: an increase in the long term German rate (the main Eurozone financial market) strengthens the Euro whereas an increase in long term US rates produces the opposite effects. Japanese interest rates do not belong directly to

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the following results: keeping all the rest constant, an appreciating exchange rate (as observed in the first sub-period, prior to the financial crisis) will cause a progressively declining mean reverting effect, because traders will expect an ever appreciating Euro-Dollar. In the second sub-period the rate had wide fluctuations around a flat-to-declining trend so the lag distribution had its traditional declining shape.

[24] The main financial institutions typically work on two shifts for traders, across the three time zones. Most of them have an office on all three zones, allowing them to manage a trading positions opened in earlier time zones.

movements of our currency pair. They enter mostly with a negative sign in sympathy – and because of the much wider business – with the US rates. The effect of Japanese interest rates on the Dollar-yen exchange rate is probably much bigger than that on the Euro-Dollar rate. That is consistent with our results.

Looking at the lag structure of interest rates and comparing the magnitude of coefficients between sub-periods the following three observations can be drawn: firstly, all lagged reactions, all shorten than a day, are under-reactions meaning that traders of subsequent trading areas confirm reactions of the traders of the preceding area. Secondly, ranking the overall effect (the sum of the current impact and lagged effects) the USA rates exert the strongest effects (-0.328 in the second sub-period, -0.395 in the first sub-period), followed by German rates (0.327 in the second sub-period and 0.158 in the first sub-period) and Japanese rates (-0.092 in the second sub-period and -0.089 in the first sub-period). Thirdly, following the financial crisis, the overall effects of the German rate on the exchange rate it almost doubles in magnitude (from 0.158 to 0.327) while the overall effect of the US rate is almost the same (from -0.395 to -0.328) but, interestingly its impact effects almost halve (from -0.309 to -0.188). The reduced impact sensitivity of the exchange rate to the US rate and the increased overall sensitivity to German rates can be a result of policies and growing fears about the stability of the Eurozone. After the financial crisis central banks of developed economies, led by the Fed, have flooded the market with liquidity. Their massive purchases of government bonds, together with regulations forcing banks to hold safer and more liquid assets, and the flight to safety by investors fearing a breakdown of the Eurozone, have driven the UK, Germany and US government nominal costs of borrowing and yields to historical low while creating a government bond bubble. Expectation and implementation of

Operation Twist led to a widespread lowering of yields on safer assets (government bonds) across developed economies.

At the same time, the sovereign debt difficulties in the Eurozone caused wide expectations of a break-up of the Euro which may have induced a reduction of the Euro-Dollar's immediate reactions to the US interest rate, as investors have most likely not been so interested into moving Dollars into Euros and may have also induced an increased attention of traders to the rate of the strongest of the Eurozone economies.

Another interesting result of Table 4 is the change in the relation between Dow Jones (DJ)[25] and the Euro-Dollar rate in the second sub-period, which is something in line with what traders around the world have come to realize. Our estimates indicate that prior to the financial crisis an increase in the DJ would mildly strengthen the Dollar (-0.049) by attracting financial flows into the US, the leading stock market in the world. In the second sub-period the effect of the DJ is much stronger and reverted in sign (0.299). As we said, this phenomenon has been a standard – and puzzling - feature in financial markets which has been partly explained by time-varying risk appetite.[26]

This is also justified in terms of a behavioural loss aversion bias as proposed by Prospect Theory.[27]

[25] The European indexes such as the German DAX and British FTSE do not appear here because they turned out to be non-statistically significant or because of their high correlation with the DJ.

[26] This is connected with risk attitude and role of emerging markets, the primary beneficiary of the increased global liquidity, injected into world financial markets, as we recalled above, with increasing values in their assets ad currencies. It has been frequently observed that the positive relation between Euro-Dollar and DJ holds even at tick frequency. And when Wall Street is closed, the relationship holds also with the DJ futures. We have many ad hoc explanations. The risk appetite is the most popular (Kumar and Persaud, 2002) in the post financial crisis period, when the DJ started trending upwardly back again a positive DJ signalled an increase in risk appetite favouring investment in Emerging Markets and higher yielding currencies (the Australian, New Zealand Dollars and also the Euro). So a short-term upward swing of the DJ would weaken the Dollar, more than the Euro for its very nature of having a higher worldwide circulation than the Euro.

[27] An increased appetite for risk, in a period of uncertainty and of realized or expected financial losses seems a contradiction but it is actually much in line with the explanation offered by Prospect Theory (PT): loss aversion bias (an asymmetry in the value function between gain and losses which renders losses loom larger than corresponding gains) induces investors to become risk seeker on the loss domain

Another possible explanation is that the negative relationship between the DJ and the Dollar is a good hedging opportunity for short-term trading in both markets, so it is possible that some kind of a stable relationship has established itself after the uncertainty brought by the financial crisis. At a time of very low US yields it is possible that hedged trading in the stock market and currency market has been seen as good opportunity. But the issue of the causality direction from the stock market to the currency market – or viceversa - remains wide open. Here it rather seems to exists some kind of a signalling simultaneous relationship as for some quite long periods in the GTD the Dollar and the Dow Jones (jointly with other US stock indexes) move together at tick frequency.

The Nikkei index becomes relevant in the second sub-period (0.128) and this is because of the nature of the Dollar-Yen rate: a better yield on yen-denominated assets, stimulates carry trade and depreciates the Dollar, causing its appreciation *vis-à-vis* the Euro, as the carry trade is stronger with the Dollar than with the Euro given the liquidity of the US Dollar market.

5.2. Results: Unscheduled news

Among the unscheduled news, the dominant ones in both first and second sub-period are those occurring in the ATZ trading zone –the American zone- and presumably these types of unscheduled news are more likely to be directly Dollar-related.[28] Table 5 reports calculations of the effects of unscheduled news on the exchange rate, as derived from the estimated coefficients reported in Table 4. For each sub-period these effects

so they tend to ride losses because in the attempt to avoid/reduce them or to regain profits, they engage in risk seeking behaviour, Kahneman and Tversky (2000), page 41.

[28] As to the US Dollar, it is worth remembering the famous "the Dollar is our currency and your problem", pronounced by US Treasury Secretary John B, Connally, after the de-pegging of the Dollar from gold in 1971, at a time when international monetary relations were really tight. Solomon (1977, page 179) and Sparke (2013, chapter 5).

are distinguished in impact, delayed and net effect (which is the algebraic sum of the impact and lag coefficients). We also introduced interaction terms to test for the presence of asymmetric reactions to the sign of the unscheduled news and asymmetric effects were present whenever the interaction terms of the positive unscheduled news were statistically relevant. [29] Four comments can be drawn from our results.

The first element to notice in Table 5 is the "time -zone bias": as expected, for both sub-periods, traders in each area react more strongly to their own news than to news of other time zones. The ranking of the magnitude of the effects of unscheduled news for both sub-periods is as follows: ATZ[30], ETZ, ASTZ. The reason is clear enough: most of Euro-US Dollar trading occurs when London and New York are open at the same time. That occurs in ATZ. ETZ is the home of Euro trading. In ASTZ Euro-Dollar is mainly moved by other currency pairs and more rarely by events in this time zone (sometimes by events after ATZ closing, typically downgrades of European countries by US based rating agencies). The main movements in ASTZ come from foreign reserve diversification out of the Dollar by Asia central banks (China first).

The second observation is about over and under-reaction of traders operating in subsequent trading areas. An over-reaction occurs when subsequent traders counteract the reactions of previous traders (inducing a reverting behaviour of the exchange rate). Under-reactions occur whenever traders in subsequent areas reinforce and confirm the reactions of previous traders (inducing a drifting behaviour of the exchange rate). Tables 4 and 5 show that lagged reactions are more common in the first sub-period than

[29] The effect of a negative unscheduled news is given directly by the coefficient of the overall vector of unscheduled news which includes both positive and negative. However, the coefficient of the positive news would need to be computed by adding together the coefficient of the interaction term and the coefficient of the overall vector of unscheduled news (positive and negative). Asymmetric effects can also be computed for delayed reactions whenever the lag of the interaction term occurs to be statistically significant.

[30] This is true except for the "dollar positive" (euro negative) unscheduled news released in the in the ATZ area during the second sub-period. The coefficient of this ATZ unscheduled news is smaller than the coefficient of the ETZ unscheduled news.

in the second and this is especially noticeable for the ATZ unscheduled surprises which, in the second sub-period, do not elicit any lagged reaction in subsequent areas and that exerts a noticeable bigger impact effect on the exchange rate when their content is adverse to the dollar (the coefficient is 1.608). This finding, that will be confirmed later on in the analysis of the volatility curve, suggests that the uncertainty of the financial crisis, in the second period, may have prompted a "higher sensitivity" and a quicker response to unscheduled Dollar-content news, especially when these unscheduled surprises are unfavourable to the dollar. The situation is different for the Asian market unscheduled news. In both sub-periods the Asian news-induced movements, tend to be partially corrected in European time (ETZ). This action of European traders tends thus to offset the over-reaction of Asian traders to ASTZ unscheduled news. By looking at other delayed reactions, it is interesting to notice again, in the first sub-period, a tendency of Asian traders to act to increase rather than to reduce the effects of unscheduled news coming from other trading zones, showing a sort of herding behaviour. In fact, as showed in Table 5, in the first sub-period both ETZ and ATZ news produce under-reactions mainly coming from Asian trading area (0.092 to European news and 0.143 to American news). This can be due to the fact that Asian markets are closed when a new market-moving event occurs in Europe or in the US, so Asian traders react when their market re-opens the following day, confirming previous traders' reaction and hence, under ceteris paribus conditions, producing a "drift" of the Euro-Dollar rate. This herding behaviour disappears in the second sub-period, which is characterized by abundant liquidity and frequent trading oscillations, and when actually Asian traders tend to correct European traders' reactions (-0.068).

The third observation is about asymmetric reactions to Euro or to Dollar positive/negative events. During the first sub-period there are no asymmetric reactions

to ETZ or ATZ unscheduled news. In the second period, however, when markets were disturbed by the financial crisis and by the policy measures taken to contrast it, our results show a quite different picture. Asymmetric reactions are elicited by ASTZ and ATZ unscheduled news only (so presumably news refers more to Dollar-related events) mainly coming from American traders who correct more strongly Asian traders' immediate reaction to ASTZ unscheduled news when these news are weakening the dollar (-0.365 which is the sum of -0.119 and -0.246) than when these news are in favour of it (-0.119). Overall the reaction to Euro-favourable (or Dollar unfavourable) news released in the Asian trading zone, leads to an appreciation of the Euro which is smaller (0.454) than the depreciation resulting from Euro-negative (Dollar positive) news.

As explained earlier on, the second sub-period is characterized by the fact that unscheduled surprises occurring in the ATZ zone do not longer elicit any lagged reaction. However, these events provoke the asymmetric reactions of American traders who respond to ATZ dollar weakening unscheduled (ATZ) news more strongly than to ATZ dollar strengthening unscheduled. This asymmetric reaction can be interpreted as the working of a negativity bias, a well-documented bias in behavioural finance to indicate the human tendency to pay more attention to bad news about a reference point. The availability bias (the tendency to weight more heavily most recent information) could also explain the reduced reaction to lagged information during sub-period 2. It is not unlikely in fact that these biases may have become stronger in the period following the world-wide financial crisis because of the higher expected or realized losses and overall increased uncertainty created by the crisis.

[PLEASE INSERT TABLE 5 HERE]

5.3. Results: Scheduled news

As reported already, out of the 68 variables we collected, only a few scheduled news appear to affect significantly the exchange rate. As market experience indicates, many of the scheduled news are popular in some phases of the Forex markets but without the continuity which would make them significant over the entire sample period. By virtue of standardization, coefficients of scheduled news can be compared across themselves[31] and our results indicate that there are a group of surprises that are reliably relevant in both sub-periods, and these are: the German IFO Business Climate Indicator, in ETZ, and the Nonfarm Payroll, and the Producer Price Index, net of food and energy, corrected to take into account of the differences in daylight saving time weeks between Europe and the US in ATZ. Some other news, such as the first two readings of GDP in the European Monetary Union (EMU) in the ETZ area and the Manufacturing Index in the ATZ area are relevant only during the first sub-period, while some others such as the first Consumer Price Index Flash in Europe (EMU) and the first two of readings of the US GDP, become relevant only in the second sub-period. In discussing their effects we would also attempt a justification of this finding.

The only non-Euro/Dollar variable, the surprise in the Bank of England rate, elicits some impact and lagged reaction. As indicated in Table 4, in the first sub-period the impact coefficient of this variable is positive but not statistically significant[32] whereas its lagged coefficients indicate some effects. Thus for instance, an unexpected hike in the UK rate would likely lead to an immediate increase in demand for Pounds relative to

[31] We cannot compare orders of magnitude of coefficients of unscheduled and scheduled news since the former ones are binary not continuous variables and the latter are standardized.

[32] Possibly due to the fact that decisions are announced in late morning, almost a the end of the European trading time, prompting sharp end quick movements in the UK Pound-US Dollar rate.

Dollars and to Euros, which is recorded for a short period, till ETZ ends. In moving into the ATZ trading zone, the reaction of American traders in closing their positions in Dollars leads to a weakening of the euro (-0.441). Asian market (coming the following day) correct mildly this action (0.100) and the overall net effect is that an unexpected increase in the BOE rate leads to a depreciation of the Euro and vice versa mainly due to American action. In the second sub-period the situation is somehow different although the net effect of a positive surprise in the BOE rate is still to depreciate the Euro but the effect is much smaller (-0.028 after the crisis versus -0.340 of the first sub-period) and mainly due to a reverting Asian correction to the European traders' impact reaction. American reaction to BOE rate seems to disappear after the crisis.

Forward-looking business climate indicators, such as the German IFO and the US ISM manufacturing index, both very popular among traders, provide different information. Surprises of the IFO maintain very similar, stable and statistically relevant coefficients in both periods with no lags, whereas the US ISM Index is significant in the first sub-period only. The coefficients have the expected signs (positive for the IFO and negative of the ISM). Why this difference in the two periods for ISM? Careful and informed market observation shows that, in recent years, the appetite in the US for these business confidence forward- looking indicators has grown considerably. All the District Banks of the Federal Reserve System publish their own business index, as the main tool to write the Beige Book.[33] The Chicago, Philadelphia, Empire State (New York), Richmond, San Francisco indexes have all gained a national reputation. So, financial markets are well informed, when the ISM is published in the first day of the month and the resulting surprise (actual less expected values) very much "flattened".

[33] This publication, assembled by the Board of Governors in Washington, gives a regional description of the economic situation in the various parts of the US.

It is interesting to note that as the surprises in this indicator lose power, the Nonfarm Payroll doubles in magnitude in the second period becoming the most powerful scheduled news to affect traders' behaviour, after the financial crisis (form -0.581 before the crisis to -1.036 after the crisis). This indicator is released in at the opening of the ATZ trading time when overlapping of ETZ and ATZ is at its peak. This contributes to explain partly the magnitude of its coefficient which captures the actions of European and American traders. The US Non-farm Payroll is published on the first Friday of each month and it is the most influential among all news in the financial world. The reason of its popularity resides in the very flexible nature of the US labour market, where hiring (when the economy is expected to pick up) and firing (in the opposite circumstance) is deemed to be a very simple process. As such, Nonfarm payroll is one of the most valuable indicator of the world.[34] Its coefficient has the expected sign (a positive surprise would strengthen the Dollar) and, as mentioned above, its effect almost doubles from the first sub-period (of buoyant growth) to the second sub-period, where uncertainty over the US business cycle looms larger.

US inflation has a small but important presence in our analysis. The Producer Price Index, net of food and energy, is a good forward looking indicator of future US CPI inflation. It keeps its positive, rather stable (slightly higher in the second sub-period) and significant coefficient in both sub-periods (0.225 post crisis versus 0.151 before the crisis). Interestingly, surprises in the EMU Consumer Price Flash index (an early estimate of the CPI) prompt only some lagged effects all coming from ATZ zone (0.026) and only after the crisis. Under normal circumstances, one would reasonably expect that higher than expected inflation would trigger a strengthening of the Euro via

[34] That was all the most true at the time of the adage "when the US sneezes, the rest of the world takes a cold" was popular. It is to some extent true today as well, after the emersion of the "emerging" markets, because a sizable share of their production is drawn by US consumption. But beyond this situation, the Nonfarm payroll still represents a good and widely respected "excuse" to buy or sell financial assets.

expectations of higher interest rates. However the liquidity trap and the European sovereign debt problems have possibly weakened this theoretical link, as indicated by the impact coefficient of the CPI flash which turns out to be not statistically relevant. The massive and widespread use of unconventional monetary tools to fight the "great recession" and to help a weak recovery has emptied the theoretical role of the CPI indicator in its own zone. In the second sub-period, central banks in developed economies, and the ECB in particular, have become noticeably less worried about their inflation targeting, more concerned to avoid choking off a feeble recovery and more willing to act unconventionally and do "whatever it takes"[35] to avoid the currency crisis. This new attitude is captured by the lag coefficient of the CPI: an increase in the index has an effect in the American zone, when European traders close their position, and it weakens the Euro. In other words, higher than expected CPI inflation is perceived as "more troubles" for the Euro, given the limited margin of manoeuvring left to the European Central bank in front of the urgency to help the recovery and avoid the Euro collapse.

The GDP readings in the US have always raised a lot of interest in financial markets, and not only there. Our results show that this indicator (in its advanced and preliminary versions) is never significant in the first sub-period (where the ISM Index is) but it is so in the second sub-period (when the ISM is not). Financial market experience suggests that in the first sub-period (2003-2007) the US economy has been growing quite fast and regularly, so it is possible that attention to GDP was smaller than in the second sub-period, when growth has been crippled by the sub-prime financial crisis. Probably politicians and market participants have been scanning GDP numbers much more

[35] ECB Governor Mario Draghi on July 26, 2012 in London. Adding: " Believe me, it will be enough". Financial Times, online edition, same day. This date is outside our estimation sample, but use of unconventional instruments by, ECB and the Fed, dates much earlier. One of the most unconventional for the ECB, namely the LTRO (Long Term Refinancing Operation), was taken in 2011.

anxiously and thus have probably recorded much sharper reactions to this type of scheduled news. The same explanation given for attention to the Nonfarm Payroll announcements is valid here: in bad times, important macro surprises produce much wider reactions.

If surprises in the USA GDP become particularly relevant in the post crisis period, surprises in the EMU GDP lose their role after the crisis. In fact, the EMU GDP first reading advance) news produced some effects only in the first sub-period and mainly because of American traders' reactions (0.343). In the earlier years of the Euro, GDP numbers were computed more quickly by domestic statistical offices than by Eurostat. So European traders were in those years were well informed, ahead of the aggregate Eurozone data. It reasonable to imagine that American traders (from banks not represented in London) could most likely have been more reactive to aggregate European data, as they have traditionally done so to their own GDP releases for many years.

5.4. Analysis of the volatility curves

The estimated coefficients of the EGARCH volatility equations are:

$$\log(h_t) = -0.1069 + 0.1362\left[|z_{t-1}| - \sqrt{(2/\pi\ )}\ \right] + 0.0154\ (z_{t-1}) - 0.1855\log(h_{t-1}) + \\ +0.2704\log(h_{t-2}) + 0.9075\log(h_{t-3}) \qquad (3.1)$$

$$\log(h_t) = -0.1775 + 0.2391\left[|z_{t-1}| - \sqrt{(2/\pi\ )}\ \right] + 0.0268\ (z_{t-1}) - 0.4512\log(h_{t-1}) + \\ +0.7257\log(h_{t-2}) + 0.7120\log(h_{t-3}) \qquad (3.2)$$

The first observation to make is that for both sub-periods the conditional variance of each trading interval is affected by its past values up to a 24 hours delay because all coefficients of past volatility are statistically relevant up to three lags. The transmission

is high and in the absence of any new "unaccounted" surprise, the volatility would die out, although slowly, as it can be showed by summing up the coefficients of the lags of the conditional variance.

For the first sub-period the asymmetric coefficient (0.015) is barely statistically relevant (significant only at 10%) but it becomes relevant and substantially bigger (0.027) after the financial crisis. For both sub-periods the asymmetric coefficient is positive, meaning that a positive surprise (for instance large positive movements, not accounted for in the specification of the EGARCH mean and hence left in the error term, due, for instance, to trading positioning causing sharp swings in Euro-Dollar) increases the conditional volatility of the Euro-Dollar rate more than a negative surprise of the order of magnitude would.

Studies on volatility of stock returns have found evidence of what they described as "leverage effect": a negative (bad) surprise increased the volatility of stock prices more than positive (good) surprises of the same magnitude.[36] However, in dealing with exchange rate, one ought to remember that it is a relative price and that the Dollar holds the privileged status of being the international reserve currency. A positive "unaccounted" news in the Euro-Dollar rate equation is Euro-positive but at the same time Dollar-negative, because of our definition of this currency pair. Therefore, an asymmetric reaction to positive innovations implies the market becomes more "nervous" in terms of increased volatility in the immediate future when hit by "unaccounted" surprises that weaken the Dollar rather than to unaccounted surprise of the same magnitude that weaken the Euro. This is especially true after the occurrence of the financial crisis.

[36] The leverage effect is due to the fact that a bad news, by reducing the price of the stock, increases the risk of holding equity because of the reduced values of the stock relative to corporate debt.

The coefficient associated with the size of the standardized innovation (i.e. the coefficient that multiplies the standardized absolute innovation) is statistically relevant and positive in both sub-periods and it becomes substantially bigger after the financial crisis (0.133 in sub-period1 and 0.239 in sub-period2). Again the financial crisis seems to have amplified the reaction of volatility to "big" surprises of both signs. In other words, the swing in the exchange rate triggered by a big unexplained surprise would be more pronounced after the crisis than before due perhaps the increased uncertainty brought by the crisis and fears of losses.

Taking into account the combined effects of sign and size of unaccounted surprises, we can conclude that unaccounted news that weaken the Dollar and strengthen the Euro tend to increase the conditional volatility in the immediate future much more than same size news that strengthen the Dollar and weaken the Euro, a result similar to the "leverage effect" in the stock market literature.

To quantify the impact of positive and large "unaccounted" surprises on volatility, one ought to transform equations into a non-logarithmic form. This is because the quantification of the asymmetric and magnitude effects on volatility is made complicated by the fact that the EGARCH is a semi-log form with the regressand expressed in logs and the regressors expressed in both logarithmic and linear forms; and by the fact that the regressand is in variance term while part of the regressors are in volatility terms (standard deviations) terms.

We then compute the news impact curve coming from the EGARCH specification of each sub-period, and we compare the curves to see if and to what extent the financial crisis produced any effect on the behavior conditional volatility of the Euro-Dollar rate. The volatility curves are obtained by computing the square root of the anti-log transformation of the conditional variance (equations 3.1 and 3.2) for different values of

the standardized and absolute standardized innovations (z-variable).[37] Table 6 reports the results. To understand the magnitude of the effects of unaccounted surprises on volatility we consider 3 different sizes of the "volatility" surprises: the small/medium positive surprises that fall in the interval between zero to 1 and that can occur with a probability of 34%; the larger positive surprises that range from 1 to 1.65 and that occur with a probability of 11%; and the big positive surprises that range between 1.26 and 2.33 and can occur with a probability of 4%. The same classification applies to negative surprise.[38] For each of these possible intervals we consider only one value: the value of each interval's upper bound. So we have 6 possible cases: 3 cases when (standardized) positive surprises take the value of 1, 1.65 and 2.33 and 3 cases when (standardized) negative surprises take the values of (-1), (-1.65) and (-2.33).

We can now quantify the post financial crisis increase in the reaction of volatility to unaccounted surprises of any sign and size: for instance a large Euro positive/Dollar negative surprise (+2.33) would increase the conditional volatility of about 36.32% after the crisis compared to an increase of 19.32% prior to the crisis. The same result is obtained when looking at negative surprises: for instance a large negative surprise (-2.33) increases the volatility by 28% compared to an increase of 15% prior to the crisis. Similar results hold for positive and negative medium (+1.65 and -1.65) surprises and for positive and negative smaller surprises (+1 and -1). Thus, as expected, the crisis brought along a general and pronounced increase in Euro/Dollar volatility. So, when we compare sizes of surprises we can see that with a probability of 4% (which is the

[37] The probability of a positive standardized innovation falling between 0 and 1 is 34%, while the one associated with one falling between 0 and 1.65 is 45% and one falling between 0 and 2.33 is 49%. Negative innovations have same values of probabilities taken on the left side of the standardized curve.

[38] Small/medium negative surprises range between (-1) and zero with a probability of 34%. The larger negative range from (-1.65) to (-1) with a probability of 11%. The big negative surprises range between (-2.33) and (-1.65) with a probability of 4%.

probability of a surprise to fall between + 1.65 and +2.33) the volatility would increase between 24.53% and 36.32% in the second sub-period but only between 13.32% and 19.32% in the first sub-period.

It is also possible to quantify the second interesting result of our EGARCH estimates, namely the post financial crisis increase in the asymmetric reaction of the conditional volatility to positive and negative surprise. From the table above, we can see that, for instance, after the crisis the percentage impact on volatility of a large Euro positive (+2.33) and of a large Euro negative (-2.33) surprises are about 36.32% for positive and about 28.06% for negative surprise. However, the volatility reaction to the same size of surprises before the crisis would have been smaller and less asymmetric with a percentage impact of 19% for large Euro positive surprises and of 15% for large Euro negative surprises. Thus the financial crisis brought not only an increase in volatility to any size and sign of surprises but also an increase in the "spread" of the asymmetric reactions to positive and negative surprises of any order of magnitude.

To summarize our results: after the financial crisis the market has become much more "nervous" and hence volatile in front of unaccounted surprises, particularly so when these surprises have been Dollar weakening and Euro strengthening. This is not surprising: although the financial crisis originated in the Dollar (with the subprime crisis), it moved later towards the Euro (with Europe's sovereign debt problems), making the Dollar a "safer" option, especially if one considers its privilege of being the international reserve currency. Financial behavioral insights can also explain this finding: in a period of increased uncertainty, characterized by global economic recession or feeble recover and by acute political issues that threatened the very existence of the Euro, the traders' behavior of increased sensitiveness to Dollar weakening surprises is in line with a human behavioral bias (negativity bias) that make

us pay more attention and give more weight to negative rather than positive information about our reference point.

[PLEASE INSERT TABLE 6 HERE]

6. Summary and Conclusions

This study aimed to investigate the determinants of the Euro-Dollar exchange rate behaviour and to assess if the financial crisis had contributed to alter its dynamics. Our approach differs from previous contributions in several ways: firstly we employ a thrice-daily frequency that reflects a "natural" partition of the trading day into three geographical trading areas, namely Asian, European and American trading time intervals; secondly we use both quantitative and qualitative news and events to ascertain the market reactions to different surprises that hit the market during the 24 hour trading day; thirdly we test for the presence of asymmetric effects to positive and negative surprises and for the presence of over-reaction and under-reaction to past news; lastly, we put trading behavior into an historical perspective and use some behavioural insights to study if and to what extent traders' behaviour may have been affected by the international financial crisis initiated in 2007-2008. We believe that this enriched approach can provide some useful insights to better understand differences across trading areas and structural changes triggered by the 2007-2008 events. We found that indeed the financial crisis affected the Euro-Dollar dynamics and its conditional volatility. Following the crisis we highlight that the Euro-Dollar displays a quicker and stronger mean reverting process as if traders would be more inclined to keep their position for shorter periods. We also observe an increased propensity to show asymmetric reactions, in the mean (via unscheduled news) and in the conditional

volatility of the EGARCH to surprises and events weakening dollar *vis-à-vis* the euro, as if traders were affected by a sort of behavioural negativity bias to unfavourable news related to the dollar. Moreover, some changes in the fundamentals, noticeably the relevance and the sign of the DJ seems to suggest a "risk" reaction to policies and a more pronounced loss aversion attitude, which might have induced an appetite for risk during a period of higher realized or potential losses. Our results shows that there is an increased importance of unscheduled events, particularly those ones generated in the American trading zone. There is also difference in the pattern of over-reaction and under-reaction to past event and a clear reduced importance of lagged scheduled and unscheduled news, with a parallel stronger effects of current news (showing a possible availability bias effect), particularly the news of pro-cyclical leading (IFO, Nonfarm Payroll) and coincident indicators (USA GDP) of the real economy. Although the use of the EGARCH (3,1) allowed us to account for asymmetries and lags of surprises, we recognize that one potential limitation of our study is that a multivariate EGARCH model specification that includes other currencies (UK Pound and Japanese Yen), and scheduled/unscheduled news related to alternative pairs could further improve our comprehension on how investors in different trading time zones react to a broader set of information. Another promising avenue of our research is to use the estimated models for day-trading decisions in two ways. First of all, for the information offered by the paper on the possible strategies by traders, across time zones, in response to news of the current zone or of the previous ones. Secondly, the models, by themselves, can be used - in forecasting mode - to give thrice-daily trading signals to go long or short on the Euro-Dollar.

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Table 1

Summary of macroeconomic announcements

Name of announcement	Unit of announcement	Release coverage	Start date	Final Date	Source	Number of obs.	Announcement Time
Euro-Area Announcements [a] (European Time Zone)							
Monthly							
Business Climate Indicator	Index	Data are for same month as the release month	07-Jan-2003	30-Aug-2011	DG ECFIN	95	11:00 am CET/05:00 am EST
ECB Rate	% level	Data are for same month as the release month	09-Jan-2003	04-Aug-2011	ECB	105	13:45 am CET/07:45 am EST
Economic Confidence	Index	Data are for same month as the release month	31-Jan-2003	30-Aug-2011	DG ECFIN	101	11:00 am CET/05:00 am EST
Consumer Confidence	Index	Data are for same month as the release month	31-Jan-2003	30-Aug-2011	DG ECFIN	100	11:00 am CET/05:00 am EST
Industrial Confidence	Index	Data are for same month as the release month	31-Jan-2003	30-Aug-2011	DG ECFIN	101	11:00 am CET/05:00 am EST
CPI Flash	Y-Y% change	Data are for the previous month	03-Jan-2003	31-Aug-2011	ESTAT	105	11:00 am CET/05:00 am EST
CPI Final	Y-Y% change	Data are for the previous month	22-Jan-2003	17-Aug-2011	ETSAT	105	11:00 am CET/05:00 am EST
CPI	M-M% change	Data are for the previous month	22-Jan-2003	17-Aug-2011	ESTAT	105	11:00 am CET/05:00 am EST
M3	M-M% change	Data are for the previous month	28-Jan-2003	26-Aug-2011	ECB	102	10:00 am CET/04:00 am EST
Unemployment rate	% of labour force	Data are for two months prior to release month	07-Jan-2003	01-Aug-2011	ESTAT	105	11:00 am CET/05:00 pm EST
PPI	M-M% change	Data are for two months prior to release month	07-Jan-2003	02-Aug-2011	ESTAT	101	11:00 am CET/05:00 pm EST
Retail Sales	M-M% change	Data are for two months prior to release month	08-Jan-2003	03-Aug-2011	ESTAT	104	11:00 am CET/05:00 pm EST
Retail Sales	Y-Y% change	Data are for two months prior to release month	08-Jan-2003	03-Aug-2011	ESTAT	105	11:00 am CET/05:00 pm EST
Industrial Production	M-M% change	Data are for two months prior to release month	17-Jan-2003	12-Aug-2011	ESTAT	105	11:00 am CET/05:00 am EST
Quarterly							
GDP Real Advance	Q/Q% change	Data are for the prior quarter	06-Mar-2003	16-Aug-2011	ESTAT	34	11:00 am CET/05:00 am EST
GDP Real Preliminary	Q/Q% change	Data are for the prior quarter	09-Jan-2003	08-Jun-2011	ESTAT	36	11:00 am CET/05:00 am EST
GDP Real Final	Q/Q% change	Data are for the prior quarter	06-Feb-2003	06-Apr-2011	ESTAT	34	11:00 am CET/05:00 am EST
Total						**1543**	
a)except for EBC rate and M3, before March 20004, all the indicators were released at 12:00 am CET/06:00 am EST							
Germany Announcements (European Time Zone)							
Monthly							
ZEW Survey	Index	Data are for same month as the release month	21-Jan-2003	23-Aug-2011	ZEW	104	11:00 am CET/05:00 am EST
IFO Business Climate	Index	Data are for same month as the release month	28-Jan-2003	24-Aug-2011	IFO	104	10:00 am CET/04:00 am EST
IFO Current Assessment	Index	Data are for same month as the release month	28-Jan-2003	24-Aug-2011	IFO	104	10:00 am CET/04:00 am EST
IFO Expectation	Index	Data are for same month as the release month	28-Jan-2003	24-Aug-2011	IFO	104	10:00 am CET/04:00 am EST
CPI Preliminary	M-M% change	Data are for same month as the release month	26-Feb-2003	29-Aug-2011	DSTATIS	103	varies
Factory Orders	M-M% change	Data are for two months prior to release month	10-Jan-2003	04-Aug-2011	DB	103	12:00 am CET/06:00 am EST
Industrial Production	M-M% change	Data are for two months prior to release month	13-Jan-2003	05-Aug-2011	DSTATIS	105	12:00 am CET/06:00 am EST
Retail Sales	M-M% change	Data are for the previous month	07-Jan-2003	31-Aug-2011	DSTATIS	103	08:00 am CET/02:00 am EST
Unemployment Level [b]	M-M change level	Data are for the previous month	09-Jan-2003	31-Aug-2011	DSTATIS	105	08:55 am CET/02:55 am EST
Unemployment Rate [b]	M-M% change	Data are for the previous month	09-Jan-2003	31-Aug-2011	DSTATIS	105	08:55 am CET/02:55 am EST
PPI	M-M% change	Data are for the previous month	23-Jan-2003	19-Aug-2011	DSTATIS	104	08:00 am CET/02:00 am EST
Quarterly							
GDP Real Preliminary	Q-Q% change	Data are for the prior quarter	26-Feb-2003	16-Aug-2011	DSTATIS	35	08:00 am CET/02:00 am EST
Total						1**179**	
b)before July 2005, varies							

United Kingdom Announcements (European Time Zone)							
Monthly							
BOE Rate	% Level	Data are for same month as the release month	09-Jan-2003	04-Aug-2011	BOE	103	13:00 am CET/07:00 pm EST
GFK Consumer Confidence	Index	Data are for same month as the release month	30-Jan-2003	31-Aug-2011	GFK NOP	104	11:30 am CET/05:30 pm EST
PPI Output	Y-Y% change	Data are for the previous month	13-Jan-2003	05-Aug-2011	ONS	104	10:30 am CET/04:30 am EST
Jobless Claim Change	M-M change level	Data are for the previous month	15-Jan-2003	17-Aug-2011	ONS	104	10:30 am CET/04:30 am EST
RPI	Y-Y% change	Data are for the previous month	21-Jan-2003	16-Aug-2011	ONS	104	10:30 am CET/04:30 am EST
RPI ex mort. Int. payment	Y-Y% change	Data are for the previous month	21-Jan-2003	16-Aug-2011	ONS	104	10:30 am CET/04:30 am EST
Retail Sales ex auto fuel	Y-Y% change	Data are for the previous month	23-Jan-2003	18-Aug-2011	ONS	104	10:30 am CET/04:30 am EST
Visible Trade	Y-Y% change	Data are for two months prior to release month	10-Jan-2003	09-Aug-2011	ONS	103	10:30 am CET/04:30 am EST
Industrial Production	Y-Y% change	Data are for two months prior to release month	14-Jan-2003	09-Aug-2011	ONS	104	10:30 am CET/04:30 am EST
Manufactoring Production	Y-Y% change	Data are for two months prior to release month	14-Jan-2003	09-Aug-2011	ONS	104	10:30 am CET/04:30 pm EST
ILO Unemployment	M-M% change	Data are for two months prior to release month	15-Jan-2003	17-Aug-2011	ONS	104	10:30 am CET/04:30 am EST
Quarterly							
GDP Real Advance	Y-Y% change	Data are for the prior quarter	24-Jan-2003	26-Jul-2011	ONS	34	10:30 am CET/04:30 am EST
GDP Real Preliminary	Y-Y% change	Data are for the prior quarter	26-Feb-2003	26-Aug-2011	ONS	35	10:00 am CET/04:00 am EST
GDP Real Final	Y-Y% change	Data are for the prior quarter	27-Mar-2003	28-Jun-2011	ONS	34	10:30 am CET/04:30 am EST
Total						***1246***	
United States Announcements (American Time Zone)							
Monthly							
Philadelfia Manufactoring Index	Index	Data are for the same month as the release month	16-Jan-2003	18-Aug-2011	FP	104	12:00 am EST/18:00 pm CET
Consumer Confidence Index	Index (1985 = 100)	Data are for the same month as the release month	28-Jan-2003	26-Jul-2011	CF. B.	104	10:00 am EST/16:00 pm CET
ISM Index	Index	Data are for the previous month	02-Jan-2003	01-Aug-2011	ISM	103	10:00 am EST/16:00 pm CET
Average Hourly Earnings	USD per hour	Data are for the previous month	10-Jan-2003	05-Aug-2011	BLS	104	08:30 am EST/14:30 pm CET
Nonfarm Payrolls	Thousands	Data are for the previous month	10-Jan-2003	05-Aug-2011	BLS	104	08:30 am EST/14:30 pm CET
Unemployment Rate	% of Labour Force	Data are for the previous month	10-Jan-2003	05-Aug-2011	BLS	104	08:30 am EST/14:30 pm CET
Retail Sales	M-M% change	Data are for the previous month	14-Jan-2003	18-Aug-2011	CB	104	08:30 am EST/14:30 pm CET
Retail Sales less Autos Fuel	M-M% change	Data are for the previous month	14-Jan-2003	18-Aug-2011	CB	104	08:30 am EST/14:30 pm CET
Producer Price Index	M-M% change, Index(1982=100)	Data are for the previous month	15-Jan-2003	17-Aug-2011	BLS	104	08:30 am EST/14:30 pm CET
Producer Price Index (Core)	M-M% change, Index(1982=100)	Data are for the previous month	15-Jan-2003	17-Aug-2011	BLS	104	08:30 am EST/14:30 pm CET
Consumer Price Index (CPI)	M-M% change, Index(1982=100)	Data are for the previous month	16-Jan-2003	18-Aug-2011	BLS	104	08:30 am EST/14:30 pm CET
Industrial Production	M-M% change	Data are for the previous month	17-Jan-2003	16-Aug-2011	FRB	104	09:15 am EST/15:15 pm CET
Leading Indicators	M-M% change	Data are for the previous month	23-Jan-2003	18-Aug-2011	CF. B.	104	10:00 am EST/16:00 pm CET
Durable Goods Orders	M-M% change	Data are for the previous month	28-Jan-2003	24-Aug-2011	CB	104	08:30 am EST/14:30 pm CET
Personal Income	M-M% change	Data are for the previous month	31-Jan-2003	02-Aug-2011	BEA	103	08:30 am EST/14:30 pm CET
Personal (Consumer) Spending	M-M% change	Data are for the previous month	31-Jan-2003	02-Aug-2011	BEA	103	08:30 am EST/14:30 pm CET
Factory Orders	M-M% change	Data are for two months prior to release month	07-Jan-2003	03-Aug-2011	CB	104	10:00 am EST/16:00 pm CET
Trade Balance	USD Billions	Data are for two months prior to release month	17-Jan-2003	11-Aug-2011	BEA	104	08:30 am EST/14:30 pm CET
Quarterly							
GDP Real Advance	Q/Q% change	Data are for the prior quarter	30-Jan-2003	29-Jul-2011	BEA	35	08:30 am EST/14:30 pm CET
GDP Real Preliminary	Q/Q% change	Data are for the prior quarter	28-Feb-2003	26-Aug-2011	BEA	35	08:30 am EST/14:30 pm CET
GDP Real Final	Q/Q% change	Data are for the prior quarter	27-Mar-2003	24-Jun-2011	BEA	34	08:30 am EST/14:30 pm CET
GDP Deflator Advance	Q/Q% change	Data are for the prior quarter	30-Jan-2003	29-Jul-2011	BEA	35	08:30 am EST/14:30 pm CET
GDP Deflator Preliminary	Q/Q% change	Data are for the prior quarter	28-Feb-2003	26-Aug-2011	BEA	35	08:30 am EST/14:30 pm CET
GDP Deflator Final	Q/Q% change	Data are for the prior quarter	30-Jan-2003	29-Jul-2011	BEA	34	08:30 am EST/14:30 pm CET
Weekly							
Jobless Claims	Number of claims(thousands)	Week-ending Saturday before the release.	02-Jan-2003	25-Aug-2011	ETA	462	08:30 am EST/14:30 pm CET
Total						**2539**	

This table presents the mean features of macroeconomic announcements issued between 01/01/2003 and 31/08/2011 for the United States, the Euro-Area, United Kingdom and Germany. Announcements are first classified by country or area and then by frequency of release (monthly, quarterly or weekly). The table reports the unit of measure of the announcements (column 2), the sequence of announcement date corresponding to data for month X (column 3), the chronological ordered starting date for each announcement according to its release coverage and frequency of release (column 4), the date of the last observation for the announcement (column 5), the total number of observations for each announcement (column 6) and the time schedule of the announcement release in Eastern Standard Time (EST) and Central European Time (CET). The global 24 trading hours day is decomposed in three consecutive 8-hour time-zone and each announcement is assigned to one the three time zone according to its time of release. M-M % change is the percent change from month to month, M-M level change is the change in level from month to month, Q/Q % change is the percent change quarter over quarter and Y/Y % change is percent change year over year. Actual values and median forecasts are collected from Bloomberg News Service, dates of release from Econoday Economic Calendar. The sources of announcements are: -for the Euro-Area: DG ECFIN, Directorate General for Economic and Financial Affairs-European Commission; ECB, European Central Bank; ESTAT, Eurostat-European Commission; -for Germany: BD, Deutsche Bundesbank; DSTATIS, Federal Statistical Office (*Statistisches Bundesamt)*-German Federal Ministry of the Interior; IFO, Institute of Economic Research (*Institut für Wirtschaftsforschung*); ZEW, Centre for European Economic Research (*Zentrum für Europäische Wirtschaftsforschung*); -for the United Kingdom: BOE, Bank of England; GFK NPO, Gfk National Opinion Polls, London-based arm of GFK (*Gesellschaft für Konsumforschung*-Society for Consumer Research); ONS, Office for National Statistics-UK Statistics Authority; -for the United States: BEA, Bureau of Economic Analysis-U.S. Department of Commerce; BLS, Bureau of Labor Statistics-U.S. Department of Labor; CF. B, Conference Board; CB, Census Bureau-U.S. Department of Commerce; ETA, Labor's Employment and Training Administration-U.S. Department of Labor; FP, Federal Reserve of Philadelphia; FRB, Federal Reserve Board of Governors; ISM, Institute for Supply Management.

Table 2
Description of unscheduled news

Date	Weekday	Text	Time-Zone /Sign	Typology	Source
12/05/2003	Monday	The dollar fell to $1.16 against the euro for the first time in more than four years after Treasury Secretary John Snow suggested (ABC Television) the U.S. isn't concerned with the currency's 21 percent slide in the past year.	ATZ/P	(B)	BLO
19/05/2003	Monday	The dollar fell to a series of lows across the board on Monday after weekend comments by John Snow, the US Treasury secretary, were seen as underlining the US administration's relaxed attitude towards the dollar's fall. After the G7 and G8 meetings ended on Sunday, Mr Snow described the dollar's fall as a "modest realignment".	ETZ/P	(B)	FT
20/05/2003	Tuesday	The dollar fell late Tuesday on news that the U.S. government decided to raise the nation's terror alert level back to orange, or "high," from yellow, or "elevated".	ATZ/P	(C)	WSJ
23/05/2003	Friday	The euro rose above its 1999 launch levels on Friday as the dollar tumbled on a combination of rising risk aversion on fresh terrorist fears and thin markets ahead of the long weekend in both the UK and the US. Its sudden move higher surprised traders, who said the speed was exacerbated by stop-loss selling - automated orders triggered when a currency pair reaches a particular level, above the euro's previous high. (in ETZ)	ETZ/P	(C,G)	FT
30/05/2003	Friday	The dollar rose the most in eight weeks against the euro in New York trading after President George W. Bush said he will express support for a 'strong dollar" at a weekend meeting of the leaders of the largest industrial nations.	ATZ/N	(D)	BLO
02/06/2003	Wednesday	The dollar eased up after strengthening sharply against the euro in early Monday trading on supportive comments from President Bush over the weekend. Growing speculation of a more aggressive rate cut by the European Central Bank also fueled the dollar's early strength.	ETZ/N	(B,G)	WSJ
11/06/2003	Wednesday	The euro gained against the dollar on Wednesday as Eurozone officials played down the likelihood of further rate cuts.	ETZ/P	(B)	FT
11/06/2003	Wednesday	The dollar softened against its trans-Atlantic counterparts on continued expectations of a U.S. interest-rate cut. Recent comments by Federal Reserve officials have fueled speculation of a rate cut at the central bank's June 24-25 policy meeting, with the market looking for additional indications Wednesday.	ATZ/P	(B)	WSJ
18/06/2003	Wednesday	The dollar advanced steadily on Wednesday as investors lowered expectations of the likelihood of a half-point interest rate cut by the Federal Reserve next week following strong data on Monday and Tuesday	ETZ/N	(G)	FT
30/06/2003	Monday	European central bankers, via the Bank for International Settlements, on Monday backed U.S. acceptance of a weaker dollar to stimulate the U.S. economy.	ATZ/P	(A)	WSJ

This table contains a sample of unscheduled news collected from various newspapers sources between May 2003 and June 2003. The first two columns indicate the date and weekday of release. The text of the news is contained in column 3. Each news is assigned to a specific time-zone and associated with the excepted impact on the Euro/Dollar exchange rate (column 4). The typology and the source of the news are showed in column 5 and 6. The (expected) effect on the euro-dollar exchange rate is the final character in above labels: P, Euro-positive; N, Euro-negative.WSJ: *Wall Street Journal*, BLO: *Bloomberg News*, FT: *Financial Times*.

Table 3
OLS estimation and stability tests

Variable	Coeff.	Signif.	S.E.	*p*-value	Hansen Stat.	Signif.	*p*-value
ΔEuro-Dollar{1}	-0.0938	***	[0.0151]	(0.0000)	0.2280		(0.2100)
ΔEuro-Dollar{2}	-0.1320	***	[0.0139]	(0.0000)	2.1296	***	(0.0000)
ΔEuro-Dollar{3}	-0.0186		[0.0152]	(0.2220)	0.0806		(0.6700)
Δ10-Year US Treasury Bond	-0.2730	***	[0.0411]	(0.0000)	1.4420	***	(0.0000)
Δ10-Year US Treasury Bond{1}	-0.0294	*	[0.0165]	(0.0749)	0.2556		(0.1800)
Δ10-Year US Treasury Bond{2}	-0.0486	**	[0.0223]	(0.0290)	0.0538		(0.8500)
Δ10-Year JBG	-0.0736	***	[0.0147]	(0.0000)	1.0716	***	(0.0000)
Δ10-Year JBG{1}	0.0226		[0.0188]	(0.2286)	0.4656	*	(0.0500)
Δ10-Year JBG{2}	-0.0306		[0.0244]	(0.2101)	0.0774		(0.6900)
Δ10-Year Bund	-0.0256		[0.0228]	(0.2624)	1.3224	***	(0.0000)
Δ10-Year Bund{1}	0.1049	***	[0.0302]	(0.0005)	0.2777		(0.1500)
Δ10-Year Bund{2}	0.0248	*	[0.0145]	(0.0871)	0.0869		(0.6400)
ΔDow Jones	-0.1030	**	[0.0425]	(0.0153)	3.3244	***	(0.0000)
ΔNikkei	0.0199		[0.0203]	(0.3267)	0.6517	**	(0.0200)
ΔNikkei{1}	-0.0028		[0.0257]	(0.9120)	0.2519		(0.1800)
POS_NEG Euro-Dollar_ASTZ	1.0610	***	[0.0929]	(0.0000)	0.7120	**	(0.0100)
POS_NEG Euro-Dollar_ASTZ{1}	-0.3947	***	[0.0711]	(0.0000)	0.7090	**	(0.0100)
POS_NEG Euro-Dollar_ETZ	1.0025	***	[0.0415]	(0.0000)	6.6745	***	(0.0000)
POS_NEG Euro-Dollar_ETZ{3}	-0.0476		[0.0370]	(0.1987)	0.3798		(0.0800)
POS_NEG Euro-Dollar_ATZ	1.2647	***	[0.0572]	(0.0000)	1.3815	***	(0.0000)
POS_NEG Euro-Dollar_ATZ{1}	0.2054	***	[0.0353]	(0.0000)	1.5778	***	(0.0000)
POS_NEG Euro-Dollar_ATZ{2}	-0.1060	**	[0.0431]	(0.0140)	3.0419	***	(0.0000)
EUR_CPI Flash	0.2571	***	[0.0954]	(0.0070)	0.0554		(0.8300)
EUR_PPI	-0.0290		[0.1152]	(0.8010)	0.1215		(0.4700)
EUR_GDP Advance	0.1117		[0.1356]	(0.4102)	0.0313		(0.9700)
EUR_GDP Advance{1}	0.2783		[0.2442]	(0.2544)	0.1570		(0.3600)
EUR_GDP Advance{2}	0.2059	**	[0.0895]	(0.0213)	0.0280		(0.9800)
EUR_GDP Preliminary	0.2018	***	[0.0314]	(0.0000)	0.0194		(1.0000)
EUR_GDP Preliminary{1}	-0.0704		[0.0593]	(0.2353)	0.3531		(0.1000)
EUR_GDP Preliminary{2}	-0.0526		[0.0519]	(0.3110)	0.1128		(0.5100)
EUR_GDP Preliminary{3}	0.1687	**	[0.0767]	(0.0279)	0.2891		(0.1400)
GER_IFO Expectation	0.2659	***	[0.0913]	(0.0036)	0.1038		(0.5500)
GER_IFO Expectation{1}	0.0214		[0.1218]	(0.8602)	0.0945		(0.5900)
GER_IFO Expectation{2}	0.0628		[0.0476]	(0.1871)	0.3195		(0.1200)
GER_PPI	-0.1418		[0.1187]	(0.2322)	0.0405		(0.9300)
GER_PPI{1}	0.1851		[0.1472]	(0.2086)	0.2060		(0.2500)
GER_PPI{2}	-0.1782	*	[0.0984]	(0.0700)	0.1561		(0.3600)
UK_BOE Rate	0.1756	***	[0.0495]	(0.0004)	0.0557		(0.8300)
UK_BOE Rate{1}	-0.3636	**	[0.1665]	(0.0290)	0.1696		(0.3200)
UK_BOE Rate{2}	0.0930	**	[0.0369]	(0.0118)	0.3118		(0.1200)
UK_BOE Rate{3}	-0.0346		[0.1034]	(0.7383)	0.3596	*	(0.0900)
UK_GDP Advance	-0.0512		[0.1072]	(0.6332)	0.0504		(0.8700)
UK_GDP Advance {1}	-0.2032	**	[0.0997]	(0.0414)	0.0587		(0.8100)
UK_Visible Trade Balance	0.0910		[0.0832]	(0.2742)	0.0397		(0.9300)
UK_PPI Output	0.1247	*	[0.0695]	(0.0726)	0.1013		(0.5600)
UK_Unemployment Rate	0.0119		[0.0905]	(0.8952)	0.1168		(0.4900)
UK_Unmeployment Rate{1}	-0.1300		[0.1261]	(0.3026)	0.0509		(0.8600)
UK_Unemployment Rate{2}	-0.0906		[0.0567]	(0.1101)	0.1321		(0.4300)
UK_Unemployment Rate{3}	0.0766		[0.0898]	(0.3938)	0.0824		(0.6600)
UK_Jobless Claims	-0.0168		[0.1335]	(0.8996)	0.0151		(1.0000)
UK_Jobless Claims{1}	-0.2367		[0.2019]	(0.2411)	0.0954		(0.5900)
UK_Jobless Claims{2}	-0.1891	**	[0.0960]	(0.0489)	0.0560		(0.8300)
UK_Jobless Claims{3}	0.0311		[0.1800]	(0.8630)	0.1317		(0.4300)
US_GDP Advance	-0.4826		[0.4118]	(0.2412)	0.1115		(0.5100)
US_GDP Advance{3}	0.1190		[0.1177]	(0.3120)	0.1936		(0.2700)
US_GDP Preliminary	-0.2100		[0.1661]	(0.2062)	0.1376		(0.4100)
US_GDP Preliminary{1}	0.0998		[0.0848]	(0.2395)	0.2039		(0.2500)
US_ISM Manufactoring Index	-0.4286	***	[0.1352]	(0.0015)	0.4863	**	(0.0400)
US_ISM Manufacturing Index{1}	0.0587		[0.0516]	(0.2556)	0.0459		(0.9000)
US_ISM Manufactoring Index{2}	-0.1204	*	[0.0627]	(0.0550)	0.0165		(1.0000)
US_ISM Manufactoring Index{3}	0.0875		[0.0922]	(0.3424)	0.1005		(0.5600)

US_Nonfarm Payrolls	-0.6740	***	[0.2568]	(0.0087)	0.0986	(0.5700)
US_Producer Price Index (Core)	0.2069	**	[0.0854]	(0.0154)	0.1882	(0.2800)
Constant	0.0085		[0.0103]	(0.4092)	0.2569	(0.1800)
R^2	0.3616					
Durbin Watson	1.9846					
Hansen stability test statistic						
Joint	29.6271	***		(0.0000)		
Variance	4.2251	***		(0.0000)		
Chow stability test statistic						
F (33, 6655)	5.3330	***		(0.0000)		

This table presents the results of OLS regression of intra-daily Euro/US Dollar exchange rate variations ($\Delta S_{i,t}$) on interest rates yields ($\Delta y_{i,t}$), stock market indexes returns ($\Delta I_{i,t}$), macroeconomic scheduled news for Euro-Area, Germany, United States and United Kingdom, unscheduled news and relative lags between January 2003 and August 2011. The model is first regressed for the entire sample period. Only variables with significant coefficient are retained and then used in a second-stage regression. The variables, except for unscheduled news, are standardized using the sample period standard deviations. Standard errors for coefficients estimates are in brackets, p-values in parentheses and lags 1,2 and 3 for eight, sixteen and twenty-four hours intervals are in braces. To assess the stability of parameter estimates, we use the Hansen's stability test. The Hansen stability test is performed using a joint test statistic and individual test statistics for each parameter in the model. We also test the existence of a structural break using a Chow test. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table 4
EGARCH estimations of Euro-Dollar Exchange rate

PART A. EGARCH (3,1) Sub-Period1 01/01/2003-29/02/2008					PART B. EGARCH (3,1) Sub-Period2 29/02/2008-31/08/2011				
Variable	**Coeff.**	**Signif.**	**S.E.**	***p*-value**	**Variable**	**Coeff.**	**Signif.**	**S.E.**	***p*-value**
Constant	0.0112		[0.0081]	(0.1640)	Constant	0.0183	***	[0.0037]	(0.0000)
ΔEuro-Dollar{1}	-0.0772	***	[0.0108]	(0.0000)	ΔEuro-Dollar{1}	-0.1282	***	[0.0090]	(0.0000)
ΔEuro-Dollar{2}	-0.1133	***	[0.0111]	(0.0000)	ΔEuro-Dollar{2}	-0.0276	***	[0.0068]	(0.0000)
ΔEuro-Dollar{3}	-0.0262	**	[0.0106]	(0.0133)	ΔEuro-Dollar{3}	-0.0225	***	[0.0054]	(0.0000)
Δ10-Year US Treasury Bond	-0.3093	***	[0.0199]	(0.0000)	Δ10-Year US Treasury Bond	-0.1878	***	[0.0174]	(0.0000)
Δ10-Year US Treasury Bond{1}	-0.0345	***	[0.0114]	(0.0024)	Δ10-Year US Treasury Bond{1}	-0.0677	***	[0.0200]	(0.0007)
Δ10-Year US Treasury Bond{2}	-0.0524	**	[0.0204]	(0.0103)	Δ10-Year US Treasury Bond{2}	-0.0716	***	[0.0179]	(0.0001)
Δ10-Year JGB	-0.0595	***	[0.0133]	(0.0000)	Δ10-Year JGB	-0.0320	***	[0.0073]	(0.0000)
Δ10-Year JGB{1}	0.0123		[0.0135]	(0.3640)	Δ10-Year JGB{1}	-0.0305		[0.0227]	(0.1791)
Δ10-Year JGB{2}	-0.0304	***	[0.0116]	(0.0085)	Δ10-Year JGB{2}	-0.0601	**	[0.0251]	(0.0164)
Δ10-Year Bund	-0.0194		[0.0178]	(0.2766)	Δ10-Year Bund	0.1354	***	[0.0130]	(0.0000)
Δ10-Year Bund{1}	0.1075	***	[0.0164]	(0.0000)	Δ10-Year Bund{1}	0.1503	***	[0.0169]	(0.0000)
Δ10-Year Bund{2}	0.0511	***	[0.0166]	(0.0021)	Δ10-Year Bund{2}	0.0419	***	[0.0119]	(0.0004)
ΔDow Jones	-0.0490	**	[0.0226]	(0.0298)	ΔDow Jones	0.2992	***	[0.0195]	(0.0000)
POS_NEG Euro-Dollar_ASTZ	0.9329	***	[0.0514]	(0.0000)	ΔNikkei	0.1284	***	[0.0116]	(0.0000)
POS_NEG Euro-Dollar_ASTZ{1}	-0.3628	***	[0.0343]	(0.0000)	POS_NEG Euro-Dollar _ASTZ	1.0026	***	[0.0122]	(0.0000)
POS_NEG Euro-Dollar_ETZ	1.0039	***	[0.0349]	(0.0000)	POS_NEG Euro-Dollar _ASTZ{1}	-0.2459	***	[0.0038]	(0.0000)
POS_NEG Euro-Dollar_ETZ{2}	0.0918	***	[0.0353]	(0.0092)	POS Euro-Dollar _ASTZ{1}	-0.1186	**	[0.0604]	(0.0496)
POS_NEG Euro-Dollar_ATZ	1.1824	***	[0.0362]	(0.0000)	POS Euro-Dollar _ASTZ{2}	-0.1836	***	[0.0537]	(0.0006)
POS_NEG Euro-Dollar_ATZ{1}	0.1431	***	[0.0372]	(0.0001)	POS_NEG Euro-Dollar _ETZ	1.3972	***	[0.0291]	(0.0000)
POS_NEG Euro-Dollar_ATZ{2}	-0.1199	***	[0.0319]	(0.0002)	POS_NEG Euro-Dollar _ETZ{2}	-0.0681	**	[0.0347]	(0.0496)
EUR_GDP Advance	0.0912		[0.1685]	(0.5884)	POS Euro-Dollar _ETZ	-0.0913		[0.0640]	(0.1538)
EUR_GDP Advance{1}	0.3432	**	[0.1646]	(0.0370)	POS Euro-Dollar _ETZ{2}	0.0845		[0.0678]	(0.2129)
GER_IFO Expectation	0.2615	***	[0.0733]	(0.0004)	POS_NEG Euro-Dollar _ATZ	1.2523	***	[0.0647]	(0.0000)
UK_BOE Rate	0.1028		[0.1250]	(0.4107)	POS_NEG Euro-Dollar _ATZ{2}	0.0629		[0.0579]	(0.2778)
UK_BOE Rate{1}	-0.4407	***	[0.1051]	(0.0000)	POS Euro-Dollar _ATZ	0.3557	***	[0.0881]	(0.0001)
UK_BOE Rate{2}	0.1000	***	[0.0164]	(0.0000)	POS Euro-Dollar _ATZ{2}	-0.0787		[0.0637]	(0.2167)
US_ISM Manufactoring Index	-0.4434	***	[0.0676]	(0.0000)	EUR_PPI	-0.0961		[0.1107]	(0.3852)
US_ISM Manufactoring Index{2}	-0.0995		[0.0786]	(0.2056)	EUR_CPI Flash	0.0258		[0.0970]	(0.7903)
US_Nonfarm Payrolls	-0.5810	***	[0.0688]	(0.0000)	EUR_CPI Flash{1}	-0.1471	*	[0.0798]	(0.0654)
US_Producer Price Index (Core)	0.1509	**	[0.0606]	(0.0128)	EUR_CPI Flash{2}	-0.0102		[0.0723]	(0.8874)
					EUR_CPI Flash_POS	0.1002		[0.1088]	(0.3569)
					GER_IFO Expectation	0.2348	**	[0.0957]	(0.0142)
					UK_BOE Rate	0.0742	***	[0.0038]	(0.0000)
					UK_BOE Rate{2}	-0.1020	***	[0.0192]	(0.0000)
					US_GDP Advance	-0.6660	***	[0.1920]	(0.0005)
					US_GDP Preliminary	-0.2401	***	[0.0363]	(0.0000)
					US_GDP Preliminary{1}	0.0907	***	[0.0075]	(0.0000)
					US_GDP Preliminary{2}	-0.2058		[0.1969]	(0.2959)
					US_Nonfarm Payrolls	-1.0362	***	[0.0768]	(0.0000)
					US_Producer Price Index (Core)	0.2253	**	[0.0887]	(0.0111)
ω	-0.1069	***	[0.0129]	(0.0000)	ω	-0.1775	***	[0.0226]	(0.0000)
γ{1}	0.1362	***	[0.0154]	(0.0000)	γ{1}	0.2391	***	[0.0538]	(0.0000)
δ{1}	-0.1855	***	[0.0239]	(0.0000)	δ{1}	-0.4512	***	[0.0196]	(0.0000)
δ{2}	0.2704	***	[0.0155]	(0.0000)	δ{2}	0.7257	***	[0.0440]	(0.0000)
δ{3}	0.9075	***	[0.0158]	(0.0000)	δ{3}	0.7120	***	[0.0089]	(0.0026)
φ{1}	0.0154	*	[0.0086]	(0.0752)	φ{1}	0.0268	***	[0.0226]	(0.0000)

This table presents the results of exponential GARCH (EGARCH) estimations of intra-daily Euro/US Dollar exchange rate variations ($\Delta S_{i,t}$) on interest rates yields ($\Delta y_{i,t}$), stock market indexes returns ($\Delta I_{i,t}$), macroeconomic scheduled news for the Euro-Area, Germany, United States and United Kingdom, unscheduled news and relative lags between January 2003 and August 2011. Only variables with significant coefficient obtained in the entire sample period OLS regression model are retained and then used in second-stage EGARCH estimations. In the second step the model is computed for two consecutive sub-sample periods. Panel A and Panel B report the results for the EGARCH (3,1) models in the first sub-period (01 January 2003 22:00 CET to 29 February 2008 at 06:00 am CET; 4040 8-hourly observations) and in the second sub-period (29 February 2008 at 6:00 am to 31 August 2011 22:00 CET; 2744 8-hourly observations) respectively. The variables, except for unscheduled news, are standardized using the sample period standard deviations. The label *_POS* after the macroeconomic news name denotes variables computed only with realized positive surprises. The label *POS* before the unscheduled news denotes variables computed only with positive expected sign on the Euro/Dollar exchange rate. Standard errors for coefficients estimates are in brackets, p-value in parentheses and lags 1,2 and 3 for eight, sixteen and twenty-four hours intervals are in braces. In the conditional variance EGARCH models, ω is the intercept term, γ_j (j=1) is the ARCH parameter, δ_l (l = 1,2,3) the GARCH parameters and φ_j (j=1) the asymmetry parameter. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table 5
Effects of Unscheduled News in the Time Zones

	Pre-crisis (Sub-period1) 01/01/2003-29/02/2008			Post -crisis (Sub-period2) 29/02/2008-31/08/2011				
	Asia	**Europe**	**USA**	**Asia**		**Europe**	**USA**	
				(1)	**(2)**		**(1)**	**(2)**
Impact Effect	0.9329	1.0039	1.1824	1.0026	1.0026	1.3972	1.6080	1.2523
Delayed reaction(s)	-0.3628	0.0918	0.0232	- 0.5481	- 0.2459	-0.0681		
Net effect	0.5701	1.0957	1.2056	0.4545	0.7567	1.3291	1.6080	1.2523
Type of effect	Over-reaction	Under-reaction	Under-reaction	Over-reaction		Over-reaction		

This table shows the effect of EGARCH estimated parameters of unscheduled news according the time-zone of reference. (1) are Euro Positive/Dollar Negative news and (2) are Euro Negative/Dollar Positive news. Over-reaction occurs when the initial effect is subsequently partially reverted while under-reaction occurs when the initial effect is successively reinforced.

Table 6
Effects of EGARCH parameters on volatility

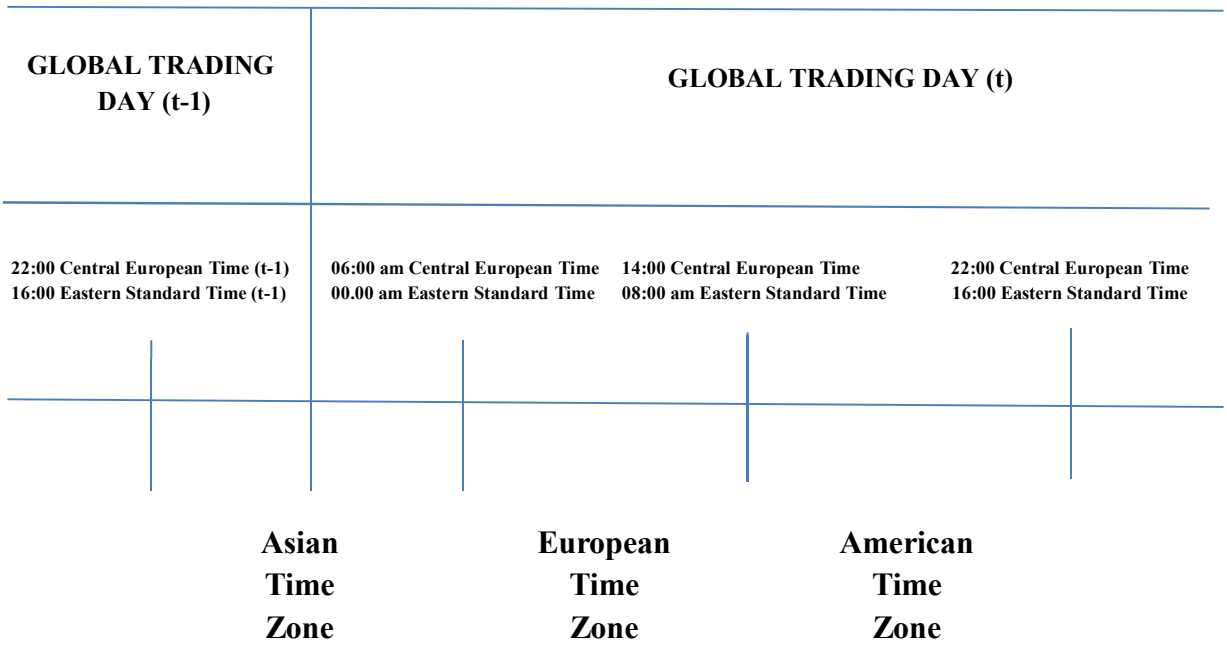
	Negative unaccounted surprises z_{t-1}			Positive unaccounted surprises z_{t-1}		
	-1	-1.65	2.33	+1	+1.65	+2.33
Sub-period1 01/01/2003-29/02/2008						
$\sqrt{e^{0.0154 z_{t-1}}}$	0.9923	0.9874	0.9822	1.0077	1.0128	1.0181
(% effect on $\sqrt{h_t}$)	-0.77%	-1.26%	-1.78%	0.77%	1.28%	1.81%
$\sqrt{e^{0.1362 \lvert z_{t-1} \rvert}}$	1.0705	1.1189	1.1720	1.0705	1.1189	1.1720
(% effect on $\sqrt{h_t}$)	7.05%	11.89%	17.20%	7.05%	11.89%	17.20%
$\sqrt{e^{(0.0154 \pm 0.1362) z_{t-1}}}$	1.0623	1.1048	1.1511	1.0787	1.1332	1.1932
(% effect on $\sqrt{h_t}$)	6.23%	10.48%	15.11%	7.87%	13.32%	19.32%
Sub-period2 29/02/2008-31/08/2011						
$\sqrt{e^{0.0268 z_{t-1}}}$	0.9867	0.9781	0.9693	1.0135	1.0224	1.0317
(% effect on $\sqrt{h_t}$)	-1.33%	-2.19%	-3.07%	1.35%	2.24%	3.17%
$\sqrt{e^{0.2391 \lvert z_{t-1} \rvert}}$	1.1270	1.2181	1.3212	1.1270	1.2181	1.3212
(% effect on $\sqrt{h_t}$)	12.70%	21.81%	32.12%	12.70%	21.81%	32.12%
$\sqrt{e^{(0.0268 \pm 0.2391) z_{t-1}}}$	1.1120	1.1914	1.2806	1.1422	1.2453	1.3631
(% effect on $\sqrt{h_t}$)	11.20%	19.14%	28.06%	14.22%	24.53%	36.31%

This table shows the effects of EGARCH estimated parameters on the volatility of the error terms. The EGARCH (3,1) coefficients are taken from the estimated logarithmic equation of the conditional variance as reported in Table 4 for the two consecutive sub-sample periods. To quantify the effects of different sizes of unaccounted surprises we take the square root of the anti-log transformation of the conditional variance equations. In the EGARCH the absolute standardized innovation is centered at 0.79 (square root of $2/\pi$). The simplification used in the specification affect only the constant term as showed below. The base case is z_{t-1} equal to zero and can be compared with the impact of the coefficient of the sign.

$$h_t = \exp\left(-0.1069 - 0.1362\sqrt{\frac{2}{\pi}}\right) + \{0.1362\,[|z_{t-1}|\,] + 0.0154\,(z_{t-1})\}(h_{t-1})^{-0.1855}(h_{t-2})^{0.2704}(h_{t-3})^{0.9075}$$

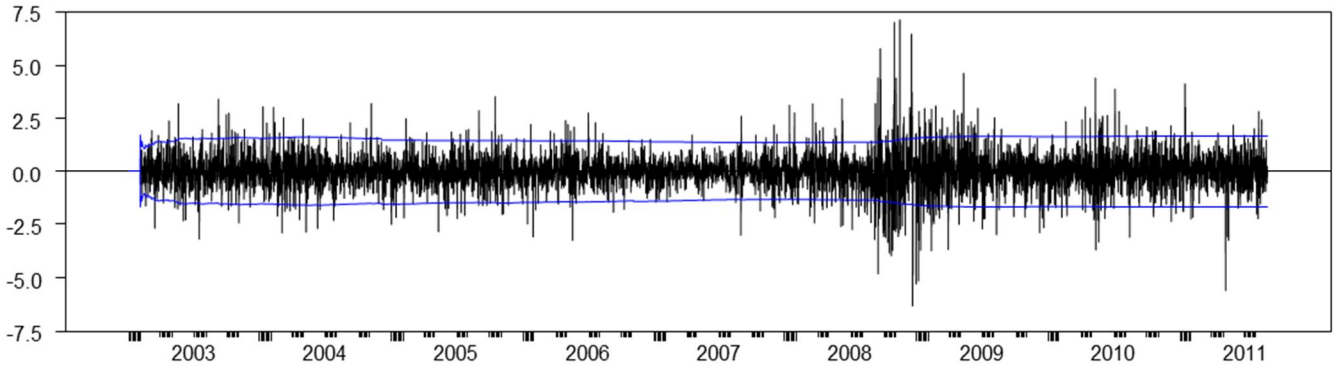
$$h_t = \exp\left(-0.1775 - 0.2391\sqrt{\frac{2}{\pi}}\right) + \{0.2391\,[|z_{t-1}|\,] + 0.0268\,(z_{t-1})\}(h_{t-1})^{-0.4512}(h_{t-2})^{0.7257}(h_{t-3})^{0.7120}$$

Figure 1
Global Trading Day and Time Zones



The 24 hours Gobal Trading Day is decomposed in three symmetric eight-hour time zones: the Asian Time Zone (ASTZ) goes from the closing of the US trading at 22:00 Central European Time (CET) of the previous day (t-1) to 06:00 am Central European Time in current day (t), the European Time Zone (ETZ) starts at 06:00 am Central European Time when the Asian foreign market is going to close and goes to 14:00 Central European Time. The American Time Zone (ATZ) goes from 14:00 Central European Time (equivalent to 08:00 am Eastern Standard Time, EST) to 22:00 Central European Time (or 16.00 Eastern Standard Time). Exchange rate closing quotes at 05:00 am, 13:00 and 21:00 Central European Time are taken by hourly series.

Figure 2
Recursive Residuals and Standard Error Band



This figure shows the recursive residuals and the upper and lower recursively generated standard error bands. The recursive residuals are obtained from recursive Least Squares estimations. If there is a break, the residuals will lie outside the band until the coefficients or the variance estimates adjust.

Appendix-Supplementary Data

Table A1
Descriptive Statistics Macroeconomics News

	Mean	Std. Dev.	Skewness	Kurtosis	Positive Surprises	Negative Surprises	Zero Surprises	Jarque-Bera	*p*-value	Q(1)	*p*-value	Q(2)	*p*-value
Euro-Area News													
Business Climate Indicator	0.0087	0.2013	-0.1468	3.2703	49	46	0	1.11	(0.5727)	3.1476*	(0.0760)	8.9519**	(0.0114)
ECB Rate	0.0000	0.0004	1.8120	34.7951	2	1	102	85.83***	(0.0000)	0.0011	(0.9733)	0.0023	(0.9989)
Economic Confidence	0.0218	1.5208	-0.6649	5.2053	51	42	8	16.23***	(0.0003)	3.1466*	(0.0761)	8.8948**	(0.0117)
Consumer Confidence	-0.1150	1.1892	0.1812	6.8348	27	33	40	15.72***	(0.0004)	1.1305	(0.2877)	7.9700**	(0.0186)
Industrial Confidence	0.0188	1.3874	-0.4457	3.8333	35	33	33	6.44**	(0.0400)	5.9728**	(0.0145)	15.9307***	(0.0003)
CPI Y-Y Flash	0.0000	0.0012	0.1817	4.0513	29	29	47	4.62*	(0.0995)	1.5483	(0.2134)	1.6836	(0.4309)
CPI Y-Y Final	0.0000	0.0005	-0.0584	3.6099	12	17	76	2.08	(0.3528)	0.4045	(0.8169)	1.5483	(0.2134)
CPI M-M	-0.0001	0.0007	-0.5951	5.7601	16	21	68	17.67***	(0.0001)	0.0094	(0.9228)	3.6844	(0.1585)
M3	0.0002	0.0017	-0.1507	3.2686	45	37	20	1.170	(0.5576)	3.4351*	(0.0638)	7.526**	(0.0232)
PPI M-M	-0.0002	0.0016	-1.8898	12.806	26	33	46	65.95***	(0.0000)	5.627**	(0.0177)	14.2352***	(0.0008)
Retail Sales M-M	-0.0017	0.0055	-0.2445	2.9396	31	60	10	1.15	(0.5639)	0.3617	(0.5475)	2.0704	(0.3552)
Retail Sales Y-Y	-0.0023	0.0096	0.0145	2.8108	43	57	4	0.03	(0.9874)	10.48***	(0.0012)	10.706***	(0.0047)
Unemployment Rate	0.0000	0.0009	0.6360	5.9629	22	27	56	19.25***	(0.0001)	1.2445	(0.2646)	2.2597	(0.3231)
Industrial Production	-0.0008	0.0053	-0.3759	3.3287	45	55	5	3.58	(0.1672)	0.2808	(0.5962)	0.3495	(0.8397)
GDP Advance	0.0000	0.0018	-0.1456	3.7631	13	14	7	2.02	(0.3647)	3.4601	(0.1773)	3.4601	(0.1773)
GDP Preliminary	0.0000	0.0003	0.8800	11.8289	2	1	33	22.85***	(0.0000)	4.6806**	(0.0305)	4.6955*	(0.0956)
GDP Final	-0.0001	0.0005	-0.3982	4.6933	2	5	27	5.44*	(0.0658)	0.0607	(0.8054)	2.8168	(0.2445)
Total					**450**	**511**	**582**						
Germany News													
Zew Survey	-0.3625	8.1997	0.1665	2.7861	46	58	0	0.58	(0.7478)	14.7086***	(0.0001)	17.7065***	(0.0001)
IFO Business Climate	0.3010	1.2942	0.0484	3.5087	63	39	2	1.64	(0.4395)	3.9087**	(0.0480)	3.9198	(0.1409)
IFO Current Assessment	0.3904	1.5110	0.3431	2.9167	62	41	1	2.21	(0.3305)	0.1672	(0.6826)	4.2870	(0.1172)
IFO Expectation	0.2971	1.4807	-0.3860	3.5700	64	35	5	4.60	(0.1005)	7.5347***	(0.0061)	11.4566***	(0.0033)
CPI Preliminary	-0.0001	0.0016	-0.3563	2.5604	39	36	28	3.14	(0.2078)	5.6592**	(0.0174)	6.9445**	(0.0310)
Factory Orders	0.0007	0.0262	-0.0730	2.4409	51	49	3	1.88	(0.3907)	0.5154	(0.4728)	0.8205	(0.6635)
Industrial Production	-0.0019	0.0149	-0.0327	3.2501	46	56	3	0.70	(0.7032)	1.7187	(0.1899)	2.8066	(0.2458)
Retail Sales	-0.0061	0.0156	0.5554	3.5960	30	68	5	7.29**	(0.0261)	4.3465**	(0.0371)	7.2296**	(0.0269)
Unemployment Level	-8486	3282	0.0612	3.8283	40	62	3	3.04	(0.2192)	6.5531**	(0.0105)	6.559**	(0.0376)
Unemployment Rate	-0.0003	0.0011	-0.5009	2.7811	26	39	40	4.56	(0.1021)	6.9332***	(0.0085)	8.5596**	(0.0138)
PPI	0.0006	0.0039	-0.6693	6.1370	54	39	11	20.43***	(0.0000)	0.9863	(0.3206)	7.9861**	(0.0184)
GDP Preliminary	0.0002	0.0034	0.56880	3.8176	13	16	6	4.31	(0.1162)	0.4580	(0.4985)	1.6326	(0.4421)
Total					**534**	**538**	**107**						
United Kingdom News													
BOE Rate	-0.0001	0.0012	-6.2659	54.2893	2	5	96	169.92***	(0.0000)	3.0419*	(0.0811)	3.0619	(0.2163)
GDP Real Advance	-0.0007	0.0024	-1.2958	5.6883	10	15	9	15.91***	(0.0004)	0.1607	(06885)	4.7395*	(0.0935)
GDP Real Preliminary	0.0000	0.0010	0.4687	4.6853	8	9	18	5.91*	(0.0521)	0.1587	(0.6904)	7.0439**	(0.0295)
GDP Real Final	-0.0003	0.0020	-1.0303	5.1393	11	13	10	11.80	(0.0027)	0.5265	(0.4681)	0.9529	(0.6210)
Gfk Consumer Confidence	0.0096	2.8778	0.7542	4.3329	37	48	19	14.46***	(0.0007)	0.0024	(0.9613)	0.6124	(0.7362)
Industrial Production	-0.0031	0.0071	-0.6876	3.9318	30	67	7	11.28***	(0.0036)	0.0776	(0.7806)	0.1999	(0.9049)
Jobless Claim Change	-1013	11880	0.4987	8.8012	46	58	0	25.94***	(0.0000)	0.1919	(0.6613)	0.4040	(0.8171)

Manufactoring Production	-0.0059	0.0438	-1.4951	5.0500	59	43	2	4.44	(0.1085)	0.0129	(0.9096)	0.0179	(0.9911)
PPI Output	0.0007	0.0032	0.6341	3.9830	52	35	17	10.47***	(0.0053)	5.624**	(0.0177)	5.8645*	(0.0533)
RPI	0.0003	0.0018	0.4476	4.4658	43	33	28	9.49***	(0.0087)	0.0779	(0.7802)	0.2333	(0.8899)
RPI ex mort. Int. payment	0.0004	0.0019	0.0481	3.9712	48	30	25	3.61	(0.1641)	0.3540	(0.5519)	0.3566	(0.8367)
Retail Sales ex auto fuel	0.0016	0.0095	0.2449	5.4538	60	39	5	11.34***	(0.0034)	5.282**	(0.0215)	6.4708**	(0.0393)
ILO Unemployment	0.0000	0.0009	0.2472	2.9387	26	29	49	1.20	(0.5496)	0.0637	(0.8008)	1.6710	(0.4337)
Visible Trade	-153	578	0.2379	2.8736	36	68	0	1.08	(0.5820)	3.6277*	(0.0568)	5.7692*	(0.0559)
Total					**468**	**492**	**286**						
United States News													
Philadelphia Manufactoring Index	-1.4192	9.2262	-0.6189	3.8249	47	56	1	9.48***	(0.0087)	0.0002	(0.9874)	0.7740	(0.6791)
ISM Index (formerly NAPM Survey)	0.2548	2.1441	0.2133	3.6352	53	47	4	2.99	(0.2246)	0.3588	(0.5492)	1.6676	(0.4344)
Consumer Confidence Index	-0.1476	5.1508	-0.2761	2.9778	52	50	1	1.51	(0.4711)	1.2524	(0.2631)	5.225*	(0.0734)
Average Hourly Earnings	-0.0125	0.1391	0.1375	2.7243	35	41	28	0.52	(0.7729)	3.6643*	(0.0556)	3.8985	(0.1424)
Nonfarm Payroll	-218367	83086	-0.1889	4.3252	37	66	1	5.90*	(0.0524)	0.8082	(0.3687)	0.8369	(0.6581)
Unemployment Rate	-0.0250	0.1531	0.0509	3.5874	27	48	29	1.97	(0.3742)	0.8632	(0.3529)	1.8328	(0.4000)
Retail Sales	-0.0298	0.5738	0.1595	4.1028	48	51	5	4.68*	(0.0963)	4.8637**	(0.0274)	4.9543*	(0.0840)
Retail Sales less Autos Fuel	-0.0010	0.5322	-0.0669	4.3672	42	49	13	5.49*	(0.0643)	3.805*	(0.0511)	3.8254	(0.1477)
Producer Price Index (PPI)	0.0712	0.5503	0.1283	3.6576	54	42	8	2.53	(0.2826)	6.3011**	(0.0121)	8.4364**	(0.0147)
PPI less food & energy (Core PPI)	0.0125	0.3036	-0.2619	6.0829	44	35	25	14.02***	(0.0009)	16.1593***	(0.0001)	22.0275***	(0.0000)
Consumer Price Index (CPI)	-0.0077	0.1405	-0.0950	3.4607	34	33	37	1.59	(0.4520)	2.6869	(0.1012)	3.9264	(0.1404)
Industrial Production	-0.0625	0.4202	-1.4467	9.6329	46	50	8	48.58***	(0.0000)	1.8861	(0.1696)	6.8173**	(0.0331)
Leading Indicators	-0.0058	0.2009	0.7870	4.1503	30	45	29	14.3***	(0.0008)	0.0831	(0.7732)	0.0845	(0.9586)
Durable Goods Orders	-0.3596	2.3466	-0.1161	4.0522	40	62	2	4.22	(0.1213)	4.8107**	(0.0283)	8.1387**	(0.0171)
Personal (Consumer) Spending	-0.0388	0.2102	-1.2050	7.3624	33	45	25	36.25***	(0.0000)	0.4732	(0.4915)	2.2548	(0.3239)
Personal Income	0.0515	0.3061	2.1941	10.738	43	39	21	67.66***	(0.0000)	0.0670	(0.7958)	3.5479	(0.1697)
Factory Orders	-0.0356	0.8445	-0.7210	4.1986	50	46	8	13.16***	(0.0014)	1.1343	(0.2869)	1.6548	(0.4372)
Trade Balance	-0.0538	3.4556	0.1992	3.7488	52	49	3	3.36	(0.1862)	2.6315	(0.1048)	3.1079	(0.2114)
GDP Real Advanced	-0.1400	0.6921	0.5109	3.3975	10	23	2	2.86	(0.2387)	0.1056	(0.7452)	1.4051	(0.4953)
GDP Real Preliminary	0.0029	0.3285	-0.3286	2.9504	15	15	5	0.98	(0.6124)	0.0348	(0.8521)	5.7463*	(0.0565)
GDP Real Final	-0.0588	0.2583	-0.2505	2.6863	10	13	11	0.47	(0.7918)	1.2557	(0.2625)	1.7691	(0.4129)
GDP Deflator Advanced	0.0229	0.1592	1.0391	2.7090	16	17	2	0.65	(0.7217)	0.3920	(0.5313)	1.4337	(0.4883)
GDP Deflator Preliminary	0.0229	0.1592	1.0391	6.5821	14	8	13	15.48***	(0.0004)	0.0496	(0.8238)	0.1275	(0.9383)
GDP Deflator Final	0.0235	0.1689	-0.2611	2.3763	16	11	7	0.92	(0.6313)	0.5282	(0.4674)	0.5818	(0.7476)
Initial Unemployment (Jobless)	1.1106	18.6400	0.1683	4.0092	233	218	11	12.74***	(0.0017)	4.3667**	(0.0366)	5.6362*	(0.0597)
Total					**1081**	**1159**	**299**						

The variables are represented by news (positive, negative and null surprises) for Euro-Zone indicators, US indicators, Germany indicators, and UK indicators. News are obtained as the difference between the actual value of a macroeconomic announcement issued at day *t* and its expected value from Bloomberg. The table provides the mean, standard deviation, skewness, kurtosis of the news (surprises), the *p*-values for the Jarque-Bera test statistic of the null hypothesis of normal distribution and the *p*-values for the Ljung-Box test statistic for the null hypothesis that autocorrelation coefficients up to 2 lags are zero. The *p*-values are contained in parentheses. Data are from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.2

Correlations between US Macroeconomic News

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(1)	**Consumer Confidence**	**1**																				
(2)	**CPI**	0.0000	**1**																			
		(0.9976)																				
(3)	**Durable Goods**	-0.0014	-0.0001	**1**																		
		(0.9088)	(0.9916)																			
(4)	**Avg Hourly Earnings**	-0.0001	-0.0001	-0.0002	**1**																	
		(0.9961)	(0.9950)	(0.9863)																		
(5)	**Factory Orders**	0.0049	0.0000	-0.0001	**-0.0411*****	**1**																
		(0.6834)	(0.9977)	(0.9935)	(0.0007)																	
(6)	**GDP Deflator**	-0.0065	0.0000	0.0003	-0.0001	0.0000	**1**															
		(0.5912)	(0.9978)	(0.9801)	(0.9964)	(0.9983)																
(7)	**GDP Real**	0.0062	-0.0001	-0.0007	-0.0002	-0.0001	**-0.2824*****	**1**														
		(0.6096)	(0.9923)	(0.9559)	(0.9875)	(0.9941)	(0.0000)															
(8)	**Industrial Production**	-0.0001	**-0.0310****	-0.0003	-0.0002	-0.0001	-0.0001	-0.0003	**1**													
		(0.9936)	(0.0103)	(0.9774)	(0.9867)	(0.9937)	(0.9942)	(0.9794)														
(9)	**Leading Indicators**	0.0000	**0.0206***	-0.0001	0.0000	0.0000	0.0000	-0.0021	0.0159	**1**												
		(0.9988)	(0.0887)	(0.9956)	(0.9974)	(0.9988)	(0.9989)	(0.8616)	(0.1894)													
(10)	**ISM Index**	0.0001	0.0001	0.0003	-0.0118	-0.0038	0.0001	0.0002	0.0003	0.0001	**1**											
		(0.9951)	(0.9937)	(0.9826)	(0.3303)	(0.7558)	(0.9955)	(0.9841)	(0.9831)	(0.9967)												
(11)	**Nonfarm Payrolls**	-0.0002	-0.0002	0.0006	**-0.1734*****	**0.0244****	-0.0002	-0.0005	-0.0006	-0.0001	-0.0128	**1**										
		(0.9889)	(0.9859)	(0.9610)	(0.0000)	(0.0432)	(0.9899)	(0.9644)	(0.9621)	(0.9926)	(0.2892)											
(12)	**Jobless Claims**	0.0015	0.0167	-0.0112	0.0019	**-0.0251****	**-0.0608*****	**-0.0264****	-0.0061	0.0072	0.0036	0.0006	**1**									
		(0.9044)	(0.1669)	(0.3560)	(0.8719)	(0.0378)	(0.0000)	(0.0291)	(0.6139)	(0.5499)	(0.7674)	(0.9573)										
(13)	**Consumer Spending**	-0.0067	-0.0001	0.0065	-0.0035	0.0186	0.0032	-0.0004	-0.0004	-0.0023	**0.0298****	0.0028	0.0166	**1**								
		(0.5774)	(0.9908)	(0.5922)	(0.7744)	(0.1236)	(0.7940)	(0.9768)	(0.9753)	(0.8476)	(0.0135)	(0.8149)	(0.1687)									
(14)	**Personal Income**	-0.0091	0.0001	-0.0188	0.0002	**0.0232***	-0.0007	0.0004	0.0004	0.0001	**0.0984*****	-0.0026	0.0002	**-0.0391*****	**1**							
		(0.4514)	(0.9909)	(0.1194)	(0.9851)	(0.0554)	(0.9568)	(0.9769)	(0.9754)	(0.9952)	(0.0000)	(0.8311)	(0.9888)	(0.0012)								
(15)	**Philadelphia Fed Survey**	-0.0001	**-0.0572*****	-0.0004	-0.0002	-0.0001	-0.0049	0.0029	**0.1184***	**-0.1195***	0.0003	-0.0006	**-0.0394*****	-0.0004	0.0004	**1**						
		(0.9932)	(0.0000)	(0.9761)	(0.9859)	(0.9934)	(0.6857)	(0.8111)	(0.0000)	(0.0000)	(0.9821)	(0.9599)	(0.0011)	(0.9739)	(0.9740)							
(16)	**PPI (Core)**	-0.0077	0.0000	0.0001	0.0001	0.0000	0.0000	0.0001	-0.0150	-0.0016	-0.0001	0.0002	**0.0227***	0.0001	-0.0001	-0.0145	**1**					
		(0.5223)	(0.9977)	(0.9937)	(0.9963)	(0.9982)	(0.9984)	(0.9942)	(0.2160)	(0.8965)	(0.9953)	(0.9894)	(0.0599)	(0.9931)	(0.9931)	(0.2314)						
(17)	**PPI**	-0.0148	0.0001	0.0003	0.0002	0.0001	0.0001	0.0003	0.0098	0.0001	-0.0051	0.0005	**0.0241****	0.0003	-0.0003	**-0.0213***	**0.4761*****	**1**				
		(0.2211)	(0.9929)	(0.9803)	(0.9884)	(0.9945)	(0.9949)	(0.9820)	(0.4192)	(0.9963)	(0.6736)	(0.9670)	(0.0463)	(0.9785)	(0.9786)	(0.0786)	(0.0000)					
(18)	**Retail Sales**	0.0000	**-0.0241****	-0.0010	-0.0001	0.0000	0.0000	-0.0010	0.0070	0.0000	0.0001	-0.0002	0.0174	-0.0001	0.0001	-0.0072	**0.0634*****	**0.1642*****	**1**			
		(0.9977)	(0.0465)	(0.9920)	(0.9953)	(0.9978)	(0.9979)	(0.9927)	(0.5601)	(0.9985)	(0.9940)	(0.9867)	(0.1510)	(0.9913)	(0.9913)	(0.5499)	(0.0000)	(0.0000)				
(19)	**Retail Sales (Net)**	0.0000	0.0181	0.0000	0.0000	0.0000	0.0000	0.0000	**-0.0262****	0.0000	0.0000	0.0000	0.0096	0.0000	0.0000	-0.0058	**0.0468*****	**0.1637*****	**0.7921*****	**1**		
		(0.9999)	(0.1332)	(0.9997)	(0.9998)	(0.9999)	(0.9999)	(0.9997)	(0.0301)	(0.9999)	(0.9998)	(0.9995)	(0.4259)	(0.9997)	(0.9997)	(0.6339)	(0.0001)	(0.0000)	(0.0000)			
(20)	**Trade Balance**	0.0000	0.0018	0.0000	0.0014	0.0000	0.0000	0.0000	0.0089	0.0080	0.0000	0.0000	-0.0111	0.0000	0.0000	0.0152	**-0.0586*****	-0.0167	-0.0016	-0.0051	**1**	
		(0.9993)	(0.8827)	(0.9976)	(0.9087)	(0.9993)	(0.9994)	(0.9978)	(0.4618)	(0.5101)	(0.9982)	(0.9990)	(0.3574)	(0.9974)	(0.9974)	(0.2071)	(0.0000)	(0.1676)	(0.8930)	(0.6750)		
(21)	**Unemployment Rate**	-0.0001	-0.0001	-0.0004	**0.0222***	-0.0090	-0.0001	-0.0003	-0.0004	-0.0001	0.0026	**0.2158*****	0.0059	0.0025	0.0004	-0.0004	0.0001	0.0003	-0.0001	0.0000	-0.0013	**1**
		(0.9930)	(0.9911)	(0.9753)	(0.0664)	(0.4573)	(0.9936)	(0.9774)	(0.9760)	(0.9953)	(0.8296)	(0.0000)	(0.6247)	(0.8358)	(0.9731)	(0.9746)	(0.9933)	(0.9791)	(0.9915)	(0.9997)	(0.9139)	

This table shows the Pearson correlation coefficients between news (positive, negative and null surprises) for 25 US macroeconomic indicators: Consumer Confidence Index, Consumer Price Index (CPI), Average Hourly Earnings, Factory Orders, Durable Goods Orders, GDP Deflator, GDP Real, Industrial Production, Leading Indicators Index, ISM Index (formerly NAPM Survey), Nonfarm Payrolls, Initial Unemployment (Jobless) Claims, Personal (Consumer) Spending, Personal Income, Philadelphia Manufactoring Index (Fed Survey), Producer Price Index (PPI) Net of Food and Energy, Producer Price Index (PPI), Retail Sales, Retail Sales (Net) less Autos Fuel, Trade Balance, Unemployment Rate. GDP Deflator and GDP Real surprises are aggregated using the Advance, Preliminary and Final releases. News are obtained as the difference between the actual value of the macroeconomic variable and its expected value. The associated p-value is contained in parentheses below the correlation coefficient estimate. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.3
Correlations between Euro-Area Macroeconomics News

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Business Climate Indicator	**1**																
(2) Consumer Confidence	**0.1896*****	**1**															
	(0.0000)																
(3) CPI M-M Final	0.0029	0.0115	**1**														
	(0.8085)	(0.3424)															
(4) ECB Rate	0.0000	0.0000	-0.0001	**1**													
	(0.9985)	(0.9972)	(0.9964)														
(5) Economic Confidence	**0.5948*****	**0.3834*****	0.0019	0.0000	**1**												
	(0.0000)	(0.0000)	(0.8775)	(0.9995)													
(6) CPI Y-Y Final	0.0048	-0.0155	**0.5200*****	-0.0001	0.0122	**1**											
	(0.6905)	(0.2006)	(0.0000)	(0.9966)	(0.3116)												
(7) CPI Y-Y Flash	**0.0803*****	**-0.1125*****	-0.0118	0.0000	**0.0612*****	0.0000	**1**										
	(0.0000)	(0.0000)	(0.3308)	(1.0000)	(0.0000)	(1.0000)											
(8) GDP Final	0.0001	-0.0001	-0.0002	-0.0001	0.0000	-0.0002	0.0000	**1**									
	(0.9954)	(0.9916)	(0.9893)	(0.9959)	(0.9984)	(0.9899)	(1.0000)										
(9) GDP Advance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**1**								
	(0.9996)	(0.9993)	(0.9991)	(0.9996)	(0.9999)	(0.9991)	(1.0000)	(0.9989)									
(10) GDP Preliminary	0.0000	0.0001	0.0001	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000	**1**							
	(0.9976)	(0.9957)	(0.9945)	(0.9979)	(0.9992)	(0.9948)	(1.0000)	(0.9937)	(0.9995)								
(11) Industrial Confidence	**0.7175*****	**0.2311*****	**0.0303****	0.0000	**0.5728*****	0.0134	**0.1101*****	0.0000	0.0000	0.0000	**1**						
	(0.0000)	(0.0000)	(0.0122)	(0.9995)	(0.0000)	(0.2674)	(0.0000)	(0.9985)	(0.9999)	(0.9992)							
(12) Industrial Production	0.0001	-0.0002	0.0150	-0.0001	0.0000	**-0.0305****	0.0000	-0.0071	**0.1217*****	0.0001	0.0000	**1**					
	(0.9940)	(0.9892)	(0.2130)	(0.9947)	(0.9980)	(0.0115)	(1.0000)	(0.5566)	(0.0000)	(0.9919)	(0.9981)						
(13) M3	0.0026	**-0.0261****	0.0001	0.0001	0.0121	0.0001	-0.0097	0.0002	0.0000	-0.0001	0.0124	0.0002	**1**				
	(0.8300)	(0.0309)	(0.9913)	(0.9966)	(0.3172)	(0.9918)	(0.4242)	(0.9899)	(0.9991)	(0.9949)	(0.3039)	(0.9871)					
(14) PPI M-M	0.0007	-0.0051	-0.0001	-0.0001	-0.0016	-0.0001	0.0000	**0.0228***	0.0000	0.0001	-0.0022	-0.0002	0.0001	**1**			
	(0.9547)	(0.6706)	(0.9902)	(0.9962)	(0.8963)	(0.9908)	(1.0000)	(0.0593)	(0.9990)	(0.9943)	(0.8576)	(0.9855)	(0.9908)				
(15) Retail Sales M-M	**-0.0564*****	0.0040	-0.0004	-0.0002	**-0.0223***	-0.0004	0.0044	-0.0005	0.0000	0.0003	**-0.0400*****	-0.0006	0.0004	-0.0036	**1**		
	(0.0000)	(0.7427)	(0.9713)	(0.9889)	(0.0648)	(0.9728)	(0.7176)	(0.9668)	(0.9971)	(0.9831)	(0.0009)	(0.9575)	(0.9730)	(0.7644)			
(16) Retail Sales Y-Y	**-0.0582*****	0.0064	-0.0003	-0.0001	**-0.0226***	-0.0003	0.0017	-0.0004	0.0000	0.0002	**-0.0440*****	-0.0005	0.0003	-0.0022	**0.7978*****	**1**	
	(0.0000)	(0.5980)	(0.9780)	(0.9915)	(0.0612)	(0.9792)	(0.8893)	(0.9746)	(0.9978)	(0.9871)	(0.0003)	(0.9674)	(0.9794)	(0.8570)	(0.0000)		
(17) Unemployment Rate	**-0.0234***	**-0.0429*****	0.0000	0.0000	-0.0198	0.0000	**0.1392*****	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-0.0126	0.0072	0.0052	**1**
	(0.0533)	(0.0004)	(0.9990)	(0.9996)	(0.1019)	(0.9991)	(0.0000)	(0.9989)	(0.9999)	(0.9994)	(0.9999)	(0.9985)	(0.9991)	(0.2966)	(0.5537)	(0.6693)	

This table shows the Pearson correlation coefficients between news (positive, negative and null surprises) for 17 Euro-Area macroeconomic indicators: Business Climate Indicator, Consumer Confidence, Consumer Price Index (CPI) Month-over-Month, ECB Rate, Economic Confidence, Consumer Price Index (CPI) Final Year-over-Year, Consumer Price Index (CPI) Flash Year-over-Year, GDP Final, GDP Advanced, GDP Preliminary, Industrial Confidence, M3 Money Supply, Producer Price Pndex (PPI), Retail Sales Month-over-Month, Retail Sales Year-over-Year, Unemployment Rate. News are obtained as the difference between the actual value of the macroeconomic variable and its expected value. The associated p-value is contained in parentheses below the correlation coefficient estimate. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.4
Correlations between Germany Macroeconomics News

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	**CPI**	**1**											
(2)	**IFO Current Assessment**	**0.0485***** (0.0001)	**1**										
(3)	**IFO Expectations**	-0.0088 (0.4652)	**0.4200***** (0.0000)	**1**									
(4)	**Factory Orders**	0.0000 (0.9991)	-0.0001 (0.9933)	-0.0001 (0.9943)	**1**								
(5)	**GDP Real Advance**	0.0025 (0.8336)	0.0000 (0.9969)	0.0000 (0.9974)	0.0000 (0.9997)	**1**							
(6)	**IFO Business Climate**	**0.0279**** (0.0209)	**0.8305***** (0.0000)	**0.8245***** (0.0000)	-0.0001 (0.9939)	0.0000 (0.9972)	**1**						
(7)	**Industrial Production**	-0.0001 (0.9955)	0.0005 (0.9679)	0.0004 (0.9729)	0.0001 (0.9966)	0.0000 (0.9984)	0.0004 (0.9709)	**1**					
(8)	**PPI**	0.0001 (0.9946)	-0.0146 (0.2261)	-0.0034 (0.7793)	**0.0622***** (0.0000)	0.0000 (0.9981)	-0.0104 (0.3913)	0.0003 (0.9805)	**1**				
(9)	**Retail Sales**	-0.0045 (0.7110)	0.0013 (0.9136)	0.0011 (0.9268)	-0.0024 (0.8408)	-0.0001 (0.9957)	0.0012 (0.9214)	0.0193 (0.1105)	0.0008 (0.9475)	**1**			
(10)	**Unemployment Rate**	-0.0164 (0.1759)	0.0010 (0.9361)	0.0008 (0.9460)	**-0.0286**** (0.0180)	0.0000 (0.9968)	0.0009 (0.9420)	0.0117 (0.3314)	0.0006 (0.9612)	-0.0178 (0.1418)	**1**		
(11)	**ZEW**	0.0000 (0.9984)	0.0002 (0.9889)	0.0001 (0.9906)	0.0000 (0.9988)	-0.0124 (0.3047)	0.0002 (0.9899)	-0.0112 (0.3535)	0.0029 (0.8087)	-0.0002 (0.9847)	-0.0002 (0.9887)	**1**	
(12)	**Unemployment Level**	**-0.0286**** (0.0181)	0.0010 (0.9347)	0.0008 (0.9447)	**-0.0255**** (0.0346)	0.0000 (0.9968)	0.0009 (0.9406)	0.0097 (0.4199)	0.0006 (0.9603)	**-0.0440***** (0.0003)	**0.8563***** (0.0000)	-0.0002 (0.9884)	**1**

This table shows the Pearson correlation coefficients between news (positive, negative and null surprises) for 12 German macroeconomic indicators: Consumer Price Index (CPI), IFO Current Assessment, IFO Expectations, Factory Orders, GDP Real Advance, IFO Business Climate Indicator, Industrial Production, Producer Price Index (PPI), Retail Sales, Unemployment Rate, ZEW Survey, Unemployment Level. News are obtained as the difference between the actual value of a macroeconomic variable and its expected value. The associated p-value is contained in parentheses below the correlation coefficient estimate. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.5
Correlations between UK Macroeconomics News

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	**BOE Rate**	**1**											
(2)	**GDP**	-0.0003	**1**										
		(0.9810)											
(3)	**Gfk Consumer Confidence**	0.0000	0.0187	**1**									
		(0.9996)	(0.1212)										
(4)	**Industrial Production**	0.0019	-0.0009	0.0000	**1**								
		(0.8735)	(0.9381)	(0.9986)									
(5)	**Jobless Claims**	-0.0002	-0.0002	0.0000	-0.0122	**1**							
		(0.9879)	(0.9854)	(0.9997)	(0.3122)								
(6)	**Manufactory Production**	0.0051	-0.0006	0.0000	**0.8620*****	**-0.0332*****	**1**						
		(0.6759)	(0.9595)	(0.9991)	(0.0000)	(0.0060)							
(7)	**PPI Output**	0.0004	0.0005	0.0000	**-0.0613*****	0.0003	**-0.0919*****	**1**					
		(0.9727)	(0.9672)	(0.9993)	(0.0000)	(0.9790)	(0.0000)						
(8)	**RPI (Net)**	0.0004	0.0004	0.0000	0.0012	0.0003	0.0008	-0.0006	**1**				
		(0.9755)	(0.9705)	(0.9993)	(0.9202)	(0.9811)	(0.9478)	(0.9576)					
(9)	**RPI**	0.0004	0.0004	0.0000	0.0012	0.0003	0.0008	-0.0006	**0.9019*****	**1**			
		(0.9762)	(0.9713)	(0.9994)	(0.9225)	(0.9817)	(0.9493)	(0.9589)	(0.0000)				
(10)	**Retail Sales (Core)**	0.0003	**-0.0459*****	0.0077	0.0010	0.0002	0.0007	-0.0006	-0.0005	-0.0005	**1**		
		(0.9789)	(0.0001)	(0.5242)	(0.9314)	(0.9838)	(0.9551)	(0.9636)	(0.9673)	(0.9682)			
(11)	**Unemployment Rate**	0.0000	0.0000	0.0000	0.0112	-0.0005	**0.0317*****	0.0000	0.0000	0.0000	0.0000	**1**	
		(1.0000)	(1.0000)	(1.0000)	(0.3539)	(0.9701)	(0.0087)	(1.0000)	(1.0000)	(1.0000)	(1.0000)		
(12)	**Visible Trade**	-0.0005	-0.0006	0.0000	**0.0258****	**-0.0242****	**0.0333*****	**0.0371*****	0.0127	-0.0078	0.0007	0.0114	**1**
		(0.9668)	(0.9600)	(0.9991)	(0.0327)	(0.0453)	(0.0059)	(0.0022)	(0.2918)	(0.5204)	(0.9557)	(0.3444)	

This table shows the Pearson correlation coefficients between news (positive, negative and null surprises) for 12 UK macroeconomic indicators: BOE Rate, GDP Real, Gfk Consumer Confidence Survey, Industrial Production, Jobless Claim Change, Manufactory Production, Producer Price Index (PPI) Output no Seasonally Adjusted, Retail Price Index (RPI) ex Mort. Interest Payment, Retail Price Index (RPI Net), Retail Sales (Core) less Auto Fuel, Unemployment Rate, Visible Trade Balance. GDP Real surprises are aggregated using the Advance, Preliminary and Final releases. News are obtained as the difference between the actual value of a macroeconomic variable and its expected value. The associated p-value is contained in parentheses below the correlation coefficient estimate. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.6

Correlations between US macroeconomics news and lagged news

	Consumer Confidence	CPI	Durable Goods	Avg. Hourly Earnings	Factory Orders	GDP Deflator	GDP Real	Industrial Production	Leading Indicators	ISM Index	Nonfarm Payroll	Jobless Claims	Consumer Spending	Personal Income	Philadelphia Fed Survey	PPI (Core)	PPI	Retail Sales	Retail Sales (net)	Trade Balance	Unempl. Rate
L3 Consumer Confidence						0.0590*** (0.0000)	-0.0635*** (0.0000)						-0.0200* (0.0983)								
L3 CPI															-0.0425*** (0.0004)	0.0205* (0.0904)					
L3 Durable Goods						-0.0726*** (0.0000)	0.0216* (0.0740)														
L3 Factory Orders				-0.0896*** (0.0000)							0.0696*** (0.0000)										
L3 GDP Deflator										-0.0438*** (0.0003)			-0.0967*** (0.0000)	0.0521*** (0.0000)							-0.0211* (0.0806)
L2 GDP Real										0.0624*** (0.0000)				-0.0642*** (0.0000)							
L3 Industrial Production									-0.0376*** (0.0019)						-0.0518*** (0.0000)		-0.0533*** (0.0000)				
L3 Leading Indicators		0.0412*** (0.0007)																			
L3 ISM Index					0.0985*** (0.0000)						0.0462*** (0.0001)		0.0252** (0.0368)								0.0310** (0.0102)
L3 Jobless Claims		0.0342*** (0.0047)	0.0246** (0.0417)	-0.0560*** (0.0000)		-0.0513*** (0.0000)					-0.0514*** (0.0000)		0.0488*** (0.0001)	0.0258** (0.0325)			-0.0269** (0.0261)	-0.0316*** (0.0088)			
L3 Consumer Spending	-0.0444** (0.0002)			-0.0585*** (0.0000)						-0.1928*** (0.0000)											
L3 Personal Income	0.0295** (0.0147)																				
L3 Philadelph. Fed Survey		0.0260** (0.0316)						-0.0526*** (0.0000)	-0.0461*** (0.0001)												
L3 PPI (Core)		0.0659*** (0.0000)													-0.0330*** (0.0064)						
L3 PPI		0.2674*** (0.0000)						0.1099*** (0.0000)													
L3 Retail Sales		0.1140*** (0.0000)						0.0361*** (0.0028)				-0.0363*** (0.0027)								0.0499*** (0.0000)	
L3 Retail Sales (Net)		0.0933*** (0.0000)													-0.0252** (0.0368)	0.0835*** (0.0000)	0.0470*** (0.0001)			0.0333*** (0.0059)	
L3 Trade Balance		0.0219* (0.0694)																-0.0618*** (0.0000)	-0.0524*** (0.0000)		

This table shows the Pearson cross-correlation coefficients between the lagged news (positive, negative and null surprises) up to three lags for each of the 25 US macroeconomic indicators. The announcements are: Consumer Confidence Index, Consumer Price Index (CPI), Average Hourly Earnings, Factory Orders, Durable Goods Orders, GDP Deflator, GDP Real, Industrial Production, Leading Indicators Index, ISM Index (formerly NAPM Survey), Nonfarm Payrolls, Initial Unemployment (Jobless) Claims, Personal (Consumer) Spending, Personal Income, Philadelphia Manufactoring Index (Fed Survey), Producer Price Index (PPI) Net of Food and Energy, Producer Price Index (PPI), Retail Sales, Retail Sales (Net) less Autos Fuel, Trade Balance, Unemployment Rate. GDP Deflator and GDP Real surprises are aggregated using the Advance, Preliminary and Final releases. News are obtained as the difference between the actual value of the macroeconomic variable and its expected value. Lagged news are computed considering the previous 8 hours (L1), 16 hours (L2) and 24 hours (L3) before the announcement. Only lagged news with statistically significant correlations coefficients are displayed. Correlations between a variable and its own 3 lags are not considered. The associated p-value is contained in parentheses below the correlation coefficient estimate. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.7
Correlations between Euro-Area macroeconomics news and lagged news

	Business Climate Indicator	Consumer Confidence	CPI M-M	ECB Rate	Economic Confidence	CPI Y-Y Final	CPI Y-Y Flash	GDP Final	GDP Advance	Industrial Confidence	Industrial Production	M3	PPI	Retail Sales M-M	Retail Sales Y-Y	Unemployment Rate
L3 Business Climate Indicator							0.0829*** (0.0000)	-0.0599*** (0.0000)						-0.0283** (0.0190)		-0.0993*** (0.0000)
L3 Conumer Confidence							-0.0215* (0.0750)	0.0249** (0.0395)				-0.0989*** (0.0000)		-0.0204* (0.0907)		-0.0763*** (0.0000)
L3 CPI M-M											0.0252** (0.0369)					
L3 Economic Confidence							-0.0232* (0.0552)					-0.0447*** (0.0002)		-0.0351*** (0.0037)		-0.0907*** (0.0000)
L3 CPI Y-Y Final							0.0312*** (0.0099)									
L3 CPI Y-Y Flash													0.0918*** (0.0000)			-0.0522*** (0.0000)
L3 GDP Final														0.0389*** (0.0013)	0.0261** (0.0305)	
L3 GDP Advance						- 0.0549*** (0.0000)										
L3 GDP Preliminary														-0.0799* (0.0000)	-0.1214*** (0.0000)	
L3 Indusrtial Confidence							0.1058*** (0.0000)	-0.0545*** (0.0000)						-0.0212* (0.0792)		-0.1487*** (0.0000)
L3 Industrial Production			0.0303** (0.0122)						-0.1252*** (0.0000)							
L3 M3	0.0512*** (0.0000)	-0.0199* (0.0999)	0.0324*** (0.0074)				0.0483*** (0.0001)			0.0228* (0.0593)						-0.0477*** (0.0001)
L3 PPI M-M	0.1251*** (0.0000)	0.1808*** (0.0000)		-0.0230* (0.0568)	0.1638*** (0.0000)					0.1139*** (0.0000)				0.0839*** (0.0000)	0.0703*** (0.0000)	
L3 Retail Sales M-M				0.0261** (0.0309)												-0.0217* (0.0732)
L3 Retail sales Y-Y				0.0226* (0.0614)				0.0602*** (0.0000)								-0.0219* (0.0704)
L3 Unemployment Rate				0.0784*** 0.0000									-0.0819*** 0.0000			

This table shows the Pearson cross-correlation coefficients between the lagged news (positive, negative and null surprises) up to three lags for each of the 17 Euro-Area macroeconomic indicators. The announcements are: Business Climate Indicator, Consumer Confidence, Consumer Price Index (CPI) month-over-month, Economic Confidence, Consumer Price Index (CPI) Final year-over-year, Consumer Price Index (CPI) Flash year-over-year, GDP Final, GDP Advanced, GDP Preliminary, Industrial Production, M3 Money Supply, Producer price index (PPI), Retail Sales month-over-month, Retail Sales year-over-year, Unemployment Rate. News are obtained as the difference between the actual value of the macroeconomic variable and its expected value. Lagged news are computed considering the previous 8 hours (L1), 16 hours (L2) and 24 hours (L3) before the announcement. Only lagged news with statistically significant correlations coefficients are displayed. Correlations between a variable and its own 3 lags are not considered. The associated p-value is contained in parentheses below the correlation coefficient estimate. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.8
Correlations between German Macroeconomics News and lagged News

	IFO Current Assessment	IFO Expectations	Factory Orders	Business Climate	Industrial Production	PPI	Retail Sales	Unemployment Rate	Unemployment Level
	0.0505***			0.0391***				0.1188***	0.1063***
L3 CPI	(0.0000)			(0.0012)				(0.0000)	(0.0000)
					0.3498***		-0.0767***		
L3 Factory Orders					(0.0000)		(0.0000)		
	0.0548***	0.0251**		0.0312***	0.0809***				
L3 PPI	(0.0000)	(0.0378)		(0.0098)	(0.0000)				
			-0.0370**				0.0691***		
L3 Unemployment Rate			(0.0022)				(0.0000)		
		0.0300**		0.0212*		-0.0870***			
L3 ZEW		(0.0129)		(0.0795)		(0.0000)			
			-0.0210*				0.0428***		
L3 Unemployment Level			(0.0829)				(0.0004)		

This table shows the Pearson cross-correlation coefficients between the lagged news (positive, negative and null surprises) up to three lags for each of the 12 German macroeconomic indicators. The announcements are: Consumer Price Index (CPI), IFO Current Assessment, IFO Expectations, Factory Orders, GDP, Business Climate Indicator, Industrial Production, Producer Price Index (PPI), Retail Sales, Unemployment Rate, ZEW Survey, Unemployment Level. News are obtained as the difference between the actual value of the macroeconomic variable and its expected value. Lagged news are computed considering the previous 8 hours (L1), 16 hours (L2) and 24 hours (L3) before the announcement. Only lagged news with statistically significant correlations coefficients are displayed. Correlations between a variable and its own 3 lags are not considered. The associated p-value is contained in parentheses below the correlation coefficient estimate. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.9
Correlations between UK Macroeconomics News and lagged News

	BOE Rate	Jobless Claims	Manufactory Production	PPI Output	RPI (Net)	RPI	Retail Sales (Core)	Unemployment Rate	Visible trade Balance
L3 BOE Rate									0.0205* (0.0903)
L3 Industrial Production								0.0280** (0.0205)	
L3 Jobless Claims							0.0516*** (0.0000)		
L3 Manufactory Production	0.0857*** (0.0000)							0.0274** (0.0236)	
L3 PPI Output					0.1306*** (0.0000)	0.1029*** (0.0000)			
L3 RPI (Net)		-0.1147*** (0.0000)						-0.0732*** 0.0000	
L3 RPI		-0.1643*** (0.0000)						-0.0792*** (0.0000)	
L3 Unemployment Rate							0.0542*** (0.0000)		
L3 Visible Trade			0.0379*** (0.0017)	-0.0265** (0.0285)				-0.0436*** (0.0003)	

This table shows the Pearson cross-correlation coefficients between the lagged news (positive, negative and null surprises) up to three lags for each of the 14 UK macroeconomic indicators: BOE Rate, GDP Real, Gfk Consumer Confidence Survey, Industrial Production, Jobless Claim Change, Manufactory Production, Producer Price Index (PPI) Output no Seasonally Adjusted, Retail Price Index (RPI) ex Mort. Interest Payment, Retail Price Index (RPI Net), Retail Sales (Core) less Auto Fuel, Unemployment Rate, Visible Trade Balance. GDP Real surprises are aggregated using the Advance, Preliminary and Final releases. Lagged news are computed considering the previous 8 hours (L1), 16 hours (L2) and 24 hours (L3) before the announcement. Only lagged news with statistically significant correlations coefficients are displayed. Correlations between a variable and its own 3 lags are not considered. The associated p-value is contained in parentheses below the correlation coefficient estimate. Data from 1-Jan-2003 to 31-Aug-2011. (***) = statistically significant at the 1% level; (**) = statistically significant at the 5% level; (*) = statistically significant at the 10% level.

Table A.10
OLS estimations of Euro-Dollar Exchange Rate

Part A. Sub-Period1					Part B. Sub-Period2				
Variable	**Coeff.**	**Signif.**	**S.E.**	**p-value**	**Variable**	**Coeff.**	**Signif.**	**S.E.**	**p-value**
ΔEuro-Dollar{1}	-0.0949	***	[0.0153]	(0.0000)	ΔEuro-Dollar{1}	-0.1490	***	[0.0205]	(0.0000)
ΔEuro-Dollar{2}	-0.1410	***	[0.0148]	(0.0000)	ΔEuro-Dollar{2}	-0.0259		[0.0194]	(0.1821)
ΔEuro-Dollar{3}	-0.0288	*	[0.0149]	(0.0543)	Δ10-Year US Treasury Bond	-0.1630	***	[0.0610]	(0.0075)
Δ10-Year US Treasury Bond	-0.2754	***	[0.0411]	(0.0000)	Δ10-Year JGB	-0.0361		[0.0287]	(0.2085)
Δ10-Year US Treasury Bond{1}	-0.0308	*	[0.0165]	(0.0629)	Δ10-Year JGB{1}	-0.0784	**	[0.0346]	(0.0236)
Δ10-Year US Treasury Bond{2}	-0.0517	**	[0.0223]	(0.0205)	Δ10-Year Bund	0.0913	***	[0.0328]	(0.0054)
Δ10-Year JBG	-0.0664	***	[0.0131]	(0.0000)	Δ10-Year Bund {1}	0.0898		[0.0607]	(0.1391)
Δ10-Year JBG{1}	0.0222		[0.0169]	(0.1884)	ΔDow Jones	0.2293	***	[0.0515]	(0.0000)
Δ10-Year JBG{2}	-0.0296		[0.0241]	(0.2188)	ΔDow Jones{1}	-0.0532		[0.0331]	(0.1072)
Δ10-Year Bund	-0.0279		[0.0226]	(0.2171)	ΔDow Jones{2}	-0.0568		[0.0384]	(0.1395)
Δ10-Year Bund{1}	0.1041	***	[0.0302]	(0.0006)	ΔDow Jones{3}	0.1241	***	[0.0448]	(0.0056)
Δ10-Year Bund{2}	0.0352	**	[0.0148]	(0.0174)	ΔNikkei	0.1674	***	[0.0475]	(0.0004)
ΔDow Jones	-0.1026	**	[0.0429]	(0.0167)	ΔNikkei{1}	0.0985	**	[0.0468]	(0.0355)
POS_NEG Euro-Dollar_ASTZ	1.0590	***	[0.0930]	(0.0000)	ΔNikkei{2}	-0.1443	***	[0.0473]	(0.0023)
POS_NEG Euro-Dollar_ASTZ{1}	-0.4021	***	[0.0710]	(0.0000)	POS_NEG Euro-Dollar_ASTZ	1.1902	***	[0.0498]	(0.0000)
POS_NEG Euro-Dollar_ETZ	1.0050	***	[0.0415]	(0.0000)	POS_NEG Euro-Dollar_ASTZ{1}	-0.3310	***	[0.0662]	(0.0000)
POS_NEG Euro-Dollar_ETZ{2}	0.0977	***	[0.0315]	(0.0019)	POS_NEG Euro-Dollar_ETZ	1.5420	***	[0.0613]	(0.0000)
POS_NEG Euro-Dollar_ATZ	1.2621	***	[0.0571]	(0.0000)	POS_NEG Euro-Dollar_ATZ	1.7432	***	[0.1094]	(0.0000)
POS_NEG Euro-Dollar_ATZ{1}	0.1835	***	[0.0357]	(0.0000)	EUR_CPI Flash{1}	-0.0020	*	[0.0012]	(0.0988)
POS_NEG Euro-Dollar_ATZ{2}	-0.1047	**	[0.0415]	(0.0116)	EUR_PPI	-0.0026	***	[0.0007]	(0.0004)
EUR_CPI Flash	0.0022	**	[0.0009]	(0.0226)	EUR_PPI_POS	0.0023	**	[0.0011]	(0.0450)
EUR_GDP Advance	0.0010		[0.0013]	(0.4654)	EUR_GDP Advance	0.0012		[0.0020]	(0.5648)
EUR_GDP Advance{2}	0.0019	**	[0.0010]	(0.0431)	EUR_GDP Advance{1}	-0.0018		[0.0026]	(0.4930)
EUR_GDP Preliminary	0.0025	***	[0.0001]	(0.0000)	EUR_GDP Advance{2}	0.0021	**	[0.0010]	(0.0421)
EUR_GDP Preliminary{3}	0.0028	***	[0.0001]	(0.0000)	EUR_GDP Preliminary	0.0017	***	[0.0003]	(0.0000)
EUR_GDP Preliminary_POS	-0.0008	**	[0.0004]	(0.0335)	EUR_GDP Preliminary{1}	-0.0064	***	[0.0005]	(0.0000)
EUR_GDP Preliminary_POS{3}	-0.0018	***	[0.0003]	(0.0000)	EUR_GDP Preliminary{2}	-0.0020	***	[0.0002]	(0.0000)
GER_IFO Expectation	0.2678	***	[0.0917]	(0.0035)	EUR_GDP Preliminary{3}	0.0007	**	[0.0003]	(0.0204)
GER_PPI	-0.0015		[0.0012]	(0.1943)	GER_IFO Expectation	0.3204	*	[0.1705]	(0.0603)
GER_PPI{1}	0.0019		[0.0015]	(0.2007)	GER_IFO Expectation {1}	0.1036		[0.1464]	(0.4791)
GER_PPI{2}	-0.0017	*	[0.0010]	(0.0800)	GER_IFO Expectation {2}	0.1825	**	[0.0928]	(0.0492)
UK_BOE Rate	0.0017	***	[0.0005]	(0.0006)	GER_PPI	-0.0002		[0.0024]	(0.9386)
UK_BOE Rate{1}	-0.0034	**	[0.0015]	(0.0237)	GER_PPI{1}	-0.0036	***	[0.0009]	(0.0000)
UK_ BOE Rate{2}	0.0017	***	[0.0005]	(0.0011)	GER_PPI_POS	-0.0004		[0.0027]	(0.8858)
UK_BOE Rate_POS{2}	-0.0016	***	[0.0006]	(0.0089)	GER_PPI_POS{1}	0.0051	**	[0.0026]	(0.0451)
UK_GDP Advance	-0.0006		[0.0011]	(0.5999)	UK_BOE Rate	0.0003		[0.0003]	(0.3776)
UK_GDP Advance {1}	-0.0021	**	[0.0010]	(0.0358)	UK_BOE Rate{1}	-0.0013	***	[0.0004]	(0.0007)
UK_PPI Output	0.0013	*	[0.0007]	(0.0699)	UK_BOE Rate{2}	-0.0009	***	[0.0001]	(0.0000)
UK_Jobless Claims	-0.0084		[0.1282]	(0.9479)	UK_BOE Rate{3}	-0.0007	***	[0.0001]	(0.0000)
UK_Jobless Claims {2}	-0.2009	**	[0.0936]	(0.0318)	UK_PPI Output	0.0033		[0.0029]	(0.2534)
US_ISM Manufactoring Index	-0.4308	***	[0.1349]	(0.0014)	UK_PPI Output{1}	0.0095	***	[0.0026]	(0.0003)
US_ISM Manufactoring Index{2}	-0.1232	*	[0.0632]	(0.0512)	UK_PPI Output_POS	-0.0025		[0.0031]	(0.4210)
US_Nonfarm Payrolls	-0.6683	***	[0.2543]	(0.0086)	UK_PPI Output_POS{1}	-0.0103	***	[0.0038]	(0.0064)
US_Producer Price Index (Core)	0.2216	***	[0.0822]	(0.0070)	UK_Unemployment Rate	0.0013		[0.0008]	(0.1132)
Constant	0.0105		[0.0104]	(0.3138)	UK_Jobless Claims	-0.0182		[0.1152]	(0.8747)
					UK_Jobless Claims{3}	0.2534	**	[0.1234]	(0.0400)
					US_GDP Advance	-0.4885	*	[0.2684]	(0.0688)
					US_GDP Advance{1}	-0.0533		[0.1206]	(0.6584)
					US_GDP Advance{2}	-0.1308		[0.1928]	(0.4974)
					US_GDP Advance{3}	0.3585	*	[0.2172]	(0.0988)
					US_GDP Preliminary_US	-0.5105	***	[0.1811]	(0.0048)
					US_GDP Preliminary_US{1}	0.2065	**	[0.0910]	(0.0232)
					US_ISM Manufactorin Index	-0.1836		[0.3307]	(0.5787)
					US_ISM Manufacturing Index {1}	-0.1751		[0.1086]	(0.1069)
					US_ISM Manufacturing Index	0.4631		[0.3920]	(0.2375)
					US_ ISM Manufacturing Index_POS{1}	0.3239	**	[0.1451]	(0.0256)
					US_Nonfarm Payrolls	-0.5523	*	[0.3032]	(0.0685)
					Constant	0.0251		[0.0181]	(0.1659)
R^2 = 0.36; D-W Stat =1.9986					R^2 = 0.42; D-W Stat =1.9943				

This table presents the results of OLS regression of intra-daily Euro/US Dollar exchange rate variations ($\Delta S_{i,t}$) on interest rates yields ($\Delta y_{i,t}$), stock market indexes returns ($\Delta I_{i,t}$), macroeconomic scheduled news for Euro-Area, Germany, United States and United Kingdom, unscheduled news and relative lags between January 2003 and August 2011. The model is first regressed for the entire sample period. Only variables with significant coefficient are retained and then used in second-stage regressions for two consecutive sub-sample periods. Panel A and Panel B report the results for the first sub-period (01 January 2003 22:00 CET to 29 February 2008 at 06:00 am CET; 4040 8-hourly observations) and the second sub-period (29 February 2008 at 6:00 am to 31 August 2011 22:00 CET; 2744 8-hourly observations) respectively. The label *_POS* after the macroeconomic news name denotes variables based on realized positive surprises. Standard errors for coefficients estimates are in brackets, p-values in parentheses and lags 1,2 and 3 for eight, sixteen and twenty-four hours intervals are in braces.(***) = statistically significant at a 1% level, (**) = statistically significant at a 5% level, (*) =statistically significant at 10% level.

Table A.11
OLS and EGARCH estimations with positive effects

Panel A. OLS regression

Variable	Coeff.	Signif.	S.E.	p-value
ΔEuro-Dollar{1}	-0.1088	***	[0.0234]	(0.0000)
ΔEuro-Dollar{2}	-0.0934	***	[0.0240]	(0.0001)
ΔEuro-Dollar{3}	-0.0300	**	[0.0149]	(0.0445)
ΔEuro-Dollar_Pos{1}	0.0266		[0.0319]	(0.4048)
ΔEuro-Dollar_Pos{2}	-0.0880	***	[0.0327]	(0.0072)
Δ10-Year US Treasury Bond	-0.2758	***	[0.0411]	(0.0000)
Δ10-Year US Treasury Bond{1}	-0.0309	*	[0.0166]	(0.0622)
Δ10-Year US Treasury Bond{2}	-0.0499	**	[0.0223]	(0.0251)
Δ10-Year JBG	-0.0655	***	[0.0131]	(0.0000)
Δ10-Year JBG{1}	0.0215		[0.0168]	(0.1994)
Δ10-Year JBG{2}	-0.0292		[0.0242]	(0.2267)
Δ10-Year Bund	-0.0288		[0.0225]	(0.2011)
Δ10-Year Bund{1}	0.1039	***	[0.0301]	(0.0006)
Δ10-Year Bund{2}	0.0355	**	[0.0147]	(0.0157)
ΔDow Jones	-0.1031	**	[0.0427]	(0.0159)
POS_NEG Euro-Dollar_ASTZ	1.0610	***	[0.0926]	(0.0000)
POS_NEG Euro-Dollar_ASTZ{1}	-0.4040	***	[0.0710]	(0.0000)
POS_NEG Euro-Dollar_ETZ	1.0051	***	[0.0416]	(0.0000)
POS_NEG Euro-Dollar_ETZ{2}	0.0941	***	[0.0315]	(0.0028)
POS_NEG Euro-Dollar_ATZ	1.2627	***	[0.0570]	(0.0000)
POS_NEG Euro-Dollar_ATZ{1}	0.1814	***	[0.0357]	(0.0000)
POS_NEG Euro-Dollar_ATZ{2}	-0.1035	**	[0.0414]	(0.0123)
EUR_CPI Flash	0.0023	**	[0.0009]	(0.0144)
EUR_GDP Advance	0.0009		[0.0013]	(0.4691)
EUR_GDP Advance{2}	0.0020	**	[0.0009]	(0.0313)
EUR_GDP Preliminary	0.0025	***	[0.0001]	(0.0000)
EUR_GDP Preliminary{3}	0.0028	***	[0.0001]	(0.0000)
EUR_GDP Preliminary_POS	-0.0010	**	[0.0004]	(0.0226)
EUR_GDP Preliminary_POS{3}	-0.0018	***	[0.0003]	(0.0000)
GER_IFO Expectation	0.2708	***	[0.0908]	(0.0029)
GER_PPI	-0.0014		[0.0012]	(0.2259)
GER_PPI{1}	0.0018		[0.0015]	(0.2108)
GER_PPI{2}	-0.0017	*	[0.0010]	(0.0847)
UK_BOE Rate	0.0015	***	[0.0006]	(0.0091)
UK_BOE Rate{1}	-0.0033	**	[0.0015]	(0.0255)
UK_BOE Rate{2}	0.0017	***	[0.0006]	(0.0018)
UK_BOE Rate_POS{2}	-0.0017	***	[0.0006]	(0.0079)
UK_GDP Advance	-0.0004		[0.0011]	(0.7172)
UK_GDP Advance {1}	-0.0021	**	[0.0010]	(0.0340)
UK_PPI Output	0.0012	*	[0.0007]	(0.0887)
UK_Jobless Claims	0.0007		[0.1277]	(0.9955)
UK_Jobless Claims {2}	-0.1962	**	[0.0959]	(0.0407)
US_ISM Manufactoring Index	-0.4276	***	[0.1366]	(0.0017)
US_ISM Manufactoring Index{2}	-0.1221	*	[0.0634]	(0.0542)
US_Nonfarm Payrolls	-0.6649	***	[0.2541]	(0.0089)
US_Producer Price Index (Core)	0.2205	***	[0.0815]	(0.0068)
Constant	0.0281		[0.0174]	(0.1051)
R^2	0.3604			
Durbin-Watson	1.9975			

Panel B. EGARCH(3,1)

Variable	Coeff.	Signif.	S.E.	p-value
Constant	0.0331	**	[0.0134]	(0.0136)
ΔEuro-Dollar{1}	-0.0941	***	[0.0202]	(0.0000)
ΔEuro-Dollar{2}	-0.0567	***	[0.0183]	(0.0019)
ΔEuro-Dollar{3}	-0.0254	**	[0.0111]	(0.0228)
ΔEuro-Dollar{1}_POS	0.0326		[0.0274]	(0.2342)
ΔEuro-Dollar{2}_POS	-0.1029	***	[0.0275]	(0.0002)
Δ10-Year US Treasury Bond	-0.3129	***	[0.0221]	(0.0000)
Δ10-Year US Treasury Bond{1}	-0.0372	**	[0.0183]	(0.0416)
Δ10-Year US Treasury Bond{2}	-0.0538	***	[0.0194]	(0.0055)
Δ10-Year JGB	-0.0594	***	[0.0128]	(0.0000)
Δ10-Year JGB{1}	0.0113		[0.0144]	(0.4304)
Δ10-Year JGB{2}	-0.0285	*	[0.0148]	(0.0538)
Δ10-Year Bund	-0.0215		[0.0181]	(0.2348)
Δ10-Year Bund{1}	0.1081	***	[0.0199]	(0.0000)
Δ10-Year Bund{2}	0.0496	***	[0.0173]	(0.0042)
ΔDow Jones	-0.0486	**	[0.0244]	(0.0463)
POS_NEG Euro-Dollar_ASTZ	0.9365	***	[0.0452]	(0.0000)
POS_NEG Euro-Dollar_ASTZ{1}	-0.3614	***	[0.0545]	(0.0000)
POS_NEG Euro-Dollar_ETZ	1.0028	***	[0.0322]	(0.0000)
POS_NEG Euro-Dollar_ETZ{2}	0.0816	***	[0.0289]	(0.0047)
POS_NEG Euro-Dollar_ATZ	1.1817	***	[0.0365]	(0.0000)
POS_NEG Euro-Dollar_ATZ{1}	0.1408	***	[0.0374]	(0.0002)
POS_NEG Euro-Dollar_ATZ{2}	-0.1210	***	[0.0353]	(0.0006)
EUR_GDP Advance	0.0838		[0.1950]	(0.6674)
EUR_GDP Advance{1}	0.3261	*	[0.1824]	(0.0738)
EUR_GDP Preliminary	0.1817		[0.1444]	(0.2082)
EUR_GDP Preliminary{1}	-0.2525	*	[0.1505]	(0.0935)
GER_IFO Expectation	0.2661	***	[0.0818]	(0.0011)
UK_BOE Rate	0.1409		[0.1080]	(0.1922)
UK_BOE Rate{1}	-0.3943	***	[0.1034]	(0.0001)
UK_BOE Rate{2}	0.0913	***	[0.0198]	(0.0000)
US_ISM Manufactoring Index	-0.4378	***	[0.0700]	(0.0000)
US_ISM Manufactoring Index{2}	-0.0839		[0.0750]	(0.2632)
US_Nonfarm Payrolls	-0.5752	***	[0.0717]	(0.0000)
US_Producer Price Index (Core)	0.1836	***	[0.0587]	(0.0018)
ω	-0.1083	***	[0.0112]	(0.0000)
γ{1}	0.1379	***	[0.0135]	(0.0000)
δ{1}	-0.1850	***	[0.0197]	(0.0000)
δ{2}	0.2683	***	[0.0125]	(0.0000)
δ{3}	0.9088	***	[0.0138]	(0.0000)
φ{1}	0.0167	*	[0.0087]	(0.0558)

This table presents the results of OLS regression and EGARCH (3,1) estimations of intra-daily Euro/US Dollar exchange rate variations ($\Delta S_{i,t}$) on interest rates yields ($\Delta y_{i,t}$), stock market indexes returns ($\Delta I_{i,t}$), macroeconomic scheduled news for Euro-Area, Germany, United States and United Kingdom, unscheduled news and relative lags between January 2003 and February 2008. The model is first regressed for the entire sample period. Only variables with significant coefficient are retained and then used in second-stage estimations. The variables, except for unscheduled news, are standardized using the sample period standard deviations. The label *_POS* after the macroeconomic news name denotes variables based on realized positive surprises. Standard errors for coefficients estimates are in brackets, p-values in parentheses and lags 1,2 and 3 for eight, sixteen and twenty-four hours intervals are in braces. The models include positive variations in lags 1 and 2 for the Euro/Dollar exchange rate. In the conditional variance equation of EGARCH models, γ_j (j=1) is the ARCH parameter, δ_l (l = 1,2,3) the GARCH parameters and φ_j (j=1) the asymmetry parameter. (***) = statistically significant at a 1% level, (**) = statistically significant at a 5% level, (*) =statistically significant at 10% level.