COMMUNICATION AND DECISION-MAKING BY CENTRAL BANK COMMITTEES

DIFFERENT STRATEGIES, SAME EFFECTIVENESS?

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EUROPEAN CENTRAL BANK

WORKING PAPER SERIES

NO. 488 / MAY 2005

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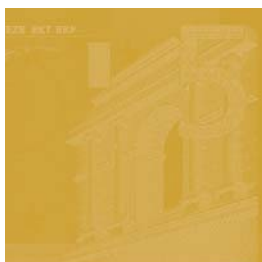## DIFFERENT STRATEGIES, SAME EFFECTIVENESS? [1]

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In 2005 all ECB publications will feature a motif taken from the €50 banknote.

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Abstract

The paper assesses the communication strategies of the Federal Reserve, the Bank of England and the European Central Bank and their effectiveness. We find that the effectiveness of communication is not independent from the decision-making process in the committee. The paper shows that the Federal Reserve has been pursuing a rather individualistic communication strategy amid a collegial approach to decision-making, while the Bank of England is using a collegial communication strategy and highly individualistic decision-making. The ECB has chosen a collegial approach both in its communication and in its decision-making. Assessing these strategies, we find that predictability of policy decisions and the responsiveness of financial markets to communication are equally good for the Federal Reserve and the ECB. This suggests that there may not be a single best approach to designing a central bank communication and decision-making strategy.

Non-technical summary

The move of many central banks over the past decade towards greater transparency as well as decision-making by committees has implied that communication through individual committee members has become increasingly relevant. How should individual members communicate? And what role should their personal views play in a central bank's overall communication strategy?

The objective of this paper is to analyse the communication strategies in the context of their underlying decision-making processes, and to assess their effectiveness for three of the world's major central banks: the Federal Reserve – since its adoption of a more transparent disclosure practice in May 1999, the Bank of England – since its independence in May 1997, and the European Central Bank (ECB) – since January 1999. We focus on two central questions. First, do communication strategies regarding future monetary policy decisions and decision-making processes in these three central banks differ and how? Second, we assess the effectiveness of communication by asking whether it enables financial markets to better anticipate monetary policy decisions and helps central banks in moving asset prices in the desired direction.

A central argument of the paper is that it is important to distinguish between what committee members say, i.e. how they communicate, from what they actually do, i.e. how they vote on monetary policy decisions. Analysing the statements by all committee members in the inter-meeting periods (speeches, interviews, testimonies, etc.), we find that the Federal Reserve is pursuing an individualistic communication strategy as there is a high degree of dispersion in what the individual members of the Federal Open Market Committee (FOMC) say. In contrast, decisions in the FOMC are generally made in a highly collegial manner, which usually implies a unanimous vote on monetary policy. A different approach has been adopted by the Bank of England, which has been following a more collegial communication strategy with a significantly higher degree of consistency among the statements of the committee members. At the same time, however, decision-making in the Monetary Policy Committee (MPC) is highly individualistic as the majority of the decisions has not been unanimous. Finally, the members of the ECB's Governing Council follow a highly collegial approach to communication as well as decision-making, and inter-meeting communication moreover shows the highest degree of consistency with future policy decisions as compared to the MPC and in particular the FOMC.

In the second part of our analysis, we ask how these differences in strategies impact the effectiveness of communication. We argue that a collegial approach to communication and decision-making as practiced by the ECB should lead to highly predictable policy decisions, and should imply that markets react to statements by all policy-makers in the same

fashion. An approach as followed by the Federal Reserve, where communication is dispersed but voting consensual, should make a central bank predictable if markets are able to figure out whose statements to watch closely. In this case, one would expect that communication by some policy-makers is relatively more influential than that of their peers. Finally, we argue that an approach as followed by the Bank of England, where communication is collegial yet voting is highly dispersed, runs the risk of being less predictable, and might imply that financial markets do not react to communication as strongly as for the other central banks.

In the empirical analysis, we find support for our hypothesis that the predictability of policy decisions is highest for the FOMC and the Governing Council, and lower for the MPC. Also the reaction of financial markets to communication essentially confirms our hypotheses. US markets react significantly stronger to statements by Chairman Greenspan and less to statements by other FOMC members, whereas euro area markets respond to communication by the ECB President and other Governing Council members to a very similar extent.

We conclude that the approaches to communication by the Federal Reserve and by the ECB have proven to be equally successful in their effectiveness, despite having pursued very different strategies, suggesting that there may not be a single best approach to designing a central bank communication and decision-making strategy.

"…[T]he willingness of FOMC members to present their individual perspectives in speeches and other public forums provides the public with useful information about the diversity of views and the balance of opinion on the Committee."
B. Bernanke (2004)

"What matters for transparency is therefore clarity as well as openness. For a new and supranational institution like the ECB, it is particularly important that it sends clear and coherent messages to the markets and the wider public. … Speaking with one voice – or at least speaking 'one language' – is of particular importance for transparency and clarity in the case of the Eurosystem."
O. Issing (1999, pp. 508-09)

1. Introduction

The recent past has witnessed a paradigm change in the way central banks around the world conduct monetary policy. This paradigm change has implied not only a change in the strategy pursued by central banks, but also in *how* central banks have implemented their respective strategies. Along with a trend towards greater independence, there has been a move towards decision-making by committees rather than individuals, as well as a strong emphasis on central bank transparency.

There is a broad consensus, that, beyond its role in making a central bank accountable, transparency may help enhance the effectiveness of policy (Blinder 1998, Woodford 2003). However, the central bank is faced with a potential conflict, as a maximum level of transparency need not be optimal for the efficiency with which it is able to pursue its mandate. Such a conflict may occur when giving more information induces not more but less clarity and common understanding among market participants, as there are limits to how much information can be digested effectively (Kahnemann 2003). Moreover, too much information may crowd out the formation of private beliefs which are a crucial source of information for a central bank, and thus for the effectiveness of policy making (Amato, Morris and Shin 2002). As such, transparency is not an end in itself but merely a means to help the authority achieve its mandate (Issing 1999, Mishkin 2004).

The move towards decision-making by committees has also implied that communication through the individual committee members has become increasingly relevant. How should individual members communicate? And what role should their personal views play in a central bank's overall communication strategy? As argued by Bernanke in the above quote, it may be desirable to communicate the diversity of the views in the committee, or, as argued by Issing, the central bank might think that this may risk inhibiting clarity and common understanding. In the first instance, a more *individualistic* approach to communication is preferable, whereas in the second case, a central

bank may opt for a more *collegial* approach. Moreover, the communication strategies by central banks are not independent of the underlying decision-making process of the committee. Decisions may be made in a highly collegial manner, or they take place in an individualistic way that allows and encourages individual members to vote in accordance with their personal views (Blinder 2004, Blinder and Wyplosz 2004). In turn, the effectiveness of communication and therefore the choice of a communication strategy may be highly dependent on the nature of the decision-making process.

The objective of this paper is to analyse the communication strategies in the context of their underlying decision-making processes, and to assess their effectiveness for three of the world's major central banks: the Federal Reserve – since its adoption of a more transparent disclosure practice in May 1999, the Bank of England – since its independence in May 1997, and the European Central Bank (ECB) – since January 1999. We focus on two central questions. First, do communication *strategies* regarding future monetary policy decisions and decision-making processes in these three central banks differ and how? Second, we assess the *effectiveness* of communication by asking whether it enables financial markets to better anticipate monetary policy decisions and helps central banks in moving asset prices in the intended way.

A central argument of the paper is that it is important to distinguish between what committee members *say*, i.e. how they communicate, from what they actually *do*, i.e. how they vote on monetary policy decisions. We analyse the statements by all committee members in the inter-meeting periods (speeches, interviews, testimonies, etc.), as reported by the newswire service *Reuters*. The reason for choosing a newswire service, rather than central bank reports, for measuring communication is our objective of analysing communication from a market perspective, i.e. to look at those statements that actually become available to market participants.[1]

We find that the Federal Reserve is pursuing an individualistic communication strategy as there is a high degree of dispersion in what the individual members of the Federal Open Market Committee (FOMC) say. In contrast, decisions in the FOMC are generally made in a highly collegial manner, which usually implies a unanimous vote on monetary policy. A different approach has been adopted by the Bank of England, which has been following a more collegial communication strategy with a significantly higher degree of consistency among the statements of the committee members. At the same time, however, decision-making in the Monetary Policy Committee (MPC) is highly individualistic as the majority of the decisions have not been unanimous. Finally, the members of

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[1] Four caveats of the methodology should be emphasised. First, newswire services are selective in their reporting, thus not covering all statements made by all the relevant committee members, although the large majority of statements are indeed reported. However, as we are interested partly in testing the market response to communication, it makes sense to focus only on those statements that actually reach market participants, and this is best achieved by looking at a prominent newswire services. Second, newswire services may wrongly report or misinterpret a statement by policy makers. Third, communication may have an undesired effect on markets, whether it is correctly or incorrectly reported. Again, our objective is to assess communication from the perspective of financial markets and therefore we analyse the information market participants actually receive. And fourth, many different pieces of news hit and influence financial markets

the ECB's Governing Council follow a highly collegial approach to communication as well as to decision-making. Inter-meeting communication moreover shows the highest degree of consistency with future policy decisions as compared to the MPC and in particular the FOMC.

In the second part of our analysis we ask how these differences in strategies impact the *effectiveness* of communication. We argue that a collegial approach to communication and decision-making as practiced by the ECB will lead to highly predictable policy decisions, and will imply that markets react to statements by all policy-makers in a similar way. An approach as followed by the Federal Reserve, where communication is dispersed but voting consensual, will make a central bank predictable if markets are able to figure out whose statements to watch closely. In this case, one would expect that communication by some policy-makers is relatively more influential than that of their peers. Finally, we argue that an approach as followed by the Bank of England, where communication is collegial yet voting is highly dispersed, runs the risk of being less predictable, and might imply that financial markets do not react to communication as strongly as for the other central banks.

In the empirical analysis, we find support for our hypothesis that the predictability of policy decisions is highest for the FOMC and the Governing Council, and lower for the MPC. Also the reaction of financial markets to communication essentially confirms our hypotheses. US markets react significantly stronger to statements by Chairman Greenspan and less to statements by other FOMC members, whereas euro area markets respond to communication by the ECB President and other Governing Council members to a similar extent. We conclude that the approaches to communication by the Federal Reserve and by the ECB have proven to be equally successful in their effectiveness, despite having pursued very different strategies, suggesting that there may not be a single best approach to designing a central bank communication and decision-making strategy.

The paper starts by reviewing the literature on central bank communication and decision-making in section 2. Section 3 then discusses our data source. The communication strategies and decision-making processes of the three central banks are analysed and compared in section 4. This is followed by an empirical analysis of the effectiveness of central bank communication in influencing asset prices in the desired way in section 5. Conclusions and policy implications follow in section 6.

2. Literature on central bank communication and decision-making

The academic and policy literature on central bank communication stresses the seminal role of communication for the effectiveness of monetary policy (Bernanke 2004, Blinder 1998, Buiter 1999, Issing 2005, King 1997).[2] Blinder (1998) and Bernanke (2004) emphasise that monetary

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every day. To ensure that we are measuring the effect of communication, rather than others news, we control for the release of important macroeconomic news.

[2] It may or may not be a coincidence that all five of these, at times, have been influential academics and policy makers.

policy has in many countries only a single direct tool, namely the overnight interest rate, such that monetary authorities can exert only an indirect effect on those asset prices that are of key importance for the economy, such as long-term interest rates, equity prices and exchange rates. Communication therefore provides an important means for central banks to influence these asset prices, but it requires credibility and a strong track record for authorities to do so.

Much of the academic literature focuses on the theoretical aspects of transparency and communication, frequently building on the influential work by Cukierman and Meltzer (1986).[3] The definition of what constitutes transparency is not always straightforward. Although it generally is understood to mean the absence of asymmetric information between markets and policy makers, there are different elements to transparency including clarity, openness, honesty and common understanding (Winkler 2000). A key issue in this literature is whether and under what conditions transparency improves economic efficiency. LeRoy and Porter (1981) and Geraats (2002) show that communication may be undesirable if it is of poor quality or sufficiently noisy so as to raise market volatility.

A second strand of the literature focuses on the extent to which communication can substitute policy action. In principle, a monetary authority that is sufficiently credible may be able to influence asset prices by communicating its views about its intended level and by signalling its intention to move policy if asset prices deviate from this target. This issue has sparked a debate about the time consistency of such "open mouth operations", which implies that authorities may have an incentive to give incorrect information to the markets and thus that communication can be fully credible and effective only if it is followed by policy action. Much of the work in this area has focused on strategic monetary policy games, building on the work by Kydland and Prescott (1977), Barro and Gordon (1983) and Walsh (1998). For instance, Goodfriend (1986) and Stein (1989) argue that one solution to this trade-off between maintaining credibility while conducting an effective communication policy is to provide imprecise announcements about its views and information, i.e. by providing less than full transparency.

A third strand of the literature has emerged more recently that shows how transparency may alter the balance of the information exchange between the monetary authority and the markets in the opposite direction of what the second strand implies, namely by inducing a sub-optimal behaviour by financial markets. Morris and Shin (2002), Amato, Morris and Shin (2002) and Padoa-Schioppa (2004) argue that communication by central banks may become too dominant by crowding out the formulation of independent beliefs by the private sector based on the information that it has a comparative advantage in gathering. Transparency and communication may thus be undesirable to the extent that it eliminates or at least reduces an important source of information for the central

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[3] Geraats (2002) and Carpenter (2004) provide a detailed review in particular of the theoretical work on transparency and communication.

bank, namely the market perspective as a distinct source of information, which plays an important role for monetary policy making.

Concerning empirical work on central bank communication, the literature is still quite small, partly reflecting the difficulty of measuring it and partly due to the relatively recent adoption of transparency as a major characteristic of central bank policy. Guthrie and Wright (2000) find that communication has been used in a systematic and highly effective way for controlling short-term rates by the Reserve Bank of New Zealand. For the United States, Kohn and Sack (2003) show that statements by FOMC Chairman Greenspan about the monetary policy inclination have a significant effect on the volatility of short-term interest rates while statements about the economic outlook tend to have a significant impact on longer maturities. Demiralp and Jorda (2004) provide related evidence by showing that it is mainly the public announcements by the Fed that move short-term interest rates, rather than the liquidity channel of open market operations. For the ECB, Gerlach (2004) analyses the content of the ECB's Monthly Bulletin in terms of inflation, economic activity and money, and whether these are consistent with monetary policy decisions. Finally, Bernanke, Reinhart and Sack (2004) and Gurkaynak, Sack and Swanson (2004) find that US markets attribute considerable importance to statements that include an indication about the future path of policy.

Haldane and Read (2000) provide evidence that the effect of monetary policy decisions on short-term interest rates in the United Kingdom has decreased over time, which may suggest that information asymmetries about the economy have been reduced. Andersson, Dillen and Sellin (2001) for Swedish Riksbank and Siklos and Bohl (2003) for the Bundesbank before 1999 also find that communication of these two central banks has indeed played some role in influencing financial markets. The latter show that Bundesbank communication is more strongly related to financial market movements if these statements are about interest rates as compared to the exchange rate. Jansen and de Haan (2004) look at the ECB in 1999-2002 and argue that statements among the individual members of the Governing Council about interest rates and about inflation exhibited some degree of contradiction, though this has decreased over time.

Finally, there has been some empirical work on the role of central bank communication in different contexts. Jansen and de Haan (2005) for the ECB and Fratzscher (2004) for the G3 monetary authorities analyse the effect of communication on exchange rates. While the former finds some effect on the volatility of the euro, the latter finds more systematic evidence in favour of effectiveness for all three G3 central banks in changing the level and volatility in the desired direction. A different strand of the empirical literature analyses the predictability of monetary policy decisions (Artus and Wyplosz 2002, Kuttner 2001, Ehrmann and Fratzscher 2003, 2004, Lange, Sack and Whitesell 2003, Perez-Quiros and Sicilia 2002), although in a companion paper we do not find that the change in the Federal Reserve's disclosure practice in May 1999 has improved the ability of markets to predict monetary policy decisions (Ehrmann and Fratzscher 2005).

The literature on the role and constitution of the policy-setting committee and institutional factors governing the decision-making process is still rather limited. A broad consensus has emerged that delegating the monetary policy decision to an independent committee of individuals leads to a superior policy for a number of possible reasons, such as the ability to pool judgments of different individuals (Blinder and Morgan 2000), ability to learn from other members (Lombardelli, Proudman and Talbot 2002) or the increased flexibility that committees show in responding to shocks of different magnitudes (Sibert 2003, Mihov and Sibert 2004). However, the literature is still in its infancy, as many issues such as those related to the role of strategic voting, the uncertain incentives of individuals to acquire and reveal private information, possibly conflicting preferences and communication among members make it hard to provide a conclusive recommendation of the role, size and constitution of committees (e.g. Gerling, Grüner, Kiel and Schulte 2003). Whether central bank committees should publish the votes of the individual members is a debated issue (e.g. Buiter 1999, Issing 1999). For the case of the ECB, Cukierman (2001) sees a danger that published votes might lead the national media to unduly discuss the voting behaviour of the governors of the National Central Banks (NCBs) from a national perspective. As the US Federal Reserve has a long-established policy-making committee, most empirical analyses are focusing on the FOMC. A thorough study of its decision-making is provided in Chappell et al. (2004). A related paper to ours is the recent work by Blinder and Wyplosz (2004), which also compares the decision-making processes of the Federal Reserve, the Bank of England and the European Central Bank, and recommends how committee structures should relate to communication policies. We will come back to their work further below.

3. Measuring communication

We first turn to the issue of how to measure communication. We want to obtain all statements related to monetary policy by the individual committee members in the *inter-meeting period*. For the policy makers, we include the FOMC's 19 members, comprising the seven governors of the Board of Governors and the 12 presidents of the Federal Reserve Banks. We do not make a distinction between voting member and non-voting members as all 19 members participate in the FOMC meetings.[4] For the MPC, we cover the governor, the other four internal members and the four external members, who are appointed directly by the Chancellor of the Exchequer. For the Governing Council of the ECB, we cover the 6 Executive Board members, including the President, and the 12 governors of the NCBs of the Eurosystem.

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[4] The 12 voting members of the FOMC comprise the seven governors and five of the 12 presidents of the Federal Reserve Banks. The President of the Federal Reserve Bank of New York has a permanent vote, the presidents of the Chicago and Cleveland branches alternate annually while the other nine presidents rotate on a three-year basis.

An additional element of communication strategies is the statements of the committees as a whole, in particular those that are released on monetary policy meeting days. All three central banks release press statements immediately after their decisions. However, the press statements are very different as the Federal Reserve provides a short summary of the decision plus a balance-of-risks assessment over the foreseeable future while the Bank of England only occasionally offers an additional explanation to its decision. Neither of the two holds a press conference on the meeting day, whereas both provide additional information at a later stage through publications of minutes. By contrast, the ECB provides a press release as well as a press conference after the first Governing Council meeting each month (during which monetary policy decisions are discussed), including an extensive Q&A session, to explain its decision. Although it may be interesting to analyse the type of communication that is released by the committee as a whole, we refrain from doing this here as the focus of this paper is on the structure and strategies of committees and their impact and effectiveness.[5]

As for the time period, we use *daily data* for all data series and begin the analysis in May 1999 for the Federal Reserve, as it then underwent significant changes in its disclosure practices and transparency. We chose the period since May 1997 for the Bank of England as at that point it was granted independence, and January 1999 for the ECB for the start of its conduct of monetary policy. Having determined the policy makers and respective time periods, we use a commonly used newswire service, *Reuters News*, to extract all reports about forward-looking policy statements, which can be three types of communication - speeches, interviews or testimonies, on a daily basis. We distinguish between two types of statements, one referring to the monetary policy inclination, and the second one to the economic outlook. Clearly, one can think of different and finer categories of communication, such as e.g. distinguishing also between statements about inflation versus monetary aggregates. However, we decided to keep the categorisation as simple as possible, following the terminology also used by Kohn and Sack (2003). The search commands we employed are the name of the policy maker together with the terms interest rates, inflation or monetary policy for the first type of statements, and together with economy or economic outlook for the second type to extract all relevant statements.

The objective is to obtain all statements in *real time*, i.e. on the day and time when they occur in order to be able to test whether these statements influence financial markets. In particular, we very carefully chose only the first report in *Reuters News*, which usually comes within minutes of each statement and is mostly descriptive without providing much analysis or interpretation, and discard

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[5] Moreover, we ensured in our analysis that no relevant communication by the committee as a whole occurred on the same day as statements by individual committee members, so that the econometric results for the committee members presented below are robust to excluding communications by the whole committee. To this end, we deleted any statement that occurred on meeting days of the decision-making bodies of all three central banks, as well as on the publication days of the Monthly Bulletin and the Annual Report for the ECB, of the Inflation Report and the MPC minutes for the Bank of England, and of the FOMC minutes and the beige book for the Federal Reserve.

all subsequent reports or analysis of the same statement. Furthermore, as much as possible, we targeted only forward-looking statements, as opposed to statements that aim to explain to the markets the most recent decision that had been taken at the time. This allows us to prevent duplication as well as to avoid including reports that occur sometimes with a delay of some days.

The final step consists of classifying the inter-meeting statements into those that give an inclination of tighter monetary policy versus no change or lower interest rates (C^{MP}),[6] and accordingly for the economic outlook (C^{EC}):

$$C_t^{EC} \quad = \quad \begin{cases} +1 & \textit{stronger econ. outlook} \\ 0 & \textit{unchanged econ. outlook} \\ -1 & \textit{weaker econ. outlook} \end{cases}$$

$$C_t^{MP} \quad = \quad \begin{cases} +1 & \textit{tightening inclination} \\ 0 & \textit{no inclination} \\ -1 & \textit{easing inclination} \end{cases}$$

The classification of statements is often referred to as content analysis, describing the systematic technique for analyzing the content of a message (Holsti 1969). An important point to stress is that this classification is based on our own judgment and reading of the newswire reports and thus does not rule out a wrong classification in individual cases. In line with the work in content analysis, we tried to reduce the chance of misclassification by having two persons analyse critical statements independently. In those cases where we were unsure about the classification of the statement, we double-checked subsequent reports about the same statement and classified them accordingly or discarded them. In the appendix we provide a few examples of Reuters reports along with our classification.

Four additional caveats of the methodology should be emphasised. First, newswire services are selective in their reporting, thus not covering all statements made by all the relevant committee members, although the large majority of statements are indeed reported. However, as we are interested partly in testing the market response to communication, it makes sense to focus only on those statements that actually reach market participants, and this is best achieved by looking at a prominent newswire services. Second, newswire services may wrongly report or misinterpret a statement by policy makers. Third, communication may have an undesired effect on markets, whether it is correctly or incorrectly reported. Again, our objective is to assess communication from the perspective of financial markets and therefore we analyse the information market participants actually receive. And fourth, many different pieces of news hit and influence financial markets

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[6] A similar methodology for the classification of monetary policy statements is used by Guthrie and Wright (2000) for New Zealand.

every day. To ensure that we are measuring the effect of communication, rather than others news, we control for the release of important macroeconomic news.

4.   Strategies of communication and decision-making

4.1 Communication in the inter-meeting period

Our first objective is to understand and compare the communication strategies by the three central banks. By "communication strategy" we mean and focus on three aspects: first, the *content* – what is being communicated and by whom – second, the *timing* – whether there is a systematic pattern to when communication occurs, in particular with regard to meetings and monetary policy changes – and third, the *consistency* – whether the content of the communication among the different members of the committee are consistent with one another and with monetary policy decisions.

4.1.1 Content

Who talks and what is being said in the inter-meeting period? Table 1 provides an overview of all statements extracted from *Reuters News* using the approach discussed above. Some interesting stylised facts emerge from this overview.

First, there are many statements that are neutral about the monetary policy inclination, and this is in particular so for members of the Governing Council of the ECB. In fact, a very often reported language of Governing Council members refers to interest rates and monetary policy in the euro area as being "appropriate", or what we label "neutral" in Table 1. Overall, 142 or 62% of all ECB statements about monetary policy were neutral. By contrast, FOMC members seem to be more inclined to provide a view of changes in monetary policy. Only 46 or 28% of the statements by FOMC members were neutral, while 41% of statements by MPC members about monetary policy inclination were neutral. Moreover, relatively more biased statements are towards easing than tightening, which makes sense as interest rates went down for most of the sample period.

Second, communication about the economic outlook mostly indicates an improvement, with hardly any statements indicating no change. This may seem somewhat at odds with the facts of booming economies till 2000, a sharp slowdown thereafter and a modest recovery since 2003. However, the results make sense considering that a statement indicating no change in the economic outlook may contain little news – whereas a neutral statement about monetary policy does – and therefore policy makers may refrain from making such statements.

Third, the head of each central bank generally communicates more than other committee members. This is the case in particular for the Federal Reserve and the Bank of England, but less so for the

ECB. What is also striking about the statements of the heads of the three central banks is that they make relatively fewer neutral statements than other members. This may be interpreted as the heads leading the communication strategy in indicating the committee's views on monetary policy and its changes. Moreover, there is again a difference across the different central banks as this point applies in particular to the Federal Reserve, and much less so for the ECB, with the Bank of England ranging in between.

Fourth, there is a difference in the way different groups of committee members communicate. For the Federal Reserve and the ECB, members who do not reside directly at the headquarters, i.e. the regional Federal Reserve presidents and the NCB governors, provide a larger number of statements than the governors of the Federal Reserve Board and the Executive Board members of the ECB (excluding the head), which reflects the fact that the first group is significantly larger than the second. However, an interesting difference is that the first group of members seem to provide biased statements, i.e. indicating tightening or easing of monetary policy, relatively more often.

In sum, these stylised facts offer some striking differences in the communication of the three central banks. We investigate in detail below whether this finding is explained by the different paths in monetary policy or rather reflects differences in communication strategies.

4.1.2 Timing

Is there are purposeful strategy behind the timing of communication? One objective of communication is to prepare markets of upcoming policy decisions. It may therefore be possible that policy makers intensify communication prior to meetings, or at least to meetings in which a change is envisaged to be likely or expected by the markets. Alternatively, some observers have argued that policy makers may agree to communicate less just before meetings in order not to raise market uncertainty.

Figures 1.a – 1.c provide an overview of the distribution of statements about the monetary policy inclination and the economic outlook over the whole period of 1999-2004 or 1997-2004. The figures underline some of the points stressed above about the content of the communication, but they also show some marked differences in the direction and frequency of communication across different sub-periods. In particular, the statements about monetary policy are largely consistent with the direction of the monetary policy rate and communication intensifies in periods of change. Specifically the years 2001 and 2002 stand out, underlining the significant changes in monetary policy and the economic outlook taking place during those two years.

Focusing in more detail on the timing of communication around monetary policy meetings, Figures 2.a – 2.c show the distribution of statements on the days before and after the policy meetings of the

three authorities. There is one striking similarity across all central banks: in the days immediately prior to the monetary policy meetings, there is a considerably smaller amount of communication compared to other days.[7] Furthermore, the intensity of communication is different before meetings than after meetings for all three central banks. With the exception of the days surrounding the monetary policy meetings, there is generally a higher level of activity before than after meetings, stressing the attempt of central banks to prepare markets for the upcoming meeting.

A formal test of the hypothesis that central banks intensify communication prior to meetings in which a change is envisaged to be likely is provided in table 2. For each central bank, the table compares the frequency of communication in the inter-meeting periods that precede meetings with and without interest rate changes. The frequency is calculated as the share of days in which communication takes place. It turns out that the difference is statistically significant for the Federal Reserve at the 99% level, and for the Bank of England at the 90% level. Both central banks do indeed intensify communication prior to meetings in which interest rates are changed. This is not the case for the ECB, however, which has virtually identical frequencies for both occasions.

4.1.3 Consistency

As the final step in the analysis of the communication strategy of the three central banks, we turn to the issue of consistency: are the statements of the individual committee members consistent with each other and with monetary policy decisions? Looking at this issue may allow us to obtain a better understanding on whether there are differences in the way the role of communication is understood and defined by the three authorities.

We use a simple statistical dispersion measure to assess the consistency of communication in the period between meetings for each of the central banks. This dispersion for a particular inter-meeting period k is defined as the sum of the distance between each of the statements in the inter-meeting period divided by the maximum total distance:

$$\Omega_k^{MP} \quad = \quad \frac{\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \left| C_i^{MP} - C_j^{MP} \right|}{\frac{1}{2} \cdot \left(N^2 - D \right)} \tag{1}$$

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[7] Unsurprisingly, as all central banks respect a black-out period prior to meeting days during which committee members refrain from giving interviews, etc. That our database records statements in the days prior to meetings is mainly related to other types of communication, like - in the case of the ECB - the hearings before the European Parliament.

with C^{MP} defined as a [-1,0,+1] variable, as outlined above, N the total number of statements in the inter-meeting period k, and D a dummy that takes the value of one if N is an odd number and zero if it is even.[8] The total dispersion measure Ω over all inter-meeting periods is the defined as the average of the individual dispersion measures Ω_k:

$$\Omega^{MP} \quad = \quad \frac{\sum_{k=1}^{K} \Omega_k^{MP}}{K} \tag{2}$$

The dispersion measure for communication about the economic outlook is defined analogously.[9] Figures 3.a – 3.c show the distribution of the dispersion measures over time, distinguishing between monetary policy inclination in the upper panel and the economic outlook in the lower one. The figures show dispersion in communication throughout the period, though for many cases there is an increase in dispersion in 2001 and 2002, when there were relatively many monetary policy changes and an increased degree of uncertainty about the prospects of the three economies.

Panel A of Table 3 shows the average dispersion for each of the central banks and gives test results for whether there are statistically significant differences in dispersion across central banks. Dispersion of communication about monetary policy for the Federal Reserve is 0.32, and significantly lower at 0.13 for the Bank of England and 0.15 for the ECB. This result is important as it suggests that communication about monetary policy among the members of the FOMC is less co-ordinated and may pursue a different objective from that of the members of the Governing Council and the Monetary Policy Committee. The result may also partly reflect the fewer statements by and fewer members of the MPC, and the fact that the ECB and the Bank of England have more frequent policy meetings.[10]

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[8] The reason for changing the weighting for the periods with an odd number of statements is that the last observation in the odd-numbered case may provide no additional information about the degree of dispersion. As an example, take the case of two statements – one being neutral and one indicating a tightening bias – which yields a distance measure of $\Omega_k = (1-0) / 0.5 * 2^2 = 0.5$. If there is a third statement it should not alter the degree of dispersion whether it is neutral or has a tightening bias. Hence, the dispersion measure in either case also yields $\Omega_k = [(1-0)+(1-0)] / 0.5 * (3^2 -1) = 0.5$, which is achieved by adjusting the denominator.
[9] The dispersion measure is also used by Jansen and de Haan (2004), who use different communication data and focus only on the ECB and Bundesbank officials in 1999-2002.
[10] Scheduled FOMC meetings occur eight times, or about every six weeks, whereas MPC meetings and Governing Council meetings at which monetary policy is discussed usually take place once a month. Before November 2001, monetary policy was discussed in each of the bi-weekly meetings of the ECB Governing Council. As a longer inter-meeting period means that more information becomes available and hence the monetary policy inclination and economic outlook is more likely to change, part of the higher dispersion may

The role that the number of committee members may play in determining the degree of dispersion is addressed in panel B of Table 3. This table shows the degree of dispersion in communication among a single committee member, namely the head of each central bank. The results show a very low degree of dispersion for each of the heads. Overall, what this underlines is that the degree of dispersion presented in panel A of Table 3 reflects the dispersion *across* committee members. We also interpret this evidence as supporting the quality of our communications data as one would indeed expect a low degree of dispersion for individual members.

Taking a different perspective, a complementary way of assessing the consistency of communication is to ask whether statements are consistent with the decision taken in the next meeting or in future meetings. Panel A of Table 4 shows the share of all statements that is consistent with the next monetary policy decision. The key finding is that 68% of all statements about the monetary policy inclination of Governing Council members are consistent with the decision at the next meeting, whereas only 56% of statements of FOMC members shows such consistency. This difference proves statistically highly significant. The Bank of England takes an intermediate position with 59%, which is not significantly different from the shares of the ECB or the Federal Reserve. If the statements were to signal future decisions, their consistency should be higher than 50%. This is indeed the case for the ECB (at the 99% level) and the Bank of England (at the 95% level), but not for the Federal Reserve.

One reason for the relatively low degree of consistency of FOMC communication may lie in the fact that the horizon of statements may go beyond the next meeting. In fact, much of the communication of the Federal Reserve in 2003 and 2004 has been stressing the medium-term outlook for monetary policy. Panel B of Table 4 presents the consistency of communication with the *direction* of monetary policy. The results reveal that indeed a much larger share of the communication for all central banks is consistent with the direction. For all three central banks, our consistency measures are statistically different from 50% at the 99% level. Nevertheless, the consistency of statements by Governing Council members is still higher than that for the Federal Reserve or the Bank of England, although this difference is not statistically significant any longer.

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be explained by these different lengths. Testing this hypothesis by using four-week windows for all central banks shows that the differences in the dispersion measures indeed become smaller and less significant. However, as this four-week period included two policy meetings for the ECB prior to November 2001, such a test introduces a bias in the results towards raising dispersion of ECB communication.

In sum, we conclude that communication exhibits significant differences in the degree of dispersion and of consistency across the three central banks. Overall, for the Federal Reserve, communication appears to follow a more *individualistic approach*, aiming at providing the public with the diversity of views among FOMC members. By contrast, communication strategies follow a more *collegial approach*, intending to mainly convey the committee view and consensus among members for the MPC and in particular for the Governing Council.

4.2 Decision-making process

In order to analyse and assess the inter-meeting communication of committee members it is crucial to understand the nature of the decision-making process at the committee meetings, as the effectiveness of such communication is likely to be determined in a central way by whether the communication strategy translates into a similar pattern in the voting on monetary policy decisions.

The minutes of the FOMC and the MPC provide the voting behaviour of all individual committee members. In contrast, the ECB does not publish how a decision was made, and it has signalled frequently that it is made in a collegial manner.

Looking at the voting pattern in the central banks shows some striking differences. For the FOMC, there were 7 out of a total of 44 meetings (or 15.9%) between May 1999 and May 2004 in which the decision was not unanimous – and in each but one case there was only one dissenting vote.[11] By contrast, the MPC shows a remarkably high degree of dispersion in voting since independence in May 1997. In more than half of the MPC meetings, or 46 out of 85 meetings (54.1%) did at least one MPC member dissent with the decision. The average number of dissenters was about two – out of a maximum possible number of dissenters of 4 in the nine-person MPC – and in as many as 6 meetings was the decision made with a majority of only a single vote – i.e. 5 votes in favour versus 4 votes against. On two occasions, in February and March 1998, there was a tie as 4 members voted in favour of a tightening while 4 voted to keep rates unchanged.[12]

Overall, this shows a remarkable degree of dispersion for the MPC and underlines its strong *individualistic* approach to decision-making. By contrast, decisions are taken in a *collegial* manner in the FOMC and the Governing Council.

5. Effectiveness of communication

We now turn to the question of whether the described differences in communication strategies across the three central banks has led to differences in the effectiveness of communication as a tool

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[11] Obviously, even in the case of unanimous decisions, some committee members might have expressed deviating views before voting (Meade, 2004).

[12] The voting records of the Bank of England and the Federal Reserve are in the public domain and are released with the minutes two weeks and three weeks, respectively, after each meeting. Note that the number of members in the MPC has been increased since independence and reached its current size of nine members only in June 1998.

of monetary policy. We define effectiveness as containing two elements: first, the ability of financial markets to predict future monetary policy decisions; and second, the ability of policy-makers to influence financial markets by moving asset prices. Clearly, these two elements are not independent of each other as communication that leads to high predictability of decisions may also have a significant effect on financial markets. Moreover, it should be stressed that these two are necessary but not sufficient conditions for successful and effective communication as communication policy should also aim at anchoring and guiding market expectations over the medium- to long-run (Issing 2005, King 2004). Furthermore, it is also clear that the three central banks operate in very different economies. For example, the United Kingdom is relatively more open and thus more affected by exchange rate movements than the US and the euro area.[13] Such differences could affect the uncertainty under which the central banks operate, and as such the predictability of decisions.

Before conducting the analysis on effectiveness, we summarise the results so far and formulate the hypotheses concerning monetary policy effectiveness in the following way:

| | **strategy** | | | **hypotheses: effectiveness** | |
	communication dispersion	communication consistency with policy decisions	voting dispersion	predict-ability	market responsiveness
Federal Reserve	high	medium	low	?	high only to some members
Bank of England	low	medium	high	medium	medium uniform to all members
European Central Bank	low	high	none	high	high uniform to all members

This table, in a nutshell, summarises in a very stylised fashion the different communication strategies, based on our analysis above, by the three central banks. The question is: what do these strategies imply for the effectiveness of communication? In principle, one would expect that more dispersion in communication and in voting, as well as lower consistency with monetary policy decisions, should reduce predictability and lower the responsiveness of markets to communication. However, markets may nevertheless react significantly to statements by some individuals if they expect that this individual's view reflects the majority view or at least is powerful enough to sway the majority on his or her point of view. Hence the communication strategy of the Federal Reserve may indeed induce high predictability and markets respond strongly, despite a high degree of communication dispersion, if markets are able to figure out whose statements to watch closely to. As committee structures generally give a strong weight to the chairman, we will test whether financial markets respond more strongly to his communication. As pointed out by Chappell et al.

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[13] As a matter of fact, several of the statements by MPC members in our database stress the importance of

(2004) and Meyer (1998), when it comes to the policy decision and voting Chairman Greenspan generally speaks first, presents his policy proposal and then asks the FOMC members for their vote. For most meetings analysed by Cappell et al., the majority of voting members agreed with his position.

For the Bank of England, the medium consistency with decisions and the high voting dispersion may imply that the inter-meeting statements are not a very good indicator for future decisions. Unless this is compensated for by other information, we would expect only a medium level of predictability. In the case that MPC members convey dispersed views in the inter-meeting period, it is furthermore not entirely clear whether financial markets should watch predominantly communication by the Bank of England's Governor. Although the Governor has a casting vote in the event of a tie, his role in the meetings of the MPC is very different from Chairman Greenspan's in the FOMC, as is clear from see the description of the MPC meeting structure in Bean and Jenkinson (2001): The Deputy Governor responsible for monetary policy usually speaks first, and is followed by the other MPC members, who normally give an indication of their policy preference. The Governor himself usually concludes the exchange of views, and, "once all Committee members have given their views, […] puts a motion that he expects will command a majority and calls for a vote" (Bean and Jenkinson, 2001, p.438). Overall, therefore, we would expect a relatively weak effect of communication on financial markets for the Bank of England. This hypothesis differs from that proposed by Blinder and Wyplosz (2004) who argue that from a purely theoretical perspective "…an *individualistic* MPC pursuing a highly *transparent* strategy may be the best arrangement for making monetary policy decisions… [and to] achieve the highest degree of both effectiveness and accountability" (p. 21), as the diversity of views should give markets the broadest possible set of information. However, we think that in such a setting it would be important to convey the individual views of the committee members to the public already *ex ante*, rather than only communicating them ex post through the publication of voting records.

By contrast, for the ECB, communication in the inter-meeting period has low dispersion and the monetary policy decision is usually unanimous and consistent with the decisions.[14] One would therefore expect that communication is highly effective in allowing markets to correctly predict decisions. One would also expect that financial markets react to communication by all members as everyone's statement should give an accurate indication of future decisions of the committee.

In this section, we present measures of predictability to assess the first element of effectiveness. We then continue by analysing in detail how differences in communication strategies are explained and reflected in the diverse reactions of financial markets to the various types of communication.

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exchange rate developments for the outlook for monetary policy in the UK.
[14] In case of divergent views, the ECB president clarified "that markets have to listen more to me than to others" (Press conference on 8/11/2001; see http://www.ecb.int/press/pressconf/2001/html/is011108.en.html.).

5.1 Predictability of monetary policy decisions

If transparency is present and markets and policy makers have the same information, markets should also be able to anticipate monetary policy decisions well. This implies that the unexpected component of the monetary policy decision should be small on meeting days. We test this hypothesis and the differences across the three central banks, by analysing the size of the short-term interest rate change on the day of the monetary policy decisions. We follow the approach of Perez-Quiros and Sicilia (2002) and use one-month EONIA swap rates for the euro area, and one-month LIBOR rates for the UK and the US.[15] Table 5 shows these results for all policy meetings in panels A and C and only for those meetings with policy changes in panels B and D. Panels A and B exclude unscheduled meetings, whereas panels C and D include them. A key result is that monetary policy surprises on all monetary policy meeting days are almost always statistically significantly higher for the Bank of England compared to the ECB and the Federal Reserve. For meetings including the unscheduled ones (panel C), the mean absolute surprise on the meeting day is 3.6 bp for the ECB, 5.6 bp for the Federal Reserve and 6.0 for the Bank of England. For those days with interest rate changes (panels B and D), the mean absolute surprises of the three authorities are very similar at around 10-12 bp when including unscheduled meetings, and somewhat lower for the Federal Reserve when excluding them.[16]

Overall, the key finding is that the Federal Reserve and the ECB are roughly equally predictable in their monetary policy decisions, where the concept of predictability is based on the change of short-term interest rates on the monetary policy meeting day. By contrast, monetary policy decisions by the Bank of England are somewhat less predictable.[17] The question that arises from this result is what prepares markets in the United States and in the euro area so that they are better able to anticipate policy decisions compared to the United Kingdom, and what role communication plays in this context.

5.2 Market reaction to communication

The second component of effectiveness of communication is the question of whether policy-makers are capable of influencing asset prices in the desired way. If communication is informative about

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[15] As explained in detail in Perez-Quiros and Sicilia (2002), one would ideally like to use overnight rates, but these prove highly volatile due to other factors, in particular due to changes in liquidity over the respective maintenance periods.

[16] The table also shows the variances of the absolute interest rate surprises on the meeting days, and confirms that this variance is lowest for the ECB and highest for the Federal Reserve, though the differences are not always statistically significant.

[17] A similar result is obtained in Moessner, Gravelle and Sinclair (2004) in a comparison of the Federal Reserve and the Bank of England.

future policy decisions, and hence monetary policy decisions are highly predictable, then one would expect that communication has a significant impact on asset prices. However, it should be stressed that high predictability does not necessarily imply that it is communication which induces markets to correctly anticipate policy decisions. In fact, it has been argued by Bank of England Governor King (2000) that, for a transparent central bank, it should be the economic developments that allow policy decisions to be predictable, rather than communication by the authority.[18]

This subsection tests for the impact of communication on financial markets. We look at both the yield curve as well as at equity prices, exchange rates and inflation expectations. Interest rate data are US Treasury bill rates for the US, and interbank rates and government bond yields for the euro area and the UK.[19] Equity returns are the daily returns of the major stock market indices (the S&P500, FTSE100 and EUROSTOXX), and exchange rates (EUR/USD, UKP/USD) are closing quotes at 18.00 EST. Inflation expectations are derived from inflation-indexed five-year bonds.

Communication may have a dual objective from a financial market perspective: it aims at influencing the *level* of asset prices as well as the degree of *volatility* and uncertainty. To allow testing both as well as to account for the interaction between the two, we model the effect of communication on asset price returns r_t and on asset price volatility h_t in a standard exponential GARCH (EGARCH) framework, proposed by Nelson (1991). Our EGARCH(1,1) model formulates the conditional mean equation for the asset price return r_t as a function of the inter-meeting communication (C^{EC}, C^{MP}), past returns (r_{t-1}) and a vector of control variables (X):

$$r_t = \alpha + \lambda\, r_{t-1} + \beta^{EC}\, C_t^{EC} + \beta^{MP}\, C_t^{MP} + \delta\, X_t + \varepsilon_t \qquad (3)$$

The vector X_t of controls includes day-of-the-week effects, monetary policy shocks and the surprise component of various macroeconomic news. Our measure of monetary policy shocks is based on the change in short-term rates as explained in section 5.1. The surprise component of macro news is constructed by subtracting market expectations obtained through a survey of market participants (using the median expectation) from the actually released figure. We included various macro announcements that have been singled out as important in earlier work.[20] We enter all these variables to ensure that our parameters of interest β^{EC} and β^{MP} capture solely the effect of inter-

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[18] King (2000) emphasises this point as follows: "A transparent monetary policy reaction function means that the news should be in the developments of the economy not in the announcements of decisions by the central bank. … Hence a successful central bank should be boring – rather like a referee whose success is judged by how little his or her decisions intrude into the game itself."

[19] All results for the UK are robust to using the more liquid two front short sterling contracts traded on LIFFE. To maintain comparability across countries, we report results for LIBOR rates in this paper.

[20] See, e.g., Ehrmann and Fratzscher (2004). The set of macro news comprises advance GDP, consumer confidence, CPI, industrial production, ISM survey, nonfarm payrolls, PPI, retail sales, trade balance and unemployment for the United States; GPD, earnings, industrial production, manufacturing production, M4, PPI, RPIX, retail sales, trade balance and unemployment for the UK; euro area business confidence and

meeting communication. We have also tested whether including the "stock" of communication affects the reaction of financial markets to an additional piece of communication. In this case, we included in the vector of controls also the variables $\sum_{i=1}^{10} C_{t-i}^{EC}$ and $\sum_{i=1}^{10} C_{t-i}^{MP}$, i.e. the "stock" of communication over the last 10 days. The results remain virtually unchanged.

We assume that $\varepsilon_t = \sqrt{h_t} \cdot v_t$, with v_t is an i.i.d. sequence with zero mean and unit variance. The conditional variance h_t can therefore be expressed as a function of communication dummies (CD^{EC}, CD^{MP}), the past variance (h_{t-1}) and innovations (ε_{t-1}), and the controls XD$_t$ (entered as dummy variables, which are equal to one on the days of FOMC meetings or macro announcements and zero otherwise):

$$\ln(h_t) = \omega + \theta_1 \left(\left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| - \sqrt{\frac{2}{\pi}} \right) + \theta_2 \left(\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right) + \theta_3 \ln(h_{t-1}) + \kappa^{EC} CD_t^{EC} + \kappa^{MP} CD_t^{MP} + \varphi XD_t \quad (4)$$

The EGARCH approach corrects for the kurtosis, skewness, and time-varying volatility of the asset price. An additional advantage of the EGARCH approach is that we do not need to impose non-negativity constraints on the conditional second moments. The model is estimated via log-likelihood estimation of the function

$$L(\mu) = -\left(\frac{T}{2} \right) \ln(2\pi) - \frac{1}{2} \sum_{t=1}^{T} \left(\ln(h_t) + \frac{\varepsilon_t^2}{h_t} \right)$$

with μ the vector of parameters of interest and T the number of observations. (3)-(4) constitutes the benchmark model underlying our analysis of effectiveness.

Table 6 shows the results for the conditional mean equation (3) and Table 7 for the conditional variance equation (4). The overall results are compelling. Monetary policy communication generally has a significant effect on the short and medium-term horizons of the yield curve. For Federal Reserve statements the effect is around 1 basis point on average, and is found for nearly all maturities between three months and 5 years. For the Bank of England, where we would have expected less of a reaction of financial markets, we do indeed find much smaller coefficients, particularly at the very short end, where it is only one half of the coefficient found for the Federal Reserve. Finally, for the ECB, where our hypothesis was that markets would generally react to communication, as it serves as a useful indicator for future monetary policy decisions, we find a

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consumer confidence, German ifo business climate, industrial production, PPI, retail sales, trade balance, unemployment, CPI and GDP for the euro area.

highly systematic pattern, in that all maturities up to 5 years are affected significantly, and the effects are the largest of all three central banks, ranging from 1.6 to 2.5 basis points.

The second set of results refers to the market response to statements about the economic outlook. The striking finding of Table 6 is that mainly US markets react to such statements by the Federal Reserve, and the effects are strongest at the medium to long end of the yield curve. By contrast, markets do not react, or much less so, in the UK and the euro area to such communication. One interpretation is that these responses reflect the different monetary policy reaction functions of the three central banks. The strategies of the Bank of England and the ECB focus on price stability whereas the Federal Reserve gives a stronger weight to the real economy, and the findings of Table 6 mirror the market perception and anticipation of these strategies.

Third, communication also has a significant effect on other asset prices. A statement indicating a bias towards tightening leads to a drop in equity markets in all three economies. Inflation expectations are basically unaffected by communication. Moreover, the response of volatility to monetary policy communication is often positive, in particular in the US (Table 7).

Finally, in order to understand whether the effects of communication on financial markets are also *economically* important, we have compared the magnitude of the coefficients in table 6 with those for the macroeconomic news. In order to arrive at comparable estimates, we recoded the surprise components into 1,0,-1 dummy variables depending on whether the surprise component on a given day was positive, zero or negative. We find coefficients of a similar magnitude, which generally are somewhat smaller for the macro surprises than for central bank communication at the short maturities, and somewhat larger at the longer maturities.[21] Although these coefficients are not strictly comparable (as, for example, our communication dummies cannot distinguish whether the content of the communication was expected by the markets or took them by surprise), we take this evidence as suggestive that both, central bank communication and macroeconomic news, affect the markets in a similar fashion. Overall, we conclude that communication by committee members can influence markets, but that its effect differs across central banks.

5.3 Differences by person, type of statement and market conditions

In trying to understand these differences in the financial market response to communication, we now turn to the role of individual persons or groups in the committees and the type of statements. In particular, what type of communication is important, and does it matter who provides this information?

We modify our model accordingly and estimate

$$r_t = \alpha + \lambda\, r_{t-1} + \beta_1^{EC}\, C_t^{EC}\, D_t + \beta_2^{EC}\, C_t^{EC}\, (1-D_t)$$
$$+ \beta_1^{MP}\, C_t^{MP}\, D_t + \beta_2^{MP}\, C_t^{MP}\, (1-D_t) + \delta\, X_t + \varepsilon_t \tag{5}$$

$$\ln(h_t) = \omega + \theta_1\left(\left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{\frac{2}{\pi}}\right) + \theta_2\left(\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right) + \theta_3 \ln(h_{t-1}) + \kappa_1^{EC}\, CD_t^{EC}\, D_t$$
$$+ \kappa_2^{EC}\, CD_t^{EC}\, (1-D_t) + \kappa_1^{MP}\, CD_t^{MP}\, D_t + \kappa_2^{MP}\, CD_t^{MP}\, (1-D_t) + \varphi X_t \tag{6}$$

which is defined analogously to the benchmark model (3)-(4), only that now we distinguish between e.g. whether the person communicating is the head ($D_t=1$) or another committee member ($D_t=0$), as well as other types of asymmetries.

Tables 8 and 9 provide the results for these tests. The first panel of Table 8 tests whether communication on monetary policy by Chairman Greenspan has a larger effect on financial markets than that by other FOMC members. We find indeed that it is mainly communication by the Chairman that moves markets, as communication by the other members of the FOMC does not affect markets significantly. For several cases, this difference in effect is statistically significant. For the Bank of England, we find similarly that the effect of communication on interest rates reported in table 6 is based on communication by Governors George and King, as communication by other members does not exert a significant effect on rates, and the estimated coefficients are smaller for the other members. Finally, for the ECB, as expected, we find that both the president and the other members of the Governing Council affect interest rates in a statistically significant way, with generally no statistically significant difference between the two.

Looking at the differences between different groups of members mirrors the distinction found for the head and the other members. (second columns, Tables 8-9). Moreover, for the case of the ECB, statements that go against the direction of past monetary policy decisions have often a larger effect on financial markets than those that confirm the direction. This indicates that markets may pay closer attention to those statements that signal a directional change in policy.

In summary, the differences across members and groups in the policy-setting committees constitute an interesting result that is overall consistent with those about the communication strategies presented in section 4. In section 4 we showed that the degree of dispersion in communication among FOMC members is significantly larger than that for the ECB's Governing Council or the Bank of England's MPC. At the same time, voting dispersion of members in the policy meetings is

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[21] Results are not reported here for brevity, but are available upon request.

large for the MPC. One interpretation of the findings here is that US market participants tend to focus on the statements of those individuals who are considered to represent the majority FOMC view, in particular those of the FOMC Chairman. These statements prove to be highly influential in financial markets. By contrast, low dispersion in communication in the euro area implies that markets pay equal attention to statements by all members. For the MPC, markets are found to react relatively less to statements, which may in part reflect the fact that communication may not yield a precise indicator for the voting behaviour of individual members and thus for MPC decisions.

6. Conclusions

With the recent trend towards independent central banks, there has been a development towards decision-making by committees rather than individuals, as well as a strong emphasis on achieving greater central bank transparency. Against this background, the paper has analysed the *strategies* as well as the *effectiveness* of communication by the Federal Reserve, the Bank of England and the ECB. We have asked how the communication strategies in these three central banks differ, and we have assessed whether communication has enabled financial markets to better anticipate monetary policy decisions and also has helped central banks in moving asset prices in the desired way. A central argument of the paper is that the effectiveness of communication is not independent from the decision-making process in the committee. We find that it is important to distinguish between what committee members *say*, i.e. how they communicate, from what they actually *do*, i.e. how they vote on monetary policy decisions.

The paper has shown that the Federal Reserve is following a more *individualistic communication strategy* in that there is a high degree of dispersion in what the individual FOMC members say. The decision-making process by the FOMC, however, is collegial in that most decisions are made unanimously. By contrast, the Bank of England has been pursuing a more *collegial communication strategy* but at the same time has also a highly individualistic approach to decision-making as the majority of MPC decisions has not been made by consensus. Finally, the approach chosen by the ECB is again fundamentally different by being collegial throughout both in its communication strategy and in its approach to decision-making.

In the second part of the analysis, the paper turned to the question of how these differences in strategies impact the *effectiveness* of communication. We argue that a collegial approach to communication and decision-making as practiced by the ECB should lead to highly predictable policy decisions, and should imply that markets react to statements by all policy-makers in the same fashion. An approach as followed by the Federal Reserve, where communication is dispersed but voting is consensual, makes a central bank predictable if markets are able to figure out whose statements to watch closely. In this case, one would expect that communication by some policy-makers is relatively more influential than that of their peers. Finally, we argue that an approach as

followed by the Bank of England, where communication is collegial yet voting is highly dispersed, runs the risk of being less predictable, and might imply that financial markets do not react to communication as strongly as for the other central banks.

In our empirical analysis, we find that the predictability of policy decisions is highest for the FOMC and the Governing Council, and lower for the MPC. Also the reaction of financial markets to communication essentially confirms our hypotheses. US markets react significantly stronger to statements by Chairman Greenspan and less to statements by other FOMC members, whereas euro area markets respond to communication by the ECB President and other Governing Council members to a very similar extent. Moreover, US markets react to statements both about the monetary policy inclination and the economic outlook, whereas UK and euro area markets respond mostly only to communication about monetary policy, a difference that most likely reflects also the different market perceptions of policy reaction functions.

Predictability and market impact of communication are necessary but not sufficient conditions for successful and effective communication as communication policy should also aim at anchoring and guiding market expectations over the medium- to long-run (Issing 2005). Moreover, it can be argued that with a transparent monetary policy reaction function, there is less need for central banks to communicate and markets may react less to statements by central banks as compared to macroeconomic news (King 2000). Nevertheless, the findings of this paper indicate that the approaches to communication by the Federal Reserve and by the ECB have proven to be equally successful in their effectiveness, despite having pursued very different strategies, suggesting that there may not be a single best approach to central bank communication.

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Table 1: Communication on monetary policy inclination and economic outlook

		monetary policy direction							economic outlook						
		tightening		neutral		easing		total	stronger		no change		weaker		total
Federal Reserve	Chairman	21	35%	7	12%	32	53%	60	16	50%	1	3%	15	47%	32
May 1999 - May 2004	Board of Governors[1]	5	21%	14	58%	5	21%	24	9	56%	1	6%	6	38%	16
	Regional Presidents	16	38%	15	36%	11	26%	42	8	38%	4	19%	9	43%	21
	total	*42*	*33%*	*36*	*29%*	*48*	*38%*	*126*	*33*	*48%*	*6*	*9%*	*30*	*43%*	*69*
Bank of England	Governor	21	42%	14	28%	15	30%	50	15	68%	2	9%	5	23%	22
May 1997 - May 2004	Internal MPC members[1]	4	13%	18	60%	8	27%	30	6	40%	4	27%	5	33%	15
	External MPC members	2	12%	8	47%	7	41%	17	3	33%	3	33%	3	33%	9
	total	*27*	*28%*	*40*	*41%*	*30*	*31%*	*97*	*24*	*52%*	*9*	*20%*	*13*	*28%*	*46*
European Central Bank	President	11	22%	28	55%	12	24%	51	20	65%	0	0%	11	35%	31
January 1999 - May 2004	Executive Board[1]	6	8%	52	73%	13	18%	71	25	50%	9	18%	16	32%	50
	NCB Governors	15	18%	49	58%	21	25%	85	34	54%	13	21%	16	25%	63
	total	*32*	*15%*	*129*	*62%*	*46*	*22%*	*207*	*79*	*55%*	*22*	*15%*	*43*	*30%*	*144*

Notes: Numbers in % indicate share of respective total number of statements for that person or group. Some statements include comments both about monetary policy and about the economic outlook.
[1] These numbers do not include the statements of the respective governors.

Table 2: Frequency of communication before meetings with and without interest rate changes

	Communication frequency prior to meetings		
	with interest rate changes	without interest rate changes	Δ
Federal Reserve	13.91%	9.33%	***
Bank of England	6.41%	4.75%	*
European Central Bank	15.43%	15.54%	

Note: Δ denotes whether the parameters are statistically significantly different across columns. ***, **, * indicate significance at the 99%, 95% and 90% levels.

Table 3: Dispersion of communication

Panel A: Dispersion among committee members

dispersion index	monetary policy direction				economic outlook			
		Δ^1	Δ^2	Δ^3		Δ^1	Δ^2	Δ^3
Federal Reserve May 1999 - May 2004	0.32	-	***	***	0.23	-	***	
Bank of England May 1997 - May 2004	0.13	***	-		0.03	***	-	***
European Central Bank January 1999 - May 2004	0.15	***		-	0.18		***	-

Panel B: Dispersion of the governor

dispersion index	monetary policy direction				economic outlook			
		Δ^1	Δ^2	Δ^3		Δ^1	Δ^2	Δ^3
Federal Reserve May 1999 - May 2004	0.07	-			0.03	-		
Bank of England May 1997 - May 2004	0.04		-		0.01		-	
European Central Bank January 1999 - May 2004	0.02			-	0.01			-

Notes: Displayed are the average dispersion measures over all inter-meeting periods, as defined in the text. Δ^1 shows statistic significance of difference with the Federal Reserve, Δ^2 with the Bank of England, and Δ^3 with the ECB.
***, **, * indicate significance at the 99%, 95% and 90% levels.

Table 4: Consistency of communication

Panel A: Consistency of communication with next policy *decision*

% share of consistent statements	monetary policy direction				economic outlook			
		Δ^1	Δ^2	Δ^3		Δ^1	Δ^2	Δ^3
Federal Reserve May 1994 - May 2004	56.0%		-	**	40.0%		-	***
Bank of England May 1997 - May 2004	58.6%			-	28.9%			-
European Central Bank January 1999 - May 2004	67.5%	**		-	21.2%	***		-

Panel B: Consistency of communication with next policy *change*

% share of consistent statements	monetary policy direction				economic outlook			
		Δ^1	Δ^2	Δ^3		Δ^1	Δ^2	Δ^3
Federal Reserve May 1994 - May 2004	84.1%	-			76.5%	-	*	**
Bank of England May 1997 - May 2004	78.0%		-		58.3%	*	-	
European Central Bank January 1999 - May 2004	87.8%			-	58.1%	**		-

Notes: Displayed are the consistent statements with the next monetary policy *change* as a share of all non-neutral statements. Δ^1 shows statistic significance of difference with the Federal Reserve, Δ^2 with the Bank of England, and Δ^3 with the ECB.
***, **, * indicate significance at the 99%, 95% and 90% levels.

Table 5: Predictability of policy decisions

	Federal Reserve May 1999-2004	Bank of England May 1997-2004		European Central Bank Jan. 1999-2004		
			Δ		Δ	Δ*
Panel A: all monetary policy meetings (*excluding* unscheduled meetings)						
Number of meetings	40	84		99		
Mean absolute surprise at meeting	0.027	0.059	***	0.032		***
Variance of the absolute change	0.019	0.012	**	0.007		
Panel B: meetings with interest rate changes (*excluding* unscheduled meetings)						
Number of meetings	16	27		14		
Mean absolute surprise at meeting	0.062	0.106	*	0.103		
Variance of the absolute change	0.013	0.014	*	0.008		
Panel C: all monetary policy meetings (*including* unscheduled meetings)						
Number of meetings	43	85		100		
Mean absolute surprise at meeting	0.056	0.060		0.036		**
Variance of the absolute change	0.026	0.012	***	0.007		
Panel D: meetings with interest rate changes (*including* unscheduled meetings)						
Number of meetings	19	28		15		
Mean absolute surprise at meeting	0.121	0.107		0.121		
Variance of the absolute change	0.027	0.013	**	0.009		

Note: Δ denotes whether the parameter in the respective column is statistically significantly different from the parameter for the Federal Reserve. Δ * compares the parameters of the ECB and the Bank of England. ***, **, * indicate significance at the 99%, 95% and 90% levels.

Table 6: Market reaction to communication, mean equation

financial market variable:	Federal Reserve monetary policy		economic outlook		sign.
3-month interest rates	0.010 ***	0.003	0.006 ***	0.002	
6-month interest rates	0.005	0.003	0.011 ***	0.002	
1-year interest rates	0.009 **	0.004	0.018 ***	0.004	
2-year interest rates	0.010 *	0.006	0.020 ***	0.007	
5-year interest rates	0.011 *	0.007	0.022 ***	0.007	
10-year interest rates	0.008	0.007	0.018 **	0.007	
20-year interest rates	0.006	0.006	0.010	0.006	
equity market	-0.003 ***	0.001	0.003 ***	0.001	***
exchange rate	0.000	0.001	-0.002 ***	0.001	*
5-year inflation expectations	0.007	0.006	-0.003	0.005	

financial market variable:	Bank of England monetary policy		economic outlook		sign.
3-month interest rates	0.005 ***	0.002	-0.003	0.002	***
6-month interest rates	0.008 ***	0.002	-0.006 **	0.003	***
1-year interest rates	0.009 **	0.004	0.000	0.004	
2-year interest rates	0.001	0.007	0.001	0.008	
5-year interest rates	0.001	0.006	0.002	0.007	
10-year interest rates	-0.002	0.006	0.010	0.008	
20-year interest rates	0.000	0.006	0.002	0.007	
equity market	-0.003 **	0.001	0.004 ***	0.001	***
exchange rate	0.000	0.001	0.002 **	0.001	**
5-year inflation expectations	-0.001	0.005	-0.003	0.005	

financial market variable:	European Central Bank monetary policy		economic outlook		sign.
3-month interest rates	0.021 ***	0.000	0.003 ***	0.000	***
6-month interest rates	0.016 ***	0.002	0.002 ***	0.000	***
1-year interest rates	0.025 ***	0.002	0.004 ***	0.001	***
2-year interest rates	0.025 ***	0.005	0.000	0.005	***
5-year interest rates	0.020 ***	0.005	-0.002	0.005	***
10-year interest rates	0.006	0.005	-0.002	0.004	
20-year interest rates	0.004	0.004	-0.003	0.003	*
equity market	-0.004 ***	0.001	0.002 *	0.001	***
exchange rate	-0.001	0.001	0.000	0.001	*
5-year inflation expectations	-0.002	0.004	0.000	0.003	

Notes: Standard errors are shown in italics to the right of the coefficients. ***, **, * indicate significance at the 99%, 95% and 90% levels, respectively. "sign." shows whether difference between the coefficients is significant.

Table 7: Market reaction to communication, volatility equation

Federal Reserve

financial market variable:	monetary policy		economic outlook		sign.
3-month interest rates	0.238 ***	0.021	-0.253 ***	0.037	***
6-month interest rates	0.190 ***	0.019	-0.201 ***	0.035	***
1-year interest rates	0.136 ***	0.026	-0.096 *	0.055	***
2-year interest rates	0.046 ***	0.016	0.015	0.027	
5-year interest rates	0.056 ***	0.018	0.013	0.030	**
10-year interest rates	0.042 *	0.021	0.050	0.033	
20-year interest rates	0.001	0.017	0.046 *	0.027	**
equity market	0.084 ***	0.021	-0.099 ***	0.033	***
exchange rate	0.003	0.020	-0.044	0.031	
5-year inflation expectations	0.074 ***	0.007	0.308 ***	0.009	***

Bank of England

financial market variable:	monetary policy		economic outlook		sign.
3-month interest rates	0.068 ***	0.008	-0.357 ***	0.013	***
6-month interest rates	0.218 ***	0.044	-0.213 ***	0.070	***
1-year interest rates	0.015	0.034	-0.090 **	0.043	
2-year interest rates	0.201 ***	0.012	-0.121 ***	0.022	***
5-year interest rates	0.015	0.022	0.059 **	0.030	
10-year interest rates	-0.048 ***	0.015	0.084 ***	0.025	***
20-year interest rates	-0.029 ***	0.009	0.051 ***	0.016	***
equity market	0.052	0.037	-0.239 ***	0.056	***
exchange rate	0.053 ***	0.003	-0.128 ***	0.004	***
5-year inflation expectations	0.001	0.019	0.029	0.028	*

European Central Bank

financial market variable:	monetary policy		economic outlook		sign.
3-month interest rates	0.415 ***	0.024	-0.244 ***	0.027	***
6-month interest rates	0.154	0.151	-0.069	0.101	
1-year interest rates	0.241 **	0.120	0.322 **	0.135	
2-year interest rates	0.043	0.026	-0.013	0.032	***
5-year interest rates	-0.041	0.025	-0.086 ***	0.031	***
10-year interest rates	-0.012 **	0.005	0.047 ***	0.006	***
20-year interest rates	-0.013	0.008	0.026 **	0.011	***
equity market	-0.158 ***	0.022	0.076 **	0.030	***
exchange rate	-0.050 ***	0.017	0.088 ***	0.023	***
5-year inflation expectations	0.293 ***	0.036	-0.567 ***	0.045	***

Notes: Standard errors are shown in italics to the right of the coefficients. ***, **, * indicate significance at the 99%, 95% and 90% levels, respectively. "sign." shows whether difference between the coefficients is significant.

Table 8: Market reaction to communication on *monetary policy inclination* -- by person and type, mean equation

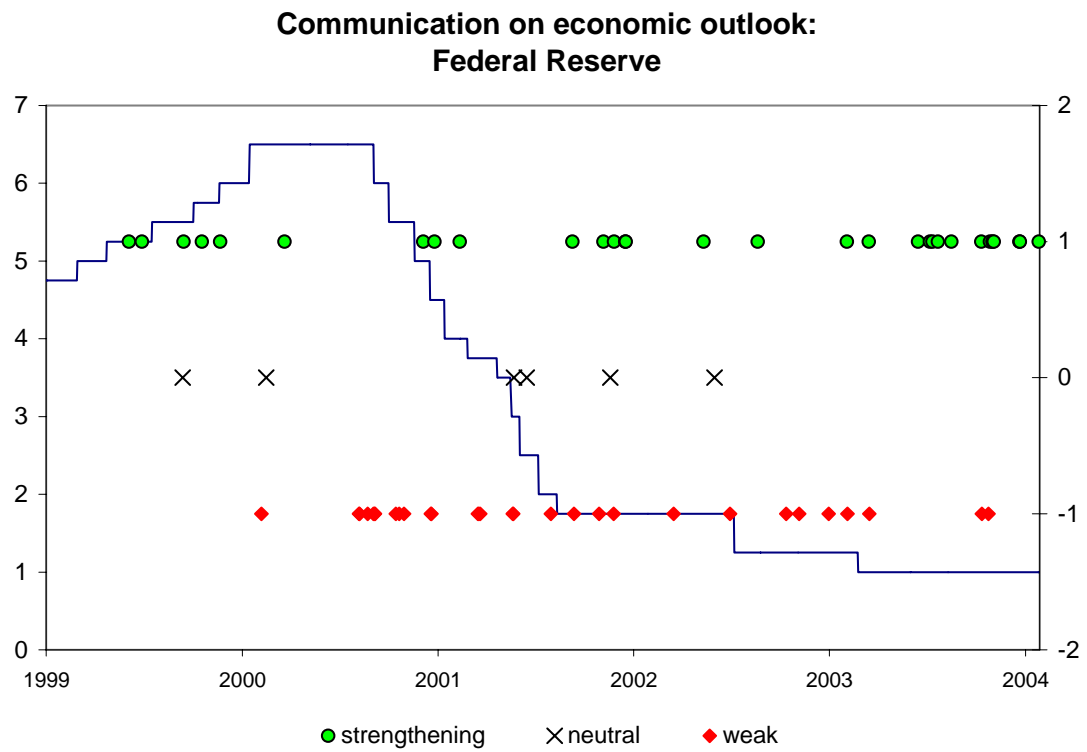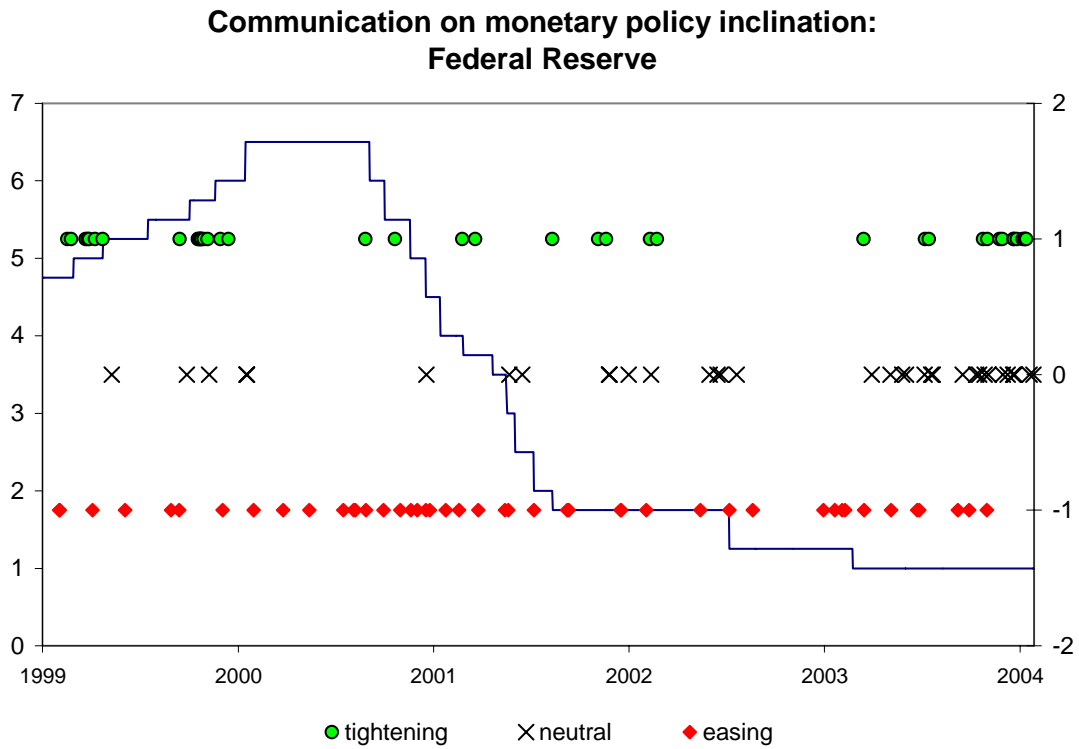|	person — head	person — others	sign.	group — Fed Governors / BoE internal / ECB Executive	group — Fed Presidents / BoE external / NCB Governors	sign.	policy direction — leaning with	policy direction — leaning against	sign.
Federal Reserve									
3-month interest rates	0.015 *** 0.004	0.011 *** 0.002		0.014 *** 0.003	0.011 *** 0.003		0.013 *** 0.003	0.009 ** 0.004	
6-month interest rates	0.017 *** 0.004	-0.002 0.004	***	0.015 *** 0.003	0.000 0.005	**	0.007 ** 0.003	0.011 ** 0.005	
1-year interest rates	0.019 *** 0.005	0.003 0.006	*	0.017 *** 0.004	0.002 0.007	*	0.019 *** 0.005	0.007 0.007	
2-year interest rates	0.022 *** 0.007	-0.002 0.008	**	0.020 *** 0.006	0.006 0.013		0.022 *** 0.008	0.009 0.007	
5-year interest rates	0.021 *** 0.007	0.003 0.012		0.017 *** 0.006	0.011 0.014		0.018 ** 0.007	0.013 0.013	
10-year interest rates	0.011 0.009	0.003 0.011		0.009 0.007	0.010 0.015		0.009 0.008	0.010 0.013	
20-year interest rates	0.009 0.006	0.005 0.013		0.006 0.007	0.010 0.013		0.009 0.007	0.006 0.007	
equity market	-0.005 *** 0.001	0.000 0.002	***	-0.004 *** 0.001	0.000 0.002		-0.003 *** 0.001	-0.003 *** 0.001	
exchange rate	-0.001 0.001	0.002 0.001	**	-0.001 * 0.001	0.001 0.001		0.000 0.001	0.000 0.001	
5-year inflation expectations	0.003 0.006	-0.001 0.010		0.001 0.007	0.005 0.009		0.003 0.009	0.009 0.011	
Bank of England									
3-month interest rates	0.007 *** 0.002	0.002 0.003		0.007 *** 0.002	-0.001 0.003	***	0.006 *** 0.002	-0.004 0.005	*
6-month interest rates	0.012 *** 0.002	0.005 0.005		0.010 *** 0.002	-0.002 0.005	**	0.008 ** 0.003	-0.001 0.010	
1-year interest rates	0.013 *** 0.005	0.007 0.007		0.012 *** 0.004	-0.002 0.006	*	0.008 ** 0.004	-0.008 0.003	***
2-year interest rates	-0.005 0.009	0.010 0.010		-0.002 0.007	0.010 0.010		0.000 0.006	-0.025 0.037	
5-year interest rates	-0.008 0.008	0.009 0.009		-0.003 0.007	0.010 0.009		-0.001 0.006	-0.018 0.024	
10-year interest rates	-0.014 * 0.008	0.010 0.011	*	-0.009 0.007	0.013 0.010	*	-0.004 0.007	-0.020 0.023	
20-year interest rates	-0.011 0.008	0.009 0.008	*	-0.006 0.007	0.011 0.008	*	-0.005 0.006	0.000 0.025	
equity market	-0.004 ** 0.002	-0.001 0.003		-0.003 ** 0.001	0.000 0.002		-0.004 *** 0.001	-0.003 0.005	
exchange rate	0.000 0.001	0.000 0.001		0.000 0.001	-0.001 0.001		0.000 0.001	-0.003 0.002	
5-year inflation expectations	-0.007 0.007	0.006 0.007	**	-0.006 0.005	0.009 0.006	**	-0.004 0.005	-0.013 0.017	
European Central Bank									
3-month interest rates	0.010 *** 0.003	0.009 *** 0.002		0.008 *** 0.000	0.015 *** 0.000	***	0.008 *** 0.002	0.017 0.011	
6-month interest rates	0.015 *** 0.003	0.015 *** 0.002		0.006 *** 0.002	0.012 *** 0.002	***	0.017 *** 0.003	0.015 *** 0.004	
1-year interest rates	0.022 *** 0.004	0.025 *** 0.002		0.007 * 0.004	0.023 *** 0.004	***	0.018 *** 0.001	0.029 *** 0.008	
2-year interest rates	0.031 *** 0.009	0.020 *** 0.006		0.010 0.006	0.013 ** 0.006	**	0.018 *** 0.006	0.072 *** 0.012	***
5-year interest rates	0.023 ** 0.010	0.019 *** 0.006		0.002 0.006	0.015 ** 0.006		0.013 ** 0.006	0.069 *** 0.019	***
10-year interest rates	0.012 0.008	0.005 0.006		-0.001 0.006	0.005 0.006		0.001 0.005	0.048 *** 0.009	***
20-year interest rates	0.005 0.009	0.001 0.006		-0.004 0.004	0.003 0.003	**	-0.005 0.004	0.042 *** 0.011	***
equity market	-0.006 *** 0.002	-0.004 *** 0.001		-0.006 *** 0.001	-0.002 * 0.001	*	-0.005 *** 0.002	-0.002 0.002	
exchange rate	-0.001 0.001	-0.002 0.001		0.000 0.001	-0.001 0.001		-0.001 0.001	-0.002 0.002	
5-year inflation expectations	0.010 0.008	-0.010 0.006	**	0.004 0.005	-0.010 * 0.006	**	-0.006 0.004	0.011 0.007	**

Notes: Standard errors are shown in italics to the right of the coefficients. ***, **, * indicate significance at the 99%, 95% and 90% levels, respectively. "sign." shows whether difference between the coefficients is significant.

Table 9: Market reaction to communication on *economic outlook* -- by person and type, mean equation

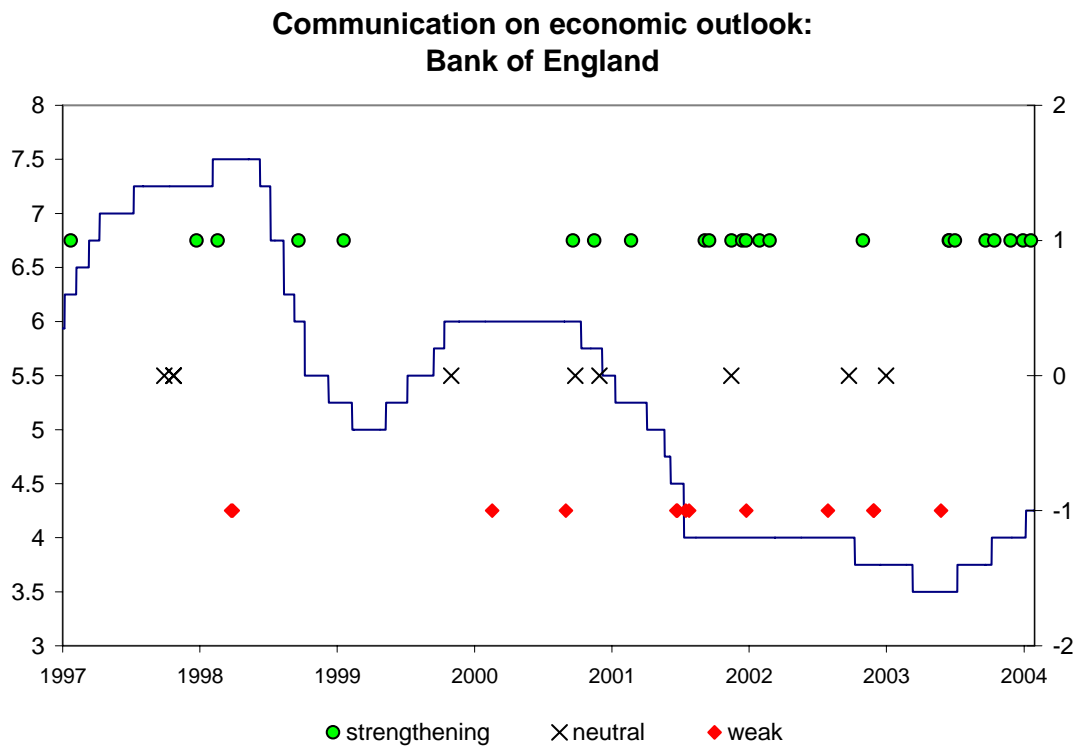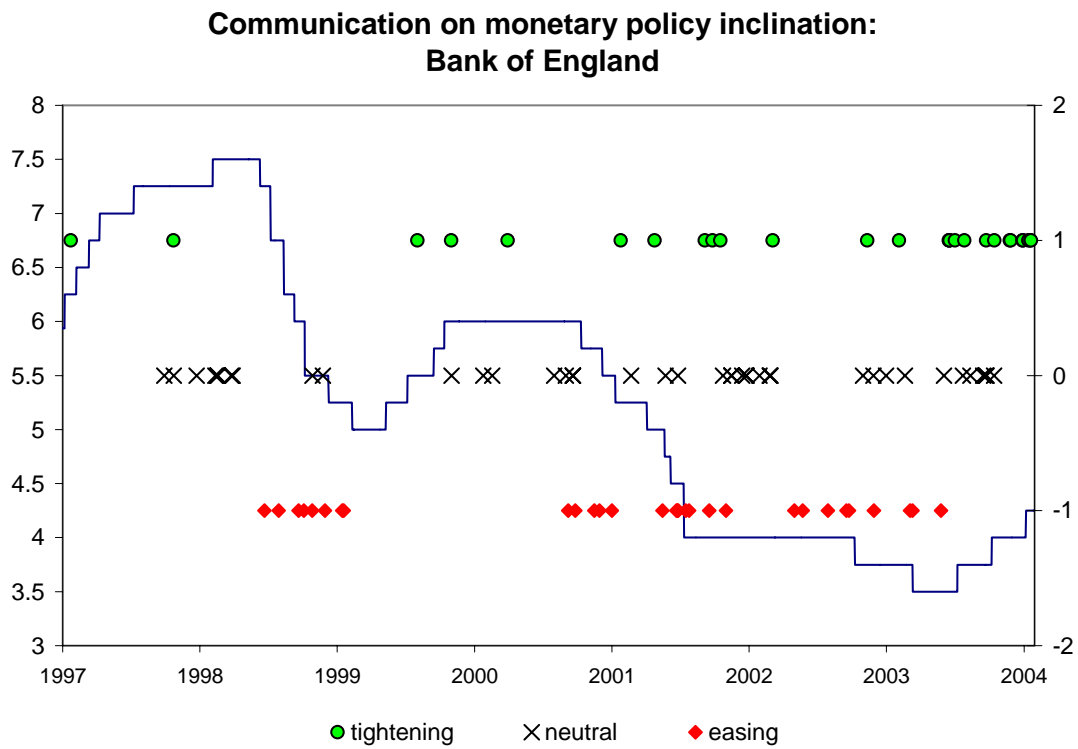|	person					group					policy direction				
	head			others		Fed Governors BoE internal ECB Executive		Fed Presidents BoE external NCB Governors		sign.	leaning with		leaning against		sign.
	coef	se	sign.	coef	se	coef / se		coef / se			coef	se	coef	se	
Federal Reserve															
3-month interest rates	0.009 ***	0.002		0.002	0.003	0.007 *** 0.001		0.006 0.006			0.009 ***	0.002	0.001	0.002	**
6-month interest rates	0.013 ***	0.003		0.006	0.006	0.012 *** 0.002		0.006 0.006			0.017 ***	0.003	0.006 *	0.004	**
1-year interest rates	0.015 ***	0.005	*	0.024 ***	0.008	0.017 *** 0.004		0.024 *** 0.008			0.021 ***	0.005	0.013	0.008	
2-year interest rates	0.018 **	0.008		0.031 ***	0.011	0.020 *** 0.007		0.044 *** 0.013			0.022 **	0.011	0.021 **	0.010	
5-year interest rates	0.023 ***	0.008		0.029 **	0.014	0.021 *** 0.007		0.038 ** 0.015			0.024 ***	0.009	0.028 **	0.014	
10-year interest rates	0.018 **	0.008		0.024 *	0.012	0.016 ** 0.007		0.036 ** 0.015			0.019 **	0.009	0.023 *	0.012	
20-year interest rates	0.006	0.009		0.010	0.011	0.006 0.006		0.025 * 0.013			0.004	0.009	0.022 **	0.011	
equity market	0.005 ***	0.001		0.002	0.001	0.004 *** 0.001		0.002 0.003			0.005 ***	0.001	0.004 ***	0.001	
exchange rate	-0.002 **	0.001	**	-0.004 **	0.002	-0.002 *** 0.001		-0.003 ** 0.001			-0.003 ***	0.001	-0.002	0.001	
5-year inflation expectations	0.006	0.008		-0.001	0.015	0.003 0.008		0.013 0.022			-0.003	0.008	-0.001	0.007	
Bank of England															
3-month interest rates	-0.004	0.003		-0.003	0.003	-0.002 0.003		-0.003 0.003			-0.003	0.003	-0.005 *	0.003	
6-month interest rates	-0.005	0.004		-0.004	0.004	-0.001 0.003		-0.003 0.004			0.001	0.007	-0.013 ***	0.004	
1-year interest rates	-0.001	0.010		-0.003	0.010	0.004 0.006		-0.004 0.008			0.006	0.013	-0.003	0.008	*
2-year interest rates	0.005	0.011		-0.003	0.015	0.007 0.010		-0.011 0.014			0.011	0.016	-0.009	0.009	
5-year interest rates	0.002	0.011		0.002	0.010	0.007 0.008		-0.011 0.009		*	0.013	0.012	-0.010	0.009	
10-year interest rates	0.015	0.011		0.004	0.011	0.020 ** 0.009		-0.015 0.010		***	0.022 *	0.011	-0.003	0.010	
20-year interest rates	0.005	0.010		0.001	0.009	0.008 0.008		-0.010 0.008		*	0.017	0.011	-0.009	0.008	*
equity market	0.007 ***	0.002		0.002	0.002	0.006 *** 0.001		-0.001 0.002		***	0.006 ***	0.002	0.001	0.002	*
exchange rate	0.003 ***	0.001		0.001	0.001	0.002 *** 0.001		0.000 0.001		**	0.002 **	0.001	0.001	0.001	*
5-year inflation expectations	0.003	0.009	*	-0.009 *	0.005	0.001 0.005		-0.009 * 0.005		**	0.006	0.006	-0.013 **	0.007	**
European Central Bank															
3-month interest rates	0.000	0.002		0.002 **	0.001	0.001 *** 0.000		0.002 *** 0.000		***	0.000	0.001	0.003 ***	0.001	*
6-month interest rates	0.002	0.003		0.003 **	0.001	0.000 0.002		0.002 * 0.001			0.000	0.002	0.004 **	0.002	*
1-year interest rates	0.004	0.004		0.004	0.003	0.005 * 0.003		0.003 0.002			-0.001	0.001	0.006 ***	0.001	***
2-year interest rates	-0.002	0.008		0.002	0.006	-0.005 0.005		0.004 0.006			-0.001	0.006	0.008	0.008	
5-year interest rates	-0.008	0.010		0.001	0.005	-0.003 0.005		0.002 0.005			0.000	0.006	-0.002	0.007	
10-year interest rates	-0.011	0.009		0.002	0.005	-0.009 * 0.005		0.006 0.005		***	0.000	0.005	-0.004	0.007	
20-year interest rates	-0.011 *	0.006		0.001	0.003	-0.008 *** 0.003		0.004 ** 0.002		***	0.001	0.004	-0.006	0.006	
equity market	0.002	0.002		0.002	0.001	0.003 *** 0.001		0.000 0.001		*	0.002	0.002	0.002	0.002	
exchange rate	0.000	0.001		0.000	0.001	0.000 0.001		0.000 0.001			0.000	0.001	0.000	0.001	
5-year inflation expectations	0.004	0.007		-0.003	0.003	0.003 0.003		-0.005 0.003		***	0.003	0.004	-0.004	0.004	

Notes: Standard errors are shown in italics to the right of the coefficients. ***, **, * indicate significance at the 99%, 95% and 90% levels, respectively. "sign." shows whether difference between the coefficients is significant.

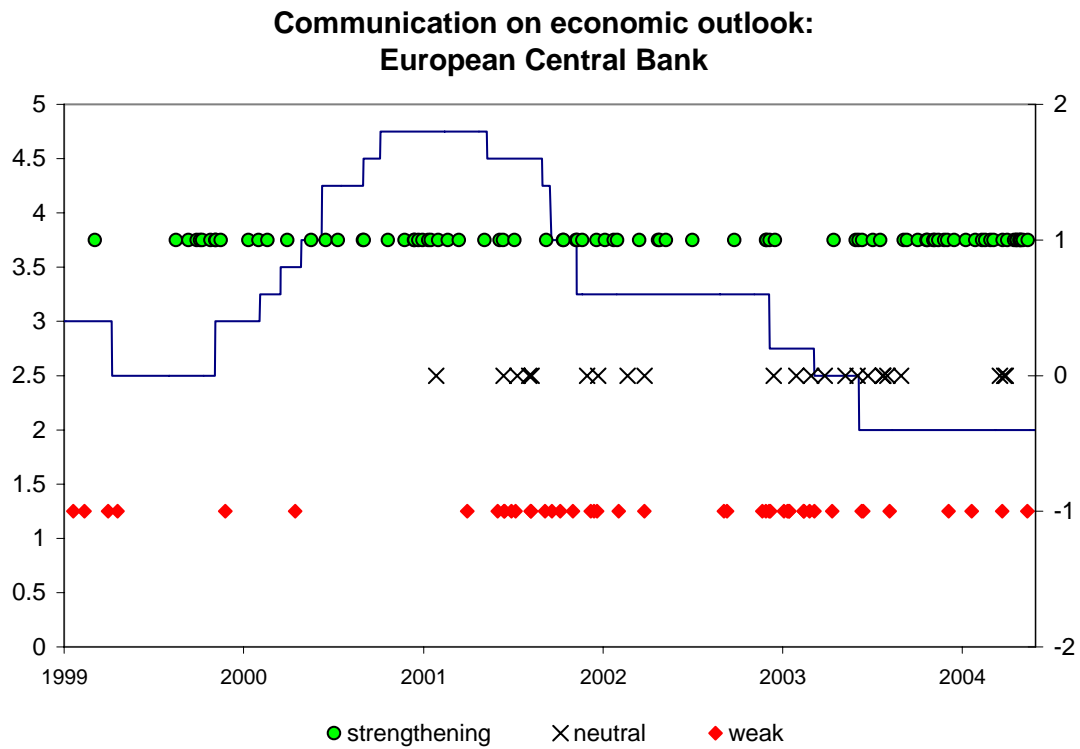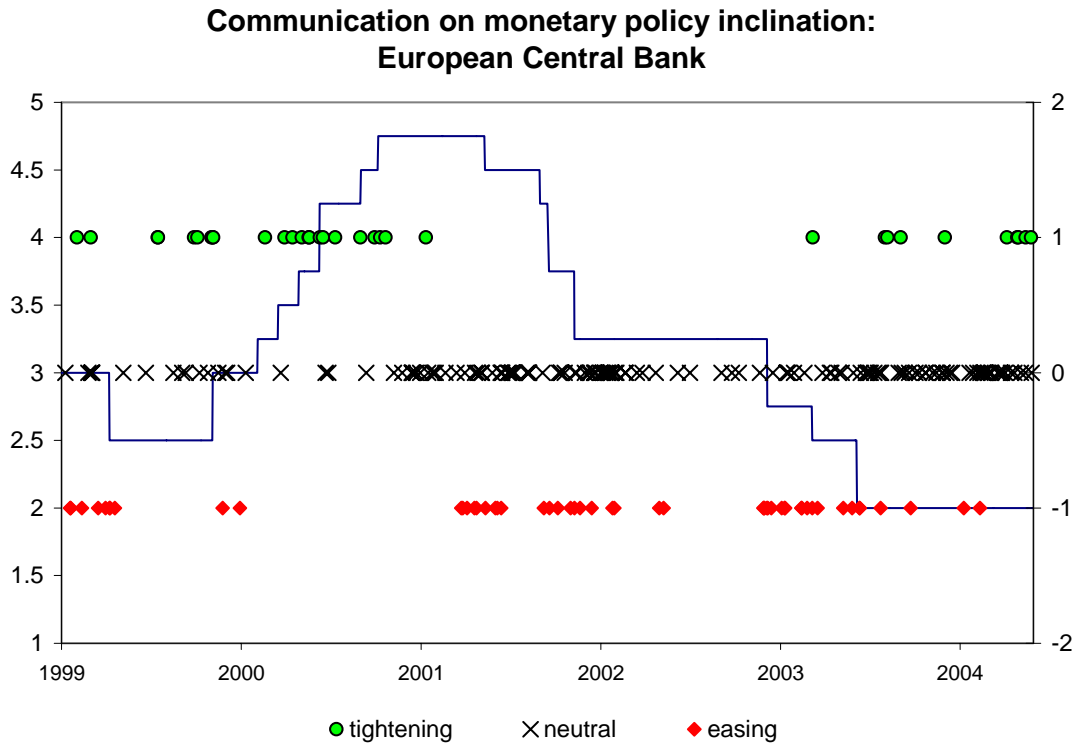# Figure 1.a: Communication by the Federal Reserve

Communication on monetary policy inclination: Federal Reserve

Legend: ● tightening   ✕ neutral   ◆ easing

Communication on economic outlook: Federal Reserve

Legend: ● strengthening   ✕ neutral   ◆ weak

Notes: See text for explanation.

Figure 1.b: Communication by the Bank of England

**Communication on monetary policy inclination:
Bank of England**

● tightening   ✕ neutral   ◆ easing

**Communication on economic outlook:
Bank of England**

● strengthening   ✕ neutral   ◆ weak

Notes: See text for explanation.

Figure 1.c: Communication by the European Central Bank

Communication on monetary policy inclination: European Central Bank

● tightening   ✕ neutral   ◆ easing

Communication on economic outlook: European Central Bank

● strengthening   ✕ neutral   ◆ weak

Notes: See text for explanation.

Figure 2.a: Frequency of communication around meetings of the Federal Reserve's FOMC
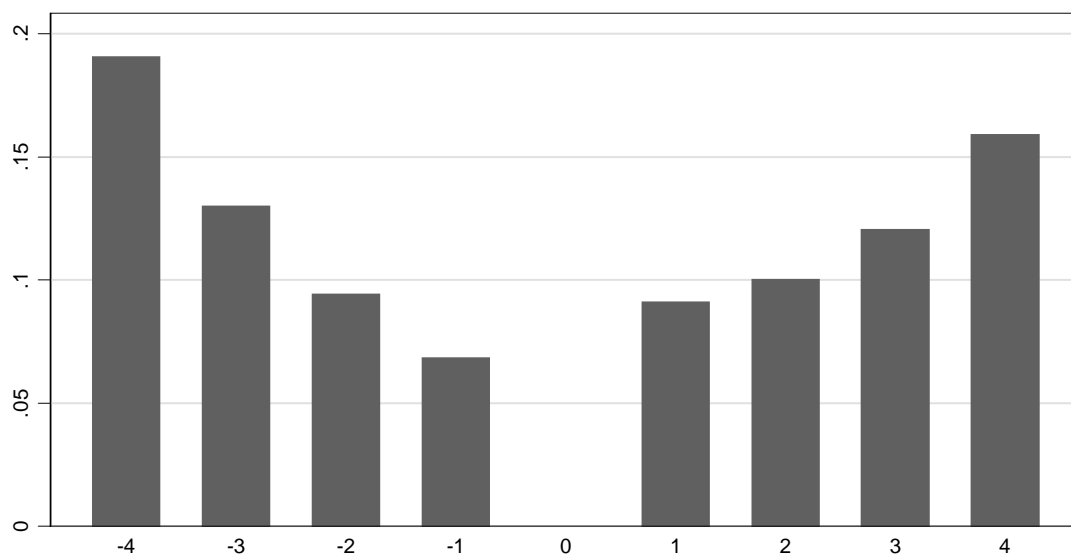
Notes: The vertical axis indicates the fraction of days in which communication takes place. The bars aggregate data from four days (i.e., bar "-1" contains days 4, 3, 2 and 1 before a meeting of the decision-making body). The first and last bars additionally contain all days beyond ±16 (for which generally less than 10 observations are available).

Figure 2.b: Frequency of communication around meetings of the Bank of England's MPC
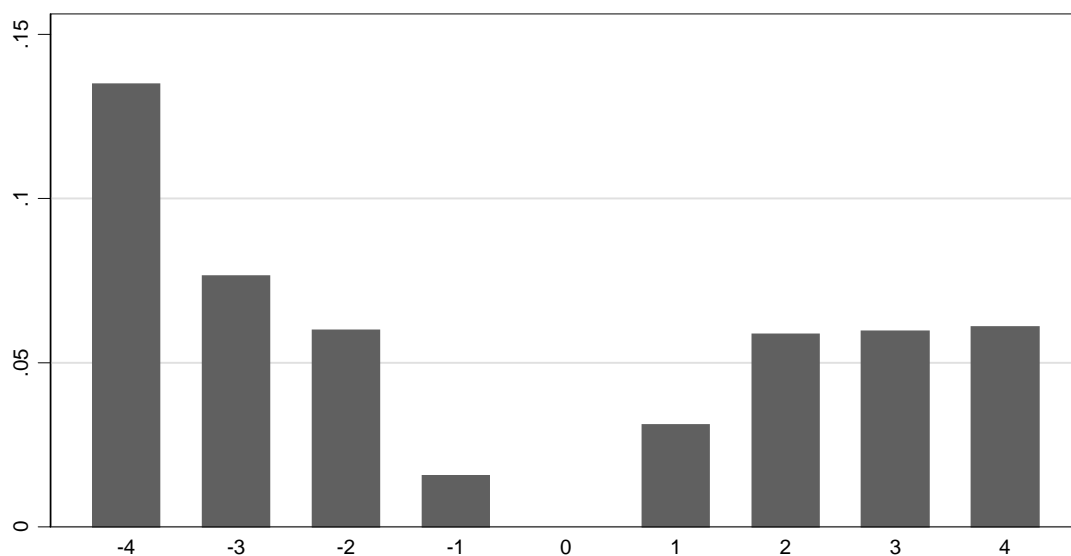
Notes: The vertical axis indicates the fraction of days in which communication takes place. The bars aggregate data from three days (i.e., bar "-1" contains days 3, 2 and 1 before a meeting of the decision-making body). The first and last bars additionally contain all days beyond ±16 (for which generally less than 10 observations are available).

**Figure 2.c: Frequency of communication around meetings of the ECB's Governing Council**
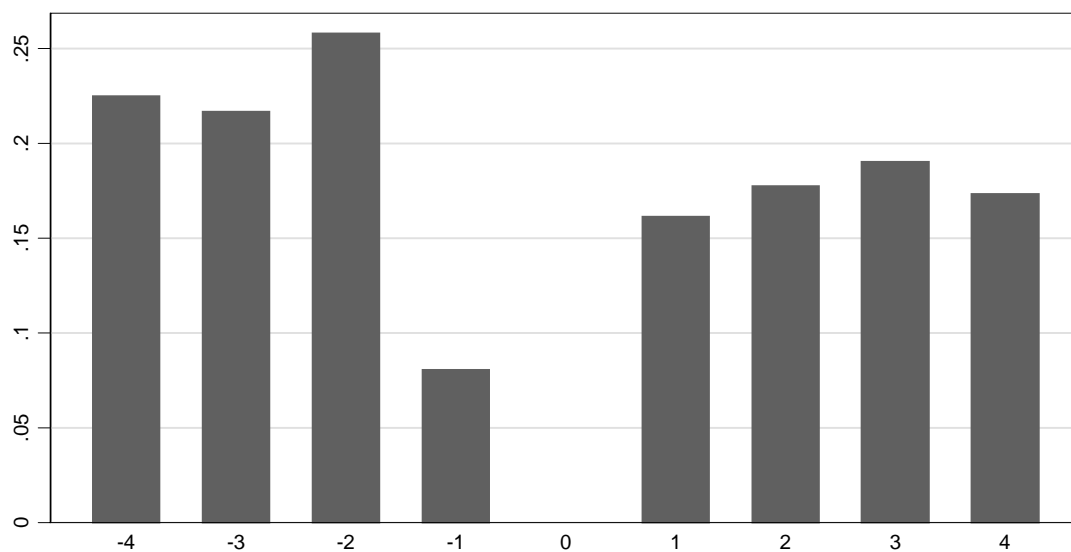
Notes: The vertical axis indicates the fraction of days in which communication takes place. The bars aggregate data from two days (i.e., bar "-1" contains days 2 and 1 before a meeting of the decision-making body). The first and last bars additionally contain all days beyond ±16 (for which generally less than 10 observations are available).

Figure 3.a: Dispersion in communication of the Federal Reserve
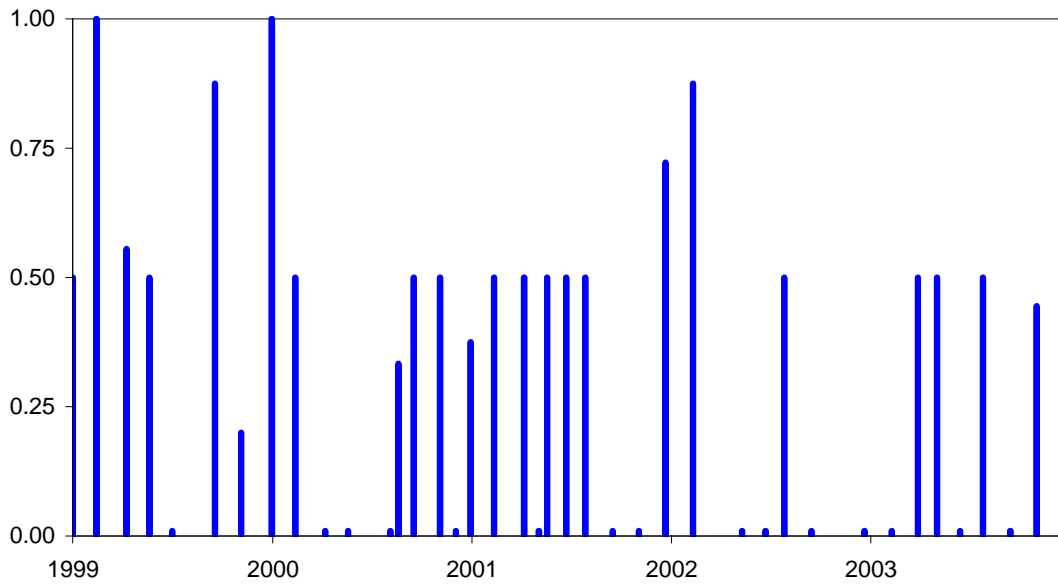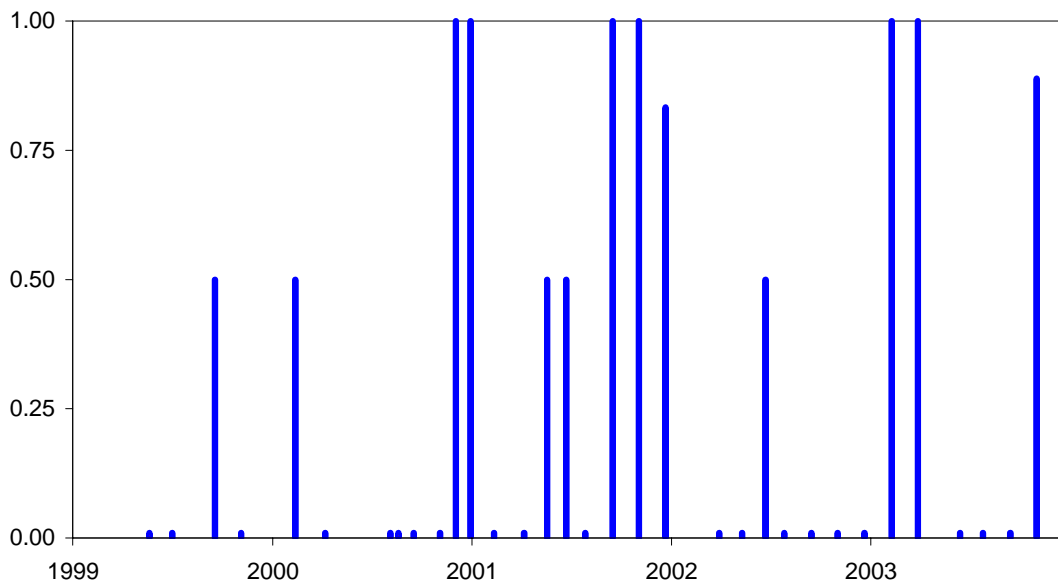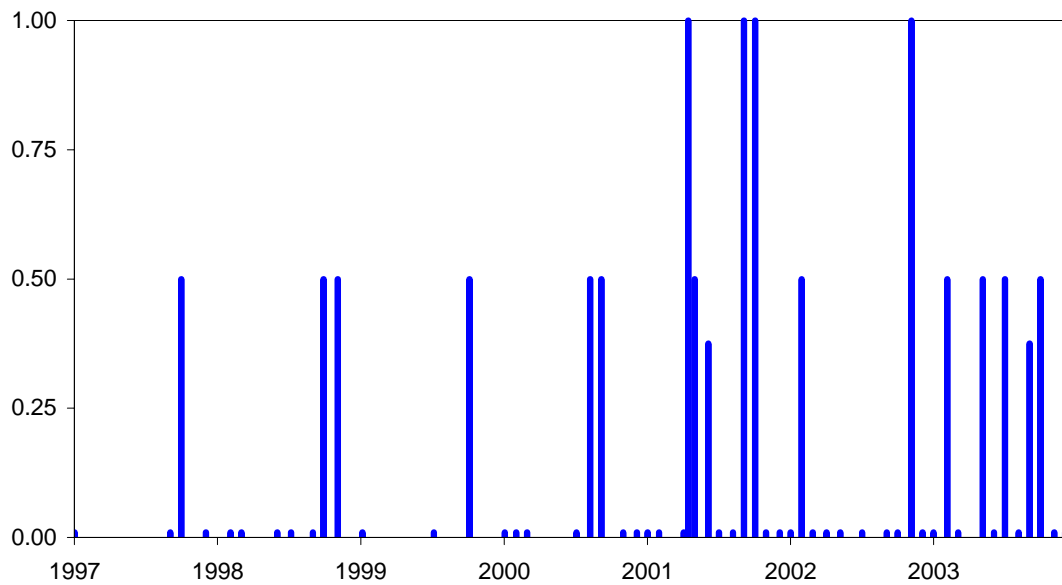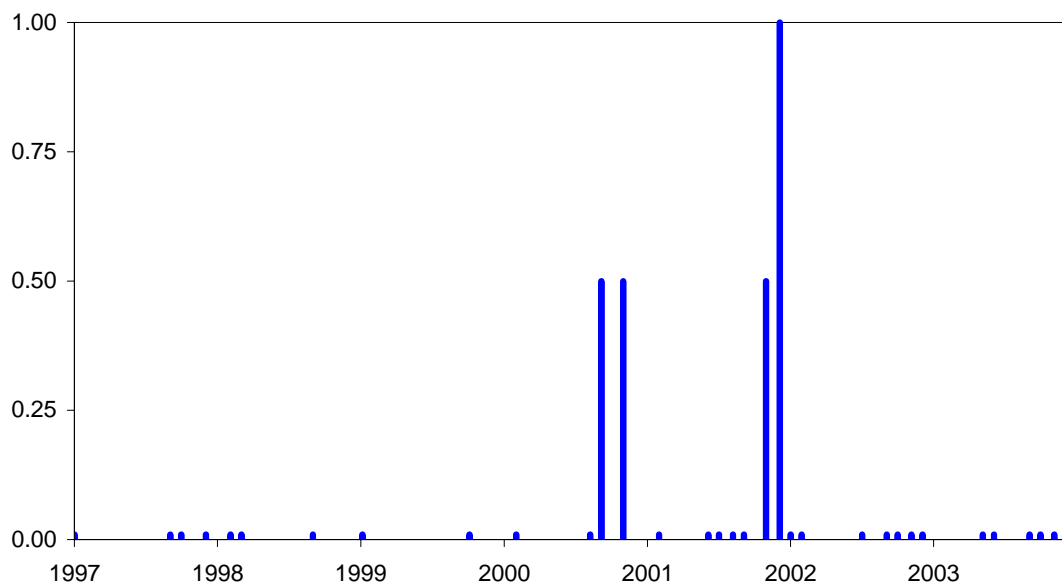
Monetary policy

Economic outlook

Notes: See text for definition. The dots at 0.00 indicate that there were statements in the respective inter-meeting period and that this communication was fully consistent.

Figure 3.b: Dispersion in communication of the Bank of England
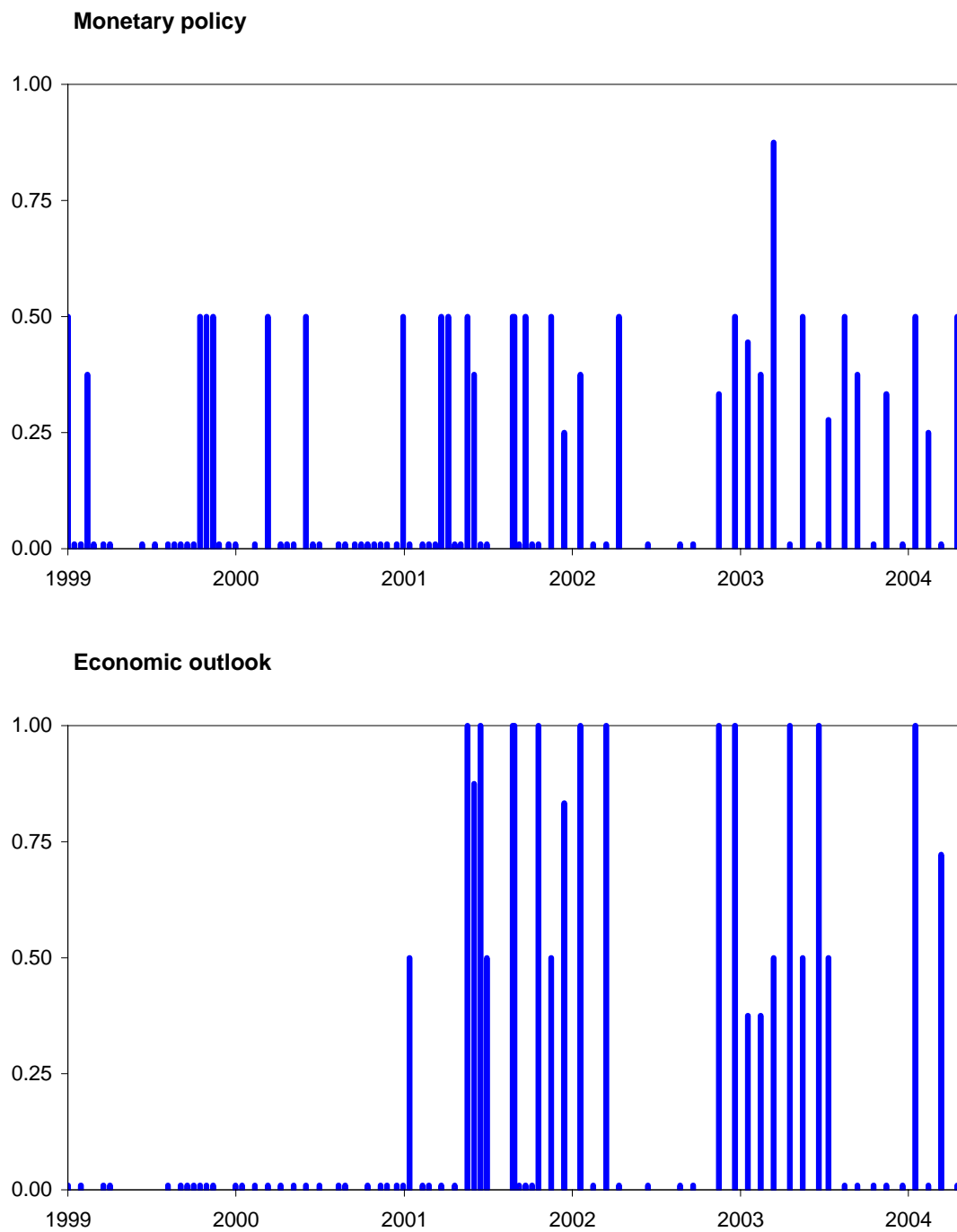
Monetary policy

Economic outlook

Notes: See text for definition. The dots at 0.00 indicate that there were statements in the respective inter-meeting period and that this communication was fully consistent.

Figure 3.c: Dispersion in communication of the European Central Bank

Monetary policy

Economic outlook

Notes: See text for definition. The dots at 0.00 indicate that there were statements in the respective inter-meeting period and that this communication was fully consistent.

Appendix - Examples of Reuters reports and their coding

Federal Reserve:

24 July 1999: "Greenspan rattles rates"

"On July 24, 1999, the US Federal Reserve has warned that it may have to lift interest rates again. Appearing before the US House Banking Committee, Federal Reserve head Alan Greenspan stated that the US economy still appeared to be growing too quickly, and that the bank may need to take pre-emptive action to prevent a rise in inflation. […]"

Coded: $C^{MP}=1$, no entry for economic outlook

23 February 2000: "Interest rates to keep rising until demand slows, N.Y. Fed chief says"

"The Federal Reserve will keep raising U.S. interest rates until the supercharged pace of domestic demand slows, New York Fed President William McDonough said Tuesday. Still, McDonough said, inflation is low and probably will even fall a bit. And though the Fed sees growing stock market wealth driving up demand, draconian monetary policy will probably not be needed to curb the wealth effect, he added. […]"

Coded: $C^{MP}=1$, no entry for economic outlook

20 April 2001: "Fed's Ferguson says slowdown isn't yet finished"

"It's still too early to see an end to the economic slowdown that has triggered a steep round of interest-rate cuts, Federal Reserve Vice Chairman Roger Ferguson said. A day after the Fed surprised markets with a half-percentage-point cut in interest rates, Mr. Ferguson told the National Economists Club here that 'it is still too early to have a strong conviction that the economy is reaching the end of this period of quite slow growth.' […]"

Coded: $C^{EC}=-1$, no entry for monetary policy

7 March 2002: "Greenspan says U.S. expansion 'well under way'"

"Federal Reserve Chairman Alan Greenspan, citing encouraging signs in recent days, painted a rosier economic picture than just a week ago and said the U.S. expansion was 'well under way'. In a rare and unexpected revision of formal testimony he delivered last week to the House of Representatives Financial Services Panel, Greenspan told a Senate committee: 'The recent evidence increasingly suggests that an economic expansion is already well under way, although an array of influences unique to this business cycle seems likely to moderate its speed.' The Fed chief, who was clearly more decided in his assessment that the U.S. recession had ended, added that he saw 'encouraging' signs in recent days that final demand was strengthening. […]"

Coded: $C^{EC}=1$, no entry for monetary policy

Bank of England:

16 January 2001: "George 'to cut rates if necessary'"

The Governor of the Bank of England last night signalled he stood ready to cut interest rates if the economy deteriorated, but said he remained calm about the impact of an American downturn on the UK. […]"

Coded: $C^{MP}=-1$, no entry for economic outlook

19 October 2001: "BoE's Clementi says 'clear downside risks' to rates"

"Bank of England deputy governor David Clementi said on Friday there were 'clear downside risks' to UK interest rates due to the slowing world economy, made worse by September's attacks on the United States. […]"

Coded: $C^{MP}=-1$, $C^{EC}=-1$

23 October 2001: "UK MPC's Allsopp says lower rates needed"

UK interest rates should be cut further to tackle a combination of a weakening global economy and a slowdown in UK consumer demand, a member of the Bank of England's Monetary Policy Committee was quoted as saying. Christopher Allsopp was quoted in Tuesday's Independent newspaper as saying there were risks to inflation in the British economy but that the threat to consumer demand was stronger. 'I think we will be in for a bumpy ride and would come out and say that further policy adjustments will need to be made,' he said. 'My own assessment is that there is weakness out there that would suggest lower interest rates in the future. The question is when.' The paper said Allsopp highlighted mounting redundancies and trouble in industries such as airlines, which were just starting to come through. […]"

Coded: C^{MP}=-1, C^{EC}=-1

26 November 2002: "BoE's George, King say UK rates may have bottomed"

"Britain's two most senior central bankers warned that interest rates could be at their low point in the current cycle, with Bank of England Governor Sir Edward George even raising the spectre of a rise. Giving evidence to Parliament's Treasury Select Committee, George said a hike in rates, which have been at a 38-year low of four percent for a year, would be necessary if consumer demand did not slow as the BoE had anticipated. He said the higher consumer spending rose, the greater the risk it would fall sharply. He said he was 'not suggesting we are there but there is concern.' Deputy governor Mervyn King told the committee British rates will probably not be cut any further if the world economy turns out as the Bank of England has forecast. Asked if interest rates had bottomed, King said, 'If the world were to evolve as in our central view, that would probably be a reasonable view.'[…]"

Coded: C^{MP}=1, no entry for economic outlook

European Central Bank:

1 November 1999: "Duisenberg warns of tightening"

"Wim Duisenberg, the president of the European Central Bank, today says the ECB's bias towards increasing interest rates had become slightly stronger since July. 'I don't know what the ECB Council will decide on 4 November but I can imagine it,' Mr. Duisenberg told the German business daily Handelsblatt. 'Our tightening bias has slightly strengthened since July. One can definitely say that.' Mr. Duisenberg said that the ECB council meeting last month had unanimously concluded the next rate move could only be upwards. […]"

Coded: C^{MP}=1, no entry for economic outlook

25 April 2002: "ECB's Domingo Solans still sees euro zone recovery"

"European Central Bank executive board member Eugenio Domingo Solans said on Thursday not too much should be read into the latest German Ifo business barometer and said it did not change expectations for a euro zone recovery this year. 'You can't draw hasty conclusions… The state of opinion is the same. This year will be a year of recovery,' Domingo Solans told reporters after giving a lecture in Salamanca."

Coded: C^{EC}=1, no entry for monetary policy

8 October 2002: "Duisenberg says rates right, Europe needs reforms"

"ECB President Wim Duisenberg stood firm in the face of pressure to cut interest rates, saying government reforms and not easier monetary policy were the key to igniting growth in Europe. Duisenberg's testimony to the European Parliament appeared to rule out a rate cut when the European Central Bank's policy council meets on Thursday to decide on interest rates. […]"

Coded: C^{MP}=0, no entry for economic outlook

29 April 2004: "ECB's Papademos says euro zone still recovering"

"The euro zone economy is still recovering and the European Central Bank is keeping all options open on interest rate policy, ECB Vice President Lucas Papademos was quoted as saying. 'All in the available information continues to point to a slow, moderate recovery,' Papademos told the Frankfurter Allgemeine Zeitung […]."

Coded: C^{EC}=1, no entry for monetary policy

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