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Working Paper

Discovering and Disentangling Effects of US Macro-Announcements in European Stock Markets

Ruhr Economic Papers, No. 500

Provided in Cooperation with:
RWI – Leibniz-Institut für Wirtschaftsforschung, Essen

Suggested Citation: Rühl, Tobias R.; Stein, Michael (2014) : Discovering and Disentangling Effects of US Macro-Announcements in European Stock Markets, Ruhr Economic Papers, No. 500, ISBN 978-3-86788-574-4, Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI), Essen, https://doi.org/10.4419/86788574

This Version is available at:
https://hdl.handle.net/10419/103323

RUHR
ECONOMIC PAPERS

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#500

Imprint

Ruhr Economic Papers

Published by

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

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Ruhr Economic Papers #500

Responsible Editor: Volker Clausen

ISSN 1864-4872 (online) – ISBN 978-3-86788-574-4

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UNIVERSITÄT DUISBURG ESSEN

Bibliografische Informationen der Deutschen Nationalbibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über: *http://dnb.d-nb.de* abrufbar.

http://dx.doi.org/10.4419/86788574
ISSN 1864-4872 (online)
ISBN 978-3-86788-574-4

Tobias R. Rühl and Michael Stein[1]

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Abstract

In this study, we analyze the effect of US macroeconomic announcements on European stock returns, return volatility and bid-ask spreads using intraday data. We find that certain announcements are generally more important to the European stock market than others, and that the direction of news is important for returns. We provide first evidence that a stock-individual analysis is crucial to disentangle overall market reactions from stock-specific impacts and that effects vary dramatically between stocks. The analysis of quoted spreads reveals that return volatility affects the spread size positively, and that spreads are systematically higher directly after news releases. This is followed by structurally lower spreads, indicating quickly decreasing asymmetric information in the market after announcements. Additionally, spreads tend to react to announcements even if the returns or the volatility of the underlying stock is not significantly affected. This points at the importance of the analysis of news events beyond return and volatility analyses.

JEL Classification: E44, G14, G15

Keywords: Macroeconomic announcement effects; european stock market; market microstructure; intraday analysis; bid-ask spreads

August 2014

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1. Introduction

During the last two decades the analysis of major market moving news events has grown into an own field of research within finance. A substantial increase in the understanding of how information leads to asset reactions and price discovery was the result of this development. Of course this was amplified by the availability of enhanced computational capacities and the emergence of an increasingly information-driven business world. Using larger amounts of data made more intraday and ultra-high frequency data analyses possible. However, the ongoing debate about announcement effects among researchers and practitioners and anecdotal evidence about market-driving news in media reports shows that there is still need for a better understanding of announcement effects and market behavior.

Since market commentators often claim that US announcements are the reason for European stock market reactions on certain trading days, it is highly interesting and necessary to investigate scientifically whether this is true. If indeed the claimed effects are present, it is of utmost importance to investigate how European stocks in detail are affected by the announcements. To the best of our knowledge only the study by Harju and Hussain (2011) is focusing on the consequences of US macroeconomic announcements for European stock markets, thereby using high-frequency data. We analyze the effects of US macroeconomic announcements such as the disclosure of the unemployment rate, and focus on the reactions of European stock market (i) returns, (ii) return volatility and (iii) bid-ask spreads. We use index and stock-individual 5-minute intraday data from 2013 until 2014 for the three variables.[1] All of those should be affected by US announcements, for two reasons: (i) News about the US economic outlook can lead to a change in the fundamental value of a stock if the company is exposed directly or indirectly to the US market[2] (ii) A change in the global economic outlook after important US announcements might lead to market-wide changes in the fundamental values of assets.

[1] There is a hard sample limit induced by the fact that data providers like Bloomberg successively need to delete (ultra)high-frequency data due to storage capacities.

[2] For example in the case of an European car producer having large sale volumes in the US.

Profound knowledge of market behavior around announcements can help to improve market efficiency when more insight into price discovery processes and market reactions due to new information is achieved. Practitioners can benefit from a deeper understanding in this field by improving trading strategies based on information, and by avoiding higher spread periods for trades in investment strategies with horizons exceeding the daily dimension. Like Andersen and Bollerslev (1998), Andersen et al. (2003) and Jubinski and Tomljanovich (2013) we use a two-stage weighted least squares (WLS) procedure for intraday news event studies related to returns and volatilities. This procedure consists of a mean equation and a variance equation in which a Flexible Fourier Form is used to account for cyclical intraday volatility pattern. As pointed out by McInish and Wood (1992), the size of bid-ask spreads might depend on risk and information so we decompose the bid-ask spread into a volatility-related component (proxying for risk or at least uncertainty), and an information component.

We provide an overview table on the most important literature concerning macroeconomic announcement effects using intraday data in the Appendix (Table A1). Naturally the results diverge between the studies, because they all have a slightly different focus concerning which announcements are used, use a different data basis, or focus on different countries. From the literature, there is strong evidence for an influence of at least some macroeconomic announcements on financial market variables. Harju and Hussain (2011) provide evidence for strong effects of US announcements on European markets, but focus on stock indices only, rather than on individual stocks. A stock-specific analysis, however, would be necessary to evaluate if the effects are common for all stocks or if there might be differing reactions among them.

Our study contributes to the literature in several ways: (i) Most studies analyze macroeconomic effects on US assets, and often these studies focus on foreign exchange markets, bond markets or stock indices. This paper, however, turns the light on European stocks, using most recent data and employing the most important US announcements.

(ii) The use of stock-individual regressions in addition to index-based analyses is new as well: As can be seen from the first table in the Appendix (Table A1), studies about

stock markets mostly use stock indices to investigate announcement impacts. But if certain assets strongly react to a given announcement while others are not or only slightly affected, an index-based analysis will be misleading. Relying on these results will lead to false assumptions about reactions in both groups, based on an averaging out of impacts. Furthermore, it is interesting to disentangle market-wide and stock-specific impacts of macroeconomic announcements. To provide comprehensive insights into the reaction of stocks to announcements, we conduct index-based analyses, stock-specific analyses and stock-specific analyses controlling for the market-wide news impact. To our knowledge this hasn't been done before and the results provide evidence that a stock-specific analysis is of high worth.

(iii) Finally it is also of great interest if macroeconomic announcements have effects not only on returns and volatility, but also on spreads that may be seen as representative of transaction costs. Since the analysis of spread reactions in the context of announcement studies is rarely done so far and is new in the context of foreign country announcement effects for stocks, we contribute in this area as well.

The study is structured as follows: In the next section we briefly discuss the theoretical reasoning behind possible announcement impacts. Further we present the data used in our investigation and how it is prepared for the empirical investigation. The estimation methodology is discussed in Section 3. Section 4 states the results and provides a discussion of the economic implications. The final section concludes and motivates further research in this area.

2. Theory and Data Preparation

As outlined above, we focus on reactions in (i) returns, (ii) volatility, and (iii) spreads. Below we discuss the economic reasoning behind possible announcement-driven effects on the three variables.

Macroeconomic announcements can affect the fundamental value (real value) of stocks through new information in the announcement that is relevant for specific stocks and/or the general market. A change in the fundamental value in turn triggers price adjustments in stocks: in a fully efficient market the price adjustment will directly occur after new in-

formation arrives at the market, and the new stock price will reflect the new fundamental value. However, Kim and Verrecchia (1994) point out that it is arguable that all market participants are fully and equally able to interpret the consequences of news arriving at the market. Following this argumentation we assume a price discovery process that is observable through price adjustments. This adjustment process is expected to start directly with the news release and to last for a while. Because of liquidity-motivated trades and incorrect price assumption adjustments of some market participants it might also be possible to observe overshooting reactions followed by price reversions. Overall, we assume that "good news" will lead to an increase in stock prices and "bad news" to a decrease. Thereby, the adjustment size depends on the strength of the new information.

For return volatility there is already evidence that on days prior to pre-scheduled announcements volatility goes down and market participants wait for the news release to alter investment decisions, or to trade on new information.[3] However, we are not focusing on calendar effects but on the impact of the actual new information contained in the announcement. Because of the price discovery process we assume that the volatility will increase immediately after an announcement, regardless whether it contains good or bad news, and that volatility will remain higher for a while. Like the adjustment in prices, it is reasonable that the size of the volatility increase depends on the strength of the news.

The assumed spread reaction is that bid-ask spreads will rise with new information, again regardless of the information direction and based on two reasons: First, higher market volatility leads to higher holding risks. An increase in market volatility makes a large price movement in the near future more likely.[4] While this depends on the assumed reaction of volatility as discussed in the previous paragraph, the second reason stands for itself: If different market participants are differently able to adequately interpret the new information, market makers and participants acting like market makers face a higher risk of adverse selection. To prevent from a loss due to that, they have to set higher spreads

[3]Bomfim (2003) for example provides evidence on pre-announcement effects.
[4]See for instance Copeland and Galai (1983) and Bollerslev and Melvin (1994).

as long as the new information is not completely incorporated in the prices.[5] Thus, the second reason is a classical asymmetric information argument.

In order to analyze the effects which macroeconomic US announcements might have on European stock markets, we are using two different types of data, namely 5-minute intraday data for the Euro Stoxx 50 index constituents and information about US macroeconomic news announcements. The sample period is March 2013 to February 2014, reflecting an annual horizon preceding the sample end. While it is arguable that one could use a longer data horizon if data would be available, this would mean to start during a very uncertain phase of the Euro crisis. At the end of 2012 the European Central Bank calmed the crisis situation with the promise to do whatever it takes to safeguard the Euro, including an unlimited Outright Monetary Transactions program. Prior to this we might find different reactions to announcements than afterwards, and to avoid a structural break in our sample we start in 2013. However, since we are using 5-minutes data we still have enough data points for our estimations and we increase robustness further by using different stocks and two different sources for market expectations. A summary of the Euro Stoxx 50 index constituents can be found in Table A2. The announcements used are shown in Table A3.

The log return of the mid-price between bid and ask quotes is the basis for the investigation of stocks' return (and volatility) adjustments to news, as the use of actual transaction prices could lead to a bias caused by the bid-ask bounce: if a trade in time t occurs at the bid (ask) price, it is possible that the return in $t+1$ is positive (negative) without any change in the fundamental value. This can be the case if the trade in $t+1$ occurs at the ask (bid) and is purely caused by the different prices for buying and selling a stock (bid-ask spread). This phenomenon increases with the spread size. Because of the previously discussed higher spreads surrounding macroeconomic announcements, this problem would be amplified further. To perform the index-based analysis, we construct

[5] Asymmetric information effects are described in detail by Glosten and Harris (1988) for example, and empirical evidence on higher spreads surrounding announcements is provided for instance by Lee et al. (1993), Krinsky and Lee (1996) and Balduzzi et al. (2001).

a return series using the mid-prices of the 50 individual stocks weighted by their market capitalization at the beginning of March 2013.

For the investigation of spread size effects of macroeconomic announcements we use the relative quoted spread calculated by the difference of the best bid and the best ask price at the end of every 5-minute period divided by their midprice.[6]

The standard trading hours on the main Euro-area stock exchanges are between 9:00 and 17:00 CET. To avoid noise and disturbances shortly after the market opening and before closing, we exclude the first and the last 5-minute periods for every trading day. This is non-hazardous for our analyses since we are excluding the same 5-minute periods for all trading days and no announcement examined in our study occurs at the very beginning or at the end of a European trading day.

As already mentioned in the introduction, we focus on US announcements to gain more insight into the effects of US announcements on European markets. We use all macroeconomic US announcements which are assigned as market moving events by the Bloomberg calendar, as well as some additional news releases which also seem to be accompanied by higher market media attention.

To measure pure news effects we have to focus on news surprises which are the deviations of the announcement size from the expected size, because if the magnitude of an announcement is already completely expected by all market participants, the actual announcement will not bring any information driving prices or variables. Additionally, we have to standardize the announcement surprises, as different announcements are measured in different units. We follow Balduzzi et al. (2001) by using the commonly used standardization procedure:[7]

$$S_{kt} = \frac{A_{kt} - E_{kt}}{\hat{\sigma}_k} \tag{1}$$

[6]High frequency data occasionally contains data errors. To avoid biases due to outliers coming from data errors, we winsorize the data on very low levels. For example when using the 99.9% level, the 0.1% extreme observations are winsorized.

[7]See for example Andersen et al. (2003), Andersen et al. (2007), Harju and Hussain (2011) among others.

The announcement surprise S_{kt} is defined as the difference between the actual announcement size A_{kt} of announcement k in period t and the market expectation E_{kt} of the announcement size, divided by the sample standard deviation $\hat{\sigma}_k$ of $(A_{kt} - E_{kt})$ for the respective announcement k.[8] The information about the announcements as well as the market expectations are taken from the Financial Times Economic Calendar. For robustness checks we repeat all our estimations with market expectations data from the Bloomberg Economic Calendar.[9]

3. Estimation Setup

In their seminal paper Andersen and Bollerslev (1997) find strong intraday cyclical pattern for foreign exchange and equity data. They point out that "direct ARCH modeling of the intraday return volatility would be hazardous".[10] This is because these models are not capable of modeling regular cyclical pattern which are existent in many markets on an intraday frequency. Instead they suggest to use a Fourier Flexible Form (FFF)[11] part in intraday models to account for the cyclical pattern and an interday conditional heteroscedasticity part to account for the well known daily effects. Based on this, Andersen et al. (2003) and many authors following, used a WLS approach. This is evident from Table A1 as well. This approach consists of a mean equation and a variance equation accounting for the intraday volatility pattern including an FFF.

Using the WLS approach became standard in the field of macroeconomic announcement effect studies if the data shows intraday cyclical pattern. Recent evidence by Harju and Hussain (2011) for stock markets as well as graphical inspections of our own data confirms intraday seasonality in stock markets. Additionally, a methodology-comparison study by Laakkonen (2013) also supports to use the FFF-method to filter out intraday seasonality pattern. Therefore we apply a model similar to the one in Andersen et al. (2003) for our return and volatility analysis:

[8] As pointed out by Andersen et al. (2003) this standardization does not affect statistical significance or the regression fit.

[9] The terms announcement effect, news effect or announcement surprise impact are used synonymously in the rest of the study and all refer to the effect of S_{kt}.

[10] Andersen and Bollerslev (1997), p. 125.

[11] Discussed by Gallant (1981).

$$R_t = \beta_0 + \sum_{i=1}^{I} \beta_i R_{t-i} + \sum_{k=1}^{K} \sum_{j=0}^{J} \beta_{kj} S_{k,t-j} + \varepsilon_t \tag{2}$$

$$|\hat{\varepsilon}_t| = c + \psi \frac{\hat{\sigma}_{d(t)}}{\sqrt{T}} + \sum_{k=1}^{K} \sum_{j=0}^{J} \beta^*_{kj} |S_{k,t-j}| + \left(\sum_{q=1}^{Q} \left(\delta_q cos\left(\frac{q2\pi t}{T} \right) + \phi_q sin\left(\frac{q2\pi t}{T} \right) \right) + \sum_{r=1}^{4} \alpha_r D_r + \alpha_5 NY \right) + u_t \tag{3}$$

Equation (2) gives the mean equation of our empirical setup which models the stock return (respectively index return in the index-based analysis) R_t at time t by using autoregressive (AR) terms and contemporaneous and lagged realizations for the K different announcement surprises. Evidence on how many lags should be used for the returns and the announcement surprises varies not only between asset classes but also within the same class in different studies. For the AR terms usually not more than two or three lags are used, and based on several randomly drawn stocks from our dataset, the Akaike and the Schwarz-Bayes information criteria also suggest to use three AR terms ($I = 3$). For the announcement surprises we choose $J = 2$ because in most cases higher lag terms were insignificant.[12]

Equation (3) gives the variance equation which consists of the absolute residual series $|\hat{\varepsilon}_t|$ of Equation (2) as dependent variable and a constant term c, the daily volatility $\hat{\sigma}_{d(t)}$, the absolute announcement surprises $|S_{k,t-j}|$ and the calendar effect bracket as explanatory variables. The daily volatility is estimated by a GARCH(1,1) model based on daily data of the respective stock and is divided by the square root of the number of daily 5 minute periods $\sqrt{T}$. Using a GARCH(1,1) model to estimate the interday volatility is standard in this kind of estimation setup.[13] The calendar effect bracket consists of the FFF cosine and sine terms to model the intraday periodicity. Again the number of terms chosen for the estimation varies across different studies but based on the information criteria we have chosen $Q = 7$. Four dummy variables were included to account for day of the week effects (D_r) and another dummy variable (NY) accounts for the time after 15:30 CET. This is to control for higher volatility on the European

[12] We have also tested for market reactions due to information leakage in advance to the official release time (negative J). There was no significant effect detectable, so we omitted leads from the analysis.

[13] See for instance Andersen et al. (2003).

Figure 1: Intraday Periodicity

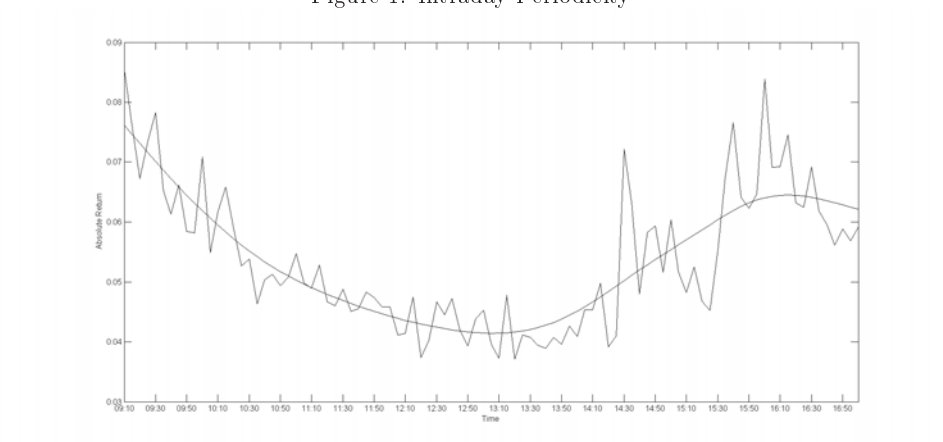

Figure 1 shows the average intraday periodicity for every 5-minute period in our sample.

stock markets after the US stock market opening around 15:30 CET, and is in line with Harju and Hussain (2011).[14] Figure 1 shows the absolute returns for the index-based estimations averaged over all trading days in the sample. We can clearly see the intraday periodicity, the US opening effect around 15:30 CET and the spike around 14:30 CET which coincides with major US announcements.

The estimation procedure for conditional returns and conditional volatility is the same as in Andersen et al. (2003): First we estimate Equation (2), then we use the absolute residuals for an estimation of the time-varying volatility (Equation (3)) and finally we use the results from the variance estimation for a WLS estimation of Equation (2). As pointed out by Andersen et al. (2007), this procedure can enhance the estimation efficiency compared for example to simple ordinary least squares estimation since it accounts for constant periodic pattern in the data.

We first perform this analysis for the index and then for the individual stocks. Afterwards we include the index return series as an explanatory variable in Equation (2). With this procedure we are controlling for the market-wide effects of the news events

[14] The NYSE opens at 9:30 EST which is 15:30 CET. The only discrepancy from this occurs when daylight saving time in Europe and US differs. We have accounted for that by adjusting the dummy variable accordingly.

and the resulting coefficients give us the pure and isolated stock-individual impact of the announcements, i.e., net of the market index impact.

For the estimation of the spread reaction, we apply a straightforward setup: as pointed out by McInish and Wood (1992), intraday periodicity can also be observed for bid-ask spreads. This is in line with our previous theoretical discussion about how price volatility is influencing spreads. Consequently, it seems natural for us to include the return volatility series constructed by Equation (3) as an explanatory variable in a bid-ask spread estimation equation. By this we can disentangle the spread effect into a volatility-related component and an information component:

$$SP_t = \beta_0 + \sum_{i=1}^{I} \beta_i SP_{t-i} + \alpha(\hat{\varepsilon}_t - u_t) + \sum_{k=1}^{K}\sum_{j=0}^{J} \beta_{kj} |S_{k,t-j}| + v_t \tag{4}$$

SP_t is the realized quoted spread measured by the difference between the last bid and ask price of the respective 5-minute period, divided by the mid of the bid and ask price. We again use $I = 3$ as suggested by information criteria for the AR terms and $J = 2$ for the announcement surprise lags. $(\hat{\varepsilon}_t - u_t)$ is the volatility proxy as estimated by Equation (3) and v_t is another i.i.d. error term. The announcement surprises are used in absolute terms since microstructure literature suggests that uncertainty about the information has an impact on fundamental values, and that it is not the direction of the new information that leads to a spread increase. Finally we also include the index return series in absolute terms for times of announcements and their lags in Equation (4), in order to control for possible impacts of market wide volatility increases. Thus, this correction is analogous to the index adjustments for the return and volatility analyses as outlined above. We discuss all results in the next section, starting with the stock index estimation results, followed by the stock-individual results both with and without controlling for market-wide influences.

4. Results

4.1. Index Results

4.1.1. Return Estimations

We first discuss the results of the index estimations. The second column of Table 1 shows the strong autoregressive pattern in the index returns, while the size of the

Table 1: Index estimation results

Variable	Return			Volatility		
Constant	0.0004			0.0147***		
Autoregressive terms (3 lags)	-0.0248***	-0.0141**	0.0214***			
Daily Volatility				0.3377***		
Announcement	Cont.	Lag 1	Lag 2	Cont.	Lag 1	Lag 2
ISM Manufacturing	0.1449***	0.0130	0.0446	0.0177	0.0179	0.0433***
ADP Employment Survey	0.0379	0.0023	-0.0016	0.0234	0.0164	-0.0018
ISM Non-Manufacturing	0.0452	-0.0223	0.0036	0.0424***	0.0000	0.0047
Non-farm Payrolls	0.0491	0.0361	-0.0181	0.0156	-0.0072	-0.0366
Unemploymentrate	0.0265	-0.0650	-0.0418**	0.0972***	0.0538**	0.0284
Initial Claims	-0.0188	-0.0248	0.0043	0.0218***	0.0388***	0.0125*
Retail Sales	0.0793***	-0.0147	-0.0113	0.0026	-0.0093	-0.0032
Consumer Price Index	-0.0385***	-0.0052	0.0049	-0.0180	-0.0007	-0.0171
Industrial Production	-0.0013	0.0056	-0.0441***	0.0029	-0.0157	-0.0112
Trade Balance	0.0213	0.0389	-0.0105	0.0789***	0.0217	0.0457***
Producer Price Index	0.0076	-0.0127	0.0183	-0.0097	0.0134	0.0044
Consumer Confidence	0.0266	0.0359**	-0.0030	0.0267*	-0.0219	-0.0223
Personal Income	0.0087	-0.0333**	-0.0433***	0.0225	-0.0137	-0.0041
Personal Spending	-0.0056	-0.0052	0.0006	-0.0290	-0.0008	-0.0250
Empire State Survey	-0.0041	-0.0071	-0.0073	0.0158	-0.0235	-0.0150
Capacity Utilisation	0.0348	-0.0033	0.0240*	0.0217	0.0052	0.0041
Durable Goods Orders	0.0425	0.0206	-0.0648***	0.0477***	-0.0026	-0.0156
Chicago PMI	-0.0001	-0.0211	0.0089	0.0087	0.0233	-0.0097
Philadelphia Fed Survey	-0.0267	0.0149	-0.0554	0.0403**	-0.0101	0.0182
Housing Starts	-0.0271	0.0242	-0.0491**	0.0689***	0.0044	0.0028
Existing Home Sales	0.051*	-0.0340	-0.0332	-0.0109	-0.0174	-0.0137
New Home Sales	0.0596***	0.0010	0.0625	-0.0382**	-0.0203	0.0123

Table 1 shows the main index estimation results for returns and volatility. The return results correspond to equation (2), the volatility results correspond to equation (3). The first part depicts the constant, autoregressive and daily volatility coefficients. The second part gives the announcement coefficients. Cont. stands for the contemporaneous, Lag 1 and Lag 2 for the first and the second 5-minute lag influence. *,** and *** indicate statistical significance on the 10%, 5% and 1% level. Due to parsimony reasons we have omitted the presentation of control variables or standard deviations.

coefficients is quite small. It may be argued that one should use heteroscedasticity and autocorrelation consistent (HAC) standard errors instead of the WLS approach. While Andersen et al. (2003) point out that the WLS approach should be more efficient, a crucial advantage of the WLS approach is that we can analyze the intraday volatility as well. Nevertheless, we double-checked the return results using HAC-standard errors. This lead to qualitatively the same results, although with more significant coefficients.

Table 1 reveals that just 12 out of 22 announcements have a significant impact on the stock index returns. Whenever significant, signs of the announcements are mostly reasonable: The ISM Manufacturing Index, Retail Sales, Consumer Confidence, New

Home Sales and Existing Home Sales show positive signs for the contemporaneous or first lag reaction. Thus, "positive" announcement surprises, meaning an unanticipated increase (or weaker decrease) in the variable leads to an increase in stock prices. These variables can be seen as positive indicators for the US economy in the sense that an increase brightens the economic outlook for the US and the world economy. The negative and significant impact of the Unemployment Rate in the second lag goes in the same argumentative direction. A rise in unemployment darkens the economic outlook or at least is a negative indicator on recent economic developments, so one expects a negative sign for this variable. Consumer Price Index and the Personal Income surprises have negative influence. Both variables are indicators for higher inflation (risks) in the US. A higher inflation (risk) rises the probability of a change away from the quantitative easing strategy of the Fed, so is a sign of higher interest rates in the long run. Higher interest rates make other investments than stocks (i.e. bonds) more profitable leading to an overall stock price depreciation. While Personal Income may have had an impact on the positive side due to being a signal for an expanding economy, this apparently is outweighed by the inflation aspects and future expected developments.

Overall, the sizes of the significant coefficients does not seem to be very high at first glance. However, the index return standard deviation is 0.0761%, so for example a one standard deviation macroeconomic news surprise in the Retail Sales with a coefficient of 0.0793% leads to a return jump of about one standard deviation. Analogously, a one standard deviation surprise in the ISM Manufacturing Index with a coefficient of 0.1449% leads to a two standard deviation return jump. The only somewhat puzzling results are that the Industrial Production, Durable Goods Orders and Housing Starts are significant and negative on the second lag. Using market expectations data from the Bloomberg Economic Calendar for robustness checking results in the same signs but with insignificant coefficients for Industrial Production and Housing Starts. Comparing our results to the results found by Harju and Hussain (2011) is just possible for the contemporaneous coefficients, since they do not report their lagged variable results. For the contemporaneous announcement impacts the results are broadly in line, except that our results show a

smaller amount of significant announcements. Speaking of this, the fact that contemporaneous effects as well as lagged effects are used may be a cause for insignificant coefficients as well. Identification of which variable is significant may be clouded by a spreading of market reactions and adjustments over several time points, hindering statistical inference on purely technical grounds. In addition, Unemploymentrate and Non-farm Payrolls for example are announced on the same time. Given that those two measures should be correlated adds further to the problem of identification in this setup. Lastly, the fact that the announcements may have differing influence on the specific stocks constituting the index may have led to averaging out of effects at least for some announcements.

4.1.2. Volatility Estimations

The estimation of Equation (3), the volatility equation, reveals overall increasing volatility in European stock markets after important US macroeconomic news. This is evident from the results presented in column 3 of Table 1, and 10 out of 22 announcements have significant impact. Other authors investigating information releases argue that the market volatility decreases before new information is released. This is because investors wait for the news about stocks before they alter their portfolio decisions.[15] After the news have hit the market, the changed perception of the true fundamental value of the respective asset(s) leads to portfolio adjustments of investors, thereby increasing the volatility. So this is in line with our findings, and only the negative significant volatility coefficient for the New Home Sales is surprising. Given that the recent financial market crisis originated in the subprime market meltdown, one explanation would be that the US housing market is still seen with caution and that surprises on the upside have a calming down effect.

The interday volatility, measured by a standard GARCH(1,1) specification, is highly significant and positive as expected. Not depicted here but also highly significant and positive is the NY dummy variable indicating that the volatility is indeed higher when the US markets are open. Finally, the day of the week effects are also important as can be seen from Figure 2.

[15]See for example Bomfim (2003).

Figure 2: Weekday periodicity

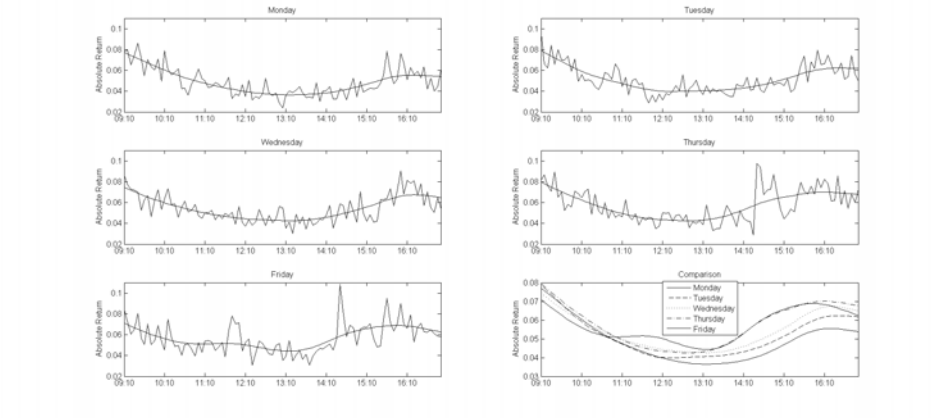

Figure 2 shows the periodicity over all days in the sample for the five individual weekdays. The sixth subplot provides the comparison graph.

As in Figure 1, Figure 2 shows the intraday volatility averaged over the whole sample weekday-wise. From the comparison subplot we can see that Friday volatility (upper solid line) and Thursday volatility (upper dashed line) is on average higher than on the other days. This is in line with the day of the week dummy variable results which indicate an increasing volatility over the week. Another interesting insight is that especially on Thursday there is a peak around 14:30. This is when many important US macroeconomic announcements are released and this peak gives visual evidence on the effect for European markets.

Given the fact that most but not all coefficients are in the right direction and not all announcement effects are significant, it is interesting to see how this turns out when focusing on specific stocks, rather than focusing on the "pooled" results from the index-based estimations. It is of special interest to see whether the apparently wrong signs that were obtained for some announcements, and the insignificance of others, is an effect of averaging out. We are able to answer these questions in the next sections. Furthermore, as stock-specific numbers are used, we are able to analyze the spreads as well, leading to insight on effects beyond return and risk, namely the pricing behavior in the presence of news flows.

Figure 3: Amount of significant announcements per individual stock

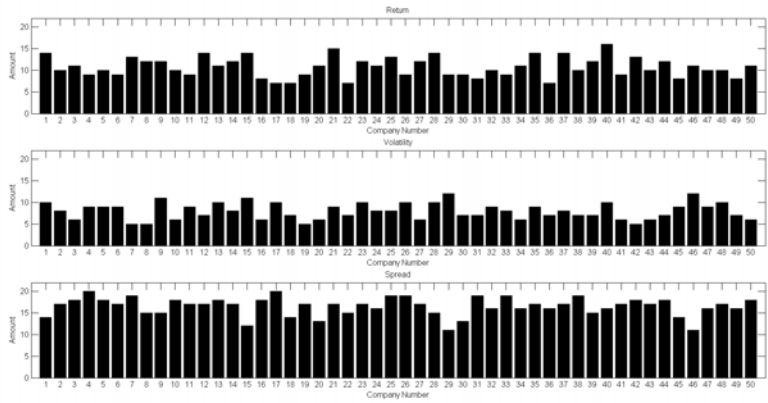

Figure 3 shows the amount of significant announcements for the individual stocks. An announcement is reported as significant for the respective stock if it has a significant contemporaneous, first or second lag impact at least on the 10% level. The stock numbers correspond to the identifying numbers in the appendix table about the stocks used in this study.

4.2. Stock-individual results

After discussing the "market-wide impact" of announcements in the index-based analysis in this subsection, we present the stock-specific analysis. All afterwards stated results are relying on a level of significance of 10%. Results for the 5% level support the 10% level results and are available upon request. Because it would be too extensive to discuss results for each stock in detail, we summarize the results wherever possible. First we discuss the amount of significant announcements for the individual stocks for all measures (return, volatility and spreads) and second we discuss the impacts announcement-wise for the respective measures.

Figure 3 provides first evidence on why it is important to conduct stock-specific estimations to gain additional insight on how announcements affect markets.

Detailed information which stock is influenced by which announcement is available upon request. From Figure 3 it is obvious that the amount of significant announcements strongly varies across the different stocks. So even though we are looking at a sample of quite similar stocks in the sense that they are all European blue chips, the announcement impacts are different. Additionally checking for the branch of the companies and the country reveals that eight companies whose returns are influenced by most announcements (16, 15 and 14) are from seven different countries and seven different branches. On the

other hand, companies with less significant influences are of differing sectors and countries as well. Thus, pooling of companies even in smaller groups may average out structures. This shows how crucial a stock-specific analysis is. It also makes perfect sense from a theoretical point of view: The first possible impact path discussed at the beginning of the study was the stock-individual US exposure impact. The strength of this path can vary dramatically even between quite common companies. While one car producer might for example be strongly affected by US news because of an important position in the US market, another producer's stock price might just barely react, given an Asian market focus. The second impact path, namely the whole market impact, is also quite heterogeneous between different stocks. As we know from asset pricing studies, there are stocks with high beta (market risk) and stocks with low beta. Naturally a market-wide reaction will affect low beta stocks much less than high beta stocks.

Another interesting result is that the amount of significant announcements varies strongly between the endogenous variables. There are on average much more announcements significant on spreads and much less significant on volatility than on returns. This shows that even if an announcement has no significant effect on return or on volatility, it might still be influential to information asymmetry and price uncertainty among market participants, resulting in different spreads than during other times. The following subsections discuss the announcement-specific results for the three estimated stock-specific variables.

4.2.1. Return Results

Table 2 presents the return estimation outcomes. The average constant term across all 50 estimations is with 0.0005 percentage points positive but close to zero as it is expected for very short-term returns. Furthermore it is just significant for 5 estimations on the 10% level. The first two autoregressive terms are significant for over 40, the third for only 13 stocks, further indicating an overall proper setup as discussed in the last section.[16] The first eight columns after the announcement description in the table show the amount

[16]Note that due to parsimony reasons the control variable results for the estimations are not depicted in detail.

Table 2: Stock-individual return estimation results

Announcement	Positive significant				Negative significant				First decile average coefficient		
	A.l.o.	Cont.	L(1)	L(2)	A.l.o.	Cont.	L(1)	L(2)	Cont.	L(1)	L(2)
ISM Manufacturing	45	42	4	19	1	0	1	0	0.1764	0.0465	0.1229
ADP Employment Survey	20	19	1	1	4	0	0	4	0.0992	0.0559	-0.0402
ISM Non-Manufacturing	9	4	1	4	5	0	5	0	0.0808	-0.07	0.0466
Non-farm Payrolls	22	20	4	0	8	0	2	6	0.2087	-0.0068	-0.0781
Unemploymentrate	5	5	0	0	30	1	10	26	0.0788	-0.1036	-0.0765
Initial Claims	2	0	0	2	12	9	4	0	-0.0561	-0.0479	0.0302
Retail Sales	40	39	3	0	9	0	4	6	0.1354	-0.0339	-0.0502
Consumer Price Index	4	0	1	3	19	19	1	1	-0.0686	-0.0065	0.0263
Industrial Production	2	2	0	0	28	1	2	27	-0.0032	-0.0072	-0.0814
Trade Balance	7	0	7	0	0	0	0	0	0.0655	0.0958	-0.0849
Producer Price Index	7	4	0	3	4	2	2	0	0.0348	-0.047	0.0499
Consumer Confidence	19	4	13	2	5	1	0	4	0.0685	0.0837	-0.0336
Personal Income	2	2	0	0	34	4	20	21	-0.0179	-0.0827	-0.1025
Personal Spending	4	3	1	0	11	5	5	2	-0.0502	-0.0398	-0.0099
Empire State Survey	2	0	1	1	6	0	5	1	-0.0289	-0.028	-0.0097
Capacity Utilisation	23	14	2	12	3	0	2	1	0.0789	-0.0011	0.0597
Durable Goods Orders	29	21	13	0	29	0	0	29	0.1292	0.1118	-0.1017
Chicago PMI	5	1	0	4	11	4	5	2	-0.0262	-0.073	0.007
Philadelphia Fed Survey	0	0	0	0	18	3	0	16	-0.081	0.0413	-0.1075
Housing Starts	17	0	17	0	27	3	0	26	-0.0928	0.1261	-0.1012
Existing Home Sales	15	15	0	0	28	0	20	13	0.0827	-0.0765	-0.0834
New Home Sales	26	24	0	5	1	0	1	0	0.1384	0.0054	0.0781

The first columns of Table 2 show the amount of stocks which are significantly (at least on the 10% level) affected by the respective announcement. The other columns show the average of the five most significant coefficients (first decile) of the respective announcement. Cont. stands for the contemporaneous, L(1) and L(2) for the first and the second 5-minute lag influence. "A.l.o." indicates that at least at one lag a significant influence on the endogenous variable can be found. Red numbers have to be interpreted with caution since we don't have (a sufficient number of) significant coefficients here.

of significant announcements. First of all we can see that no announcement type has an effect on all stocks. In many cases the announcements have impacts on just half of the stocks or even less. This again supports the notion that stock-individual investigations are highly recommendable.

Second, the results are overall plausible since they show the assumed impact direction for the different announcements. As in the case of the index-based estimation, the returns of many stocks are positively affected by contemporaneous positive surprises in the ISM Manufacturing Index, the Retail sales, Existing Home Sales and New Home Sales. However, the results here reveal that there are much more announcements having a positive significant impact at least for a couple of stocks, i.e. for instance the ADP Employments Survey, the Non-farm Payrolls or the Capacity Utilization. These results are all reason-

able since they are positive indicators for the US economy. Contemporaneous, negative and significant effects are just seen for the Consumer Price Index, which is backed by the index results and for the Initial Claims which is a new result but reasonable since it is a negative indicator. The news in Unemployment, Consumer Confidence, Housing Starts and Personal Income seem to work with some lag but overall in reasonable direction.

Results for the lagged news announcements also reveal additional information about the few puzzling results in the index-based estimation: we can observe that for some announcements the lagged impacts are counter-intuitive. The second lag coefficient of Durable Goods Orders and Housing Starts for example shows a negative significant impact on a mentionable amount of stocks which is in line with the index-based estimation, but not with economic intuition. However, we can observe that these variables have strong contemporaneous or first lag impacts on many stocks in the economically reasonable (positive) direction. So this phenomenon points at an initial overreaction to the announcement followed by a mean-reverting process. This was already discussed in the theoretical section and can be explained by the different (in)abilities of market participants to interpret the implications of the news event for the fundamental value of the respective assets. Additionally, we have checked if it is the same stocks that first have increasing prices and then decreasing ones on later lags, this indeed holds true and is good news in terms of reliability and sensibility of the results. The only announcement which still provides a puzzling result is the Industrial Production, and there are some other indicators which are generally not relevant, for example the Empire State Survey or the Trade Balance.

The last three columns give the average coefficient of the 5 most significantly affected stocks of the respective announcement and lag. Note that the depicted coefficients on different lags are not necessarily from the same stocks. As pointed out in the data section, the announcement surprises are standardized, so the coefficients give the impact of a one standard deviation macroeconomic news surprise.[17] Overall, the coefficients support our

[17]The red numbers have to be interpreted with caution since there are not at least five statistically significant coefficient estimates for the respective announcement and/or the lag at least at the 10% level.

Table 3: Stock-individual volatility estimation results

Announcement	Positive significant				Negative significant				First decile average coefficient		
	A.l.o.	Cont.	L(1)	L(2)	A.l.o.	Cont.	L(1)	L(2)	Cont.	L(1)	L(2)
ISM Manufacturing	28	13	5	15	3	2	1	0	0.0870	0.0549	0.0655
ADP Employment Survey	9	7	4	0	1	1	0	0	0.0804	0.0779	0.0070
ISM Non-Manufacturing	21	19	2	4	4	0	2	2	0.0899	0.004	0.0275
Non-farm Payrolls	5	3	1	1	10	3	5	3	0.0254	-0.0779	-0.0574
Unemploymentrate	47	43	31	5	1	0	0	1	0.1488	0.1657	0.0560
Initial Claims	46	25	44	7	0	0	0	0	0.0305	0.0465	0.0241
Retail Sales	4	4	0	0	1	0	1	0	0.0474	-0.0081	-0.0232
Consumer Price Index	2	1	1	1	8	7	2	1	-0.0373	-0.0154	-0.0178
Industrial Production	2	2	0	0	1	0	1	0	0.0340	-0.0755	-0.0194
Trade Balance	46	45	7	29	2	0	2	0	0.1203	0.0625	0.1107
Producer Price Index	0	0	0	0	1	1	0	0	-0.0189	0.0307	0.0021
Consumer Confidence	9	9	1	0	21	0	11	12	0.0757	-0.0302	-0.0574
Personal Income	2	2	0	0	0	0	0	0	0.0481	-0.0445	-0.0187
Personal Spending	2	0	2	0	9	7	0	2	-0.0594	-0.0010	-0.0512
Empire State Survey	6	6	0	2	5	0	3	2	0.0514	-0.0467	-0.0047
Capacity Utilisation	1	0	1	0	0	0	0	0	0.0529	0.0727	0.0235
Durable Goods Orders	24	24	0	0	1	0	0	1	0.0866	-0.0327	-0.0442
Chicago PMI	7	1	5	1	4	1	0	3	0.0002	0.0590	-0.0091
Philadelphia Fed Survey	18	15	0	4	2	0	2	0	0.0785	-0.0282	0.0682
Housing Starts	30	30	0	0	1	0	0	1	0.1602	-0.0070	-0.0026
Existing Home Sales	2	2	0	0	9	3	1	6	-0.0152	-0.0449	-0.0569
New Home Sales	3	0	0	3	10	5	5	0	-0.0545	-0.0558	0.0680

The first columns of Table 3 show the amount of stocks which are significantly (at least on the 10% level) affected by the respective announcement. The later columns show the average of the five most significant coefficients (first decile) of the respective announcement. Cont. stands for the contemporaneous, L(1) and L(2) for the first and the second 5-minute lag influence. "A.l.o." indicates that at least at one lag a significant influence on the endogenous variable can be found. Red numbers have to be interpreted with caution since we don't have (a sufficient number of) significant coefficients here.

findings of mean-reverting price adjustment processes at least for some announcements. It also shows that the overall effects mostly are in the assumed direction. For example in the case of Durable Goods Orders we see a strong, positive contemporaneous and first lag price increase and a decrease on the second lag. However, the sum stays positive. The size of the coefficients is reasonable with the strongest effect seen for Non-farm Payrolls with a positive impact of 0.21 percentage points and ISM Manufacturing Index with a positive impact of 0.18 percentage points on the 5-minute returns for the five most significantly affected stocks.

4.2.2. Volatility Results

For the volatility estimations all control variables are reasonable with statistically positive constants in 45 cases and an average size of 0.0285 percentage points. Addition-

ally the daily volatility variable is positive and significant in all cases. The New York market dummy variable is always positive and statistically significant in 35 cases, indeed indicating a positive volatility effect in European markets due to open US markets. This coincides with the findings of Harju and Hussain (2011). As for the index estimations, the day-dummy variables indicate that the volatility is lower at the beginning of the week, increasing during the week and reaching the peak at Thursday. Controlling for day of the week effects therefore seems highly recommendable. Overall, the control variables are in line with the index volatility estimation as discussed in the first subsection.

Table 3 presents the volatility estimation results. The impact of announcement surprises on volatility seems to be a bit more clear-cut among the different stocks than it is on the return reactions, and is also in line with the index-based estimation. While some announcements have an effect on only a small number of stocks, announcements like the Unemployment numbers, the Initial Claims or the Trade Balance seem to affect almost all stock volatilities. This provides evidence that these announcements work as market-wide/global indicators for the economic situation and therefore are in line with index estimations, as opposed to those announcements that have an effect on only few stocks, an insight that is only possible to obtain from stock-specific analyses.

In addition, it is especially interesting to interpret the different results between return and volatility: in the case of the Trade Balance for example the return results have shown significant impact on much less stocks than the volatility results. This indicates that the announcement leads to more market activity and price adjustments, but not with a clear price direction assigned to the surprise direction. Naturally, this is in line with economic reasoning: A positive announcement in the trade balance, meaning for the US nowadays a less negative trade balance than expected, can have different reasons with completely different implications for the economic outlook. Suppose the surprise in this announcement is positive because the exports have risen stronger than expected. This is a clear positive signal for the US economy and might also be positive for Europe. However, if the surprise in this announcement comes from a sharp and unexpected drop in imports to the US it might darken the world economic outlook and especially the

outlook for European exporters to the US. In the first case one can expect a positive return reaction, in the second case one can expect a negative return reaction, but in both cases it is reasonable that volatility goes up. This reasoning explains why we do not see a clear impact for returns but for volatility in this announcement.

The direction of the volatility impacts overall is quite reasonable for most announcements. Almost all announcement types with a significant impact lead to an increase in volatility. This is in line with economic reasoning as discussed in Section 2. There are only a couple of announcements which have a significant and negative impact on the volatility of some stocks. Worth to mention here is the Consumer Confidence, however, whose impact is only negative and significant on the first and second lag and might indicate a more quite phase in the market after the adjustment process to the news has already occurred earlier. The coefficient sizes are all reasonable with the Housing Starts and Unemployment announcement having the strongest volatility impact for the five most significantly affected stocks.

4.2.3. Spread Results

Finally we turn to the results of the bid-ask spread estimations. Again for parsimony reasons we do not display the control variables in detail but discuss them briefly hereafter. For all stocks the constant term is positive and significant on the 1% level with an average size of 0.0187 (recall that the spreads are measured in percent of the stock price which is the midpoint between ask and bid), so the "basis-spread" is on average 0.0187% of the stock price. For 48 out of 50 stocks the stock price volatility variable constructed by Equation (3) is positive and statistically significant on the 1% level. This gives strong support to our view that the return volatility (daily and intraday) has a strictly positive impact on spreads and is perfectly in line with microstructure theory. However, how strong is this effect? The average coefficient over all 50 stocks is 0.0968. If we take the mean of the volatility variable $(\hat{\varepsilon}_t - u_t)$ of the index-based estimations as a volatility benchmark-value (0.0525%), we would have an impact on the spread of 0.0051 percentage points which is in turn a 27% markup on the constant. The higher holding risk in times of higher volatility is one major part of the bid-ask spread.

Table 4: Stock individual spread estimation results

Announcement	Positive significant				Negative significant				First decile average coefficient		
	A.l.o.	Cont.	L(1)	L(2)	A.l.o.	Cont.	L(1)	L(2)	Cont.	L(1)	L(2)
ISM Manufacturing	48	47	1	0	38	0	23	27	0.0487	-0.0094	-0.0145
ADP Employment Survey	44	40	5	1	12	0	4	9	0.0285	0.0039	-0.0106
ISM Non-Manufacturing	40	38	1	2	33	0	24	20	0.0347	-0.0140	-0.0110
Non-farm Payrolls	19	7	10	6	9	0	3	6	0.0625	0.0144	-0.0107
Unemploymentrate	35	28	1	6	21	0	13	9	0.0591	-0.0264	-0.0176
Initial Claims	45	45	0	0	37	0	31	18	0.0263	-0.0081	-0.0081
Retail Sales	33	26	7	3	14	0	11	4	0.0317	-0.0019	0.0013
Consumer Price Index	25	23	3	0	20	0	13	13	0.0206	-0.0054	-0.0121
Industrial Production	17	8	6	3	12	1	5	10	0.0299	-0.0284	-0.0226
Trade Balance	13	13	0	1	25	0	16	15	0.0219	-0.0099	-0.0103
Producer Price Index	39	37	0	2	27	0	25	14	0.0344	-0.0128	-0.0113
Consumer Confidence	42	33	17	0	19	0	2	18	0.0201	0.0081	-0.0098
Personal Income	41	37	5	10	22	2	17	8	0.0390	-0.0093	-0.0041
Personal Spending	33	30	7	5	20	0	8	14	0.0516	-0.0028	0.0121
Empire State Survey	20	17	2	2	15	1	6	9	0.0127	0.0005	-0.0076
Capacity Utilisation	13	2	6	8	18	11	5	3	-0.0277	-0.0042	0.0036
Durable Goods Orders	40	33	9	5	23	0	10	15	0.0626	0.0034	-0.0072
Chicago PMI	27	22	3	7	21	1	13	9	0.0116	-0.0116	0.0003
Philadelphia Fed Survey	38	37	2	0	27	0	10	23	0.0464	-0.0135	-0.0153
Housing Starts	21	17	5	3	15	0	11	6	0.0375	-0.0090	-0.0025
Existing Home Sales	17	13	2	3	15	0	4	12	0.0298	-0.0006	-0.0137
New Home Sales	32	32	1	0	32	0	21	25	0.0503	-0.0108	-0.0153

The first columns of Table 4 show the amount of stocks which are significantly (at least on the 10% level) affected by the respective announcement. The later columns show the average of the five most significant coefficients (first decile) of the respective announcement. Cont. stands for the contemporaneous, L(1) and L(2) for the first and the second 5-minute lag influence. "A.l.o." indicates that at least at one lag a significant influence on the endogenous variable can be found.

The other part in our estimations comes from asymmetric information considerations, and these impacts can be seen directly from the results of the announcements in Table 4. The AR terms are almost always highly significant and positive. It can be argued that one could include more autoregressive terms for some stocks, however, we account for that by using Newey-West autoregressive and heteroscedasticity consistent standard errors in the spread estimation. Additionally, the Durbin-Watson statistic for all regressions shows a value of between 2.0 and 2.1, so no serial correlation is evident. The average R-Squared is 0.1861. Table 4 shows a summary of estimation results concerning the effect of macroeconomic announcements on relative bid-ask spreads.

The results show the pure impact of the announcement surprises net of the effect which might come from higher return volatility, since we are controlling for that. It is remarkable that all announcements in our investigation seem to have an effect on

the spreads of many different stocks. It is also observable that in the period after an announcement, the significant spread effects are almost always positive, indicating an increase in spreads. This can be explained by higher information asymmetry as it is discussed in the model section. Nevertheless, the information asymmetry does not seem to stay long in the market since the significant first and second lags mostly show a negative sign. It shows that the uncertainty about the news impact decreases completely in the first 5 minutes after the announcement and is followed partially by a low uncertainty phase compared to the constant estimated. This is reasonable since after such a market-moving news event other important news releases are not that likely and adjustments were already made based on the news flow. The constant on the other hand will be influenced by low uncertainty phases as well as some higher uncertainty phases, such as around other stock-specific relevant news releases.

The coefficient size estimates are quite common for most announcements, with Non-Farm Payrolls and Unemployment having the highest positive impact on spreads. The coefficients with values around 0.04 percentage points indicate roughly a two to three times higher spread right after announcements (net of volatility effects) for a one standard-deviation surprise.

Overall, these results show that US announcements strongly affect the asymmetric information in European stock markets. Most interesting is that a spread increase occurs even for announcements and stocks where returns and volatilities seem to be just barely affected or not at all. This shows that even if we do not see a significant reaction in returns and volatility, asymmetric information can still rise and market makers and market participants acting as liquidity suppliers still protect themselves against potential informed trading surrounding announcements. This leads to the important insight that announcements which in the literature so far have been regarded as not being important can indeed be important from an information and trading cost point of view, that is, when analyses go beyond return and dispersion investigations.

4.3. Stock-individual results net of index effects

After performing the index-based estimations and the stock-specific estimations, we are interested in the results when controlling for index returns. We have performed the estimations of the previous subsection, now extended by including the index returns for the times and lags of US macroeconomic announcements.[18]

The results for the constant and autoregressive terms in the return estimations do not change much in comparison to the estimations without the index return series. Interestingly, the index return series is significant and positive for all stocks and the coefficient ranges from 0.67 to 1.64. This term can be interpreted similar to the classical market beta that we know from asset pricing literature. This span is reasonable and in addition shows that we can expect strong variation between the stocks when controlling for the market influence.

We omit to display the results here as we have done it in the last sub-sections, because we do not gain much additional insight into the behavior of the stocks when focusing just on summary results. Many announcements are statistically positive for some stocks and negative for others. Taking for instance the Unemployment rate, we have a significant and positive impact on 11 and a significant and negative impact on 15 stocks. This is because one stock can be differently affected by different announcements.

The inclusion of the market return leads to an alternative interpretation of the announcement specific variables than in the previous section: They do not give the complete impact for a stock due to the announcement any more, but serve as correction variables for the divergence of the stock specific announcement reaction from the overall market reaction of the stock. Suppose a stock has a market index coefficient of 1, then the return reaction due to announcement effects has on average the same strength as for the overall market index, as the returns of the stock and the index should move in tandem. However, if there is now an announcement included which does not affect this specific stock but the market index (for example positively) then the coefficient of this announcement must

[18]We have also checked for the results including the index returns not only at the time of the announcements but for every five minute period in the sample leading to similar result interpretations.

Table 5: Return result comparison example

Variable	Return			Return with beta		
Constant	0.0000			-0.0001		
AR(1)/AR(2)/AR(3)	-0.0159**	-0.0348***	0.0000	-0.0149**	-0.0333***	-0.0007
Index Return				1.006***		
Announcement	Cont.	Lag 1	Lag 2	Cont.	Lag 1	Lag 2
ISM Manufacturing	0.1524***	-0.0024	0.0417	-0.0077	-0.0081	-0.0357
ADP Employment Survey	0.0576*	0.0183	0.0151	0.0102	0.0037	0.013
ISM Non-Manufacturing	0.0467	-0.0015	0.0086	0.0203	0.0137	-0.0032
Non-farm Payrolls	0.0195	0.0510	-0.0046	-0.0501**	0.0234	0.025
Unemploymentrate	0.0981	-0.0344	-0.0247	0.0253	0.0407*	0.018
Initial Claims	-0.0390	-0.0114	0.0189	-0.0045	-0.0023	-0.0047
Retail Sales	0.0150	-0.1004*	0.0172	-0.0728**	-0.0654*	0.0251
Consumer Price Index	-0.0600**	0.0219	0.0346	-0.0323	0.0297	0.0294
Industrial Production	0.0015	0.0062	-0.0535**	0.0113	-0.0055	-0.0036
Trade Balance	0.0251	0.0693	0.0224	-0.0153	0.0273	0.0435**
Producer Price Index	0.0186	-0.0371	-0.0238	0.0257	-0.0245	-0.0312
Consumer Confidence	-0.0344	0.0095	-0.0020	-0.0696***	-0.0115	0.0031
Personal Income	-0.0271	-0.0098	-0.0360	-0.0365	0.0262	0.0006
Personal Spending	-0.0075	0.0470	0.0058	-0.0286	0.0580*	0.0064
Empire State Survey	0.0032	-0.0167	-0.0127	0.0106	-0.0072	-0.0071
Capacity Utilisation	0.0450	-0.0175	-0.0170	-0.0061	-0.0192	-0.0375**
Durable Goods Orders	0.0497	-0.0058	-0.0002	-0.0211	-0.0279	0.0629**
Chicago PMI	0.0127	-0.0422	0.0128	0.0283	-0.0087	0.0002
Philadelphia Fed Survey	-0.0534	0.0084	-0.0427	-0.0065	-0.0092	0.0288
Housing Starts	-0.0867	0.0468	-0.0757	-0.0371	-0.0082	-0.0307
Existing Home Sales	0.0716**	-0.0744**	-0.0289	0.005	-0.0433**	0.0064
New Home Sales	0.0678**	0.0449	0.0230	0.0109	0.0480**	-0.0192

Table 5 shows an example stock return estimation without including the index as a explanatory variable compared to the estimation results including the index return. Cont. stands for the contemporaneous, Lag 1 and Lag 2 for the first and the second 5-minute lag influence. *,** and *** indicate statistical significance on the 10%, 5% and 1% level. Due to parsimony reasons we have omitted the presentation of control variables or standarddeviations.

correct for that fact (will be negative). Accordingly, the correction coefficients deliver insight into the relative strengths of reactions between stocks and the index. In addition, this setup can reveal a very important result, namely that we indeed have a noteworthy number of significant correction coefficients. This points again at the importance of stock-specific investigations. For illustrative reasons Table 5 gives the estimation results for the stock with the beta coefficient closest to 1 in our sample (stock 22).

The respective parts of the table state the results without and with controlling for the index return. We can see that this stock is significantly and positively affected by the ISM Manufacturing Index with a contemporaneous impact. The contemporaneous coefficient for this announcement in the second estimation shows a negative sign but

is insignificant. The index results in Table 1 reveal a slightly lower coefficient for this announcement, explaining the negative but insignificant coefficient. The same holds true for the other announcements and we can see that this setup can be used to disentangle the stock-specific effects from the reactions due to movements in the overall market. In detail, the change from significant to insignificant coefficients shows that the previous finding of a specific impact indeed has an effect on the respective stock return, but it is not the announcement that drives the return, it is the market movement.

For the volatility estimates the picture is quite clear as well: after using the index return in the mean equation we overall have almost no significant and positive announcement. As we have seen in Table 1, many announcements affect either almost all or almost no stock in our sample, so we have either a market-wide reaction or no volatility reaction.[19] However, there are more significant and negative coefficients than without the index return in the mean equation. This is especially the case for the announcements where just about half of the stocks were affected, for instance ISM Manufacturing, ISM Non-Manufacturing and Philadelphia Fed Survey. This points at the fact that these announcements are just affecting parts of the market. It is also the case for announcements with already negative coefficients in the estimation in the last subsection (i.e. Consumer Confidence).

Finally, we are interested in the spread estimation, augmented by the absolute market return series. Indeed our estimates reveal that the new variable shows a significant and positive sign for all stocks, indicating that market-wide volatility is influential for stock-specific bid-ask spreads and this is a new insight. The average coefficient size over all 50 stocks is 0.0557. The average coefficient size for the stock individual volatility variable is 0.0958 and the average constant is 0.0189%, so it has not changed much. The average R-Squared is 0.1877 and did not really increase compared to the previous spread estimations. This comes as no surprise since we just have included the index returns for the time of announcements and their lags. Most interesting is how the actual news coefficients have

[19]Remind that we are using the absolute residual return as our endogenous variable in the volatility equation.

changed and here we do not see any major changes. Overall, the coefficients are a bit smaller for the positive (contemporaneous) variables and in absolute terms a bit larger for the negative (lagged) variables. However, the changes are not strong and there are just minor changes in the amount of significant coefficients, so we omitted the presentation of a result table here. Overall, the argumentation of the last subsection concerning spreads still holds true and is augmented by the result that market-wide volatility also affects spreads.

5. Conclusion

In this study we have shown that certain US macroeconomic announcements matter for European stock markets. While index-based estimations give insight into the effects on average, a detailed stock-wise analysis revealed that the importance of announcements varies strongly between different stocks, advocating stock-individual analysis as a crucial tool to understand stock market reactions to news events. Controlling for market returns in stock-specific estimations helps to understand how the behavior of certain stocks differs from the overall market reactions due to announcements, since it is possible to disentangle market-wide from stock-specific reactions in this setup. Some news surprises such as the ISM Manufacturing Index or the Unemployment numbers affect the returns and volatility of many stocks in our sample, while other announcements like the Empire State Survey have virtually no effects. Additionally, the direction of news is important for returns. If an announcement has a statistically significant influence, then good news lead to a positive effect on stock returns and bad news lead to a negative effect. Return volatility tends to rise shortly after important announcements. Interestingly, almost all US announcements in the sample have significant effects on quoted relative bid-ask spreads of European stocks. This points at the importance of the analysis of news events even if they are assumed to be unimportant to return and volatility. The spreads tend to be drastically higher right after the announcement but seem to be followed by a low spread phase 5 minutes later, which is a signal for a quick decrease in information asymmetry in the market. Furthermore, both stock-specific and market volatility seem to play an important role for the size of bid-ask spreads.

Stock-specific analyses of macroeconomic news effects on volatility and returns for European markets are rare and the analysis of their spreads is almost not investigated in this kind of a setup. With this study we fill this research gap. We argue that researchers and practitioners focusing on European stock markets have to take into account the stock-individual effects of US announcements in their analyses and decisions. Even if stock returns and volatility seem not to react to a certain announcement, information asymmetry might still have an important effect as they lead to higher transaction costs in the market.

Further research in the area of market microstructure reactions to macroeconomic announcements would be highly recommendable to improve the understanding of financial market functioning. One interesting task for further research would be to analyze if the effects of foreign country announcements found here also work in the other direction, hence, if European announcements affect US stock markets in similar fashion, or if US macroeconomic news have a unique position as worldwide leading indicators.

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Table A1: Literature Review

Authors	Year	Data frequency	Markettype	Country	Announcement type	Main variable of interest
Jubinski, Tomljanovich	2013	Intraday (5 min)	Stocks (individual)	USA	Fed Open Market Committee	Returns, Volatility
Elder et al.	2012	Intraday (5 min)	Futures (commodities)	USA	US Macroeconomic	Returns, Volatility, Volume
Evans	2011	Intraday (5 min)	Futures (stock, bond, FX)	USA	US Macroeconomic	Returns
Harju, Hussain	2011	Intraday (5 min)	Stocks (indices)	Europe	US Macroeconomic	Returns, Volatility
Chulia et al.	2010	Intraday (5 min)	Stocks (individual)	USA	Federal Funds Rate changes	Returns, Volatility, Correlation
Evans, Speight	2010	Intraday (5 min)	FX	Euro-others	Macroeconomic (different countries)	Volatility
Hussain	2010	Intraday (5 min)	Stocks (indices)	USA and Europe	Central bank	Returns, Volatility
Andersson et al.	2009	Intraday (5 min)	Government bonds	Germany	Central bank, Macroeconomic (US and Europe)	Returns, Volatility
Andersen et al.	2007	Intraday (5 min)	Futures (stock, bond, FX)	USA and Europe	US Macroeconomic	Returns, Volatility
Sager, Taylor	2004	Intraday (5 min)	FX	Euro-Dollar	ECB Governing Council	Volatility
Andersen et al.	2003	Intraday (5 min)	FX	Dollar-others	US Macroeconomic	Returns
Dominguez	2003	Intraday (5 min)	FX	Dollar-others	Central bank	Returns, Volatility
Cai et al.	2001	Intraday (5 min)	FX	Yen-Dollar	US and Japanese Macroeconomic	Volatility
Andersen et al.	2000	Intraday (5 min)	Stocks (indices)	Japan	Japanese Macroeconomic	Volatility
Chen et al.	1999	Intraday (60 min)	Stocks (indices)	USA	Fed discount rate changes	Returns, Volatility, Volume
Andersen, Bollerslev	1998	Intraday (5 min)	FX	Mark-Dollar	Macroeconomic (mainly US)	Volatility
Andersen, Bollerslev	1997	Intraday (5 min)	Futures (stock indices), FX	USA	Discussion about intraday modelling	Intraday Volatility

This table summarizes the literature in the area of macroeconomic announcement studies. The column "Markettype" states the main market(s) under investigation. The column "Country" gives either the country under investigation or, in case of Foreign Exchange (FX) the currencies under investigation. The column results comprises the main results of the paper relevant for our study. The column "Estimation Method" states the estimation method for the most important investigation of the respective paper. FFF stands for Fourier Flexible Form and WLS means Weighted Least Squares. Red entries indicate similarities to our study.

Table A1 cont.: Literature Review

Authors	Estimation Method	Results
Jubinski, Tomljanovich	WLS using FFF	Equity returns are essentially unaffected by FOMC news. Conditional volatility is lower prior and higher after announcements.
Elder et al.	Linear regression	Announcements have a positive impact on volatility and volumes. Price impacts are observable and their direction depends on the news direction.
Evans	Jump-diffusion process	One third of jumps are related to macroeconomic news announcements.
Harju, Hussain	WLS using FFF	Stock market opening raises volatility in European markets. US macro announcements have major impacts on European markets.
Chulia et al.	Linear regression	Unexpected target rate changes lead to price level, volatility and correlation reactions which are asymmetric, depending on the change direction.
Evans, Speight	WLS using FFF	US announcements have strong impacts on FX volatilities were monetary policy and real activity statements causing the largest reactions.
Hussain	WLS using FFF	Announcements have a significant and immediate impact on stock index returns and volatilities.
Andersson et al.	WLS using FFF	Especially US-Announcements have strong impacts on volatility and returns.
Andersen et al.	WLS	Announcements induce conditional mean jumps. Bad news negatively influence stocks during contractions but positive impacts during expansions.
Sager, Taylor	Markov-switching	Higher volatility surrounding announcements.
Andersen et al.	WLS using FFF	Conditional mean jumps after announcement surprises.
Dominguez	Event-study	Higher volatility and significant return impact surrounding announcements.
Cai et al.	Two step (FFF)	Order flow and portfolio shifts are responsible for much of the volatility. Significant announcements effects especially for employment reports.
Andersen et al.	Two step (FFF)	Strong double U-shaped volatility pattern. Little impact of announcements.
Chen et al.	Linear regression	Unexpected discount rate changes lead to higher volatility and higher trading volumes. Equity returns respond negatively.
Andersen, Bollerslev	Two step (FFF)	Strong intraday volatility pattern are observable as well as volatility response to announcements.
Andersen, Bollerslev	FFF	Strong cyclical pattern in intraday data can be found.

This table summarizes the literature in the area of macroeconomic announcement studies. The column "Markettype" states the main market(s) under investigation. The column "Country" gives either the country under investigation or, in case of Foreign Exchange (FX) the currencies under investigation. The column results comprises the main results of the paper relevant for our study. The column "Estimation Method" states the estimation method for the most important investigation of the respective paper. FFF stands for Fourier Flexible Form and WLS means Weighted Least Squares. Red entries indicate similarities to our study.

Table A2: Stock-information

Stockn.	Company	Sector	Country	Bloombergcode
1	Anheuser Busch InBev	Beverages	Belgium	ABI BB Equity
2	Air Liquide	Chemicals	France	AI FP Equity
3	Alianz Versicherung	Financial Services	Germany	ALV GY Equity
4	ASML Holding	Semiconductor Industry	Netherlands	ASML NA Equity
5	BASF	Chemicals	Germany	BAS GY Equity
6	Bayer	Pharmaceuticals	Germany	BAYN GY Equity
7	Banco Bilbao Vizcaya Argentaria	Financial Services	Spain	BBVA SQ Equity
8	BMW	Automotive	Germany	BMW GY Equity
9	Danone	Food Processing	France	BN FP Equity
10	BNP Paribas	Financial Services	France	BNP FP Equity
11	Carrefour	Retailing	France	CA FP Equity
12	Cement Roadstone Holding	Building Materials	Ireland	CRH ID Equity
13	AXA	Financial Services	France	CS FP Equity
14	Daimler	Automotive	Germany	DAI GY Equity
15	Deutsche Bank	Financial Services	Germany	DBK GY Equity
16	Vinci	Construction	France	DG FP Equity
17	Deutsche Telekom	Telecommunication	Germany	DTE GY Equity
18	Airbus Group	Aerospace, Defence	France	EAD FP Equity/AIR FP
19	Essilor International	Medical Equipment	France	EI FP Equity
20	Enel	Electric Utility	Italy	ENEL IM Equity
21	Eni	Oil and Gas	Italy	ENI IM Equity
22	E.ON	Electric Utility	Germany	EOAN GY Equity
23	Total	Oil and Gas	France	FP FP Equity
24	Assicurazioni Generali	Financial Services	Italy	G IM Equity
25	Societe Generale	Financial Services	France	GLE FP Equity
26	GDF Suez	Electric Utility	France	GSZ FP Equity
27	Iberdrola	Electric Utility	Spain	IBE SQ Equity
28	ING Group	Financial Services	Netherlands	INGA NA Equity
29	Intesa Sanpaolo	Financial Services	Italy	ISP IM Equity
30	Inditex	Retailing	Spain	ITX SQ Equity
31	LVMH	Luxury Goods	France	MC FP Equity
32	ArcelorMittal	Steel	Luxembourg	MT NA Equity
33	Munich Re	Financial Services	Germany	MUV2 GY Equity
34	L'Oreal	Personal Care	France	OR FP Equity
35	Orange	Telecommunication	France	ORA FP Equity
36	Philips	Electronics	Netherlands	PHIA NA Equity
37	Repsol	Oil and Gas	Spain	REP SQ Equity
38	RWE	Electric Utility	Germany	RWE GY Equity
39	Sanofi	Pharmaceuticals	France	SAN FP Equity
40	Banco Santander	Financial Services	Spain	SAN SQ Equity
41	SAP	Software	Germany	SAP GY Equity
42	Saint Gobain	Building Materials	France	SGO FP Equity
43	Siemens	Engineering and Electro	Germany	SIE GY Equity
44	Schneider Electric	Electrical Equipment	France	SU FP Equity
45	Telefonica	Telecommunication	Spain	TEF SQ Equity
46	UniCredit	Financial Services	Italy	UCG IM Equity
47	Unibail-Rodamco	Property	France	UL NA Equity
48	Unilever	Consumer Goods	UK/Netherlands	UNA NA Equity
49	Vivendi	Telecommunication	France	VIV FP Equity
50	Volkswagen	Automotive	Germany	VOW3 GY Equity

Table A2 states information about the companies used in the empirical investigation.

Table A3: List of Announcements

Number	Announcements	Frequency	Regular time	Weekday	Time during month
1	ISM Manufacturing	Monthly	16:00	Irregular	First three days
2	ADP Employment Survey	Monthly	14:15	Wednesday	First week
3	ISM Non-Manufacturing	Monthly	16:00	Irregular	First week
4	Non-farm Payrolls	Monthly	14:30	Friday	First to second week
5	Unemployment	Monthly	14:30	Friday	Non-farm Payrolls
6	Initial Claims	Weekly	14:30	Thursday	Weekly
7	Retail Sales	Monthly	14:30	Irregular	Midmonth
8	Consumer Price Index	Monthly	14:30	Irregular	Midmonth
9	Industrial Production	Monthly	15:15	Irregular	Midmonth
10	Trade Balance	Monthly	14:30	Irregular	First week
11	Producer Price Index	Monthly	14:30	Irregular	Midmonth
12	Univ of Michigan Consumer Confidence	Monthly	15:55	Friday	Midmonth
13	Personal Income	Monthly	14:30	Irregular	End or beginning
14	Personal Spending	Monthly	14:30	Irregular	Personal Income
15	Empire State Survey	Monthly	14:30	Irregular	Midmonth
16	Capacity Utilisation	Monthly	15:15	Irregular	Midmonth
17	Durable Goods Orders	Monthly	14:30	Irregular	End
18	Chicago Purchasing Managers Index	Monthly	15:45	Irregular	Last three days
19	Philadelphia Fed Survey	Monthly	16:00	Thursday	Third or fourth week
20	Housing Starts	Monthly	14:30	Irregular	Midmonth
21	Existing Home Sales	Monthly	16:00	Irregular	Midmonth
22	New Home Sales	Monthly	16:00	Irregular	End

Table A3 states information about the announcements used in the empirical investigation. The column "Regular time" gives the usual MET time of the announcements. Deviations from this time can occur due to different daylight saving time dates in the US and in Europe. The "Weekday" and "Time during month" columns state the usual weekday and time during month of the respective announcement. However single deviations from this scheme occurred occasionally. If there is another announcement mentioned in the last column it means that both macroeconomic indicators are announced together.