# Transparency, Disclosure, and the Federal Reserve*

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This paper provides an assessment of central bank transparency for the efficiency of monetary policy implementation, using the introduction of balance-of-risks assessments by the Federal Reserve as a testing device. We find that markets anticipated monetary policy decisions equally well under this new disclosure regime as before, but arrived at their expectations differently. Now, markets extract information from the statements, whereas before, they reverted to other types of Federal Reserve communication in the intermeeting periods. These findings suggest that the Federal Reserve's new disclosure practice may have improved transparency, as information is now released at an earlier time and with clearer signals.

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## 1. Introduction

Over the past decade, there has been a remarkable change in the way central banks conduct monetary policy. For example, until February 1994 the Federal Open Market Committee (FOMC) did not publicly announce its decisions about changes in the target federal funds rate after its meetings. In current monetary policymaking, an unprecedented degree of transparency has become common practice. Such

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transparency relates to various parts of the policy process, such as the publication of the policy objectives and institutional arrangements, of the policy models and central bank forecasts of relevant variables, or of the communication of monetary policy decisions, often including an explanation of the underlying considerations that led to the decision or an indication of the likely future outlook for monetary policy.[1] Different central banks have opted for different approaches in this respect. In the communication of monetary policy decisions, for example, the European Central Bank holds press conferences after each decision on policy rates. Others, like the U.S. Federal Reserve, publish immediately after each meeting a press statement that contains not only an assessment of the current economic developments and the monetary policy stance but also an assessment of the balance of risks in the near future.

The rationale behind increased transparency is manifold; for the purpose of this paper, we want to highlight the role of transparency for improving the *efficiency of policy implementation* (see, e.g., Bernanke 2004). Financial markets need to *infer* the intentions of policymakers, but such inference is necessarily prone to mistakes, e.g., if financial markets attribute inappropriate weights to indicators (such as communication by policymakers or macroeconomic news), or if there is dissent among market participants about the interpretation of relevant news, which induces uncertainty in financial markets. Central banks can reduce this uncertainty through *deeds*, i.e., monetary policy decisions, as well as through *words*, i.e., the communication of their intentions and views about the future path of monetary policy and the economic outlook.

In this paper, we focus on the question of whether central bank transparency can indeed improve the efficiency of monetary policymaking. Our testing vehicle is the change in regime that occurred

[1]For two influential works on the importance of transparency, see Cukierman and Meltzer (1986) and Blinder (1998). An overview of the various forms of central bank transparency, the theoretical justifications for transparency, and the recent empirical evidence of its effects is provided in Geraats (2002). On a cautious note that transparency might go too far and should only be supported if it helps achieve the central bank's tasks, see Mishkin (2004). The seminal work by Stein (1989) and Goodfriend (1986) emphasizes the potential time-inconsistency problem of communication in a monetary policy setting, and possible solutions to it.

in 1999 at the Federal Reserve, when the FOMC decided to publish immediately after its meetings a statement that not only explains its monetary policy decision but also contains a forward-looking element—initially in the form of an outlook for the monetary policy stance and, later, in the form of a balance-of-risks assessment concerning inflationary pressures and economic conditions in the "foreseeable future." As a first step, we analyze whether the release of such a forward-looking statement has helped markets anticipate the upcoming monetary policy decisions better. We find that financial markets were equally good at anticipating the decisions under both regimes, as the magnitude of the surprises of FOMC decisions on meeting days was equally large under both regimes.

We next ask whether the statements influence financial markets. We test the impact of words versus deeds—i.e., of FOMC statements as well as monetary policy actions—on the yield curve, comparing the period February 1994–April 1999 with the period since the regular issuance of FOMC statements after May 1999. We find that both monetary policy decisions and the FOMC balance-of-risks statements have had a statistically and economically meaningful impact on interest rates of up to a five-year maturity. FOMC surprises are found to have the largest effect on the short end of the maturity spectrum. By contrast, FOMC statements have the largest effect on medium-term interest rate horizons. Moreover, once the effect of monetary policy surprises on interest rate levels is taken into account, we find that conditional market volatility rose significantly in response to the surprises prior to 1999, which is no longer the case afterward. These results are compelling as well as intuitive. In particular, the significant impact of FOMC statements suggests that the FOMC managed to influence market expectations about monetary policy, and that it has been able to do so not only over the short run but especially at medium-term horizons of up to two years. In addition, the fact that the existence of the balance-of-risks statements reduces conditional interest rate volatility in response to monetary policy surprises indicates that this communication has generally been successful in lowering market uncertainty about the future path of monetary policy.

The results that markets extract information from the released statements yet arrived at equally good expectations of the decisions when the statements were not released seem to contradict each other.

There are two potential explanations for this finding. First, monetary policy decisions may be inconsistent with earlier bias statements if the FOMC decides to deviate from the statements due to the arrival of new information, leading to larger surprises. We show that this has generally not been the case, as most FOMC decisions since 1999 have been consistent with previous balance-of-risks assessments. The second potential explanation is that market participants have obtained information necessary to anticipate monetary policy decisions in fundamentally different ways under the old versus the new disclosure regimes. We find significant evidence in favor of this hypothesis. In particular, we show that under the old regime, markets reacted more strongly to other types of Federal Reserve communication—such as testimonies, interviews, and speeches by FOMC members[2]—in the intermeeting periods. Based on these findings, we argue that the regime change increased transparency, as markets are provided with relevant information at an earlier stage and in a more-transparent manner. This makes it easier and less costly for markets to obtain the information, and helps reduce market uncertainty about the future course of monetary policy. On the other hand, our finding that markets attach such a strong importance to the statements by the FOMC is contrary in spirit to King (2000), who argues that, with a transparent monetary-policy reaction function, news should not be in the announcements of central banks but should entirely arise in the development of the economy.

The present paper is closely related to a number of studies in the literature. In their seminal work, Romer and Romer (2000) stress the close link between expectations about the path of monetary policy and expectations of output and inflation. Gürkaynak, Sack, and Swanson (2005a) use a two-factor model, where they interpret their two unobserved factors as reflecting monetary policy surprises and FOMC meeting statements, and find that both have a significant impact on the yield curve. Their results are similar to ours in the present paper; however, we not only identify the effect of FOMC statements directly but also link our assessment of the statements

[2]We also test for the effect of the releases of macroeconomic fundamentals and find some, though limited, evidence that prior to 1999 markets reacted more to some news.

of the FOMC on meeting days, on the one hand, with the importance of communication in the intermeeting periods and macroeconomic news, on the other hand. Kohn and Sack (2004) focus on and find evidence for the effect of intermeeting communication by former FOMC Chairman Greenspan on the volatility of financial markets since 1994. Again, the present paper attempts to broaden this analysis by linking meeting statements with intermeeting communication and macroeconomic news, by estimating their impact on the level and conditional volatility of interest rates, and by underlining the differences under the two disclosure regimes. In line with our findings, Gürkaynak, Sack, and Swanson (2005b) stress the importance of macroeconomic data releases on inflation and output as drivers of long-term interest rates. Our empirical analysis and findings are consistent with the theoretical analysis by Reifschneider and Williams (2000) and Eggertsson and Woodford (2003), who stress the role of communication in shaping market expectations about future monetary policy and thus in reducing interest rate volatility, as well as the work by Bernanke, Reinhart, and Sack (2004) and Woodford (2005), who emphasize the importance of communication for policy effectiveness if the zero lower bound is binding.

Finally, a number of papers analyze potential effects of the increased transparency of the Federal Reserve. The most recent paper in that context is Swanson (2006), who finds that private-sector interest rate forecasts have improved considerably over time, along with movements toward more transparency in the Federal Reserve's policy process. Swanson's study covers the period from 1988 to 2003, which includes the regime change that is of interest in this paper. However, Swanson focuses in particular on the change in 1994, when the FOMC started announcing decisions on the intended federal funds rate on the day of its meetings. He models this change by a step dummy and alternatively allows for a time trend. As such, his analysis cannot single out *further* effects on predictability of the regime change in 1999, which is the focus of this paper. Furthermore, we will study not only the effects on predictability but also how market participants form their expectations about upcoming monetary policy decisions.

The remainder of this paper is organized as follows. In section 2, we describe the changes in the FOMC disclosure practices that have occurred since 1994 and ask whether the balance-of-risks

statements have provided an accurate signal about future monetary policy decisions. Section 3 introduces the data underlying our analysis. Section 4 analyzes the effect of the new disclosure regime, looking at the accuracy of market expectations of monetary policy decisions, the reaction of markets to monetary policy, and the role of alternative sources of information—namely, other central bank communication and releases of macroeconomic fundamentals. Section 5 summarizes the results and concludes.

## 2. The Balance-of-Risks Assessments of the FOMC

### *2.1 Changes in the FOMC Disclosure Practices*

#### *2.1.1 1994: Immediate Release of Decisions on the Target Federal Funds Rate*

A major change in the disclosure practice of the Federal Reserve took place in February 1994, when the FOMC started announcing decisions on the intended federal funds rate on the day of its meetings. Before, markets needed to infer the intended rate from the type and size of the open market operations by the Federal Reserve, until the decision was published after the subsequent FOMC meeting. There is substantial evidence that this change has improved the markets' understanding of monetary policy considerably: Demiralp (2001), Lange, Sack, and Whitesell (2003), and Poole and Rasche (2003) observe that markets were able to improve their forecasts of monetary policy decisions, and they relate this to the change in transparency.[3] The most recent paper in this literature is Swanson (2006), who also finds that private-sector interest rate forecasts have improved substantially since 1994. Importantly, he shows that the improved forecast performance is not driven by an improvement in the private sector's ability to assess the state of the economy, such that it must arise from a better understanding of the Federal Reserve's monetary policy. The regime change has also affected market uncertainty. Lee (2002) shows that the effect of Federal Reserve announcements on interest rate volatility has decreased in the last

[3]Bomfim and Reinhart (2000), however, observe that the reactions of financial markets to monetary policy surprises did not change pre- and post-1994.

decades. Swanson (2006) finds that market uncertainty has been strongly reduced in response to the FOMC announcements since 1994. Finally, Demiralp and Jorda (2002) provide evidence that by announcing changes in the intended federal funds rate, it was possible to move the federal funds rate with a smaller volume of open market operations than was possible prior to 1994, which indicates clearly that increased transparency can indeed be beneficial for the efficiency of policy implementation. Given the importance of this structural change, we will use only the post-1994 period in our analysis.

#### *2.1.2 1999: Immediate Release of an Assessment about the Likely Future Path of Monetary Policy*

Between 1983 and 1998, the FOMC issued a policy directive comprising the committee's expectations about the relative chances of an increase or decrease in the target federal funds rate as well as instructions for current policy to the Open Market Trading Desk. These directives focused in particular on the intermeeting period and were not made public until after subsequent FOMC meetings. In December 1998, the FOMC decided that it would release its assessment about the likely future path of monetary policy without delay after its meetings, "to communicate to the public a major shift in its views about the balance of risks or the likely direction of future policy" (Federal Reserve Board 1998). The first such announcement was released in May 1999, with a total of six announcements in the course of 1999.

#### *2.1.3 2000: Modifications to the Release: The Balance-of-Risks Assessments*

One year later, at its meeting in December 1999, the FOMC decided to modify its disclosure proceedings in four ways: (i) a statement would now be issued after *every* FOMC meeting, not only in the case of policy action or a major shift in the views about future developments; (ii) the statement would cover a time horizon that extends beyond the next FOMC meeting; (iii) the statement would no longer be phrased in terms of a bias with respect to future interest rate changes but, instead, in terms of the balance of risks to the

goals of price stability and economic growth; and (iv) the balance-of-risks statement would be assembled from a set of predefined sentences. The FOMC strictly adhered to the new rules until March 2003, when it decided not to convey a balance of risks in light of the large uncertainties due to the U.S. intervention in Iraq. In the subsequent meetings, an assessment of the balance of risks was provided again, although it was no longer taken from the set of predefined sentences.

In this paper, we will analyze, in general, the period from May 1999 to April 2004 and compare it with the period from February 1994 to April 1999.[4] Our sample ends in April 2004, as we do not want to include in our analysis the statements of the recent tightening cycle, which might be qualitatively different from the regular statements made otherwise and most likely to be made again in the near future (Woodford 2005).

### *2.2 How Informative Are Balance-of-Risks Assessments?*

As one of the objectives of the balance-of-risks assessments is to help markets anticipate better the path of monetary policy, the assessments should generally be consistent with future monetary policy decisions. Of course, one needs to keep in mind that any forward-looking statement is conditional on the information available at the time of the statement. Accordingly, a policy action might appear to look inconsistent with a statement ex post, if conditions have altered in the meantime. However, we would expect that, on average, the information set will not change in a systematic fashion that makes actions seemingly inconsistent with statements. In our consistency analysis, we assume that markets interpreted an assessment highlighting the risks of inflation as pointing to higher interest rates,

[4]Although there could potentially be differences in the way markets react to the statements made in 1999 and those released since, we will not analyze these two types of statements separately, due to the few observations that are available for the first type. In the remainder of the paper, we will use the phrases "bias," "balance-of-risks assessments," or "the statements" interchangeably, generally referring to both types of statements.

**Table 1. Consistency of FOMC Balance-of-Risks Assessments and Monetary Policy Decisions**

| **February 1994–April 1999** | | | | |
|---|---|---|---|---|
| | **Monetary Policy Decision** | | | |
| **Bias** | Easing | No Change | Tightening | All |
| Easing | 2 | 1 | 0 | 3 |
| Symmetric | 4 | 15 | 4 | 23 |
| Tightening | 0 | 14 | 4 | 18 |
| All | 6 | 30 | 8 | **44** |
| **May 1999–2004** | | | | |
| | **Monetary Policy Decision** | | | |
| **Bias** | Easing | No Change | Tightening | All |
| Easing | 13 | 7 | 0 | 20 |
| Symmetric | 0 | 11 | 2 | 13 |
| Tightening | 0 | 5 | 4 | 9 |
| All | 13 | 23 | 6 | **42** |

**Note:** The table shows which bias announcement in the *current* FOMC meeting has been followed by what policy action in the *subsequent* meeting. As the stated horizon of the bias has been not only on the next meeting but also on the "foreseeable future," note that there is one case since 1999 in which an asymmetric bias has been announced for *two* consecutive meetings, with a corresponding monetary policy change at the *third* meeting only (August 13, September 24, and November 6, 2002). We have included the bias announcements for *both* meetings preceding the interest rate change as correctly anticipating the next move.

and an assessment that stresses the risks to economic growth as pointing to lower interest rates.[5]

Table 1 reveals that twenty-eight out of forty-two bias announcements (67 percent) in 1999–2004 were followed by corresponding

[5]Poole (2004) argues that employment and inflation are not highly correlated, such that "an unbalanced balance-of-risks statement should not be interpreted as an indication of a future policy action in a specific direction," although he admits that "unfortunately, it is too often interpreted that way by market participants."

monetary policy decisions.[6] A closer look at the remaining fourteen announcements reveals that there has not been a single case in this period when the Federal Reserve changed interest rates with an asymmetric bias pointing in the opposite direction. In two cases, interest rates were tightened while the bias released at the preceding meeting was symmetric. The other twelve cases consist of situations where an asymmetric bias was not acted upon—which is not necessarily inconsistent, as the bias is by no means meant to indicate that action will automatically follow. Overall, these statistics indicate that FOMC biases were consistent with policy actions in the 1999–2004 period.

A comparison of the old and the new disclosure regimes provides some revealing differences and a better understanding of the underlying motivations of the different disclosure practices. Table 1 for 1994–99 shows that the FOMC provided fewer asymmetric policy directives and also made fewer interest rate changes than in 1999–2004. However, the table also reveals that the directives provided a poor prediction of monetary policy actions at the subsequent FOMC meetings, as there are far fewer entries on the diagonal of this table. This raises the question of why there is such a sharp difference in the biases across the two regimes. One central factor is that the policy directives until May 1999 were clearly directed at *internal* Federal Reserve objectives and were not intended to provide public information since they focused on the intermeeting period and were released only after the next FOMC meeting. By contrast, the balance-of-risks assessments since 1999 mainly have an *external* objective in that they intend to provide the markets with additional information about possible future policy decisions and existing risks. For

[6]A potential caveat is that since 2000 the focus of the statements has been not on the intermeeting period but over the foreseeable future. Hence a balance-of-risks assessment may still be consistent with future monetary policy decisions if there is an asymmetric assessment and a corresponding policy change occurs two or more meetings later, *and* the same assessment was issued at the next meetings as well. Since 1999, there was only one such case—August 13, 2002—which is classified as a "correct" anticipation of future decisions in the tables. Moreover, throughout the paper, we have excluded the FOMC meeting on September 17, 2001—when interest rates were decreased by 50 basis points in response to the terrorist attacks on September 11—due to the exceptional circumstances of this FOMC meeting. Excluding other unscheduled meetings also does not affect our results.

this information to be credible, the biases need to be broadly in line with actual policy decisions.[7]

## 3. The Data

### *3.1 Interest Rates*

Our interest rate data consist of constant maturity treasury rates that are provided by the U.S. Treasury. We expect the effect of monetary policy actions to differ depending on the maturity of the interest rate. For instance, a tightening of monetary policy can be compatible with a reduction in long-term interest rates if markets perceive the tightening as a credible step by monetary authorities to reduce inflation in the long run. The effect of a monetary policy decision on long rates can therefore be not only quantitatively but also qualitatively different from that on shorter maturities. Furthermore, in order to understand the effects of communication on market expectations about the future course of monetary policy, it will be revealing to see which maturity spectrum reacts strongest. Accordingly, we look at maturities of three and six months as well as one, two, five, and ten years.

As to the frequency of the analysis, we use daily frequency rather than intraday or tick-by-tick data (see also Gürkaynak, Sack, and Swanson 2005b). The drawback of choosing a lower frequency is that other events and news during the day may introduce some noise, thereby possibly making the measurement of announcement effects less accurate. However, over a sufficiently long time sample, the effect of other news should average out to zero, such that the

[7]This nevertheless leaves open the question of why the policy directives before 1999 were so out of sync with monetary policy decisions. One possible explanation is that because the assessments were targeted at an external audience after May 1999, their consistency was ensured—or, alternatively, that only once their consistency became feasible, the FOMC decided to target them to an external audience. Nonetheless, even in these cases, the purpose of the earlier directives is not clear. Thornton and Wheelock (2000) argue that the main internal Federal Reserve objective of the directive before 1999 was that of consensus building. In other words, the policy directive may have been used to increase the number of FOMC members supporting the current decision. For instance, FOMC members may be more willing to agree to a change in policy if a neutral directive is adopted at the same time, indicating the FOMC's intention not to embark on further changes.

coefficient estimates are estimated with larger standard errors but are nonetheless unbiased. The advantage of using daily data is to avoid estimating biased coefficients that can arise if overshooting occurs in the very short run.

The daily interest rate data are characterized by negative skewness, excess kurtosis, and serial correlation. The econometric model therefore needs to take into account these specific data characteristics.

### *3.2 Expectations of Monetary Policy Decisions and Macroeconomic Announcements*

Our expectations data for monetary policy decisions and macroeconomic announcements originate from surveys conducted by Reuters and Money Market Services International among market participants, conducted on Fridays before each FOMC meeting and the release of the various macroeconomic data. We use the mean of the survey as our benchmark expectations measure, although using the median yields similar results.[8] We construct the *surprise component* contained in each announcement by deducting the expectation from the actual announcement.[9] To match the frequency of this data source with the daily interest rate data, we construct a daily series for each announcement, which is set to zero on days without announcements and contains the surprise component on announcement days. We will make use of this surprise variable to measure the effect of announcements on markets. The reason why we do not use the actual announcements is that their expected component is already priced into the market prior to the announcement. At the point of the announcement, the market reacts merely to the surprise component contained in the news (Kuttner 2001). Analyzing the reaction of markets to surprises is therefore a proxy to assess the importance of the underlying announcement.

As an alternative to *survey* data on monetary policy decisions, expectations can be extracted from the federal funds futures rate,

[8]This has consistently been found also in earlier work with this type of data (Ehrmann and Fratzscher 2006, who also show that the survey data are unbiased and efficient).

[9]Additionally, we standardize the surprises regarding the macro data with the standard deviation of the announcements.

as proposed by Kuttner (2001). We have used both measures and find that the results are qualitatively identical for both measures of market expectations.

### *3.3 FOMC Communication*

We analyze two types of central bank communication. First, we look at the effect of the FOMC bias statements. We classify these statements according to their implications for the future interest rate path, and construct two indicator variables. The indicator "symmetric bias" takes the value 1 on those days where the FOMC released a statement that it perceives the risks of economic weakness and of inflationary pressure as balanced, and the value 0 on all other days. The indicator "asymmetric bias" takes the value 1 for statements that highlight a risk of inflationary pressure, the value −1 for statements that consider the risk to be tilted toward economic weakness, and the value 0 otherwise.[10]

Second, we look at other communication made by FOMC members in the intermeeting periods. For that purpose, we make use of the data set developed in Ehrmann and Fratzscher (2006). This data set includes three types of communication—speeches, interviews, and testimonies—and includes all FOMC members. The data are extracted from a widely used newswire service, *Reuters News*, which provides a news report usually within minutes after the corresponding communication. This way of collecting the data is somewhat different from that used by Kohn and Sack (2004), who take all speeches and testimonies made by FOMC members. The key difference is that *Reuters News* reports about the great majority but not about all central bank communication, e.g., if it deems it as not providing new or market-relevant information. Since our primary focus is on the market reaction and perception in response to communication by the Federal Reserve, the *Reuters News* source may be more appropriate for this purpose.

The data set separates communication about the economic outlook ($C^{EC}$) or future monetary policy ($C^{MP}$) and classifies

[10] Obviously, Poole's (2004) caveats mentioned in footnote 5 apply here also.

each type in the following way:

$$C_t^{EC} = \begin{cases} +1 & \textit{strong economic outlook} \\ 0 & \textit{neutral economic outlook} \\ -1 & \textit{weak economic outlook} \end{cases}$$

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

Again, to match the frequency of these data with the interest rates, we construct a daily series for each indicator, which is set to zero on days without corresponding communication and contains the classification values on communication days. More details on this data set and the classification scheme are provided in Ehrmann and Fratzscher (2006). Clearly, however, we should stress the important caveat that this classification is judgmental. It is therefore possible that some reports are misclassified relative to the market's interpretation or the speaker's intention. However, our objective is to assess communication from the perspective of financial markets, and we therefore want to focus on the information that market participants actually receive.

## 4. The Effect of the New Disclosure Regime

### *4.1 Hypotheses on the Effect of the New Regime: An Illustrative Example*

Figure 1 provides an illustration of the differences in the adjustment of the three-month T-bill rate around two consecutive FOMC meeting dates under the two disclosure regimes. Both cases are very similar in that no change occurred at the first of the two FOMC meetings (marked as day 0 on the horizontal axis) and a rise in the target federal funds rate of 25 basis points took place at the subsequent meetings (marked as day 30). Furthermore, in both cases, the FOMC had actually adopted a tightening bias at the previous meeting. The main difference between the meetings lies in the communication of this bias, which had been released immediately in

**Figure 1. Adjustment of Market Interest Rates under Alternative Disclosure Regimes**

*(Comparison of 25-Basis-Point Tightening on March 25, 1997, versus February 2, 2000)*


**Note:** Three-month money market rates for the March 25, 1997, tightening episode are shown on the right-hand-side axis, whereas those for the February 2, 2000, episode are depicted on the left-hand-side axis. Both tightening days are scaled so as to be shown on day 30 on the horizontal axis. Day 0 refers to the corresponding previous FOMC meetings.

one case (February 2, 2000) but had been released only after the subsequent meeting in the other case (March 25, 1997).

In both instances, the policy decision to change interest rates (on day 30) was well predicted by the market, as can be seen by the fact that interest rates had already increased substantially by the time the FOMC met. However, it is apparent that this anticipation of the decision was achieved through very different mechanisms in the two regimes.

Although the example shown in the figure certainly provides an exceptionally strong case, it illustrates most of the potential effects of the bias announcements. First, when a tightening bias was released at day 0, markets already priced in most of the interest

rate rise of the next meeting within one day. After this initial jump, market interest rates remained relatively stable and rose gradually until the next meeting. By contrast, in the case without a released statement, interest rates adjusted much later. Interestingly, interest rates started anticipating the interest rate move on the day of then-Chairman Greenspan's testimony before the U.S. Senate on February 26, 1997 (day 11 in the chart).[11]

This illustration raises various questions about the effect of the change in regime, which we will attempt to answer empirically in the subsequent sections:

- Has the release of the balance-of-risks assessments improved the ability of markets to anticipate a monetary policy decision by the time when the FOMC meets?
- Have markets changed their behavior on the days of the FOMC meetings? Do they react to the release of the statements, and if so, how?
- Do interest rate reactions in response to the release of the statements anticipate the required adjustment between FOMC meetings, such that lower intermeeting interest rate adjustments are needed under the new regime?
- Is the release of the statements a substitute or a complement to other sources of information, like intermeeting communication by FOMC members or macroeconomic data releases that might have allowed markets in the earlier regime to anticipate monetary policy decisions equally well?

### *4.2 Market Expectations of Monetary Policy Actions*

Since the FOMC statements are released in order to communicate to the markets the FOMC's assessment of future developments, a first natural question is whether they have improved the predictability of monetary policy decisions. However, it has been shown that monetary policy decisions had been anticipated by market participants very well since 1994 (Demiralp 2001; Lange, Sack, and Whitesell

[11] A finding in our paper that is not reflected in the figure, however, relates to the reduction in conditional volatility—that is, once the immediate response of interest rate levels is taken into account, we find that market volatility is significantly lowered in the new regime relative to the time prior to 1999, a pattern that is not reflected in the figure.

2003; Poole and Rasche 2003; Swanson 2006), such that it might be difficult to improve upon this performance.

Table 2 reports various statistics regarding the expectations data, using both the Reuters survey-based expectations and the surprises as calculated from federal funds futures, separately for all scheduled FOMC meeting dates as well as for those where interest rates were actually changed. We analyze these dates separately because, on several occasions, the decision that interest rates would remain unchanged was extremely easy to predict. As such, we think that the prediction of actual interest rate *changes* is an interesting additional test of the forecastability of FOMC decisions. The columns denoted by $\Delta$ report the results of tests for differences across the subsamples: we cannot find any difference in the size of the mean surprise. However, even if the surprises have the same mean, they could be drawn from different distributions, e.g., if for one period there are more large (positive and negative) surprises. We test for this in four different ways: (i) by checking whether the variance of the surprise over time is different across time periods, (ii) by calculating the mean absolute surprise, (iii) through the variance of the absolute surprise, and (iv) with the maximum absolute surprise. In no case do we find a statistically significant difference. Importantly, using Reuters-based expectations or surprises extracted from the federal funds futures does not alter any of the results.

This leads us to the conclusions that market anticipations of monetary policy decisions have been relatively accurate throughout the period since 1994, and that there has basically been no improvement since 1999.[12]

### *4.3 Market Reactions to Monetary Policy*

The finding that financial markets are as surprised by monetary policy decisions under the new disclosure regime as they were under the old regime does not necessarily imply that there is no difference in the process through which markets arrive at their expectations.

[12]Swanson (2006) estimates a model for private-sector interest rate forecasts that allows for a linear trend, ranging over a sample from 1988 to 2003, and finds a significant improvement over time. As his sample includes the important change of 1994, the effect of the changes introduced in 1999 cannot be singled out in his study.

**Table 2. Market Expectations about Monetary Policy Decisions**

| | Reuters Polls | | | Federal Funds Futures | | |
|---|---|---|---|---|---|---|
| | **Feb. 1994–Apr. 1999** | **May 1999–Apr. 2004** | **Δ** | **Feb. 1994–Apr. 1999** | **May 1999–Apr. 2004** | **Δ** |
| **All FOMC Meeting Days** | | | | | | |
| Number of Meetings | 44 | 42 | | 44 | 42 | |
| Mean Surprise | −0.006 | −0.018 | | −0.008 | −0.020 | |
| Variance of the Surprise | 0.010 | 0.016 | | 0.005 | 0.010 | |
| Mean Absolute Surprise | 0.050 | 0.050 | | 0.050 | 0.053 | |
| Variance of the Absolute Surprise | 0.007 | 0.013 | | 0.003 | 0.008 | |
| Maximum Absolute Surprise | 0.250 | 0.500 | | 0.203 | 0.425 | |
| **FOMC Meeting Days with Interest Rate Changes** | | | | | | |
| Number of Meetings | 14 | 18 | | 14 | 18 | |
| Mean Surprise | 0.012 | −0.049 | | 0.022 | −0.051 | |
| Variance of the Surprise | 0.027 | 0.035 | | 0.011 | 0.022 | |
| Mean Absolute Surprise | 0.114 | 0.108 | | 0.091 | 0.102 | |
| Variance of the Absolute Surprise | 0.013 | 0.026 | | 0.003 | 0.014 | |
| Maximum Absolute Surprise | 0.250 | 0.500 | | 0.203 | 0.425 | |

**Note:** Δ denotes whether the parameters in the respective row are statistically significantly different for the two samples. *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively.

For example, it could be that markets do indeed learn important information about future monetary policy decisions from the balance-of-risks assessments, whereas under the old regime, markets acquired this information through alternative channels. The focus of this section is therefore to analyze, first, whether financial markets behave differently on FOMC meeting days under the two regimes. Second, we investigate whether the balance-of-risks statements themselves affect interest rates and whether the reaction of markets to monetary policy surprises depends on the content of the accompanying balance-of-risks statements.

### *4.3.1 Market Behavior on FOMC Meeting Days*

Do markets behave differently on FOMC meeting days under the new disclosure regime, where a statement accompanies each meeting? To test this hypothesis, we employ an EGARCH(1,1) model following Nelson (1991), explaining the entire set of daily changes in the market interest rates $\Delta r_t$ (i.e., not only including days with FOMC meetings, macro announcements, or FOMC communication). The conditional mean equations are expressed as a function of the surprise component of a monetary policy decision, $s_t$; of the surprise component of the releases of important macroeconomic data; and of communication by the members of the FOMC ($z_{i.t}$; the results for these will be discussed further below). The effects of all variables are modeled separately for each disclosure regime by interacting them with a dummy, $D_t$, which is equal to one for the new regime, and zero otherwise. Additionally, we enter the regime dummy separately and control for past interest rate changes as well as day-of-the-week effects (*Mon, Fri*):[13]

$$\begin{aligned}\Delta r_t = {} & \alpha_1 + \alpha_2 D_t + \beta \Delta r_{t-1} + \gamma_1\, s_t(1 - D_t) + \gamma_2\, s_t D_t \\ & + \sum_i \lambda_{i,1}\, z_{i,t}(1 - D_t) + \sum_i \lambda_{i,2}\, z_{i,t} D_t \\ & + \delta_M Mon + \delta_F Fri + \varepsilon_t. \end{aligned} \tag{1}$$

[13]Day-of-the-week effects were also tested for other days, but only the coefficients for the Friday and Monday dummies were found to be significant in some specifications.

We assume that $\varepsilon_t = \sqrt{h_t} \cdot v_t$, where $v_t$ is an i.i.d. sequence with zero mean and unit variance. The conditional variance $h_t$ is formulated as a function of the past variance ($h_{t-1}$) and innovations ($\varepsilon_{t-1}$), as well as the day-of-the-week effects (*Mon, Fri*). The effect of FOMC meeting days is modeled by a dummy variable ($n_t$), as is the effect of macro announcements and FOMC communication ($w_{i,t}$), all of which take the value 1 on days when the corresponding event has occurred, and 0 otherwise. The EGARCH approach accounts for the skewness, the kurtosis, and the time-varying volatility of the interest rate data by formulating a non-normal density for the residuals of the interest rate processes in the following way:

$$\begin{aligned}\ln(h_t) = {} & \omega_1 + \omega_2 D_t + \theta_1 \left( \left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| - \sqrt{\frac{2}{\pi}} \right) + \theta_2 \left( \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right) \\ & + \theta_3 \ln(h_{t-1}) + \kappa_1 \, n_t(1 - D_t) + \kappa_2 \, n_t D_t \\ & + \sum_i \tau_{i,1} \, w_{i,t}(1 - D_t) + \sum_i \tau_{i,2} \, w_{i,t} D_t + \varphi_M Mon + \varphi_F Fri. \end{aligned} \tag{2}$$

A further advantage of the EGARCH approach is that it does not require us to impose non-negativity constraints on the coefficients of the conditional second moments. The model is estimated via log-likelihood estimation of the function

$$L(\mu) = -\left(\frac{T}{2}\right) \ln(2\pi) - \frac{1}{2} \sum_{t=1}^{T} \left( \ln(h_t) + \frac{\varepsilon_t^2}{h_t} \right), \tag{3}$$

with $T$ the number of observations and $\mu$ the vector of parameters of interest.

An alternative approach adopted in a number of related studies (e.g., Kohn and Sack 2004) consists of estimating the effect of an event dummy (taking the value of 1 on days with events, such as FOMC communication, and 0 otherwise) on *absolute* returns. This approach has the advantage that no classification of communication data in terms of their intended direction is required. However, the limitation of this approach is that it cannot distinguish the effect of an event on the level of interest rates and on conditional market volatility, as in the EGARCH model.

This distinction is important, as it allows testing of two different hypotheses. If a central bank announces its decision, this is likely to trigger a contemporaneous market reaction, measured as $\gamma_1$ and $\gamma_2$ in the mean equation (1). As persistence in the mean equation is usually estimated to be very low, consistent with market efficiency, this reaction is basically concluded within the day of the announcement. On top of this, the model estimates a possible effect of the announced decision on conditional volatility through $\kappa_1$ and $\kappa_2$ in the conditional variance equation (2). Given the extremely high persistence parameters that are usually (and in our case) estimated for the conditional volatility, significant parameter estimates for $\kappa_1$ and $\kappa_2$ suggest that the announcement triggers a longer-lasting effect on market volatility that can be interpreted as market uncertainty in response to the announcement. It is therefore possible for a monetary policy decision to have a large contemporaneous effect on the level of interest rates while at the same time reducing their *conditional* volatility over time.

In the case of a transparent central bank, where markets understand well the implications of a release on the future path of monetary policy, we would expect to see a relatively small effect on conditional market volatility, whereas in the case of an opaque central bank, a release would trigger market uncertainty, such that we would expect to find $\kappa_1 > \kappa_2$. Evidence for such an effect has been provided by Swanson (2006), who shows that market uncertainty decreases substantially in response to the FOMC announcements made since 1994. In this paper, we test whether there has been a further decrease in market uncertainty since 1999 as compared to before 1999.

The implications of increased transparency for the mean equation are less straightforward. A more-opaque monetary policy communication is likely to imply that markets will need longer to come to a final assessment of the implications of any given policy decision—which is precisely why we would expect to see market volatility rising. For the level of interest rates, this implies that the reactions are more protracted, whereas a transparent monetary policy will trigger the full adjustment of interest rates instantaneously. Whether we would expect a larger or smaller instantaneous average response depends on the adjustment path in the opaque regime, though. On the one hand, if there is an overshooting on the day

**Table 3. The Effect of Monetary Policy Surprises (I): Mean Equation**

| Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|
| Three Months | 0.484*** | *0.078* | 0.456*** | *0.048* | |
| Six Months | 0.433*** | *0.045* | 0.417*** | *0.037* | |
| One Year | 0.401*** | *0.048* | 0.294*** | *0.058* | |
| Two Years | 0.242*** | *0.058* | 0.216** | *0.105* | |
| Five Years | 0.200*** | *0.059* | 0.210 | *0.142* | |
| Ten Years | 0.040 | *0.054* | 0.143 | *0.158* | |

**Note:** The table shows estimates for $\gamma_1$ and $\gamma_2$ in equation (1). *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

of the announcement that is corrected later on, the effect is larger in the opaque regime than in the transparent one. On the other hand, if rates react gradually until they reach their new equilibrium level, the market reaction on the announcement day is smaller in the relatively more-opaque regime.[14]

Table 3 shows the coefficients for the monetary policy surprise in the mean equation (1), $\gamma_1$ and $\gamma_2$, for the various interest rate maturities, separated for the different disclosure regimes.[15] As the two coefficients are estimated jointly in one model, we can test for differences in the coefficients across the two samples. The corresponding results are reported in the last column of table 3. We find that, generally, there is no significant difference across regimes.

[14]This reasoning is, in two respects, different from the one proposed by Demiralp (2001), who argues that the effect on the day of the announcement should be smaller if more of the announcement has been anticipated. First, we only look at the surprise component, not the announcement itself, and second, we have shown in the previous section that the anticipation effect has not changed across the disclosure regimes, in that the expectations of decisions just before FOMC meetings have not improved.

[15]The results are based on monetary policy surprises from Reuters survey data. As discussed above, the results using federal funds futures are very similar and qualitatively identical to those for the Reuters surveys. For brevity, results for the estimates with federal funds futures are not shown.

**Table 4. The Effect of Monetary Policy Surprises (II): Variance Equation**

| Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|
| Three Months | 0.510*** | *0.072* | −0.016 | *0.061* | *** |
| Six Months | 0.294*** | *0.065* | 0.040 | *0.065* | *** |
| One Year | 0.165*** | *0.058* | −0.094 | *0.076* | *** |
| Two Years | −0.034 | *0.062* | 0.122* | *0.068* | * |
| Five Years | 0.053 | *0.069* | 0.126 | *0.085* | |
| Ten Years | 0.055 | *0.072* | 0.147* | *0.083* | |

**Note:** The table shows estimates for $\kappa_1$ and $\kappa_2$ in equation (2). *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

The test for the effect of FOMC meetings on conditional volatility is more revealing. Table 4 reports the coefficients for the monetary policy surprise in the conditional volatility equation (2), $\kappa_1$ and $\kappa_2$, for the two regimes. Conditional volatility in response to FOMC decisions is generally lower under the new disclosure regime. In particular, FOMC decisions that are accompanied by statements under the new regime no longer increase conditional volatility for maturities up to and including one year. Importantly, these results are robust to dropping all meetings where interest rates were changed. Interest rate changes were accompanied by FOMC statements also prior to 1999 (yet without containing a bias statement), such that a control for the existence of a statement as such is advisable. However, such a control is observationally equivalent to a control for interest rate changes prior to 1999. A valid robustness test does therefore consist of dropping all such meetings before and after 1999. The robustness of the results confirms that there is an effect of the content, and not merely of the existence, of a statement.

In sum, the results suggest that the change in the Federal Reserve's disclosure practice has indeed had a significant effect on financial markets, mainly by reducing the conditional volatility of interest rates at short maturities on the day of the FOMC meetings.

#### *4.3.2 Market Reactions to the FOMC Balance-of-Risks Statements*

So far we have analyzed whether FOMC meetings per se have a different effect on markets in the two regimes. In this subsection, we go one step further and analyze whether the balance-of-risks assessments of the new regime affect markets differently, depending on whether they are tilted toward easing or tightening as compared to being neutral, and whether markets react differently to the monetary policy surprise, depending on whether the balance of risk is symmetric or asymmetric. To test these hypotheses, we modify the model of (1)–(2) further and estimate

$$\begin{aligned}\Delta r_t = {} & \alpha_1 + \alpha_2\, S_t + \alpha_3\, A_t + \beta \Delta r_{t-1} + \gamma_1\, s_t S_t + \gamma_2\, s_t |A_t| \\ & + \sum_i \lambda_i\, z_{i,t} + \delta_M\, Mon + \delta_F\, Fri + \varepsilon_t \qquad (4)\end{aligned}$$

$$\begin{aligned}\ln(h_t) = {} & \omega_1 + \omega_2 S_t + \omega_3 |A_t| + \theta_1 \left( \left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| - \sqrt{\frac{2}{\pi}} \right) \\ & + \theta_2 \left( \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right) + \theta_3 \ln(h_{t-1}) \\ & + \kappa_1\, |s_t| + \sum_i \tau_i\, w_{i,t} + \varphi_M\, Mon + \varphi_F\, Fri \qquad (5)\end{aligned}$$

over the new disclosure regime only. All variables and parameters are defined as for model (1)–(2), except that we now introduce a dummy variable $S_t$, which takes the value 1 if the FOMC meeting is accompanied by a symmetric balance-of-risks statement, and a dummy variable $A_t$, which is set to 1 if the risk assessment points toward a tightening of monetary policy, to $-1$ in case of a tilt toward easing of monetary policy, and to 0 otherwise. The hypotheses that this model allows us to test are whether the release of an asymmetric bias has an effect on market interest rates compared to the release of a symmetric bias ($\alpha_2$ and $\alpha_3$), whether such a release induces conditional market volatility ($\omega_2$ and $\omega_3$), and whether markets react differently to the surprise component contained in a monetary policy decision, depending on whether the accompanying risk assessment is symmetric or asymmetric ($\gamma_1$ and $\gamma_2$).

As shown in the first two columns of table 5, the release of an asymmetric bias in itself led to a change in market rates: a tightening (easing) bias increases (decreases) interest rates by around 1 to 2 basis points, predominantly at the shorter maturities. However, there does not seem to be an important difference in the effect of the statements themselves on conditional market volatility. Generally, the differences between the effect of a symmetric and an asymmetric bias are not statistically significant (table 6).

Interestingly, the strength of the response of short-term interest rates to monetary policy *surprises* depends on the type of statement (last two columns of table 5): in the case of an asymmetric bias, the response is significantly larger than the responses to surprises that are accompanied by symmetric statements. This implies that the release of an asymmetric bias can not only change the assessment of the *future* path of monetary policy, it can also be useful information for markets in interpreting the *present* decision.

We conclude that the release of balance-of-risks statements after each meeting under the new regime has had a significant effect on financial markets. Overall, we find that balance-of-risks statements provide information that reduces market uncertainty. Asymmetric balance-of-risks statements are particularly important since they affect the level of interest rates and can, at times, increase their response to monetary policy surprises.

### *4.4 Interest Rate Adjustment in the Intermeeting Periods*

The evidence presented so far shows that the balance-of-risks statements are used by financial markets to predict the future course of monetary policy, which leads to reduced market uncertainty, a reaction of interest rates to asymmetric statements, and a differential response to announced monetary policy decisions when these are accompanied by asymmetric statements. However, this does not necessarily mean that market participants can indeed also better anticipate future monetary policy decisions already at the time when the statements are released, i.e., immediately after the FOMC meetings. The aim of this section is therefore to analyze whether markets have improved their ability to anticipate future decisions at such an early stage. A necessary condition for this is the consistency of the policy bias with future monetary policy decisions, for which we

**Table 5. The Effect of Balance-of-Risks Statements (I): Mean Equation**

| Maturity | Symmetric Bias | | Asymmetric Bias | | Δ | Policy Surprise with Symmetric Bias | | Policy Surprise with Asymmetric Bias | | Δ |
|---|---|---|---|---|---|---|---|---|---|---|
| Three Months | −0.010*** | *0.003* | 0.011*** | *0.004* | *** | 0.301** | *0.118* | 0.627*** | *0.065* | ** |
| Six Months | −0.005 | *0.004* | 0.014*** | *0.004* | *** | 0.250*** | *0.061* | 0.498*** | *0.066* | *** |
| One Year | 0.001 | *0.007* | 0.012** | *0.006* | | 0.468*** | *0.109* | 0.270*** | *0.070* | |
| Two Years | 0.005 | *0.012* | 0.022** | *0.010* | | 0.350 | *0.302* | 0.172 | *0.118* | |
| Five Years | −0.010 | *0.012* | 0.015 | *0.012* | | 0.270*** | *0.064* | 0.169 | *0.105* | |
| Ten Years | 0.001 | *0.012* | 0.013 | *0.014* | | 0.222 | *0.359* | 0.121 | *0.179* | |

**Note:** The table shows estimates for $\alpha_2, \alpha_3, \gamma_1$, and $\gamma_2$ in equation (4). *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples. Sample period: May 1999–April 2004.

**Table 6. The Effect of Balance-of-Risks Statements (II): Variance Equation**

| Maturity | Symmetric Bias | | Asymmetric Bias | | Δ |
|---|---|---|---|---|---|
| Three Months | −0.216 | *0.136* | −0.089 | *0.074* | |
| Six Months | −0.173 | *0.161* | −0.106 | *0.091* | |
| One Year | −0.166 | *0.117* | −0.249*** | *0.087* | |
| Two Years | 0.114 | *0.078* | −0.015 | *0.053* | |
| Five Years | 0.081 | *0.083* | 0.010 | *0.038* | |
| Ten Years | −0.043 | *0.123* | −0.071 | *0.089* | |

**Note:** The table shows estimates for $\omega_2$ and $\omega_3$ in equation (5). *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples. Sample period: May 1999–April 2004.

have found supportive evidence in section 2. However, the fact that we know this today *with hindsight* does not necessarily imply that markets believed this at the time when the biases were released. Markets may have had to learn how to respond and act under the new policy regime, and this may mean that markets possibly attached limited weight to these balance-of-risks assessments. Although markets reacted more strongly to monetary policy news on FOMC days with biases, as shown above, this does not necessarily mean that markets were better at anticipating future monetary policy decisions under the new disclosure regime at the time when the bias assessment was made.

To analyze this issue, we test whether market interest rates changed as much during the intermeeting period under the new disclosure regime as under the old regime. The hypothesis is that if the statements and biases issued under the new regime have helped markets anticipate future monetary policy decisions better, then one should see a smaller change in market interest rates between the point in time when the bias announcement has been priced into the market and the next FOMC meeting.

Table 7 reports statistics for the mean absolute changes, the variance of the absolute changes, and the maximum absolute change in

**Table 7. Adjustment of Market Interest Rates in the FOMC Intermeeting Period (Three-Month T-Bill Rates)**

| | Feb. 1994–Apr. 1999 | May 1999–Apr. 2004 | Δ |
|---|---|---|---|
| **All FOMC Meetings** | | | |
| Number of Meetings | 44 | 42 | |
| Mean Absolute Change | 0.187 | 0.146 | |
| Variance of the Absolute Change | 0.038 | 0.018 | ** |
| Maximum Absolute Change | 0.870 | 0.480 | |
| **FOMC Meetings with Interest Rate Changes** | | | |
| Number of Meetings | 14 | 18 | |
| Mean Absolute Change | 0.362 | 0.205 | ** |
| Variance of the Absolute Change | 0.063 | 0.013 | ** |
| Maximum Absolute Change | 0.870 | 0.480 | |

**Note:** Δ denotes whether the parameters in the respective row are statistically significantly different over the two samples. *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively.

the three-month interest rates between the day following an FOMC meeting and the day preceding the next FOMC meeting (i.e., from $t_1 + 1$ to $t_2 - 1$). The upper panel presents the results for all FOMC meeting days, the lower one only for those days when monetary policy rates were changed in the subsequent meeting.

The results reveal that the intermeeting adjustment in market interest rates was statistically significantly lower in 1999–2004, in particular when monetary policy changed in the subsequent meeting. When policy changes occurred, the average absolute intermeeting change in market interest rates in the intermeeting period was 36.2 basis points in 1994–99, whereas it fell to 20.5 basis points in 1999–2004. This finding is even more remarkable considering that the policy changes in 1999–2004 were much larger (nine of the eighteen changes being 50-basis-point changes) than those in 1994–99, when only three of the fourteen changes were 50 basis points and one was 75 basis points. It is also consistent with the findings in table 5:

the balance-of-risks assessments seem to be particularly valuable to markets when they are asymmetric, and thus foreshadow an interest rate adjustment. Finally, also the variance of the absolute daily changes in market rates across the FOMC meetings has been significantly smaller under the new than under the old disclosure regime, both for all FOMC meetings and those with interest rate changes.

### *4.5 Alternative Sources of Information: Communication and Macro News*

So far, we have presented three pieces of evidence: First, we have found that markets have been surprised as much by monetary policy decisions, when comparing the expectations just before each meeting with the actual decisions, under the new disclosure regime as under the old one (section 4.2). Second, markets react more strongly to monetary policy surprises under the new regime if an asymmetric bias has been adopted by the FOMC (section 4.3). And third, markets also are better at anticipating the next monetary policy decision under the new disclosure regime (section 4.4). The first of these findings may seem to contradict the second and third of the results. The question therefore is how, even without the statements, markets managed to predict the upcoming decision equally well just prior to the next FOMC meeting.

It must be the case that under the old regime, markets were capable of extracting information from other sources in the intermeeting period. In this section, we ask what this information may have been. We look in particular at two types of information: other Federal Reserve communication—such as speeches, interviews, and testimonies by FOMC members—and macroeconomic news about the economic outlook and inflationary pressures.

#### *4.5.1 The Role of Central Bank Communication*

In between their meetings, FOMC members have the opportunity to convey new information to the markets by making public speeches. Kohn and Sack (2004) and Ehrmann and Fratzscher (2006) argue that such communication conveys important information to market participants and, as such, can affect market interest rates. As mentioned above, we would expect that markets have understood

the future course of monetary policy better since 1999, such that their need to extract information from intermeeting communication by FOMC members might be reduced. In our estimates of model (1)–(2) in the preceding section, we already entered the communication of FOMC members as a control variable. The results for the corresponding variables will be of interest here. In the benchmark model, we distinguished communication by content (with respect to the economic outlook and monetary policy, as described in section 3.3). In this section, we will furthermore distinguish it by occasion (namely, hearings and speeches). In the estimation of the benchmark models, all communication events had been entered, although separately for communication about the monetary policy inclination and the economic outlook. The variables had been coded with the value 1 if the content of communication points toward higher interest rates or a strong economic outlook, with the value $-1$ if it suggests lower interest rates or a weak economic outlook, and with the value 0 if it is neutral. Accordingly, if central bank communication is an effective tool to move markets, the corresponding regression coefficients should be positive and significant.

Table 8 shows the estimated parameters $\lambda_{i,1}$ and $\lambda_{i,2}$ for the mean equation (1), separately for the periods 1994–99 and 1999–2004. Looking at the first subsample, it becomes clear that communication by FOMC members is indeed a means to move markets: interest rates respond significantly to communication, although somewhat more consistently if communication is about monetary policy, whereas the effect of communication about the economic outlook is mainly found for the shorter maturities. The occasions with the largest effect on interest rates are the Congress hearings, where interest rates responded to monetary-policy-related communication with a hump-shaped pattern, by up to 8 basis points for intermediate maturities.

Over the second subsample, 1999–2004, we find significantly lower parameter estimates in a large number of cases. Whereas communication in general still moves the markets, we do not find any significant response of interest rates to Congress hearings any longer. We conclude from this that in the period without FOMC statements, markets needed to infer the future course of monetary policy to a much larger extent from intermeeting communication.

**Table 8. The Effect of FOMC Communication on (I): Mean Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Communication on Economic Outlook** | Three Months | 0.010*** | *0.003* | 0.006*** | *0.002* | |
| | Six Months | 0.013*** | *0.004* | 0.010*** | *0.002* | |
| | One Year | 0.011** | *0.004* | 0.017*** | *0.004* | |
| | Two Years | 0.012* | *0.006* | 0.023*** | *0.006* | |
| | Five Years | 0.007 | *0.007* | 0.024*** | *0.007* | * |
| | Ten Years | 0.004 | *0.007* | 0.018*** | *0.007* | |
| **Communication on Monetary Policy** | Three Months | 0.055*** | *0.003* | 0.011*** | *0.003* | *** |
| | Six Months | 0.031*** | *0.004* | 0.005* | *0.003* | *** |
| | One Year | 0.033*** | *0.005* | 0.012*** | *0.004* | *** |
| | Two Years | 0.029*** | *0.006* | 0.015** | *0.007* | |
| | Five Years | 0.033*** | *0.006* | 0.014** | *0.007* | ** |
| | Ten Years | 0.027*** | *0.006* | 0.010 | *0.007* | * |
| **Hearings, Economic Outlook** | Three Months | 0.042*** | *0.007* | −0.001 | *0.011* | *** |
| | Six Months | 0.040*** | *0.010* | 0.008 | *0.007* | *** |
| | One Year | 0.064*** | *0.014* | 0.006 | *0.010* | *** |
| | Two Years | 0.059*** | *0.016* | −0.005 | *0.013* | *** |
| | Five Years | 0.052*** | *0.018* | 0.010 | *0.015* | * |
| | Ten Years | 0.037* | *0.020* | 0.007*** | *0.000* | |

(*continued*)

**Table 8 (continued). The Effect of FOMC Communication on (I): Mean Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Hearings, Monetary Policy** | Three Months | 0.030** | *0.012* | 0.008 | *0.010* | |
| | Six Months | 0.035** | *0.015* | 0.012 | *0.015* | |
| | One Year | 0.068*** | *0.013* | 0.021 | *0.016* | ** |
| | Two Years | 0.075*** | *0.013* | 0.016 | *0.026* | ** |
| | Five Years | 0.081*** | *0.018* | 0.010 | *0.022* | ** |
| | Ten Years | 0.078*** | *0.017* | 0.031* | *0.017* | ** |
| **Speeches, Economic Outlook** | Three Months | 0.011*** | *0.004* | 0.003 | *0.003* | |
| | Six Months | 0.008 | *0.006* | 0.006 | *0.005* | |
| | One Year | 0.007 | *0.008* | 0.006 | *0.009* | |
| | Two Years | 0.006 | *0.010* | 0.007 | *0.013* | |
| | Five Years | 0.008 | *0.010* | 0.000 | *0.014* | |
| | Ten Years | 0.009 | *0.010* | −0.001 | *0.013* | |
| **Speeches, Monetary Policy** | Three Months | 0.044*** | *0.006* | 0.013*** | *0.003* | *** |
| | Six Months | 0.020*** | *0.007* | 0.003 | *0.004* | ** |
| | One Year | 0.009 | *0.008* | 0.015** | *0.006* | |
| | Two Years | 0.007 | *0.011* | 0.014 | *0.009* | |
| | Five Years | 0.011 | *0.011* | 0.012 | *0.010* | |
| | Ten Years | 0.009 | *0.010* | 0.006 | *0.010* | |

**Note:** The table shows estimates for $\lambda_1$ and $\lambda_2$ in equation (1). *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

The results are less clear-cut when looking at the effects of communication on conditional market volatility (parameters $\tau_{i,1}$ and $\tau_{i,2}$ in equation (2), shown in table 9).[16] Consistent with the reduced effect of Congress hearings on the level of interest rates, we find that the response of conditional market volatility to communication has disappeared entirely under the new regime. For communication made on other occasions, there is a clear difference with respect to the content of communication: whereas we find that conditional market volatility is generally reduced more in the second regime in response to communication about the economic outlook, it has significantly risen for monetary-policy-related communication. One potential explanation for this could be the fact that communication about monetary policy has, during the second subsample, intensified relative to the time prior to 1999 (we count such communication on 9 percent of all days since 1999 and on 6.9 percent of all days before) and relative to communication about the economic outlook (which remained stable, at 4.5 percent and 4.9 percent of all days, respectively). Furthermore, in the presence of a released bias statement, there is now the possibility that intermeeting communication could potentially be different from what is implied by the bias. Both the increase in communication frequency and the possibility that the views expressed stand in contrast with the bias might have led to increased conditional market volatility.

### *4.5.2 The Role of Macroeconomic News*

An alternative source of information from which markets can infer about the likely future course of monetary policy and the economic development obviously are the releases of macroeconomic fundamentals. This source of information should therefore have been used more intensely under the old disclosure regime than nowadays. We test therefore whether markets reacted more strongly to the surprise component contained in the released macroeconomic news prior to 1999, both in the sense that interest rates showed a stronger response and that conditional volatility increased more.

[16] As mentioned above, the variables that distinguish the speeches according to content (with respect to the economic outlook or monetary policy) take the values of 1 and –1; we enter these with their absolute values in the variance equations.

**Table 9. The Effect of FOMC Communication on (II): Variance Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Communication on Economic Outlook** | Three Months | −0.355*** | *0.044* | −0.245*** | *0.037* | * |
| | Six Months | −0.101*** | *0.035* | −0.144*** | *0.039* | |
| | One Year | −0.028 | *0.023* | −0.003 | *0.045* | |
| | Two Years | 0.017 | *0.028* | −0.019 | *0.046* | |
| | Five Years | 0.010 | *0.041* | 0.017 | *0.051* | |
| | Ten Years | 0.044 | *0.042* | 0.011 | *0.049* | |
| **Communication on Monetary Policy** | Three Months | 0.253*** | *0.035* | 0.250*** | *0.018* | |
| | Six Months | 0.178*** | *0.032* | 0.176*** | *0.021* | |
| | One Year | 0.164*** | *0.030* | 0.123*** | *0.025* | |
| | Two Years | 0.107*** | *0.031* | 0.153*** | *0.026* | |
| | Five Years | 0.052 | *0.036* | 0.155*** | *0.030* | ** |
| | Ten Years | 0.030 | *0.040* | 0.145*** | *0.032* | ** |
| **Hearings, Economic Outlook** | Three Months | −0.748*** | *0.203* | 0.256* | *0.154* | *** |
| | Six Months | 0.411** | *0.175* | 0.153 | *0.160* | |
| | One Year | 0.875*** | *0.167* | 0.305* | *0.174* | ** |
| | Two Years | 0.943*** | *0.163* | 0.157 | *0.190* | *** |
| | Five Years | 0.757*** | *0.198* | 0.171 | *0.172* | ** |
| | Ten Years | 1.160*** | *0.202* | 0.276 | *0.194* | *** |

(*continued*)

**Table 9 (continued). The Effect of FOMC Communication on (II): Variance Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Hearings, Monetary Policy** | Three Months | 0.450*** | *0.160* | −0.141 | *0.185* | ** |
| | Six Months | −0.234 | *0.164* | −0.043 | *0.229* | |
| | One Year | −0.205 | *0.171* | 0.146 | *0.249* | |
| | Two Years | −0.440*** | *0.148* | 0.290 | *0.220* | *** |
| | Five Years | −0.229 | *0.173* | 0.017 | *0.226* | |
| | Ten Years | −0.388** | *0.187* | −0.243 | *0.226* | |
| **Speeches, Economic Outlook** | Three Months | −0.274*** | *0.078* | −0.445*** | *0.065* | * |
| | Six Months | −0.228*** | *0.065* | −0.504*** | *0.077* | *** |
| | One Year | −0.086 | *0.058* | −0.421*** | *0.084* | *** |
| | Two Years | −0.020 | *0.063* | −0.206*** | *0.079* | * |
| | Five Years | 0.007 | *0.080* | −0.045 | *0.089* | |
| | Ten Years | −0.006 | *0.082* | −0.015 | *0.092* | |
| **Speeches, Monetary Policy** | Three Months | 0.051 | *0.066* | 0.347*** | *0.023* | *** |
| | Six Months | 0.100** | *0.050* | 0.257*** | *0.027* | *** |
| | One Year | 0.019 | *0.055* | 0.243*** | *0.033* | *** |
| | Two Years | 0.080 | *0.057* | 0.287*** | *0.036* | *** |
| | Five Years | −0.034 | *0.061* | 0.254*** | *0.041* | *** |
| | Ten Years | −0.083 | *0.063* | 0.196*** | *0.046* | *** |

**Note:** The table shows estimates for $\tau_1$ and $\tau_2$ in equation (2). *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

Again, we can resort to our earlier estimates of equations (1) and (2), where we already had included the macroeconomic releases as control variables. Table 10 shows the results for parameters $\lambda_{i,1}$ and $\lambda_{i,2}$ for the mean equation (1) for a number of macroeconomic announcements that have been found to be important (Andersen et al. 2003; Ehrmann and Fratzscher 2005), including leading indicators like the consumer confidence and ISM surveys and retail sales; real variables like industrial production; productivity; employment data like the nonfarm payroll and unemployment figures; and, finally, releases of the consumer price index. The parameters show generally the correct sign: stronger than expected leading indicators, output, employment, and price data should increase interest rates, whereas larger unemployment rates should lead to falling interest rates. The largest reactions are found for the intermediate maturities, which is a common finding in the literature (e.g., Fleming and Remolona 1999) and is intuitive in the sense that monetary policy is likely to react to such surprises in the medium run rather than the short run.

Comparing the two subperiods, it turns out that there are only very few instances where the parameters differ significantly across regimes. Nonetheless, there is an overall tendency for markets to react less to macroeconomic announcements under the new disclosure regimes. The estimated parameters are generally smaller; in more than 80 percent of all cases—namely, for thirty-nine of the forty-eight estimated coefficients—a drop in the market response is observed. Furthermore, the share of significant parameters (at least at the 90 percent level) drops from 73 percent to 60 percent.[17] Looking at the results for the conditional volatility equation in table 11, a similar picture emerges: the reaction of conditional market volatility is generally smaller under the new disclosure regime, with the exceptions of the ISM survey and the unemployment rate. In some cases, like for nonfarm payrolls or the CPI, consistent conditional volatility effects throughout the maturity spectrum have disappeared entirely.

Overall, there is therefore only weak evidence about a reduction in the importance markets attribute to macroeconomic releases; they still form an important source of information for markets. One possibility for this could be that macroeconomic releases are particularly

[17]Omitting observations for a few months after September 11, 2001, when some unusually large surprises were observed, does not alter the results.

**Table 10. Market Reactions to Macro Announcements (I): Mean Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Consumer Confidence** | Three Months | 0.009 | *0.024* | −0.010 | *0.008* | |
| | Six Months | 0.088*** | *0.027* | 0.021 | *0.015* | ** |
| | One Year | 0.120*** | *0.030* | 0.054* | *0.030* | |
| | Two Years | 0.137*** | *0.037* | 0.066 | *0.041* | |
| | Five Years | 0.149*** | *0.041* | 0.090** | *0.038* | |
| | Ten Years | 0.109*** | *0.040* | 0.088** | *0.038* | |
| **ISM Survey** | Three Months | 0.015** | *0.006* | −0.005 | *0.006* | ** |
| | Six Months | 0.029*** | *0.009* | 0.020** | *0.008* | |
| | One Year | 0.062*** | *0.013* | 0.058*** | *0.010* | |
| | Two Years | 0.086*** | *0.016* | 0.099*** | *0.019* | |
| | Five Years | 0.095*** | *0.017* | 0.102*** | *0.021* | |
| | Ten Years | 0.077*** | *0.017* | 0.098*** | *0.020* | |
| **Retail Sales** | Three Months | 0.067*** | *0.015* | 0.086*** | *0.018* | |
| | Six Months | 0.012 | *0.011* | 0.010* | *0.005* | ** |
| | One Year | 0.033*** | *0.011* | 0.004 | *0.006* | |
| | Two Years | 0.052*** | *0.015* | 0.033** | *0.013* | |
| | Five Years | 0.070*** | *0.018* | 0.067*** | *0.015* | |
| | Ten Years | 0.078*** | *0.020* | 0.059*** | *0.016* | |

(*continued*)

**Table 10 (continued). Market Reactions to Macro Announcements (I): Mean Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Industrial Production** | Three Months | 0.010 | *0.012* | 0.007 | *0.005* | |
| | Six Months | 0.011 | *0.014* | 0.005 | *0.005* | |
| | One Year | 0.035** | *0.015* | 0.010 | *0.010* | |
| | Two Years | 0.048** | *0.019* | 0.036** | *0.014* | |
| | Five Years | 0.042** | *0.019* | 0.039** | *0.016* | |
| | Ten Years | 0.025 | *0.017* | 0.033** | *0.015* | |
| **Productivity (Preliminary)** | Three Months | 0.022 | *0.044* | 0.002 | *0.012* | |
| | Six Months | −0.001 | *0.059* | −0.002 | *0.015* | |
| | One Year | 0.023 | *0.038* | −0.006 | *0.045* | |
| | Two Years | 0.013 | *0.048* | −0.008 | *0.046* | |
| | Five Years | 0.034 | *0.030* | −0.017 | *0.038* | |
| | Ten Years | 0.036 | *0.090* | −0.048 | *0.056* | |
| **Unemployment Rate** | Three Months | −0.100*** | *0.029* | −0.032 | *0.032* | |
| | Six Months | −0.157*** | *0.034* | −0.121** | *0.052* | |
| | One Year | −0.111*** | *0.042* | −0.100 | *0.078* | |
| | Two Years | −0.183*** | *0.052* | −0.212* | *0.119* | |
| | Five Years | −0.169*** | *0.056* | −0.180 | *0.138* | |
| | Ten Years | −0.134** | *0.055* | −0.178 | *0.113* | |

(*continued*)

**Table 10 (continued). Market Reactions to Macro Announcements (I): Mean Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Nonfarm Payrolls** | Three Months | 0.026*** | *0.004* | 0.018*** | *0.003* | |
| | Six Months | 0.055*** | *0.006* | 0.023*** | *0.003* | *** |
| | One Year | 0.071*** | *0.011* | 0.047*** | *0.008* | * |
| | Two Years | 0.078*** | *0.013* | 0.067*** | *0.011* | |
| | Five Years | 0.091*** | *0.014* | 0.061*** | *0.014* | |
| | Ten Years | 0.073*** | *0.015* | 0.048*** | *0.012* | |
| **CPI** | Three Months | 0.018 | *0.012* | 0.005 | *0.005* | |
| | Six Months | 0.014 | *0.013* | 0.017*** | *0.006* | |
| | One Year | 0.050*** | *0.015* | 0.029*** | *0.009* | |
| | Two Years | 0.050*** | *0.017* | 0.035*** | *0.012* | |
| | Five Years | 0.046** | *0.018* | 0.041*** | *0.013* | |
| | Ten Years | 0.034* | *0.019* | 0.022* | *0.013* | |

**Note:** The table shows estimates for $\lambda_1$ and $\lambda_2$ in equation (1). Data for productivity are available from 1998. *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

**Table 11. Market Reactions to Macro Announcements (II): Variance Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Consumer Confidence** | Three Months | 0.636* | *0.352* | −1.036*** | *0.334* | *** |
| | Six Months | 1.052*** | *0.348* | −0.199 | *0.344* | ** |
| | One Year | 2.097*** | *0.250* | 1.534*** | *0.339* | |
| | Two Years | 1.537*** | *0.259* | 1.073*** | *0.318* | |
| | Five Years | 1.479*** | *0.287* | 0.693* | *0.372* | * |
| | Ten Years | 1.409*** | *0.312* | 0.774** | *0.380* | |
| **ISM Survey** | Three Months | 0.435*** | *0.114* | 0.811*** | *0.096* | ** |
| | Six Months | 0.444*** | *0.161* | 0.910*** | *0.093* | ** |
| | One Year | −0.132 | *0.133* | 0.329*** | *0.103* | *** |
| | Two Years | −0.265* | *0.137* | 0.825*** | *0.102* | *** |
| | Five Years | −0.406** | *0.158* | 1.030*** | *0.135* | *** |
| | Ten Years | −0.329** | *0.166* | 0.800*** | *0.163* | *** |
| **Retail Sales** | Three Months | −0.697*** | *0.187* | −0.153 | *0.104* | ** |
| | Six Months | −0.327** | *0.156* | 0.156 | *0.097* | *** |
| | One Year | 0.458*** | *0.140* | 0.366*** | *0.103* | |
| | Two Years | 0.373** | *0.150* | 0.383*** | *0.103* | |
| | Five Years | −0.068 | *0.175* | 0.358*** | *0.116* | ** |
| | Ten Years | −0.250 | *0.192* | 0.324*** | *0.115* | ** |

(*continued*)

**Table 11 (continued). Market Reactions to Macro Announcements (II): Variance Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Industrial Production** | Three Months | 0.109 | *0.191* | −0.717*** | *0.169* | *** |
| | Six Months | 0.166 | *0.132* | −0.720*** | *0.151* | *** |
| | One Year | −0.333*** | *0.106* | −0.625*** | *0.148* | |
| | Two Years | −0.323*** | *0.123* | −0.439*** | *0.147* | |
| | Five Years | −0.549*** | *0.152* | −0.448*** | *0.166* | |
| | Ten Years | −0.528*** | *0.162* | −0.455*** | *0.172* | |
| **Productivity (Preliminary)** | Three Months | −2.960*** | *0.809* | −0.635 | *0.401* | ** |
| | Six Months | −1.819** | *0.776* | −0.700** | *0.320* | |
| | One Year | −3.813*** | *0.756* | 0.056 | *0.368* | *** |
| | Two Years | −3.593*** | *1.025* | −0.156 | *0.276* | *** |
| | Five Years | −2.888** | *1.164* | 0.064 | *0.325* | ** |
| | Ten Years | −1.165 | *0.869* | 0.749** | *0.298* | ** |
| **Unemployment Rate** | Three Months | −3.314*** | *0.553* | 4.568*** | *0.216* | *** |
| | Six Months | −2.184*** | *0.552* | 5.125*** | *0.245* | *** |
| | One Year | −2.279*** | *0.512* | 4.812*** | *0.261* | *** |
| | Two Years | −2.266*** | *0.542* | 2.679*** | *0.295* | *** |
| | Five Years | −1.549*** | *0.577* | 0.640 | *0.431* | *** |
| | Ten Years | −1.025* | *0.570* | −0.044 | *0.675* | |

(*continued*)

**Table 11 (continued). Market Reactions to Macro Announcements (II): Variance Equation**

| | Maturity | Feb. 1994–April 1999 | | May 1999–April 2004 | | Δ |
|---|---|---|---|---|---|---|
| **Nonfarm Payrolls** | Three Months | 0.588*** | *0.070* | 0.070 | *0.079* | *** |
| | Six Months | 0.756*** | *0.067* | 0.066 | *0.069* | *** |
| | One Year | 1.062*** | *0.049* | 0.006 | *0.085* | *** |
| | Two Years | 1.074*** | *0.049* | −0.052 | *0.086* | *** |
| | Five Years | 1.019*** | *0.058* | 0.000 | *0.093* | *** |
| | Ten Years | 1.005*** | *0.063* | 0.005 | *0.105* | *** |
| **CPI** | Three Months | 0.759*** | *0.193* | 0.214* | *0.110* | ** |
| | Six Months | 0.395** | *0.165* | 0.236* | *0.126* | |
| | One Year | 0.321** | *0.147* | 0.005 | *0.130* | |
| | Two Years | 0.502*** | *0.160* | 0.063 | *0.125* | ** |
| | Five Years | 0.717*** | *0.172* | −0.234* | *0.132* | *** |
| | Ten Years | 0.825*** | *0.183* | −0.041 | *0.141* | *** |

**Note:** The table shows estimates for $\tau_1$ and $\tau_2$ in equation (2). Data for productivity are available from 1998. *, **, and *** denote significance at the 90 percent, 95 percent, and 99 percent level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

informative about the future path of monetary policy in the medium run (as reflected by the fact that it is primarily the intermediate maturities that react to these releases), such that markets consider them important to update their expectations beyond the horizon of the next FOMC statements.

## 5. Conclusions

The objective of the paper has been to assess whether the change in the Federal Reserve's disclosure practice of 1999 was successful in enhancing the effectiveness and transparency of U.S. monetary policy. This regime change entailed the publication of a statement, immediately after each FOMC meeting, that not only explains its monetary policy decision but also contains a forward-looking element—initially in the form of an outlook for the monetary policy stance and, later, in the form of a balance-of-risks assessment concerning inflationary pressures and economic conditions in the "foreseeable future."

The empirical approach taken in the paper has been to compare both the market's reaction to FOMC decisions and its ability to anticipate and predict the future course of monetary policy under the new regime as compared to the previous regime. First, we find that markets have anticipated monetary policy decisions equally well under both regimes, when comparing the expectations just before each meeting with the actual decisions. Second, the reactions of financial markets to monetary policy are strikingly different across the two regimes. Not only do they have a larger effect on the level of interest rates if they are accompanied by an asymmetric risk assessment, but also the conditional volatility induced by FOMC meetings has been significantly lower since 1999. Third, markets anticipate the next monetary policy decision earlier under the new disclosure regime, such that market interest rates move by a smaller magnitude over the whole intermeeting period under the new regime.

Taken together, these three pieces of evidence suggest that under the old regime, markets were capable of compensating their lack of information from FOMC announcements by extracting information from other sources in the intermeeting period. We show that markets reacted more strongly to other types of Federal Reserve communication—such as testimonies, interviews, and speeches by

FOMC members—in the intermeeting periods. In this sense, markets may merely have shifted their attention from other types of information to the statements and balance-of-risks assessments of the FOMC decisions themselves to obtain the relevant information.

How shall one assess this regime change? On the one hand, the change in the disclosure regime may be interpreted as an increase in transparency, as markets are provided with relevant information at an earlier stage and in a more-transparent manner. This makes it easier and less costly for markets to obtain the information, and helps reduce market uncertainty about the future course of monetary policy. On the other hand, our finding that markets attach such a strong importance to the statements by the FOMC is contrary in spirit to King (2000), who argues that, with a transparent monetary-policy reaction function, news should not be in the announcements of central banks but should entirely arise in the development of the economy.

Several major issues are left unanswered, as the scope and objective of the paper has been limited to the analysis of the change in the FOMC disclosure regime. In particular, while we have provided evidence that the market's anticipation of monetary policy has improved in some ways, a verdict is still out on whether the approach adopted by the FOMC is optimal or whether alternative communication strategies are superior in providing transparency and in enhancing the efficiency of monetary policy. What constitutes an "optimal" communication strategy is hotly debated and very much depends on one's understanding of the concepts of transparency and effectiveness of monetary policy. Some phrase their view in the same manner as William Poole (2003, 7):

> Some will regard this approach [of choosing among a relatively few standard phrases] as providing "boilerplate" language with little real meaning. My own judgment is that it is better to provide boilerplate with clear meaning than rich language with a multiplicity of possible meanings. It just is not true that lots of words equals lots of disclosure and greater transparency.

By contrast, others, such as Issing (2005, 70), argue that the use of simple language and code words bears some serious dangers:

> However, with the use of such code words, the central bank puts itself under pressure to honour a quasi-promise. If, in the meantime, its assessment of the situation has changed, owing

> to new developments, the central bank will be faced with the dilemma of triggering market disturbances if they "disappoint" expectations, even though they may have convincing arguments to justify their reassessment of the circumstances. For this reason, indications about future decisions must always be seen only as conditional commitments. In practice, however, it is likely to prove extremely difficult to communicate this proviso with sufficient clarity. The more straightforward the "announcement" and the simpler the code, the more difficult it will be to explain its conditionality ex ante.

In order to assess these claims, one would need to compare the consequences of the different ways of communication chosen by different central banks. We leave this for future research.

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