Explaining Monetary Policy in Press Conferences*

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The question of how best to communicate monetary policy decisions remains a highly topical issue among central banks. Focusing on the experience of the European Central Bank, this paper studies how explanations of monetary policy decisions at press conferences are perceived by financial markets. The empirical findings show that ECB press conferences provide substantial additional information to financial markets beyond that contained in the monetary policy decisions, and that the information content is closely linked to the characteristics of the decisions. Press conferences have on average had larger effects on financial markets than the corresponding policy decisions, with lower effects on volatility. Moreover, the Q&A part of the press conference fulfills a clarification role, in particular during periods of large macroeconomic uncertainty.

JEL Codes: E52, E58, G14.

1. Introduction

The way central banks communicate with the public has seen dramatic changes in recent decades. Further modifications to current practices are in the making, with a number of central banks currently debating whether and how to modify communication practices. An

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interesting case in point is the decision in 2007 by the Swedish Riksbank to hold a press conference after each policy meeting to "provide more detailed and more regular information." At the time, the press conference had been given substantially more weight in the Riksbank's communication strategy, as it was initially intended (yet changed in 2008) not to give any further communication on monetary policy intentions through speeches in the intermeeting periods.[1]

Overall, there is a clear tendency to provide more information, and to do so in a much more timely fashion. Not only do central banks communicate more about their policy objectives (most prominently in the case of inflation targets) and their strategies, but the way central banks communicate their monetary policy decisions has also evolved considerably. In general, enhanced communication and transparency is widely argued by both policymakers and academics to have improved the effectiveness of monetary policy considerably.[2]

Whereas it is nowadays common practice to announce policy decisions immediately by means of a press release, central banks have adopted various approaches as to how policy decisions are *explained* to the public. One relatively recent approach has been the introduction of press conferences, where monetary policy decisions are explained in detail and journalists are given the chance to ask questions to the central bank officials.[3] Regular press conferences to explain monetary policy decisions are currently held by the central banks of the Czech Republic, Japan, New Zealand, Norway,

[1]On May 11, 2007, First Deputy Governor Irma Rosenberg declared the following: "Firstly, press conferences will in future be held after each monetary policy meeting, regardless of what decision has been taken. . . . By [. . .] holding press conferences after each monetary policy meeting the Riksbank will provide more detailed and more regular information on the considerations taken by the Executive Board." Moreover, she stated, "The Executive Board has come to the conclusion that there is not normally any reason to indicate how the repo rate will be set in speeches and press releases issued prior to the monetary policy meetings. Our assessment is that it is enough to signal our intentions clearly in connection with the seven monetary policy meetings held every year." (Rosenberg 2007)

[2]This point is stressed by a number of important studies—though this list is by no means exhaustive—including Blinder (1998), Bernanke (2004), Goodhart (2005), Issing (2005), Woodford (2005), and Reinhart and Sack (2006).

[3]With the notable exceptions of the Swedish and Swiss central banks, the introduction of regular press conferences dates back only to the turn of the millennium (Issing 2005).

Poland, Sweden, and Switzerland, as well as by the European Central Bank (ECB). An alternative approach has been to provide only a short statement on the decision on the meeting day, followed by the release of minutes, usually a few weeks later. This approach is currently employed in particular by the Bank of England and the Federal Reserve.

With a view to the ongoing reassessment of communication strategies of central banks, and having gained some experience with press conferences as a communication instrument, a first evaluation of their usefulness is now in order. This paper analyzes the case of the ECB's press conferences, which have been part of the ECB's communication tools right from the start of its monetary policy in January 1999. Following the rate-setting meetings of the ECB's decision-making body, the Governing Council, which typically take place on the first Thursday of each month, the ECB announces the monetary policy decisions at 13:45 (CET). Forty-five minutes later, at around 14:30, the ECB President and Vice-President hold a press conference (with the exception of one meeting in summer, where normally no press conference is held). It comprises two elements: a prepared introductory statement that contains the background considerations for the monetary policy decision, and a questions-and-answers (Q&A) part during which the President and the Vice-President are available to answer questions by the attending journalists.

The paper analyzes the ECB's experience from a financial-market perspective. We are interested in knowing to what extent press conferences systematically add relevant information to explain given decisions. The separation of the release of the decision from its explanation allows us to disentangle the effects of monetary policy decisions from those of the accompanying communication. Moreover, because the press conference is broadcasted, and reported upon in real time by financial-market newswire services, it is possible to trace the information flow to financial markets, and thus to separately analyze market reactions to the various types of information.[4] Finally,

[4]This stands in contrast to the information flow for many other central banks, where relevant information on the decisions, such as the minutes of the meetings, is released to the media with an embargo time. In these cases, newswire services prepare a set of news lines that are then released to the markets simultaneously as soon as the embargo time has elapsed. With this simultaneous arrival of news, it is not possible to test the relevance of the various parts of central bank communication.

the Q&A session provides an interesting tool of central bank communication. It gives journalists the opportunity in real time to digest the information provided through the decision and the introductory statement, to compare it with their own prior information, and to ask questions on those issues that need clarification. The analysis in this paper assesses under what circumstances the Q&A session is valuable to clarify issues and the overall message of the press conference.

The main findings of the paper can be summarized as follows. Overall, press conferences have systematically added information. In fact, the size of the market reaction to the press conference is on average substantially larger than the reaction to the policy decision itself, while the press conference at the same time exerts lower effects on market volatility. Moreover, the market reaction to the press conference is related to the characteristics of the decision: the less well a decision has been anticipated by the market, the stronger is the reaction to the introductory statement. This suggests that the statement contains relevant explanations for the reasons underlying the decision, which helps clarify the market participants' interpretation of the decision.

More specifically, the paper asks to what type of information and statements markets react during press conferences. It shows that statements made during the press conference containing a reference to inflationary developments are strong market movers. Furthermore, responses to questions regarding rate discussions at the Governing Council meeting have substantial effects on markets. Other statements—e.g., about the economic outlook, second-round effects, or money growth—are important as well, yet not as consistently as those about inflation and rate discussions.

Finally, the findings on the role of the Q&A session suggest that it does not systematically add information beyond that given in the introductory statement, but it appears to play a clarification role, in the sense that it triggers large financial-market reactions under specific circumstances. In particular, we find that markets are more likely to move in a different direction than in their reaction to the policy decision when there is a high degree of uncertainty among market participants about the state and outlook of the economy. Under situations of elevated macroeconomic uncertainty, the market response to the release of the monetary policy decision itself is

muted, suggesting that market participants wait for the clarification provided during the press conference. On the other hand, such directional changes are less likely to occur if the decision itself contains a lot of information (such as when it surprised markets or interest rates were changed).

By looking at financial-market reactions to the announcement of policy decisions and the surrounding communication, this paper is related to different strands of the literature. First, there are numerous studies that analyze market reactions to monetary policy decisions. Most of the work in this literature has focused on the Federal Reserve, though there is increasingly also work on other central banks, including the ECB.[5] This strand of research has reached a consensus that financial-market reactions to the release of monetary policy decisions are substantial.

Second, a number of recent papers analyze issues relating to central bank communication, reflecting the increased importance communication aspects have gained in the conduct of monetary policy over the last decades. Two recent contributions look at the intersection of the announcement of policy decisions and communication, as we do in this study. Gürkaynak, Sack, and Swanson (2005) decompose the policy surprises of Federal Open Market Committee (FOMC) decisions and show that they contain an element of surprise not only about the current decision but also about the future path of interest rates. Given the high degree of predictability of FOMC decisions in recent years, financial markets react predominantly to this "path surprise," which can furthermore be related to the existence of FOMC statements—i.e., communication surrounding the release of the policy decisions. A similar approach has been applied to study the ECB's case in Brand, Buncic, and Turunen (2006), who also find that it is less the announcement of the decision that contains information, but more the press conference that provides substantial new information to financial markets. The present paper shares this finding and goes further by decomposing the elements of the press

[5] Examples of studies on the Federal Reserve are Thornton (1998), Fleming and Remolona (1999), Kuttner (2001), Cochrane and Piazzesi (2002), Bomfim (2003), Ehrmann and Fratzscher (2004), Rigobon and Sack (2004), and Bernanke and Kuttner (2005). Studies covering the ECB are Gaspar, Perez-Quiros, and Sicilia (2001), Hartmann, Manna, and Manzanares (2001), and Ehrmann and Fratzscher (2003). A comparison for the two central banks is provided in Andersson (2008).

conference and by identifying the individual pieces of information to which markets react and which make the press conference constitute a clarifying communication tool.[6]

Another strand of the literature analyzes financial-market reactions to policy decisions and communication, both by committees (Kohn and Sack 2004; Andersson, Dillen, and Sellin 2006; Reeves and Sawicki 2007) and by individual committee members (Reinhart and Sack 2006; Ehrmann and Fratzscher 2007). Research on the role of minutes has emphasized the relevance of timeliness in communication. With the expedited release practices of both the Federal Reserve and the Bank of England, whereby the minutes are now made public prior to the subsequent meeting, financial-market reactions have strengthened considerably (Reinhart and Sack 2006; Reeves and Sawicki 2007). Some (though limited) work has been undertaken on understanding how the media digest information provided by central banks (de Haan, Amtenbrink, and Waller 2004; Berger, Ehrmann, and Fratzscher 2006).[7] Much of this literature analyzes the effect of monetary policy meetings and their announcements; however, to our knowledge the present paper is the first to look in detail—minute by minute and statement by statement—at the individual components of the ECB press conference.

The remainder of this paper is structured as follows. Section 2 provides a simple conceptual framework linking the reaction of financial markets to the information flow of policy decisions and communication. Section 3 presents the data underlying our analysis. Section 4 contains the discussion of the empirical results, together with various extensions and robustness checks. Section 5 focuses on the specific statements contained in the press conferences and analyzes how these have been priced into markets, while section

[6]A number of studies have constructed wording indicators to classify the content of the introductory statements of the ECB's press conferences (Berger, de Haan, and Sturm 2006; Heinemann and Ulrich 2007; Rosa and Verga 2007), showing that there have been significant changes in the tone and the message of these statements—in particular, with regard to the initial years of the ECB—and the effectiveness of certain code words and phrases.

[7]Related studies that focus on the overall role of transparency and communication for different central banks are Guthrie and Wright (2000) and Geraats (2002), or the impact of specific pieces of central bank and other news on financial markets (e.g., Fleming and Remolona 1999; Andersson, Overby, and Sebestyén 2009).

6 specifically investigates to what extent the Q&A part fulfills a clarification role. Finally, section 7 concludes.

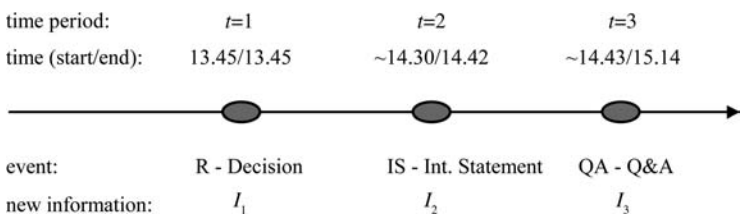
2. The Effect of Press Conferences on Asset Prices: A Simple Framework

This section offers a simple framework for understanding the flow of information on Governing Council meeting days and how this information can affect asset prices. More specifically, we want to sketch how the information that is provided through the three elements of the ECB monetary policy decision—the announcement of the decision, the introductory statement, and the Q&A part—may influence financial markets.

Figure 1 provides an illustration of the sequence with which the ECB provides information to financial markets on meeting days. The first piece of information is the decision itself (I_1), announced at 13:45 CET, which is followed by the introductory statement at 14:30 (I_2), and then finally the subsequent Q&A part of the press conference (I_3).

While these events occur at different points in time, it is important to note that they are not independent. To give an example, let us assume the Governing Council makes a decision that is somewhat unexpected by financial markets. This will imply that the news content in the release of the decision is relatively large. At the same time, knowing that this decision had not been perfectly predicted, the ECB may wish to provide an explanation for the surprising decision. More often than not, this will imply that in the introductory statement as well, the news content is relatively large. Contrasting

Figure 1. Timeline of ECB Monetary Policy Decision and Communication



this with a case where the decision is as expected—i.e., contains no news, such that the introductory statement most likely reaffirms the views of market participants as well—shows that one cannot exclude the possibility that the news content of the introductory statement depends on the news contained in the release of the decision. This endogeneity becomes even clearer in the case of the Q&A session, where the questions obviously are responsive to the earlier pieces of news. This can be formulated as follows: $I_2 = \phi_2(I_1)$ and $I_3 = \phi_3(I_1, I_2)$.

To understand how financial markets will respond to this flow of information, it is useful to think of the price of a financial asset p_t in a present-value setting, whereby it reflects agents' expectations of future fundamentals f_{t+i}: $p_t = (1-\theta)\sum_{i=0}^{\infty}\theta^i E_t(f_{t+i}|\Omega_t)$, with Ω_t as the information set at time t, E as the expectations operator, and θ as the discount factor. Given the short time window we are interested in during the announcement and press conference, we ignore the discount factor. By defining a vector f that contains the fundamentals of all future periods f_{t+i}, we can formulate a dynamic expression of the change of the asset price Δp_{t+1} as

$$\Delta p_{t+1} = E_{t+1}(f|\Omega_t, I_{t+1}) - E_t(f|\Omega_t) = \Delta E_{t+1}(f|\Omega_t, I_{t+1}), \quad (1)$$

in which the emergence of new information I_t is assumed to be the only factor inducing a price change at time $t+1$. Note that we assume that the vector of fundamentals does not change through the arrival of news—it is merely agents' expectations that are affected. This simplification assumption is also made on the basis of the short time window we are interested in.

In this framework, the response of asset prices to news depends on the way agents update their expectations about the underlying fundamental f. In the simplest case, this process can be described by a linear relationship,

$$\Delta p_{t+1} = \Delta E_{t+1}(f|\Omega_t, I_{t+1}) = \beta\ I_{t+1}, \quad (2)$$

the assumption usually applied in the literature on announcement effects.[8] Taking into account the three-tiered information flow on

[8]A similar model framework is provided in Faust et al. (2007).

the occasion of Governing Council meetings, this amounts to the following relationship:

$$\Delta p_{1,R} = \beta_1 I_1 + \varepsilon_1 \tag{3a}$$

$$\Delta p_{2,IS} = \beta_2 I_2(I_1, \varepsilon_1) + \varepsilon_2 \tag{3b}$$

$$\Delta p_{3,QA} = \beta_3 I_3(I_2, \varepsilon_2, I_1, \varepsilon_1) + \varepsilon_3. \tag{3c}$$

Equations (3a)–(3c) take into account the endogeneity of the information flow. Moreover, since we can measure the information I_t only imperfectly, we also include the unobserved information components ε_t in each step.

While simple, it might not be very realistic to assume that the updating of expectations is a linear function of the news. For instance, in the presence of a rather noisy information set, the implications of a news item on fundamentals might be less clear-cut, such that there is only a muted response to news. In that case, a more generalized setup can be imagined whereby the updating depends on the information set currently available.

The aim of this stylized framework is to illustrate the information flow and the updating of agents' expectations, as well as the corresponding movements of asset prices and trading activity. The next step is to identify the information components in the various steps of the ECB decision and its communication, to which we turn now.

3. Data

This section discusses the main data used in the empirical analysis—foremost, the three-month Euribor futures rates, the newswire, and other data on ECB press conferences, as well as the proxies for macroeconomic uncertainty.

3.1 Three-Month Euribor Futures

This paper analyzes the reaction of three-month Euribor futures to the communication on Governing Council meeting days, given the fact that this is the most traded money-market instrument on this occasion. We have obtained intraday data from Tick Data, Inc. The

prices are recorded as actual transaction prices on LIFFE on a tick-by-tick basis.[9] Because these observations are unequally spaced, we calculate price data on a minute-by-minute frequency by linear interpolation of the two tick prices immediately before and after the full minute (Andersen et al. 2003). For an analysis of trading activity, we furthermore obtain the number of ticks recorded within a given minute. In addition, although only as of July 2003, the data contains information on traded volumes, measured as the number of contracts (over €1 million each) traded.

The decision to calculate minute-by-minute data arises because this is the frequency at which we can obtain data on the news headlines by the financial newswires (described below). From the price data, we calculate returns as $r_t = 100 * [\ln(p_t) - \ln(p_{t-1})]$. An alternative measure for the market evolution would consist in the first difference of prices, as the implied futures rate i_t is derived from the quoted price by subtracting the latter from 100, such that $i_t - i_{t-1} = (100 - p_t) - (100 - p_{t-1}) = p_{t-1} - p_t$. The two measures are extremely similar, with a 1 percent return being roughly equivalent to a 100-basis-point decrease in the implied futures rate. Finally, we construct a measure of realized volatility based on Andersen et al. (2003) as the sum of the squared returns over the relevant time windows.[10]

As is well known, such high-frequency financial-market data are subject to intraday patterns and day-of-the-week effects, which will have to be controlled for in any subsequent analysis.

[9]Euribor futures contracts are based on an interbank rate, which is highly correlated with the ECB's policy rate. The data generally refer to the contract with the nearest maturity. The switch to the next maturity is done by a procedure that compares daily tick volumes for two adjacent contracts. It switches usually around three to five days before expiration of the contract with the nearest maturity, when daily tick volumes exceed those of the old contract. This procedure ensures maximum liquidity of the considered contracts. For more information, see http://www.tickdata.com.

[10]Choosing a length of the time window over which realized volatility is calculated, and the frequency of the underlying return data, is subject to a trade-off (Andersen et al. 2003). In our case, the minutely frequency of the return data is naturally given by the frequency of some of the explanatory variables. The time window over which we calculate realized volatility similarly arises naturally, through the length of the various parts of the press conference.

3.2 Monetary Policy Decisions and the Press Conference

Information on the ECB's monetary policy decisions and press conferences has been obtained from its web site. The taped versions of the press conferences on Bloomberg allow us to determine the length of the introductory statement and the Q&A session, respectively, for each press conference. Due to data availability, our sample starts with the press conference in July 2001; it ends with the conference in April 2006, such that our sample contains fifty-three observations. It is therefore important to keep in mind that results are based on a small sample. Table 1 provides a few summary statistics for the press conferences in our sample. It has lasted on average around forty-four minutes, with twelve minutes taken up by the reading of the introductory statement and thirty-two minutes for the Q&A session. On average, there are around sixteen questions asked in the Q&A session. However, all figures vary substantially over time. The number of questions posed, for instance, varies from eight on August 30, 2001, to thirty-one on June 5, 2003 (interestingly, both days on which policy rates were changed).

As we are inter alia interested in market reactions to individual statements made during the press conference, we extract the real-time reports (snaps) released on a commonly used newswire service, Reuters News. As the snaps are available from Reuters for thirteen consecutive months only, our sample starts only in September 2004.[11] Furthermore, the sample ends in July 2005 (note that

Table 1. Summary Statistics for the ECB's Press Conference

	Average	**Minimum**	**Maximum**
Length of Press Conference	43.77	26	72
Length of Introductory Statement	11.92	8	19
Length of Q&A Session	31.85	16	54
Number of Questions during Q&A Session	16.36	8	31

Note: Statistics based on fifty-three press conferences from July 2001 to April 2006.

[11] Alternative sources like Bloomberg or Market News International provide these data for considerably shorter periods only.

no press conferences are held in August), in order to restrict the analysis to a relatively homogeneous time sample—namely, a period where markets did not expect any immediate changes in policy rates.

As an illustration, table 7 in the appendix provides the snaps released on Reuters during the press conference in November 2004. Each snap consists of a brief statement, reporting about the main points made during the press conference. Importantly for our purposes, the time stamp is available for each snap, such that we know the exact minute at which the information reaches the markets. We distinguish the snaps according to their content, differentiating between statements on the economic outlook, inflation, second-round effects, money growth, and interest rates.[12] The latter classification was chosen for statements that relate directly to the discussion on policy rates in the Governing Council. Such statements are never made during the introductory statement but are sometimes made in response to a question (such as whether a rate decision was made unanimously or whether the Governing Council has discussed all options—i.e., increasing, decreasing, maintaining interest rates, etc.) during the Q&A session. From the snaps, we construct a time series for each of the content categories, which is equal to one in any minute where an according snap is recorded on Reuters, and equal to zero otherwise.

A number of caveats of this methodology should be emphasized. First, newswire services may wrongly report or misinterpret a statement. However, as our objective is to assess communication from the perspective of financial markets, it is important to analyze the information market participants actually receive. Second, there are a number of newswire services that report in real time, and the press conference is furthermore televised. Accordingly, financial-market

[12]Our data set contains 530 snaps. Of these, 483 have an economic content (as opposed to snaps reporting that the ECB President opens the press conference or the Q&A session, or snaps related to topical issues other than monetary policy or the economic developments, such as central bank gold sales). Our classification covers two-thirds of the statements with economic content. Snaps not covered relate, for instance, to global imbalances or fiscal policy. Their inclusion does not alter the results of our econometric analyses.

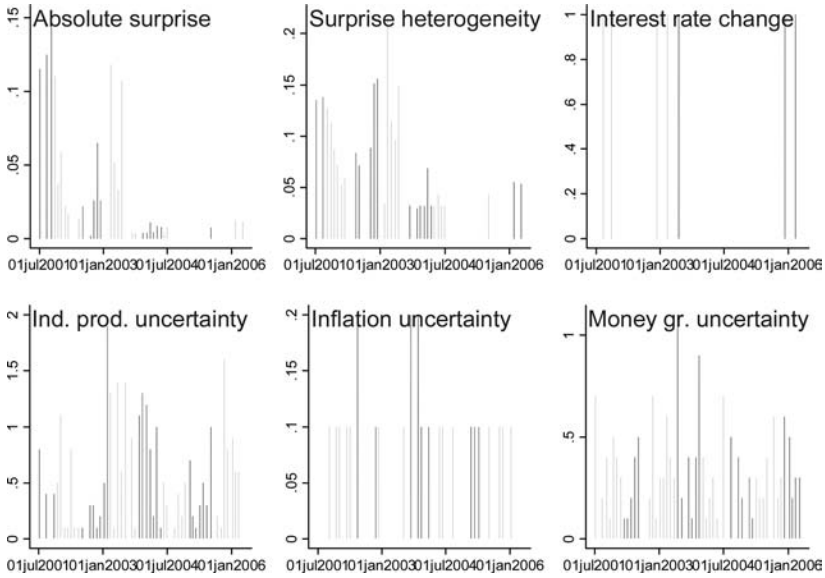
participants might receive different information, depending on their source. However, a comparison of the snaps released by Reuters, Bloomberg, and Market News International shows no major differences with respect to their timing and content. Furthermore, the delay in newswire reports relative to the televised version is minimal. Finally, to ensure that we are measuring the effect of the ECB's communication, rather than other news, we control for the market reaction to the release of U.S. jobless claims figures, which occurs at 14:30 on Thursdays. We do so by calculating the surprise component contained in the released figures as the actual release minus market expectations measured through the median response of a Bloomberg survey among market participants.

Finally, we are interested in obtaining measures that characterize a given policy decision. First, we obtain information on the decision from the ECB web site, and define a dummy variable that is equal to one when interest rates have been changed, and to zero otherwise. Furthermore, for a measure of the surprise component contained in a decision, we employ the results of a Reuters survey among market participants, which is conducted a few days prior to the Governing Council meeting. The surprise component in the decision is constructed as the difference between the decision and the mean response in the survey. Of interest in our analysis is the absolute value of this surprise component. The second proxy for the surprise relates to the heterogeneity in expectations across market participants. For that purpose, we calculate the standard deviation of expectations across individual analysts participating in the Reuters survey. As shown in figure 2, this measure of heterogeneity in market expectations is highly positively correlated with the absolute surprise. In order to obtain uncorrelated regressors for our econometric analyses, we obtain the residuals of a regression of the absolute surprise on the heterogeneity measure, estimated in a simple OLS regression.

3.3 Macroeconomic Uncertainty

The final type of data used in this paper (also shown in figure 2) relates to macroeconomic uncertainty, as we are interested in the effects of the press conference conditional on the macroeconomic

Figure 2. Data on Characteristics of Monetary Policy Decisions and Macroeconomic Uncertainty



Note: The figure shows data on characteristics of monetary policy decisions and macroeconomic uncertainty, with the latter measured as the absolute difference between the latest macroeconomic release prior to a Governing Council meeting and the corresponding market consensus (derived as the median response of a Bloomberg poll among financial-market analysts a few days prior to the release). Sample period: July 2001 to April 2006.

environment.[13] However, macroeconomic uncertainty is obviously hard to measure. Our proxy makes use of the surprise component in macroeconomic releases for euro-area industrial production, HICP inflation, and money growth by subtracting the announced figures from market expectations (as measured by the median response in corresponding Bloomberg surveys). For each of these variables,

[13]Gropp and Kadareja (2006) show that stock market reactions to news depend on the quality of public information. With lower-quality public information, the stock market reacts with more volatility to news, suggesting that better public information lowers the extent to which traders differ in their interpretation of new information. In a similar vein, we might expect that the market response to a monetary policy decision is affected by the degree of macroeconomic uncertainty.

we obtain the latest release that occurred prior to a Governing Council meeting and use the surprise component contained therein as our measure of macroeconomic uncertainty at this point in time.

4. The Effect of the ECB's Meeting-Day Communication

We start by estimating the relevance of the ECB's meeting-day communication by comparing market developments on meeting days to nonmeeting days (section 4.1) before turning to the specific market reactions to the individual components of ECB decisions and communications (section 4.2).

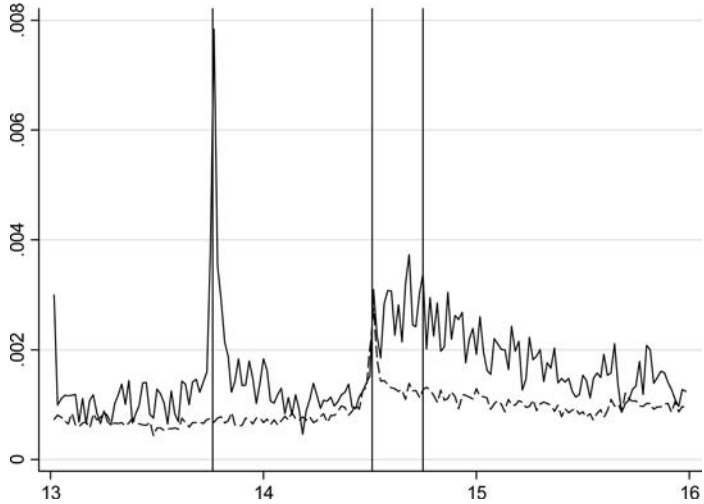
4.1 Relevance for Financial Markets

Figures 3–5 illustrate how the three-month Euribor futures market behaves on the days of the ECB's Governing Council meetings. For each minute from 13:00 to 16:00, the solid lines show the average absolute return (figure 3), the average number of ticks (figure 4), and the average volume traded (figure 5) on days of ECB Governing Council meetings and press conferences. For a comparison, the same statistics, measured on Thursdays without Governing Council meetings, are shown by the dashed line.[14]

A number of interesting facts are apparent from the figures. First, there are clear intraday patterns in market behavior. On both ECB meeting days and other Thursdays, market activity picks up considerably in the afternoon, which coincides with the opening of the U.S. markets. In particular, the weekly release of U.S. jobless claims at 14:30 leads to a spike in absolute returns, ticks per minute, and traded volume alike. Second, the effects of the release of the monetary policy decision at 13:45 and of the press conference, which starts at around 14:30, are also clearly discernible. Market activity rises considerably at 13:45 and remains elevated for a considerable period of time. Just before the start of the press conference, market

[14]Days with a Governing Council meeting but without a press conference are excluded from the calculation of both lines shown in the figures. The comparison group is calculated for Thursdays exclusively in order to avoid the possibility that day-of-the-week patterns in financial-market behavior affect their properties.

Figure 3. Average Absolute Returns on Press Conference Days versus Thursdays without Governing Council Meetings

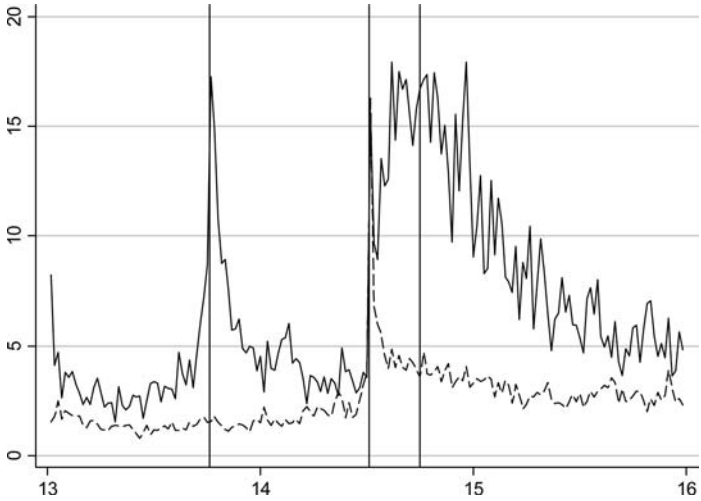


Note: The figure shows average absolute returns per minute in three-month Euribor futures, on days with a press conference (solid line) versus benchmark Thursdays without Governing Council meetings (dashed line), for a time window from 13:00 to 16:00. Vertical lines show the time of the release of the decision, the start of the press conference, and the average start of the Q&A session. Sample period: July 2001 to April 2006.

activity is roughly back to normal. The effects of the press conference appear in the data a couple of minutes after 14:30. This is to be expected, not only because the press conference sometimes starts with a slight delay, but also because it does not immediately start with information to which a market reaction should be expected: the ECB President first welcomes all participants, often informs about the attendance at the Governing Council meeting (e.g., if the president of the Ecofin has attended), and starts by reiterating what decision has been made at the meeting, which is of course known to markets since 13:45.

Beyond this graphical inspection, table 2 reports the outcome of some statistical tests. Absolute returns, ticks per minute, realized

Figure 4. Average Number of Ticks per Minute on Press Conference Days versus Thursdays without Governing Council Meetings

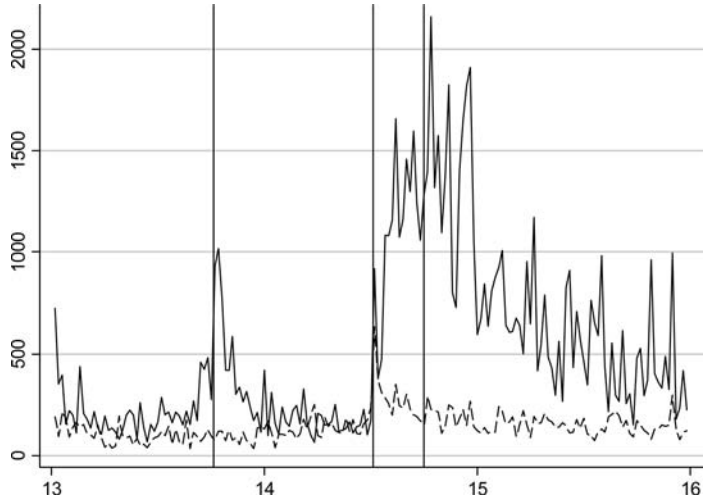


Note: The figure shows average ticks per minute in three-month Euribor futures, on days with a press conference (solid line) versus benchmark Thursdays without Governing Council meetings (dashed line), for a time window from 13:00 to 16:00. Vertical lines show the time of the release of the decision, the start of the press conference, and the average start of the Q&A session. Sample period: July 2001 to April 2006.

volatility (calculated per minute, as the length of time windows differs), and volume are compared for different time windows on press conference days and on benchmark Thursdays without Governing Council meetings through simple mean comparison tests. The first column compares market reactions to the release of the monetary policy decision in a ten-minute window—i.e., from 13:45 through 13:54—with market developments in the control window on non-meeting days.[15] The second column compares the market activity during the reading of the introductory statement—based on averages for starting time and length, as recorded on Bloomberg, namely from

[15] All results related to the effect of the release of the decision in this paper will be based on this ten-minute window; none of the results is affected significantly when extending this time window.

Figure 5. Average Volume Traded per Minute on Press Conference Days versus Thursdays without Governing Council Meetings



Note: The figure shows the average volume traded per minute in three-month Euribor futures, on days with a press conference (solid line) versus benchmark Thursdays without Governing Council meetings (dashed line), for a time window from 13:00 to 16:00. Vertical lines show the time of the release of the decision, the start of the press conference, and the average start of the Q&A session. Sample period: July 2001 to April 2006.

14:32 through 14:43—with a control window on nonmeeting days. The third column provides estimates of the effect of the Q&A session. As the length of the Q&A sessions varies substantially (see table 1), often covering various topics unrelated to monetary policy toward the end, we decided to cut off the analysis after fifteen minutes. Such an approach also seems justified by the financial newswire coverage of the press conference: snaps typically become less frequent toward the end of the press conference. Finally, the fourth column shows market reactions for the combined introductory statement and Q&A session.

All four tests—for returns, tick numbers, volatility, and volume—clearly show evidence for substantially increased market activity on meeting days, with all differences being significant at the 99 percent

Table 2. Market Effects of the ECB's Press Conference

	Release of Decision			**Intr. Statement**			**Q&A**			**Entire Press Conference**		
	Actual	Control	Diff.	Actual	Control	Diff.	Actual	Control	Diff.	Actual	Control	Diff.
Absolute Return	0.006	0.002	***	0.012	0.004	***	0.010	0.004	***	0.018	0.006	***
Ticks per Minute	9.051	1.413	***	14.980	4.806	***	14.173	3.755	***	14.522	4.222	***
Realized Volatility	0.329	0.021	***	0.191	0.055	***	0.161	0.047	***	0.173	0.051	***
Volume per Minute	513.422	92.014	***	1210.451	265.961	***	1308.326	198.638	***	1278.749	228.559	***

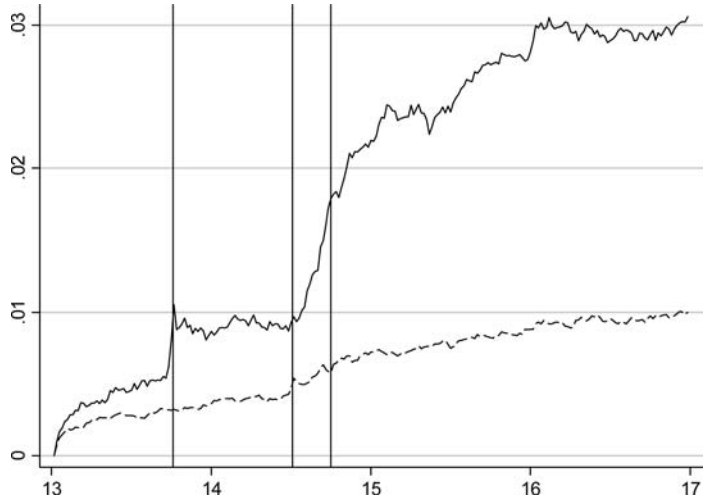
Note: All figures are calculated for the actual time windows of ECB communication ("Actual") and a corresponding control time window on non-announcement days ("Control"). "Difference" represents results for tests of equality. "Release of the Decision" relates to the ten minutes following the release of the ECB's monetary policy decisions, and a time window from 13:45 through 13:54 on non-announcement Thursdays. Figures calculated for the various parts of the press conference are compared with a time window on other Thursdays, from 14:32 through 14:43 for the introductory statement, and from 14:44 through 15:58 for the Q&A session. *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively.

level (as indicated by the stars in the column labeled "Diff."). Moreover, an important stylized fact is that the market reaction to the entire press conference is substantially higher than the market reaction to the announcement of monetary policy decisions. On average, the absolute return reaction to the whole press conference is about three times stronger than the market reaction to the announcement of the policy decision. The figures in column 1 are significantly larger than those in column 4 at the 1 percent level for absolute returns and ticks per minute, and at the 5 percent level for volume. While being an important market mover, it is striking that the effect of the press conference is digested by financial markets in a relatively smooth fashion. A comparison of the realized volatility measures shows that the large effect of the press conference occurs with only half of the volatility compared with the release of the decision (statistically significantly smaller at the 6 percent level). These results underscore the importance of the press conference as a central source of information.

To assess the news content contained in the ECB's communication on Governing Council meeting days, figure 6 shows the price movements in three-month Euribor futures on meeting and nonmeeting days. Prices are normalized at 0 at 13:00, and their absolute level relative to the price at 13:00 is plotted for the subsequent four hours. There is clear evidence that prices move by substantially more on meeting days, and that the movements are highly persistent. A jump in prices is observed on the occasion of the release of the decision; prices remain basically flat thereafter until the beginning of the press conference, then continue moving in the same direction of the initial jump until around 16:00, after which they once more remain basically flat.

There is therefore clear evidence that the release of monetary policy decisions and the ensuing press conference are considered relevant by financial-market participants, and that substantial amounts of news are priced into the markets on Governing Council meeting days. Furthermore, the magnitude of the effect is sizable. The average absolute return, for instance, rises by a factor of around 3 relative to Thursdays without Governing Council meetings. The volume of trade increases by even more—both the number of ticks per minute and volume increase by a factor of around 6 during the release

Figure 6. Price Movements in Three-Month Euribor Futures Contracts on Press Conference Days versus Thursdays without Governing Council Meetings



Note: The figure shows the average evolution of prices of three-month Euribor futures compared with the level of prices pertaining at 13:00, in absolute terms, on days with a press conference (solid line) versus benchmark Thursdays without Governing Council meetings (dashed line), for a time window from 13:00 to 17:00. Vertical lines show the time of the release of the decision, the start of the press conference, and the average start of the Q&A session. Sample period: July 2001 to April 2006.

of the monetary policy decision compared with non-announcement days. Moreover, press conferences appear to be a substantial market mover—even more so than the announcements of monetary policy decisions themselves—while at the same time leading to relatively little market volatility given the magnitude of the observed market moves.

4.2 Determinants of Market Reactions

Having seen that markets react strongly to the ECB's communication, we want to understand better what factors determine market reactions to the different communication events on Governing Council meeting days. In the search for these determinants, we attempt

to explain the absolute returns,[16] ticks per minute, and market volatility as observed on the fifty-three meeting days by a number of factors, in a regression model of the type

$$y_{R,t} = \alpha_{1,R} + \sum_i \beta_{i,R} x_{i,t} + \sum_j \gamma_{j,R} c_{j,t} + \varepsilon_{R,t} \tag{4a}$$

$$y_{IS,t} = \alpha_{1,IS} + \sum_i \beta_{i,IS} x_{i,t} + \sum_j \gamma_{j,IS} c_{j,t} + \delta_{1,IS} \hat{\varepsilon}_{R,t} + \varepsilon_{IS,t} \tag{4b}$$

$$y_{QA,t} = \alpha_{1,QA} + \sum_i \beta_{i,QA} x_{i,t} + \sum_j \gamma_{j,QA} c_{j,t} + \delta_{1,QA} \hat{\varepsilon}_{R,t} + \delta_{2,QA} \hat{\varepsilon}_{IS,t} + \varepsilon_{QA,t}, \tag{4c}$$

where y is average absolute returns, average ticks per minute, or market volatility, as measured over the relevant time windows for the release of the decision (y_R, 13:45–13:54, equation (4a)), for the introductory statement (y_{IS}, equation (4b)), and for the Q&A session (y_{QA}, equation (4c)), respectively. t denotes the day of a Governing Council meeting, such that $t = 1, \ldots, 53$. When modeling the average number of ticks per minute, we include a time trend to allow for increasing market depth for this variable (which does not enter significantly in the other models and is therefore not included elsewhere).

The models contain three types of explanatory variables. First, we include proxies for the informational content—akin to I_1 in the simple framework of section 2—of the release of the decision, summarized in the terms $\sum_i \beta_i x_{i,t}$, which relate to the characteristics of the decision itself. Second, as discussed in section 2, we allow for an effect of the unexplained parts of the market reaction to the policy decision $\hat{\varepsilon}_{R,t}$ on the market behavior during the introductory statement and Q&A part, as well as for an effect of the unexplained part of the introductory statement $\hat{\varepsilon}_{IS,t}$ on the market during the Q&A session. Again, we see these as proxies for the informational content of the various announcements.

[16]Note that we are analyzing the response of the *absolute* returns, rather than returns, mainly because some of the explanatory variables are unsigned by definition.

Finally, we control for the degree of market uncertainty before the decision, proxied by realized volatility from 10:00–13:00 in the morning of Governing Council meeting days and by the degree of macroeconomic uncertainty. These variables are denoted as controls $c_{j,t}$.

The regression results are reported in table 3. Turning first to the *characteristics* of the policy decisions, it is clear that markets react more to the release of the decision the larger the surprise component in a given decision (first set of results in the three panels of table 3). This has to be expected, as a more surprising decision contains more news, and this requires a stronger market adjustment. Heterogeneity in market expectations does not appear to exert any effect on absolute returns, whereas it affects the number of trades exercised after the release of the decision. Heterogeneity in expectations around a certain mean (which the model has controlled for by means of the surprise component contained in the decision) does not increase the *average* news component of the decision; it only implies that more individual market participants will have to rebalance their market positions. The results are in line with this reasoning. Finally, market activity is furthermore rising in the case of changing policy rates, without any further effect on absolute returns or market volatility. The effects are relatively sizable. A one-standard-deviation increase in the size of the absolute surprise leads to 4.7 more ticks per minute (an increase of more than 50 percent of the average 9 ticks per minute recorded in table 2); a one-standard-deviation increase in market heterogeneity leads to around 4 extra ticks (a 44 percent increase).

While several of the explanatory variables are significantly estimated in model (4a)—i.e., for the market reaction to the release of the decision—only a few explanatory factors emerge for the press conference, i.e., the introductory statements and the Q&A sessions (see second and third set of results in table 3). In particular, average absolute returns and market volatility during the introductory statement depend on the magnitude of the surprise component contained in a monetary policy decision—the larger this component, the bigger is the market reaction during the introductory statement. This is in line with the hypothesis that the news content of the introductory statement is endogenous with regard to the news content of the decision—in case of a surprise, explanations are provided to the

Table 3. Determinants of the Market Effects of the ECB's Press Conference

	Release of Decision				Introductory Statement				Q&A			
	Actual		Control		Actual		Control		Actual		Control	
Absolute Return	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Proxies for News Content												
Characteristics of the Decision												
Absolute Surprise	0.095**	0.036	—		0.081***	0.027	—		0.092	0.056	—	
Surprise Heterogeneity	−0.005	0.033	—		0.037	0.037	—		0.052	0.062	—	
Interest Rate Change	0.001	0.004	—		−0.003	0.004	—		−0.009	0.006	—	
Residuals												
Release of Decision	—		—		0.786***	0.220	−0.088	0.160	−0.063	0.165	0.331**	0.132
Introductory Statement	—		—		—		—		0.284**	0.112	0.126**	0.057
Proxies for Uncertainty												
Prior Realized Volatility	0.019	0.048	0.017	0.012	0.023	0.044	0.071	0.044	0.034	0.034	0.085***	0.027
Macro Uncertainty												
Industrial Production	−0.001	0.002	0.000	0.000	0.002	0.003	0.001	0.001	0.000	0.004	−0.001	0.001
Inflation	−0.040***	0.011	0.003	0.003	0.049**	0.024	0.005	0.007	−0.048	0.032	−0.009	0.006
Money Growth	0.001	0.005	−0.001	0.001	0.004	0.005	−0.003	0.002	−0.008	0.005	0.001	0.001
# of Observations	53		188		53		188		53		188	
R-Squared	0.398		0.024		0.350		0.069		0.167		0.057	
Control: Time Trend	No		No		No		No		No		No	

(continued)

Table 3. (Continued)

	Release of Decision				Introductory Statement				Q&A			
	Actual		Control		Actual		Control		Actual		Control	
Ticks per Minute	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Proxies for News Content												
Characteristics of the Decision												
Absolute Surprise	116.870***	23.499	—		49.160	44.039	—		110.825	79.616	—	
Surprise Heterogeneity	132.662***	28.280	—		25.986	39.142	—		50.044	71.901	—	
Interest Rate Change	6.803***	2.293	—		6.257	5.674	—		−0.265	6.438	—	
Residuals												
Release of Decision	—		—		0.969**	0.362	0.222	0.144	0.875***	0.224	0.265*	0.145
Introductory Statement	—		—		—		—		0.592***	0.145	0.367***	0.084
Proxies for Uncertainty												
Prior Realized Volatility	−11.759	20.197	11.069	6.838	−33.676	59.239	60.090***	17.640	−36.721	53.307	55.628***	11.553
Macro Uncertainty												
Industrial Production	0.948	1.377	−0.140	0.237	−0.942	2.521	0.842	0.744	−2.472	3.168	0.155	0.473
Inflation	−30.231***	9.174	0.643	2.763	22.502	21.777	4.432	6.055	−34.217	21.894	−0.880	3.899
Money Growth	−5.137*	2.786	0.452	0.432	4.072	5.710	−1.550	1.402	0.989	5.415	−0.181	0.844
# of Observations	53		188		53		188		53		188	
R-Squared	0.764		0.022		0.370		0.086		0.526		0.323	
Control: Time Trend	Yes		Yes		Yes		Yes		Yes		Yes	

(continued)

Table 3. (Continued)

	Release of Decision				Introductory Statement				Q&A			
	Actual		Control		Actual		Control		Actual		Control	
Realized Volatility	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**	**Coef.**	**Std. Err.**
Proxies for News Content												
Characteristics of the Decision												
Absolute Surprise	12.203***	3.772	—		1.291*	0.728	—		0.115	0.818	—	
Surprise Heterogeneity	1.233	3.329	—		1.375	0.932	—		1.035	1.147	—	
Interest Rate Change	0.477	0.376	—		−0.050	0.094	—		−0.028	0.103	—	
Residuals												
Release of Decision	—		—		0.175*	0.101	0.261	0.226	−0.001	0.047	0.198	0.162
Introductory Statement	—		—		—		—		0.269*	0.154	0.282***	0.076
Proxies for Uncertainty												
Prior Realized Volatility	−0.668	1.292	0.319***	0.101	−0.160	0.879	1.395***	0.421	0.714	1.204	1.527**	0.694
Macro Uncertainty												
Industrial Production	0.031	0.159	−0.006*	0.003	0.009	0.065	−0.001	0.007	−0.080	0.078	−0.014	0.009
Inflation	0.213	0.722	0.015	0.030	0.340	0.431	−0.028	0.075	−0.582	0.538	−0.012	0.091
Money Growth	−0.690	0.484	0.009	0.007	0.193	0.167	−0.013	0.023	0.021	0.091	−0.018	0.027
# of Observations	53		188		53		188		53		188	
R-Squared	0.542		0.091		0.344		0.200		0.093		0.107	
Control: Time Trend	No		No		No		No		No		No	

Notes: Results are based on estimation of model (4a)–(4c), using three-month Euribor futures. *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively.

public for the reasons behind the given decision. Interestingly, there is no further relationship between the size of the surprise and market reactions during the Q&A session, which could indicate that the explanations in the introductory statement have provided sufficient information to the public, such that no further need for clarification in that respect arises during the Q&A session.

Furthermore, returns, trading activity, and realized volatility are mostly significantly related to the unexplained component of the release of the decisions—i.e., the residuals $\hat{\varepsilon}_{R,t}$—suggesting that large market moves in reaction to the release of the monetary policy decision are generally also followed by large moves during the press conference. Again, this is in line with the idea that lots of news in one part of the event chain is followed by lots of news in the other parts.

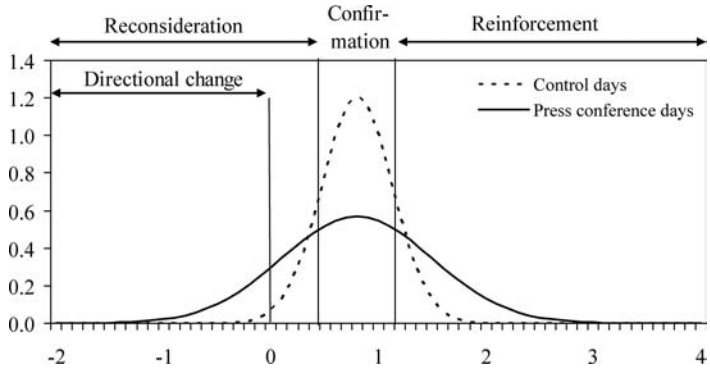
Finally, table 3 shows that while prior market volatility does not affect the market reactions to ECB decisions and to press conferences, the degree of macroeconomic uncertainty does. With increasing uncertainty about inflation developments in particular, the market reaction to the release of monetary policy decisions becomes muted, a pattern not observed on days without press conferences. The effects imply that a one-standard-deviation increase in the size of uncertainty about inflation leads, e.g., to a reduction by 1.8 ticks (roughly 20 percent of the average number of ticks recorded).

5. The Clarification Objective of the Q&A Session

An interesting feature of the ECB's press conference is its Q&A session, which provides journalists with an opportunity to ask clarification questions, whereby the news content is clearly endogenous relative to the previous communication events. This section analyzes whether there is indeed evidence for such a clarification role, and under what conditions.

Our empirical approach is based on the following considerations. In the absence of a counterfactual—i.e., an estimate of how financial markets would have evolved after the reading of the introductory statement, but without a subsequent Q&A session—we assume that market developments tend to be persistent, as it takes time until the arrival of earlier information (in our case, the information provided through the introductory statement) is correctly priced (see,

Figure 7. Stylized Description of Market Movements with and without Arrival of New Information



Note: The figure plots hypothetical distributions of the autoregressive coefficient of market movements under two scenarios: (i) the absence of new information (dotted line) and (ii) the arrival of new information (solid line). In both cases, the mean coefficient stands at 0.8, indicating the persistence of market movements across subsequent time windows. With the arrival of new information, market developments are more likely to deviate from this coefficient. Market movements in the vicinity of 0.8 suggest that the new information has roughly confirmed previous information. Substantially larger coefficients point to reinforcing information, as market movements continue in the same direction, yet are strengthened. Substantially smaller coefficients arise if the new information corrects earlier information, leading to a weakening of market moves or even directional changes (with autoregressive coefficients below 0).

e.g., Evans and Lyons 2005). Once new information arrives (in our case, the information contained in the Q&A session), earlier market moves can either be confirmed, reinforced, or reconsidered. For the latter case, the trend movements can either weaken while continuing in the same direction or they can change direction. These possibilities are depicted in a stylized fashion in figure 7. As is clear from the figure, both "reinforcement" and "reconsideration" become more likely with the arrival of new information. For testing purposes, the relevant question is where to locate the dividing lines between "confirmation," "reinforcement," and "reconsideration." In the absence of a clear prior on the location of these lines, the most objective criterion is the dividing line between directional changes and continuations of the direction of earlier market moves. Our hypothesis

is therefore that a clarification role of the Q&A session should lead to more frequent directional changes.

As a starting point, table 2 shows that, on average, market movements initiated during the introductory statement are continued during the Q&A session, as the absolute return measured over the entire press conference is substantially larger than during the introductory statement (0.018 versus 0.012). A mean comparison test shows that this difference is statistically significant, with a p-value of 0.05. However, at the same time, it is also apparent that there are instances where the market movement during the introductory statement does change direction, as the sum of the absolute return during the introductory statement and during the Q&A session (0.012 and 0.010) add up to more than the absolute return during the entire press conference (0.018). Importantly, the equivalent test for non-press-conference days gives a different picture, where absolute returns during the control window for the entire press conference are bigger than during the control window for the introductory statement with a p-value of 0.01. This suggests that there is less variance on non-press-conference days, or in other words that there are fewer cases of a directional change.

Table 4 provides a more direct comparison. It calculates the relative share of directional changes. On control days, this occurs consistently in less than 50 percent of all cases, suggesting that market movements are indeed somewhat persistent. By comparison, on press conference days, directional changes are more likely. In 60 percent of all cases, the market move following the release of the decision tends in the opposite direction than the move during the Q&A session, which is significantly larger than the corresponding number on control days (namely 44 percent), at the 95 percent significance level.[17]

Taken together, this evidence is in line with the hypothesis that the Q&A session fulfills a clarification role, as (i) the *size* of market movements is significantly larger during Q&A sessions than during comparable times and (ii) the *direction* of movements is significantly different, as the higher likelihood of directional changes indicates.

As the next step, we want to know under which circumstances this clarification objective is particularly useful. In other words, we

[17]Note, however, that this number is insignificantly different from 50 percent.

Table 4. Probability of Directional Changes

	Actual	**Control**	**Difference (p-value)**
Introductory Statement vs. Release of Mon. Policy Decision	0.472	0.466	0.473
Q&A vs. Release of Mon. Policy Decision	0.604	0.444	0.020
Q&A vs. Introductory Statement	0.491	0.406	0.140

Note: All figures are calculated for the actual time windows of ECB communication ("Actual") and a corresponding control time window on non-announcement days ("Control"). "Difference" represents the p-value of the test of equality.

would like to identify the determinants of directional changes. To conduct such an analysis, we create a discrete dummy variable that is equal to one in the case of a directional change. We model this variable (for which we have fifty-three observations) by means of a probit specification, containing the same regressors as model (4a)–(4c) above.

Table 5 provides the corresponding results. Positive parameters raise the probability that the dependent variable equals one, i.e., that a directional change has occurred. The table reports marginal effects, i.e., the change in the probability for an infinitesimal change in each independent variable (or the discrete change in the probability for dummy variable), evaluated at the mean of the independent variables.

As to the characteristics of policy decisions, the empirical results indicate that for decisions with large informational content (such as in the case of an interest rate change, as well as for large surprises), markets are less likely to change their direction during either the Q&A session or the introductory statement. In a similar fashion, strong market moves in response to the release or the introductory statement are also less likely to be corrected during the Q&A session, as can be seen from the negative coefficients estimated for the various residuals. These findings are revealing, as they suggest that there is less need for a fundamental clarification following communication that contains a lot of information.

Turning to the role of market and macroeconomic uncertainty, the results suggest that the market reactions during Q&A sessions

Table 5. Determinants of Directional Changes

	Intr. Statement vs. Release of Decision				Q&A vs. Release of Decision				Q&A vs. Intr. Statement			
	Actual		Control		Actual		Control		Actual		Control	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Proxies for News Content												
Characteristics of the Decision												
Absolute Surprise	−6.472**	2.811	—		−7.542***	2.108	—		−1.965	2.254	—	
Surprise Heterogeneity	1.096	2.455	—		1.927	2.630	—		−3.743	3.038	—	
Interest Rate Change	−0.029	0.246	—		−0.739***	0.087	—		−0.175	0.228	—	
Residuals												
Release of Decision	−60.864***	15.573	−32.610**	14.592	−49.898***	17.905	−24.074*	13.784	−9.620	11.619	22.814*	13.141
Introductory Statement	—		—		−18.969*	10.406	6.501	6.104	−29.766***	10.031	−5.076	7.201
Proxies for Uncertainty												
Prior Realized Volatility	−4.754	3.339	1.401	1.850	3.849	4.400	1.341	1.798	−2.672	3.793	−0.464	1.743
Macro Uncertainty												
Industrial Production	−0.049	0.166	0.019	0.082	0.453**	0.178	−0.118	0.083	0.613***	0.203	−0.138*	0.080
Inflation	0.668	1.454	0.359	0.624	2.871*	1.611	−0.165	0.644	0.741	1.430	−0.395	0.641
Money Growth	1.593***	0.466	−0.124	0.166	1.002***	0.400	0.023	0.161	0.100	0.374	0.082	0.161
# of Observations	53		188		53		188		53		188	
Pseudo R-Squared	0.380		0.026		0.484		0.025		0.270		0.029	

Notes: Results are based on estimation of model (4a)–(4c), using three-month Euribor futures, but with a discrete dependent variable, taking the value of one if the returns during two elements of the ECB's communication have a different sign, and zero otherwise. *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively.

and introductory statements are more likely to lead to a market reversal in the presence of large macroeconomic uncertainty. The probability of market reversals is particularly elevated when comparing market movements in response to the decision and the Q&A session, highlighting that the Q&A session can serve as a useful tool for markets to clarify their opinions on the earlier decision. Importantly, no such pattern is found on control days, where macroeconomic uncertainty generally does not exert any effect on the probability of a reversal. The only exception suggests that, if anything, reversals are even less likely on non-press-conference days in the presence of macroeconomic uncertainty.

In sum, this section shows that holding a Q&A session gives the public the chance to ask clarifying questions, which appears to be especially relevant if there is large uncertainty about the macroeconomic environment in which monetary policy is operating.

6. Real-Time Effects of Press Conference Statements

The preceding sections have shown that the press conference contains valuable information for financial markets. But what is this additional information that is provided during press conferences, or more specifically, to what type of statements do financial markets react? To investigate these questions, the structure of the press conference is particularly helpful, as newswire services report in real time or market participants directly watch the broadcast of the press conference while at their trading desks. This allows us to trace the information flow and thus to investigate to what type of statements financial markets react predominantly.[18]

Table 7 in the appendix gives an impression about the way financial newswires report about the press conference. Because the snaps are recorded along with a time stamp, it is possible to identify the timing of the information flow. As mentioned in section 2, we distinguish the snaps according to their content, differentiating between

[18]This stands in contrast to the release of minutes or a press statement on the central bank's web site. As this is usually done through previous circulation to the press, albeit with an embargo time, financial newswires tend to prepare a number of snaps, which are then delivered simultaneously as soon as the embargo time has elapsed.

statements on the economic outlook, inflation, second-round effects, money growth, and interest rates. We create one time series for each of these categories; if a statement is classified accordingly, the time series for the corresponding category is allocated a "1" in the minute of the time stamp recorded by Reuters. For all other minutes, the variable is equal to zero. Our intention is to analyze the reaction of absolute returns, ticks per minute, and traded volumes to these variables. For that purpose, we will allow for at least one lag: if a Reuters snap is released toward the end of the minute, markets are most likely not reacting to this snap within this same minute. Hence, even under the assumption of near-instantaneous market responses, allowing for a lag is essential.

We include data from 14:30 to 15:45—i.e., the relevant time window for the press conference—and estimate the model for all Thursdays in the sample period, i.e., from September 2004 to July 2005. Finally, given the intraday patterns in the Euribor market (as seen in figures 3–5), it is essential to control for the time of day in such an analysis. Therefore, the regression model does include time dummies for each minute of this time window. The model is estimated as

$$y_t = \alpha + \sum_i (\beta_{1,i} x_{i,t} + \beta_{2,i} x_{i,t-1}) + \beta_{1,jobless} x_{jobless,t} + \beta_{2,jobless} x_{jobless,t-1} + \delta_t + \varepsilon_t, \quad (4)$$

where y_t denotes minute-by-minute absolute returns, number of ticks, or volume traded. $x_{i,t}$ denotes the variables for the different statement categories i as described above. $x_{jobless,t}$ stands for the absolute surprise component in the release of U.S. jobless claims at 14:30, measured by the difference between the released value and the median response in the Bloomberg survey. Finally, δ_t denotes a full set of time dummies, covering each minute from 14:30 to 15:45. The inclusion of a lag of the dependent variable does not alter the results in terms of significance of the estimated β-parameters. We thus decided against its inclusion, as the model without a lagged endogenous variable allows for an easier interpretation of the estimated parameters.

Table 6 reports the results, separately for absolute returns, ticks per minute, and volume traded in the three different panels. Three

Table 6. Market Reaction to Press Conference Statements

	Entire Press Conference		Introductory Statement		Q&A	
Absolute Return	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
U.S. Jobless Claims	0.000	0.003	0.001	0.003	—	—
Lagged Value	0.004	0.002	0.003	0.003	—	—
Economic Outlook	0.113***	0.025	0.121***	0.041	0.116***	0.034
Lagged Value	0.032	0.026	−0.018	0.042	0.085**	0.036
Inflation	0.068***	0.026	0.110***	0.037	0.036	0.041
Lagged Value	0.113***	0.026	0.143***	0.035	0.085**	0.040
Interest Rates	−0.026	0.046	—	—	−0.024	0.044
Lagged Value	0.231***	0.046	—	—	0.238***	0.045
Second-Round Effects	0.086*	0.046	0.067	0.059	—	—
Lagged Value	0.199***	0.051	0.230***	0.074	—	—
Money Growth	−0.031	0.040	−0.068	0.058	—	—
Lagged Value	0.091**	0.036	0.105**	0.047	—	—
R-square	0.049		0.098		0.030	
# of Observations	3,723		928		3,016	

(continued)

Table 6. (Continued)

	Entire Press Conference		Introductory Statement		Q&A	
Ticks per Minute	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
U.S. Jobless Claims	0.021	0.124	0.021	0.124	—	—
Lagged Value	0.211*	0.123	0.206*	0.124	—	—
Economic Outlook	2.434*	1.256	4.313**	1.728	1.289	1.642
Lagged Value	1.518	1.285	2.457	1.779	−0.138	1.702
Inflation	4.048***	1.303	3.437**	1.536	4.353**	1.953
Lagged Value	11.013***	1.269	6.442***	1.481	17.419***	1.912
Interest Rates	3.876*	2.264	—	—	3.970*	2.118
Lagged Value	12.690***	2.278	—	—	12.804***	2.145
Second-Round Effects	1.738	2.249	5.782**	2.461	—	—
Lagged Value	0.263	2.513	6.814**	3.111	—	—
Money Growth	4.704**	1.958	−2.393	2.450	—	—
Lagged Value	2.782***	1.774	10.549***	1.962	—	—
R-square	0.069		0.148		0.065	
# of Observations	3,723		928		3,016	

(continued)

Table 6. (Continued)

	Entire Press Conference		Introductory Statement		Q&A	
Volume	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
U.S. Jobless Claims	−2.357	10.737	−3.344	12.013	—	—
Lagged Value	7.576	10.642	0.319	12.012	—	—
Economic Outlook	108.511	109.018	−93.337	166.904	257.596*	138.142
Lagged Value	185.075*	111.532	441.008***	171.869	−87.970	143.132
Inflation	610.865***	113.019	841.212***	148.379	215.775	164.271
Lagged Value	789.608***	110.108	692.328***	143.083	1046.833***	160.841
Interest Rates	597.634***	196.436	—	—	610.282***	178.131
Lagged Value	1523.487***	197.618	—	—	1559.144***	180.417
Second-Round Effects	221.290	195.183	442.567*	237.714	—	—
Lagged Value	514.801**	218.013	861.098***	300.566	—	—
Money Growth	59.832	169.928	−216.735	236.686	—	—
Lagged Value	45.006	153.896	208.846	189.528	—	—
R-square	0.080		0.154		0.069	
# of Observations	3,723		928		3,016	

Notes: Results are based on estimation of model (4), testing for the effects of minute-by-minute newswire snaps on three-month Euribor futures. *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Coefficients in panel 1 are multiplied by 100.

results are reported for each variable—once for the entire press conference, once for the introductory statement only, and once for the Q&A session only. For the last time window, the statements regarding second-round effects and money growth and their lags were discarded, as the data set contains fewer than ten entries for these.

The model comprises two types of controls—the surprise component in the U.S. jobless claim releases and the set of time dummies. A large number of time dummies are highly statistically significant, whereas no effect is found for the U.S. jobless claims. This might seem puzzling, especially given the spikes in trading at 14:30 on both press conference and non-press-conference days, which are clearly related to this data release. However, it is important to note that the release takes place at 14:30 each week, such that the time dummy for 14:30 and 14:31 will soak up any increase in market activity that is invariant across all days. The regressor $x_{jobless,t}$ contains the surprise component, which is estimated on top of the 14:30 and 14:31 effects. It is only this additional component that does not appear to affect the three-month Euribor futures in any significant fashion.

Looking at the response to the statement variables, there is clear evidence that returns, as well as trading activity, respond to the ECB's communication. The most robustly estimated effect, which is found across all three variables and for all three time windows, relates to statements about inflation—not surprisingly, given the importance of inflation data for the conduct of monetary policy. Adding up the contemporaneous and the lagged effect, a single statement about inflation affects returns by around 0.002 percent[19] (or changes implied future interest rates by around 0.2 basis points), leads to roughly fifteen additional trades, and increases the number of contracts traded by 1,400. Statements that relate directly to the discussion of policy rates in the Governing Council (which are never made during the introductory statement but are sometimes made in response to a question) have also clearly identified effects, on returns as well as on both measures of market activity. While the effects on returns and number of trades are about the same as those for inflation statements, substantially more trade volume is generated, with an increase of around 2,100 contracts (or €2 billion notional). Finally,

[19]Note that the parameters in panel 1 of table 6 are multiplied by 100, in order to enhance readability.

statements about possible second-round effects, money growth, and the economic outlook are found to be relatively influential, too, although the latter are particularly relevant if mentioned during the introductory statement and less so during the Q&A session.

7. Conclusions

Press conferences have recently become an important tool for several central banks to communicate monetary policy decisions to financial markets in real time. With several years of experience with press conferences among several central banks, it is now useful to evaluate this communication tool. This paper has exploited the experience of the ECB with press conferences, analyzing in particular (i) to what extent they provide systematic information in addition to the release of policy decisions and (ii) specifically, whether the press conferences fulfill a clarification role for financial markets.

The results of the paper indicate that press conferences add substantial information to the release of the decisions themselves, often exerting an even larger effect on financial markets than the release of the decisions. One of the central findings of the paper is that the information content of the press conference appears to be closely related to the characteristics of a given decision, as the introductory statement adds information in a systematic manner when the policy decision has been relatively unexpected. In particular, press conferences are found to be especially useful when there is a high degree of macroeconomic uncertainty. Under such circumstances, market participants are more likely to seek guidance from central bank communication and show a more muted reaction to the release of the decisions but a larger response to press conferences, and in particular Q&A sessions, as these provide clarification.

The paper has also analyzed what type of information is particularly relevant for financial markets, using data of minute-by-minute newswire snaps. It is specifically statements about inflation as well as statements related directly to the discussion of policy rates in the Governing Council that exert the largest and most systematic impact on financial markets during the press conference. Statements about second-round effects, the economic outlook, and money growth also influence financial markets, though their effects are less significant statistically.

In sum, the paper suggests that press conferences can provide a useful tool in explaining monetary policy to the public, in particular because the sequence of events allows for a useful flow of information, whereby later parts of the communication sequence can react to the information content of earlier parts, a pattern most evident in the form of the clarification that Q&A sessions can provide. Given the importance of a common understanding between the public and the central bank for the effectiveness of monetary policy, this advantage cannot be overemphasized. However, the focus on the ECB's case in this paper leaves open the question of how other communication tools perform in comparison. We leave this important policy question for future research.

Appendix

Table 7. Reuters Snaps during the ECB's Press Conference in November 2004

Date	Time	Snap
04/11/04	14:32	TRICHET—CPI A WORRISOME DEVELOPMENT
04/11/04	14:32	TRICHET—NO EVIDENCE INFLATION PRESSURES PICKING UP IN EURO ZONE
04/11/04	14:32	TRICHET—UPSIDE RISKS TO PRICE STABILITY, NEED STRONG VIGILANCE
04/11/04	14:33	TRICHET—SHORT-TERM ECON INDICATORS MORE MIXED
04/11/04	14:33	TRICHET—INDICATORS STILL POINT TO GROWTH IN 2005
04/11/04	14:33	ECB'S TRICHET SAYS EURO AREA EXPORTS SHOULD STILL BENEFIT FROM GLOBAL DEMAND NEXT YEAR
04/11/04	14:34	TRICHET—STILL SCOPE FOR STRONGER PRIVATE CONSUMPTION
04/11/04	14:34	TRICHET—OUTLOOK SURROUNDED BY UNCERTAINTY, MAINLY FROM OIL
04/11/04	14:34	TRICHET—MAGNITUDE, NATURE OF OIL SHOCK DIFFERENT FROM PAST
04/11/04	14:35	TRICHET—RECENT OIL PRICE RISES STILL SIZABLE ADVERSE SHOCK TO EURO ZONE
04/11/04	14:35	TRICHET—MORE OIL RISES COULD DAMPEN GROWTH
04/11/04	14:36	ECB'S TRICHET SAYS OCTOBER CPI SAW STRONG JUMP, OIL PRICE HAD DIRECT IMPACT
04/11/04	14:36	TRICHET—OIL PRICES MAY FEED THROUGH ECON, GENERATE INDIRECT EFFECTS
04/11/04	14:36	TRICHET—DATA SO FAR DO NOT SUGGEST STRONGER UNDERLYING CPI PRESSURES
04/11/04	14:36	TRICHET—WAGE MODERATION EXPECTED TO CONTINUE, GIVEN MODERATE GROWTH

(continued)

Table 7. (Continued)

Date	Time	Snap
04/11/04	14:37	TRICHET—RISKS LINKED TO OIL PRICES, TAXES, POTENTIAL SECOND-ROUND EFFECTS
04/11/04	14:37	TRICHET—DOWNTREND IN M3 APPEARS TO HAVE HALTED IN RECENT MONTHS
04/11/04	14:37	ECB'S TRICHET SAYS M3 DEVELOPMENTS REFLECT LOW INTEREST RATES
04/11/04	14:38	TRICHET—LOW INT RATES FUELLING PRIVATE CREDIT DEMAND
04/11/04	14:38	TRICHET—LOAN DEMAND NOW MORE BROADLY BASED
04/11/04	14:38	TRICHET—MORE CASH IN EURO ZONE THAN NEEDED TO FINANCE CPI-FREE GROWTH
04/11/04	14:39	TRICHET—EXCESS CASH COULD POINT TO INFLATION AHEAD, BOOST ASSET PRICES
04/11/04	14:39	TRICHET—UNDERLYING INFLATION CONTAINED BUT MEDIUM-TERM RISKS NEED TO BE MONITORED
04/11/04	14:39	ECB'S TRICHET SAYS NEED STRONG VIGILANCE ON RISKS TO PRICE STABILITY
04/11/04	14:40	TRICHET—SEE SOME ENCOURAGING SIGNS THAT GOVTS PLANNING TO CORRECT BUDGET DEFICITS
04/11/04	14:40	TRICHET—BUT FISCAL IMBALANCES ELSEWHERE COULD BE ON THE RISE
04/11/04	14:41	TRICHET—COMPLYING WITH BUDGET TARGETS WILL BUILD CONFIDENCE, HELP UPSWING
04/11/04	14:41	TRICHET—ECB WARNS AGAINST CHANGES TO STABILITY PACT, EXCESS DEFICIT PROCEDURE
04/11/04	14:42	TRICHET—FISCAL CONSOLIDATION PLANS SHOULD BE PART OF STRUCTURAL REFORM EFFORT
04/11/04	14:42	ECB'S TRICHET SAYS STRUCTURAL REFORM CRUCIAL TO RAISE GROWTH, EMPLOYMENT
04/11/04	14:44	TRICHET—ASKED IF ECB HAS BIAS, SAYS UPWARD RISKS TO PRICE STABILITY "AUGMENTING"
04/11/04	14:44	TRICHET—"WE WON'T LET SECONDARY EFFECTS MATERIALISE"
04/11/04	14:45	TRICHET—REAFFIRMS G7 STATEMENT ON CURRENCIES
04/11/04	14:45	TRICHET—G7 STATEMENT CAPTURES "PRESENT SENTIMENT"
04/11/04	14:46	TRICHET—DISORDERLY MOVEMENTS IN FX RATES UNDESIRABLE FOR GROWTH
04/11/04	14:46	ECB'S TRICHET SAYS U.S. POLICY REMAINS ONE OF "STRONG DOLLAR"
04/11/04	14:49	TRICHET—"CLEAR" THAT PRESENT PICKUP IN CPI WILL CONTINUE FOR SOME MONTHS, MAY INCREASE
04/11/04	14:50	TRICHET—WILL RETURN TO PRICE STABILITY "AT A CERTAIN MOMENT"
04/11/04	14:50	TRICHET—DECLINES TO FORECAST AVERAGE CPI FOR 2005
04/11/04	14:51	TRICHET—OIL IMPACT ON INFLATION UPWARD, ON GROWTH DOWNWARD
04/11/04	14:53	TRICHET—ASKED ON EURO FX RATE, REPEATS EXCESS VOLATILITY, DISORDERLY MOVES, UNDESIRABLE

(continued)

Table 7. (Continued)

Date	Time	Snap
04/11/04	14:54	ECB'S TRICHET SAYS SEES ASSET INFLATION IN REAL ESTATE IN A NUMBER OF ECONOMIES
04/11/04	14:56	TRICHET—ON U.S. TWIN DEFICITS, ECB SAYS U.S. NEEDS TO CORRECT SAVINGS PROBLEM
04/11/04	14:56	TRICHET—EUROPE NEEDS TO TACKLE STRUCTURAL REFORMS AS PART OF REDUCING IMBALANCES
04/11/04	14:56	TRICHET—NEED PROGRESSIVE, EFFICIENT CORRECTION OF LACK OF SAVINGS IN U.S.
04/11/04	14:58	TRICHET—APPROPRIATE FOR CHINA TO USE "MARKET ECONOMY WEAPONS" TO COOL ECONOMY
04/11/04	14:59	TRICHET—NUMBER OF ASIA CURRENCIES COULD APPRECIATE IN PROGRESSIVE, ORDERLY MANNER
04/11/04	15:03	ECB'S TRICHET—ECB READY TO PREVENT SECOND-ROUND EFFECTS
04/11/04	15:10	TRICHET—IN PERMANENT CONTACT WITH U.S., BUT NONE SINCE U.S. ELECTION
04/11/04	15:11	TRICHET—WHAT IS GOOD FOR CHINA ECONOMY IS GOOD FOR GLOBAL ECONOMY
04/11/04	15:11	TRICHET—DOES NOT SEE RISK OF STAGFLATION FOR EURO ECONOMY NOW
04/11/04	15:12	TRICHET—"WE HAVE IN HAND" THE DELIVERANCE OF PRICE STABILITY OVER TIME
04/11/04	15:13	TRICHET—WILL CONTINUE TO SEE GROWTH CLOSE TO POTENTIAL IN EURO AREA
04/11/04	15:17	ECB'S TRICHET SAYS DOES NOT LIKE "ONE OFF" FISCAL MEASURES AS A RULE

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