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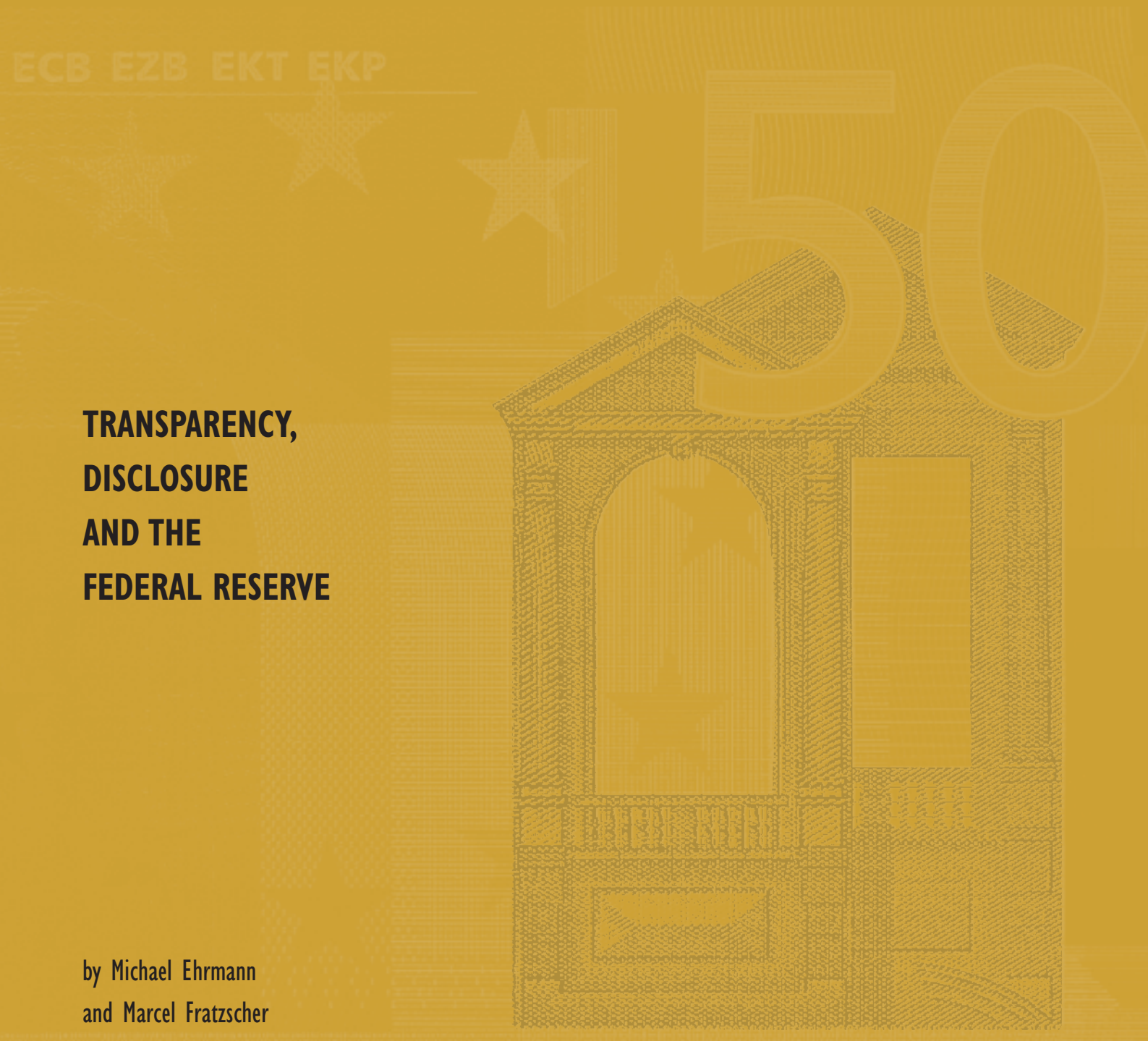

TRANSPARENCY, DISCLOSURE AND THE FEDERAL RESERVE

by Michael Ehrmann
and Marcel Fratzscher

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Abstract

This paper assesses the change in Federal Reserve policy introduced in 1999, with the publication of statements about the outlook for monetary policy (and later about the balance of risks) immediately after each FOMC meeting. We find that markets anticipated monetary policy decisions equally well under this new disclosure regime than before, but arrived at their expectations in different ways. Under the new regime, markets extract information from the statements, whereas before, they needed to revert to other types of Fed communication in the inter-meeting periods, and come to their own assessment of the implications of macroeconomic data releases. Taken together, these findings suggest that the Fed's new disclosure practice may indeed have improved transparency in the sense that information is now released to the markets at an earlier time and with clearer signals, but that the Fed can extract less information from observing market reactions to macroeconomic data releases.

JEL classification: E43, E52, E58, G12
Keywords: transparency; monetary policy; announcements; communication; disclosure.

Non-technical summary

In current monetary policy making, an unprecedented degree of transparency has become common practice. Such transparency relates to various parts of the policy process, such as the publication of the policy objectives and institutional arrangements, of policy models or central bank forecasts of relevant variables, or 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. A central bank that releases such forward-looking statements is the Federal Reserve. Since May 1999, it publishes immediately after meetings of the FOMC a statement that not only explains its monetary policy decision, but also contains a forward-looking element, in the form of an outlook for the monetary policy stance initially, and a balance-of-risks assessment concerning inflationary pressures and economic conditions in the "foreseeable future" nowadays. In this paper, we will analyse whether financial markets' understanding of monetary policy has improved and in what way their reaction to central bank communication has changed with the change in regime in May 1999.

Our empirical analysis focuses on three questions: first, have markets been less surprised about monetary policy decisions under the new disclosure regime? Second, do market interest rates respond to the statements issued by the FOMC under the new regime, and do monetary policy decisions affect financial markets differently compared to the old regime? And third, have the statements of the new regime helped markets better anticipate the path of future FOMC decisions? Concerning the first of these questions, we find no systematic evidence that markets are less surprised by FOMC decisions under the new disclosure practice. However, this in itself does not necessarily mean that the new disclosure practice is not effective. It only implies that *by the time* a monetary policy decision is made, market participants are nowadays no better prepared to anticipate the decisions than they were under the old disclosure regime. In fact, we present evidence that the way through which markets arrive at their expectations of monetary policy decisions differs across regimes. Through their response to FOMC statements and monetary policy decisions financial markets anticipate future monetary policy decisions to a large extent already at the time of the release of the FOMC statements. Moreover, the balance-of-risks assessments of the new regime generally provide an accurate signal about future FOMC decisions.

Taken together, these pieces of evidence suggest that the new regime of the Federal Reserve has indeed improved the markets' anticipation of future monetary policy decisions, in the sense that the new disclosure practice provides market participants with relevant information *at an earlier stage*. Under the regime prior to 1999, markets were, immediately before FOMC meetings, prepared just as well as under the new regime, but had to infer this information from other sources. Indeed, we find that markets reacted more strongly to other types of Federal Reserve communication in the

inter-meeting periods, such as testimonies, interviews and speeches by FOMC members, as well as to releases of macroeconomic fundamentals.

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, the reduced importance of macroeconomic news might prove costly for the Federal Reserve. The reaction of financial markets to the release of macroeconomic fundamentals can be an important source of information for the central bank about the markets' diverse and possibly deviating views. Under its new disclosure policy, the Federal Reserve has less such information available.

1. Introduction

Over the past decade, there has been a remarkable change in the way central banks conduct monetary policy. For example, as recently as 1993, the United States' Federal Open Market Committee (FOMC) did not publicly announce its decisions about changes in the federal funds target rate after its meetings. In current monetary policy making, an unprecedented degree of transparency has become common practice. Such transparency relates to various parts of the policy process, such as the publication of the policy objectives and institutional arrangements, of the policy models or central bank forecasts of relevant variables, or 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, where the decisions taken are discussed in great detail. Others, like the Bank of England, publish minutes of the Monetary Policy Committee meetings after two weeks. Others again, like the US Federal Reserve, publish a press statement immediately after each meeting 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). In an environment with a relatively opaque central bank, financial markets need to *infer* the intentions of policy makers. Such inference will necessarily at times be prone to mistakes, e.g., if financial markets attribute inappropriate weights to indicators (such as communication by policy makers or macroeconomic news), or if there is dissent among market participants about the interpretation of relevant news, which will induce uncertainty in financial markets. As emphasised by Cecchetti (2000), monetary policy will always be conducted in an uncertain environment – "but in conducting policy, there is one uncertainty that policy makers can reduce: the uncertainty they themselves create" (p. 32).

In this paper, we analyse whether central bank transparency can indeed improve the efficiency of monetary policy making. Our testing vehicle is the change in regime that has occurred in 1999 at the US 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, in the form of an outlook for the monetary policy stance initially, and a balance-of-risks assessment concerning inflationary pressures and economic conditions in the "foreseeable future"

[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 achieving the central bank's tasks see Mishkin (2004).

nowadays. As argued in Bernanke et al. (2004) and Gurkaynak et al. (2004), financial markets attribute considerable importance to statements about the future path of policy. We will use the change in regime to analyse whether financial markets' understanding of monetary policy has improved and in what way their reaction to central bank communication has changed.

The focus of our analysis will be the reaction of market interest rates to monetary policy, since they are closely linked with the policy rate. We focus on three questions: first, have markets been less surprised about monetary policy decisions under the new disclosure regime? Second, do market interest rates respond to the statements issued by the FOMC under the new regime, and do monetary policy decisions affect financial markets differently compared to the old regime? And third, have the statements of the new regime helped markets better anticipate the path of future FOMC decisions? Concerning the first of these questions, we find no systematic evidence that markets are less surprised by FOMC decisions under the new disclosure practice. However, this in itself does not necessarily mean that the new disclosure practice is not effective. It only implies that *by the time* a monetary policy decision is made, market participants are nowadays no better prepared to anticipate the decisions than they were under the old disclosure regime. In fact, we present evidence that the way through which markets arrive at their expectations of monetary policy decisions differs across regimes. Through their response to FOMC statements and monetary policy decisions interest rates anticipate future monetary policy decisions to a large extent already at the time of the release of the FOMC statements. Moreover, the balance-of-risks assessments of the new regime generally provide an accurate signal about future FOMC decisions.

Taken together, these pieces of evidence suggest that the new regime of the Federal Reserve has indeed improved the markets' anticipation of future monetary policy decisions, in the sense that the new disclosure practice provides market participants with relevant information *at an earlier stage*. Under the regime prior to 1999, markets were, immediately before FOMC meetings, prepared just as well as under the new regime, but had to infer this information from other sources. Indeed, we find that markets reacted more strongly to other types of Federal Reserve communication in the inter-meeting periods, such as testimonies, interviews and speeches by FOMC members, as well as to releases of macroeconomic fundamentals.

The question is how to assess this regime change. On the one hand, it 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 more importance to the statements and the balance-of-risks assessments at FOMC meetings and less importance to news about macroeconomic fundamentals 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. We furthermore believe that the reaction of financial markets to the release of macroeconomic fundamentals can be an important source of information for the central bank about the markets' diverse and possibly deviating views. Under its new disclosure policy, the Federal Reserve has less such information available.

In the remainder of this paper, we describe the changes in the FOMC disclosure practices that have occurred since 1994 in section 2, 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 analyses 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 summarises the results and concludes.

2. The balance-of-risks assessments of the FOMC

2.1 Changes in the FOMC disclosure practices

1994: Immediate release of decisions on the federal funds target 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: Lange et al. (2003), Poole and Rasche (2003) and Demiralp (2001) observe that markets were able to improve their forecasts of monetary policy decisions, and they relate this to the change in transparency.[2] Lee (2002) shows that the effect of Fed announcements on interest rate volatility has decreased in the last decades. However, his analysis ends in 1999; we will demonstrate below that there have been further changes in the volatility following monetary policy actions since 1999. 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 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.

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 federal funds target rate as well as instructions for current policy to the Open Market Trading Desk. These directives focused in particular on the inter-meeting 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). In the course of 1999, the FOMC made six such announcements. As an example for the phrasing of these statements, the first such statement, which was released on May 18, 1999, noted that "[…] the Committee was concerned about the potential for a build-up of inflationary imbalances that could undermine the favourable performance of the economy and therefore adopted a directive that is tilted toward the possibility of a firming in the stance of monetary policy." (Federal Reserve Board, 1999). As there had been a debate among FOMC members about the likely effects of such releases - some arguing that the statements would allow financial markets to price the future course of monetary policy more accurately, others that fear of market reactions would make the FOMC more cautious in changing the outlook - it was decided to evaluate after some time whether further changes would be desirable.

2000: Modifications to the release: the balance-of-risks assessments

One year later, at its meeting in December 1999, the FOMC decided to follow the proposals made by a Working Group on the Directive and Disclosure Policy and 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; iv) the balance of risks statement would be assembled from a set of pre-defined sentences.

The FOMC strictly adhered to the new rules until March 2003, when it decided not to convey a balance of risks in the light of the large uncertainties due to the US 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 pre-defined sentences. The main reason for this modification has to be seen in the possibility to provide separate assessments of the risks to both goals, which was not foreseen in the predefined sentences (Federal Reserve Board, 2003).

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

In this paper, we will in general analyse the period from May 1999 to April 2004 and compare it with the period from February 1994 to April 1999. Although there could potentially be differences in the way markets react to the statements made in 1999 and those released since, we will only analyse the case of the 1999 statements separately when this is feasible despite the few observations that are available. 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.

2.2 Consistency of balance-of-risks assessments

In this section, we analyse whether the FOMC's balance-of-risks assessments are generally consistent with future monetary policy decisions, a necessary condition if the statements are meant to help markets anticipate better future decisions. In doing so, we assume that markets interpreted an assessment highlighting the risks of inflation as pointing to higher interest rates, and an assessment that stresses the risks to economic growth as pointing to lower interest rates.[3]

Table 1 shows how often the bias was followed or not followed by an according monetary policy decision at the subsequent meeting for the two sub-periods February 1994-April 1999 and May 1999- April 2004. One important caveat is that the policy directives prior to May 1999, as discussed in section 2, focused on the inter-meeting period only and did not provide any clue to markets about the next monetary policy decision since they were released publicly only after the subsequent meeting. It is nevertheless interesting to compare the consistency of policy biases across these two periods.[4]

Table 1 reveals that 28 out of 42 bias announcements (67%) in 1999-2004 were followed by corresponding monetary policy decisions.[5] A closer look at the remaining 14 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 wrong direction (which would certainly be the worst case of inconsistency). In two cases, interest rates were tightened while the bias released at

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

[4] A second caveat is that since 2000 the focus of the statements has been not on the inter-meeting period any longer, 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, 13 August 2002, which is classified as a "correct" anticipation of future decisions in the tables.

[5] Throughout the paper, we have excluded the FOMC meeting on September 17th, 2001, when interest rates were decreased by 50 bp in response to the terrorist attacks on September 11th. We have done this due to the exceptional circumstances of this FOMC meeting. Excluding also other unscheduled meetings does not affect our results. An interesting case in this regard is represented by the unscheduled meeting on January 3rd, 2001, where the FOMC decided to lower its target rate by 50 basis points. This interest rate cut was preceded by a change in the direction of the balance-of-risks assessment, which had been tilted towards inflationary risks in November 2000, and was turned into one highlighting risks of economic weakness in December 2000.

the preceding meeting was symmetric (probably a less serious case of inconsistency, but nonetheless important as the bias has not helped anticipating the change). The other 12 cases consist of situations where an asymmetric bias was not followed by corresponding action (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.

However, these findings do not necessarily imply that the biases improve the ability of markets to anticipate future decisions. For instance, an asymmetric bias may provide little additional information if the FOMC issued a lot of asymmetric biases but monetary policy hardly ever changed. To test this case, rows (3) and (4) in Table 2 show that, although the FOMC indeed issued a lot of asymmetric balance-of-risks assessments since 1999 (namely at 69.1% of all FOMC meetings), the probability that a change in interest rates is preceded by such an asymmetric assessment (which furthermore has the correct sign) is statistically significantly larger at 89.5%.

Market expectations of monetary policy decisions could obviously improve if an asymmetric bias were to increase the probability of a corresponding interest rate change at the next meeting. Rows (1) and (2) in Table 2 reveal that, in 1999-2004, 58.6% of all asymmetric biases were followed by corresponding interest rate changes at the next meeting. By contrast, interest rates were changed only at 45.2% of all meetings. The conditional probability of an asymmetric bias being followed by a corresponding policy move is therefore higher than the unconditional probability of a policy change, although we do not find this difference to be statistically significant.

Overall, we conclude that the new disclosure regime since 1999 has improved transparency of Federal Reserve policy in that it has provided useful information for anticipating future monetary policy decisions.

A comparison of the old and the new disclosure regime 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, Table 2 reveals that the directives provided a poor prediction of monetary policy actions at the subsequent FOMC meetings. In only 28.6% of the cases was an asymmetric bias followed by a corresponding policy change, which is lower than the 31.8% of meetings when the FOMC actually changed interest rates (see rows (1) and (2) of Table 2). Similarly, only 42.9% of interest rate changes were preceded by an asymmetric bias, whereas the FOMC had a policy tilt in 47.7% of the meetings (see rows (3) and (4)). Rows (5) and (6) indicate

that in more than half of the cases were the policy directives not followed in the next FOMC meeting.

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* Fed objectives and were not intended to provide public information since they focused on the inter-meeting 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 surrounding risks. For this information to be credible, the biases need to be broadly in line with actual policy decisions.

This nevertheless leaves open the question why the policy directives before 1999 were so much 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* Fed 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 at the same time a neutral directive is adopted, indicating the FOMC's intention not to embark on further changes.

Rows (1) to (3) and (4) to (6) in the lower panel of Table 2 confirm that for 65.9% of the FOMC meetings in 1994-99, the issued policy directive was contrary to the monetary policy decision at the same meeting, i.e. unchanged interest rates were accompanied by an asymmetric bias or changed interest rates by a neutral bias, whereas only in 34.1% of the meetings was the directive the same as the policy action. By contrast, for 59.5% of the FOMC meetings since 1999, the biases have been consistent with the policy decisions.

3. The data

3.1 Interest rates

Our interest rate data consists of constant maturity treasury rates which are provided by the US 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 central bank 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 3 and 6 months as well as 1, 2, 5, 10 and 20 years.

As to the frequency of the analysis, we use daily frequency rather than intra-day or tick-by-tick data. 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 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.

As we have shown in previous work (Ehrmann and Fratzscher, 2004a), the daily interest rate data are characterised by negative skewness, excess kurtosis, non-normality 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 Markets 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.[6] We have shown in earlier work (Ehrmann and Fratzscher, 2004a and 2004b) that the survey data are unbiased and efficient.

As an alternative to survey data on monetary policy decisions, expectations can be extracted from the Fed funds futures rate, as proposed by Kuttner (2001). We have tested our results for robustness with respect to the choice of the measure for market expectations. However, our preferred measure is the ones based on surveys, which allows us to extract not only the market expectation (through the mean or median response), but also a measure of uncertainty (through the disagreement across survey respondents), which we will analyse in section 4.2. This choice is also supported by Söderström (2001), who provides evidence that it is difficult for futures-based expectation measures to outperform the survey-based measures. Finally, Piazzesi and Swanson (2004) show that Fed funds futures rates can only be used as measures for market expectations about future monetary policy once risk premia are properly taken into account.

We construct the *surprise component* contained in each announcement by deducting the expectation from the actual announcement.[7] For days without announcements, this surprise is defined to be zero. We will make use of this surprise variable to measure the effect of announcements on markets. The

[6] This has consistently been found also in earlier work with this data (Ehrmann and Fratzscher 2004b).

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

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 (see, e.g., Kuttner, 2001). Analysing the reaction of markets to surprises is therefore a proxy to assess the importance of the underlying announcement.

3.3 FOMC communication

We analyse two types of central bank communication. First, we look at the effect of the FOMC statements about the outlook for monetary policy and the balance of risk assessment described in section 2 themselves. 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 one on those days where the FOMC released a statement that it perceives the risks of economic weakness and of inflationary pressure as balanced, and zero on all other days. The indicator "asymmetric bias" takes the value one for statements that highlight a risk of inflationary pressure, the value minus one for statements that consider the risk to be tilted towards economic weakness, and the value zero otherwise.[8]

Second, we look at other communication made by FOMC members in the inter-meeting periods. This data set includes three types of communication - speeches, interviews and testimonies - and includes all FOMC members. The data is extracted from a widely used newswire service, *Reuters News*, which provides a news report usually within minutes of each statement.[9] This way of collecting the data is somewhat different from that used by Kohn and Sack (2003), who take all speeches and testimonies made by FOMC members. The key difference is that *Reuters News* reports the great majority but not all of these statements since it may decide to leave out a statement if it considers 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.

We use the extracted data in two ways in our empirical model. First, we include each statement as a dummy with the value one for those days when the statement took place and zero otherwise. Second, we classify each statement by whether it provides information about the economic outlook (C^{EC}) or future monetary policy (C^{MP}) in the following way:

$$C_t^{EC} = \begin{cases} +1 & stronger\ econ.\ outlook \\ 0 & unchanged\ econ.\ outlook \\ -1 & weaker\ econ.\ outlook \end{cases} \qquad C_t^{MP} = \begin{cases} +1 & tightening\ inclination \\ 0 & no\ inclination \\ -1 & easing\ inclination \end{cases}$$

[8] Obviously, also here Bill Poole's caveats mentioned in footnote 3 apply.

Clearly, we should stress that an important caveat is that this classification is judgmental and reflects our own reading of the statements as reported by Reuters News. It is therefore possible that we may have misclassified some statements in that markets have interpreted them differently. It is also possible that markets interpret the statements differently from what was intended by the FOMC member. A more detailed account of the methodology and discussion of the caveats is provided in Ehrmann and Fratzscher (2004c).

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 3-month t-bill rate around two consecutive FOMC meeting dates under the two disclosure regimes. In both cases, no change occurred at the first of the two FOMC meetings (marked as day 0 on the horizontal axis) and a rise in the federal funds target rate by 25 bp took place in the subsequent meetings (marked as day 30). One of these meetings - 25 March 1997 - occurred under the old regime when the FOMC had actually adopted a tightening bias in the preceding meeting, which was not made public. The second of these meetings - 2 February 2000 - took place under the new regime when the FOMC had adopted *and released* an asymmetric bias towards tightening at the preceding FOMC meeting.

In both instances, the policy decision to change interest rates 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.

The figure illustrates that, in the new disclosure regime, markets already priced in most of the 25-bp rise of the next meeting within one day of the bias announcement. After this initial jump, market interest rates remained relatively stable and rose gradually until the next meeting. By contrast, under the old regime interest rates hardly moved at the first meeting, but then adjusted much more strongly towards the second meeting when the 25 bp change was implemented.

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

1) 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?

[9] The same source and methodology has been used in Fratzscher (2004) for the analysis of the effectiveness of exchange rate communication in the G3 economies.

2) Have markets changed their behaviour on the days of the FOMC meetings? Do they react to the release of the statements, and if so, how?
3) Do interest rate reactions in response to the release of the statements anticipate the required adjustment between FOMC meetings, such that lower inter-meeting interest rate adjustments are needed under the new regime? And, finally,
4) Is the release of the statements a substitute or a complement to other sources of information, like inter-meeting 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 (Lange et al., 2003; Poole and Rasche, 2003; Demiralp, 2001), such that it might be difficult to improve upon this performance.

Table 3 reports various statistics regarding the expectations data, separately for all scheduled FOMC meeting dates as well as for those where interest rates were actually changed. We analyse 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 a more stringent test of the forecastability of FOMC decisions. First, we find that the mean surprise over all sub-samples (shown in the second rows of the panels in Table 3) is insignificantly different from zero (as indicated by the t-statistics provided in the third rows of the panels in Table 3), regardless of whether interest rates are changed or not. The columns denoted by Δ report the results of tests for differences across the sub-samples: we cannot find any difference in the size of the mean surprise.

However, even if the surprises are zero on average, 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 only one case do we find a statistically significant difference, and only at the 90% level: the variance of the absolute surprise has been significantly smaller in 1999 than in the period 1994-1999 for FOMC meetings on which changes in the target rate took place.

Since the survey-based measures of expectations are constructed from the answers of several respondents, it is possible to analyse the extent to which the respondents disagree.[10] This will also be informative about the predictability of monetary policy decisions: the more respondents agree, the easier the decisions can apparently be predicted. The natural way to look at this issue would be to calculate the standard deviation across responses in each survey. Since for some surveys we only have information on the share of respondents that gave a certain answer, but do not know the overall number of participants, we cannot calculate the standard deviation. Instead, we have calculated a different measure of dispersion, the mean deviation.[11] We do this for every survey, and then take the mean of this statistic over all meetings for each sub-sample, yielding the "mean mean deviation". As an alternative, although rather crude measure, we define a dummy variable that is equal to one for each survey where respondents recorded dissenting answers, and zero if all respondents answer in the same way. Again, we construct the mean of this variable (which we call "dissent") across the surveys for each sub-sample and compare across periods. For none of these measures, we can detect any statistically significant differences.

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.

4.3 Market reactions to monetary policy

The finding that financial markets are as surprised by monetary policy decisions under the new as under the old disclosure regime does not necessarily imply that there is no difference in the process through which markets arrive at their expectations. For example, it could be that markets do indeed learn important information about future monetary policy decisions from the balance-of-risks assessments of the new regime, whereas under the old regime markets acquired this information through alternative channels. The focus of this section is therefore to analyse, 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.

[10] In a similar test, Swanson (2004) finds that there is less diversity in the interest rate forecasts of private sector forecasters since the late 1980s.

[11] The mean deviation is defined as $MD \equiv \frac{1}{N}\sum_{i=1}^{N} | x_i - \bar{x} |$, where $\bar{x}$ is the mean of the distribution and N denotes the sample size. To calculate *MD*, it is sufficient to know the mean of the distribution and the shares of the respondents with answer x_i.

Market behaviour 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) in which the conditional mean equations for the changes in the market interest rates Δr_t are expressed as a function of the surprise component of a monetary policy decision, s_t. The effects of the surprises are modelled separately for each 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 the surprise components of the releases of important macroeconomic data and for communication by the members of the FOMC ($z_{i,t}$; the results for each of the controls will be discussed further below), past interest rate changes, as well as day-of-the-week effects (*Mon, Fri*):[12]

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

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 (ε_{t-1}), as well as the day-of-the-week effects (*Mon, Fri*). The effect of FOMC meeting days is modelled by a dummy variable (n_t), as well as the effect of macro announcements and FOMC communication ($w_{i,t}$). The EGARCH approach accounts for the skewness, 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:

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

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

[12] 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.

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

with T the number of observations, and μ the vector of parameters of interest.

If an announced decision on the intended Federal funds rate and the future course of monetary policy is understood by market participants, a monetary policy decision should not lead to market uncertainty. Accordingly, we would expect to see a smaller effect of FOMC meetings on market volatility if the central bank is more transparent about the future course of monetary policy under the new regime, i.e. $\kappa_1 > \kappa_2$. The implications 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 response depends on the adjustment path in the opaque regime, though. On the one hand, if there is an overshooting on the day 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.[13]

Table 4a shows the coefficients γ_1 and γ_2 of the mean equation (1) for the various interest rate maturities, separated for the different disclosure regimes. 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 4a. We find that generally, there is no significant difference across regimes.

The test for the effect of FOMC meetings on market volatility is more revealing. Table 4b reports the coefficients in the volatility equation for the two regimes. 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 do no longer increase volatility for maturities up to and including one year.

[13] 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.

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 volatility of interest rates at short maturities on the day of the FOMC meetings.

Market reactions to the FOMC balance-of-risks statements

So far we have analysed whether FOMC meetings *per se* have a different effect on markets in the two regimes. In this subsection, we go one step further and analyse whether the balance-of-risks assessments of the new regime affect markets differently depending on whether they are tilted towards 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:

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

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

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 one if the FOMC meeting is accompanied by a neutral balance-of-risks statement, and a dummy variable A_t which is set to one if the risk assessment points towards a tightening of monetary policy, to minus one in case of a tilt towards easing of monetary policy, and zero otherwise. The hypotheses that this model allows us to test are whether, first, the release of an asymmetric bias has an effect on market interest rates compared to the release of a symmetric bias (α_2 and α_3), whether such a release induces market volatility (ω_2 and ω_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 (γ_1 and γ_2).

As shown in the first two columns of Table 5a, 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 one to two 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 market volatility. Generally, the differences between the effect of a symmetric and an asymmetric bias are not statistically significant (Table 5b).

Interestingly, the strength of the response of short-term interest rates to monetary policy surprises depends on the type of statement: 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. Looking at the individual cases, we find that this result is mainly driven by events where the FOMC decided to change interest rates by 50 basis points (and thus by more than was expected by the markets), while signalling at the same time that the bias continues to be in the same direction, i.e. that there could be further changes ahead.[14]

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. 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 inter-meeting 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 analyse whether markets have improved their ability to anticipate future decisions already 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 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 may possibly have 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 have actually been better in anticipating

[14] For example, on November 6, 2001, interest rates were decreased by 50 basis points, whereas markets had only priced in 40 basis points. Three-month rates dropped by 16 basis points on that day, thus exceeding the magnitude of the surprise. One year later, on November 6, 2002, interest rates were again decreased by 50 basis points, while the market expectations had been at 25 basis points only. Three-month rates fell by 19 basis points on this day, leading to a near one-to-one movement along with the surprise.

future monetary policy decisions under the new disclosure regime already at the time when the bias assessment was made.

To analyse this issue, we test whether market interest rates changed as much during the inter-meeting period under the new regime as under the old disclosure 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 6 reports statistics for the mean absolute changes, the variance of the absolute changes and the maximum absolute change in the 3-month interest rates between the day following an FOMC meeting and the day preceding the next FOMC meeting. 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 inter-meeting adjustment in market interest rates was statistically significantly lower in 2000-04, in particular when monetary policy changed in the subsequent meeting. When policy changes occurred, the average absolute inter-meeting change in market interest rates in the inter-meeting period was 36.2 bp in 1994-99, whereas it fell to 17.8 bp in 2000-2004. This finding is even more remarkable considering that the policy changes in 2000-2004 were much larger (10 of the 16 changes in 2000-2004 were 50 bp changes) than those in 1994-99 - when only 3 of the 14 changes were 50 bp and one 75 bp. Finally, also the variance of the absolute 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

We have so far presented three pieces of evidence: first, we have found that markets have been as much surprised 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, they also are better in 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: what explains that the FOMC balance-of-risks statements under the new regime provide information that helps markets in anticipating future decisions, but 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 inter-meeting 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.

The role of central bank communication

In between their meetings, FOMC members have the possibility to convey new information to the markets by making public speeches. Kohn and Sack (2003) argue that such statements convey 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 inter-meeting 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, interviews and speeches).[15]

Table 7a shows the effects on the mean equation, separately for the period 1994-99 and 1999-2004. Looking at the first sub-sample, 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. In particular for monetary policy-related communication, interest rates respond with a hump-shaped pattern: rates at intermediate maturities respond most. The occasions with the largest effect on interest rates are the Congress hearings, where interest rates responded by up to 9 basis points.

[15] Breakdowns into communication by the Chairman and other members, by internal and external members and by leaning with or against the wind for the second regime are analysed in the companion paper, Ehrmann and Fratzscher (2004c).

Over the second sub-sample, 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 inter-meeting communication.

The results are less clear-cut when looking at the effects of communication on market volatility (Table 7b).[16] Consistent with the reduced effect of Congress hearings on the level of interest rates, we find that the response of market volatility to communication has disappeared entirely under the new regime. For communication made at other occasions, there is a clear difference with respect to the content of communication: whereas we find that market volatility is generally reduced more strongly in the second regime in response to statements about the economic outlook, it has significantly risen for monetary policy-related communication.

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 volatility increased more.

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 8a shows the results for the mean equation for a number of macroeconomic announcements that we found to be important in earlier work (Ehrmann and Fratzscher, 2004a), 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- rather than the short-run.

[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 plus and minus one; we enter these with their absolute values in the variance equations.

Comparing the two subperiods, it turns out that, although there are only very few instances where the parameters differ significantly across regimes, there is nonetheless an overall tendency for markets to react less to macroeconomic announcements under the new disclosure regimes. With the exception of the ISM survey, the parameters are generally smaller, and the share of significant parameters (at least at the 90% level) drops from 73% to 59%. Overall, this suggests that there is indeed some reduction in the importance markets attribute to macroeconomic releases, although these do still form an important source of information for markets.

Another possibility is that markets have become more selective in what macroeconomic variables they focus on. In particular productivity has featured prominently in the Federal Reserve's communication in recent years, and thus it may be possible that productivity releases have become more important under the new disclosure regime. However, we do not find strong evidence for this in the data as productivity releases do not affect the mean of interest rates significantly.[17]

Looking at the results for the volatility equation in Table 8b, a similar picture emerges: the reaction of 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 volatility effects throughout the maturity spectrum have disappeared entirely.

5. Conclusion

The objective of the paper has been to assess whether the change in the Federal Reserve's disclosure practice of 1999/2000 was successful in enhancing the effectiveness and transparency of US monetary policy. This regime change entailed the publication of a statement immediately after each FOMC meeting which not only explains its monetary policy decision, but also contains a forward-looking element, in the form of an outlook for the monetary policy stance initially, and a balance-of-risks assessment concerning inflationary pressures and economic conditions in the "foreseeable future" nowadays.

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

[17] Interest rates can respond in an ambiguous fashion to productivity releases. On the one hand, real interest rates increase with higher productivity. On the other hand, several FOMC statements in our sample period contained a reference to high productivity growth as a contributing factor to contain costs and price pressures (see, e.g., the press release on 3 October 2000), which implies that expectations of monetary policy should ease, and thus interest rates should fall in response to higher than expected productivity.

interest rates if they are accompanied by an asymmetric risk assessment, but also the 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 inter-meeting 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 inter-meeting period. We find evidence that other Federal Reserve communication in the inter-meeting period, such as speeches, interviews and testimonies by FOMC members, have exerted a significantly larger impact on financial markets under the old regime. We also find that the markets reacted more strongly to releases of macroeconomic fundamentals under the regime prior to 1999. In this sense, markets may merely have shifted their attention from other types of information, such as inter-meeting communication and news about macroeconomic fundamentals, 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 less importance to news about macroeconomic fundamentals 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. We furthermore believe that the reaction of financial markets to the release of macroeconomic fundamentals can be an important source of information for the central bank about the markets' diverse and possibly deviating views. Under its new disclosure policy, the Federal Reserve has less such information available.

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 ones understanding of the concepts of transparency and effectiveness of monetary policy. Some, as William Poole, phrase their view as: "Some will regard this approach [of choosing among a relatively few standard phrases] as providing 'boilerplate' language with little real meaning. My own judgement 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" (Poole, 2003, p. 7). By contrast, others, such as Issing (2004), argue that the use of simple language and code words bears some serious dangers: "[With] the use of such 'codes'… the central bank puts itself under pressure to fulfil a 'quasi promise'. But if new developments change the assessment of the situation, then the central bank faces the dilemma of causing market disruptions through 'disappointments' of expectations, even if it can provide convincing reasons for the new assessment. Indications about future decisions are therefore always only conditional commitments. … The simpler the code, the larger the difficulty of clarifying the 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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Appendix

Table 1: Consistency of FOMC balance-of-risks assessments and monetary policy decisions (I): summary statistics

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 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 (13 August, 24 September and 6 November 2002). We have included the bias announcements for *both* meetings preceding the interest rate change as correctly anticipating the next move.

Table 2: Consistency of FOMC balance-of-risks assessments and monetary policy decisions (II): probability tests

	1994-2004	1994-April 1999	May 1999-2004	May-Dec. 1999	2000-2004
Monetary policy (mp) consistency with bias of *previous* meeting					
prob (mp change$_t$)	38.4%	31.8%	45.2%	50.0%	44.4%
prob (consistent mp change$_t$ | asymmetric bias$_{t-1}$)	46.0%	28.6%	58.6%	100.0% **	55.6%
prob (asymmetric bias$_t$)	58.1%	47.7%	69.1%	33.3%	75.0%
prob (correct asymmetric bias$_{t-1}$ | mp change$_t$)	69.7%	42.9%	89.5% **	66.7%	93.8% *
prob (contrary bias$_{t-1}$ | mp decision$_t$)	43.0%	52.3%	33.3%	16.7%	36.1%
prob (consistent bias$_{t-1}$ | mp decision$_t$)	57.0% *	47.7%	66.7% ***	83.3% **	63.9% **
Bias consistency or change with monetary policy (mp) at *current* meeting					
prob (asymmetric bias$_t$ | no mp change$_t$)	59.3%	60.0%	58.3%	66.7%	57.1%
prob (symmetric bias$_t$ | mp change$_t$)	43.8%	78.6%	16.7%	100.0%	0.0%
prob (contrary bias$_t$ | mp decision$_t$)	53.5%	65.9%	40.5%	83.3%	33.3%
prob (asymmetric bias$_t$ | mp change$_t$)	56.3%	21.4%	83.3%	0.0%	100.0%
prob (symmetric bias$_t$ | no mp change$_t$)	40.7%	40.0%	41.7%	33.3%	42.9%
prob (consistent bias$_t$ | mp decision$_t$)	46.5%	34.1%	59.5% *	16.7%	66.7% ***

Note: A "consistent" monetary policy (mp) change is defined as one that is preceded by a balance-of-risks assessment or bias in the same direction. A "consistent" bias is defined as one where the subsequent monetary policy decision follows the bias. An according definition holds for the term "contrary" bias. For the upper panel, the same correction has been applied as in table 1. The stars in the first panel indicate whether the probability in the second row of each pair is significantly larger than the probability in the first row. The stars in the second panel indicate whether the probability of a consistent bias (last row) is larger than the probability of a contrary bias (third row). *, **, *** denotes significance at the 90%, 95% and 99% level, respectively.

Table 3: Statistical properties of market expectations about monetary policy decisions

	Feb 1994 - April 1999	May 1999 - April 2004				
			of which			
		Δ	1999	Δ	2000-2004	Δ∗
all FOMC meeting days						
Number of meetings	44	42	6		36	
Mean surprise	-0.006	-0.018	0.021		-0.025	
t-stat	*-0.418*	*-0.941*	*0.996*		*-1.115*	
Variance of the surprise	0.010	0.016	0.003		0.018	
Mean absolute surprise	0.050	0.050	0.023		0.054	
Variance of the absoute surprise	0.007	0.013	0.002		0.015	
Maximum absolute surprise	0.250	0.500	0.125		0.500	
Mean mean deviation	0.034	0.026	0.026		0.025	
Mean dissent	0.318	0.381	0.500		0.361	
FOMC meeting days with interest rate changes						
Number of meetings	14	18	3		15	
Mean surprise	0.012	-0.049	0.044		-0.068	
t-stat	*0.271*	*-1.108*	*1.091*		*-1.312*	
Variance of the surprise	0.027	0.035	0.005		0.040	
Mean absolute surprise	0.114	0.108	0.044		0.120	
Variance of the absoute surprise	0.013	0.026	0.005	*	0.029	
Maximum absolute surprise	0.250	0.500	0.125		0.500	
Mean mean deviation	0.055	0.048	0.047		0.048	
Mean dissent	0.500	0.556	0.667		0.533	

Note: Δ denotes whether the parameter in the respective column is statistically significantly different from the parameter for February 1994 - April 1999. Δ∗ compares the periods 1999 and 2000-2004. *, **, *** denotes significance at the 90%, 95% and 99% level, respectively.

Table 4a: The effect of monetary policy surprises (I): mean equation

maturity	Feb 1994-April 1999		May 1999-April 2004		Δ
3 months	0.484 ***	*0.078*	0.456 ***	*0.048*	
6 months	0.433 ***	*0.045*	0.417 ***	*0.037*	
1 year	0.401 ***	*0.048*	0.294 ***	*0.058*	
2 years	0.242 ***	*0.058*	0.216 **	*0.105*	
5 years	0.200 ***	*0.059*	0.210	*0.142*	
10 years	0.040	*0.054*	0.143	*0.158*	
20 years	-0.071	*0.055*	0.070	*0.130*	

Note: *, **, *** denotes significance at the 90%, 95% and 99% level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

Table 4b: The effect of monetary policy surprises (II): variance equation

maturity	Feb 1994-April 1999		May 1999-April 2004		Δ
3 months	0.510 ***	*0.072*	-0.016	*0.061*	***
6 months	0.294 ***	*0.065*	0.040	*0.065*	***
1 year	0.165 ***	*0.058*	-0.094	*0.076*	***
2 years	-0.034	*0.062*	0.122 *	*0.068*	*
5 years	0.053	*0.069*	0.126	*0.085*	
10 years	0.055	*0.072*	0.147 *	*0.083*	
20 years	0.148 **	*0.069*	0.232 ***	*0.075*	

Note: *, **, *** denotes significance at the 90%, 95% and 99% level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

Table 5a: 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
3 months	-0.010 ***	*0.003*	0.011 ***	*0.004*	***	0.301 **	*0.118*	0.627 ***	*0.065*	**
6 months	-0.005	*0.004*	0.014 ***	*0.004*	***	0.250 ***	*0.061*	0.498 ***	*0.066*	***
1 year	0.001	*0.007*	0.012 **	*0.006*		0.468 ***	*0.109*	0.270 ***	*0.070*	
2 years	0.005	*0.012*	0.022 **	*0.010*		0.350	*0.302*	0.172	*0.118*	
5 years	-0.010	*0.012*	0.015	*0.012*		0.270 ***	*0.064*	0.169	*0.105*	
10 years	0.001	*0.012*	0.013	*0.014*		0.222	*0.359*	0.121	*0.179*	
20 years	0.004	*0.013*	0.002 ***	*0.000*		0.130 ***	*0.033*	-0.008	*0.043*	**

Note: *, **, *** denotes significance at the 90%, 95% and 99% 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 5b: The effect of balance-of-risks statements (II): variance equation

maturity	symmetric bias		asymmetric bias		Δ
3 months	-0.216	*0.136*	-0.089	*0.074*	
6 months	-0.173	*0.161*	-0.106	*0.091*	
1 year	-0.166	*0.117*	-0.249 ***	*0.087*	
2 years	0.114	*0.078*	-0.015	*0.053*	
5 years	0.081	*0.083*	0.010	*0.038*	
10 years	-0.043	*0.123*	-0.071	*0.089*	
20 years	-0.003	*0.116*	-0.017	*0.060*	

Note: *, **, *** denotes significance at the 90%, 95% and 99% 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: Adjustment of market interest rates in the FOMC inter-meeting period (3-month t-bill rates)

	Feb 1994 - April 1999	May 1999-April 2004						
			Δ	*of which* 1999	Δ	2000-2004	Δ	Δ∗
all FOMC meetings								
Number of meetings	44	42		6		36		
Mean absolute change	0.187	0.146		0.282		0.123	*	**
Variance of the absolute change	0.038	0.018	**	0.022		0.014	***	
Maximum absolute change	0.870	0.480		0.480		0.450		
FOMC meetings with interest rate changes								
Number of meetings	14	18		3		15		
Mean absolute change	0.362	0.205	**	0.340		0.178	**	
Variance of the absolute change	0.063	0.013	**	0.018		0.008	***	
Maximum absolute change	0.870	0.480		0.480		0.340		

Note: Δ denotes whether the parameter in the respective column is statistically significantly different from the parameter for February 1994-April 1999. Δ∗ compares the periods 1999 and 2000-2004. *, **, *** denotes significance at the 90%, 95% and 99% level, respectively.

Table 7a: The effect of FOMC communication (I): mean equation

	maturity	Feb 1994 - April 1999		May 1999 - April 2004		Δ
communication on economic outlook	3 months	0.010 ***	*0.003*	0.006 ***	*0.002*	
	6 months	0.013 ***	*0.004*	0.010 ***	*0.002*	
	1 year	0.011 **	*0.004*	0.017 ***	*0.004*	
	2 years	0.012 *	*0.006*	0.023 ***	*0.006*	
	5 years	0.007	*0.007*	0.024 ***	*0.007*	*
	10 years	0.004	*0.007*	0.018 ***	*0.007*	
	20 years	0.000	*0.006*	0.009	*0.006*	
communication on monetary policy	3 months	0.055 ***	*0.003*	0.011 ***	*0.003*	***
	6 months	0.031 ***	*0.004*	0.005 *	*0.003*	***
	1 year	0.033 ***	*0.005*	0.012 ***	*0.004*	***
	2 years	0.029 ***	*0.006*	0.015 **	*0.007*	
	5 years	0.033 ***	*0.006*	0.014 **	*0.007*	**
	10 years	0.027 ***	*0.006*	0.010	*0.007*	*
	20 years	0.025 ***	*0.006*	0.008	*0.006*	**
hearings, economic outlook	3 months	0.042 ***	*0.007*	-0.001	*0.011*	***
	6 months	0.040 ***	*0.010*	0.008	*0.007*	***
	1 year	0.064 ***	*0.014*	0.006	*0.010*	***
	2 years	0.059 ***	*0.016*	-0.005	*0.013*	***
	5 years	0.052 ***	*0.018*	0.010	*0.015*	*
	10 years	0.037 *	*0.020*	0.007 ***	*0.000*	
	20 years	0.041 ***	*0.016*	-0.010	*0.012*	**
hearings, monetary policy	3 months	0.030 **	*0.012*	0.008	*0.010*	
	6 months	0.035 **	*0.015*	0.012	*0.015*	
	1 year	0.068 ***	*0.013*	0.021	*0.016*	**
	2 years	0.075 ***	*0.013*	0.016	*0.026*	**
	5 years	0.081 ***	*0.018*	0.010	*0.022*	**
	10 years	0.078 ***	*0.017*	0.031 *	*0.017*	**
	20 years	0.046 ***	*0.016*	0.008	*0.015*	*
speeches, economic outlook	3 months	0.011 ***	*0.004*	0.003	*0.003*	
	6 months	0.008	*0.006*	0.006	*0.005*	
	1 year	0.007	*0.008*	0.006	*0.009*	
	2 years	0.006	*0.010*	0.007	*0.013*	
	5 years	0.008	*0.010*	0.000	*0.014*	
	10 years	0.009	*0.010*	-0.001	*0.013*	
	20 years	0.005	*0.009*	-0.004	*0.012*	
speeches, monetary policy	3 months	0.044 ***	*0.006*	0.013 ***	*0.003*	***
	6 months	0.020 ***	*0.007*	0.003	*0.004*	**
	1 year	0.009	*0.008*	0.015 **	*0.006*	
	2 years	0.007	*0.011*	0.014	*0.009*	
	5 years	0.011	*0.011*	0.012	*0.010*	
	10 years	0.009	*0.010*	0.006	*0.010*	
	20 years	0.001	*0.010*	0.010	*0.009*	

Note: *, **, *** denotes significance at the 90%, 95% and 99% level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

Table 7b: The effect of FOMC communication (II): variance equation

	maturity	Feb 1994 - April 1999		May 1999 - April 2004		Δ
communication on economic outlook	3 months	-0.355 ***	*0.044*	-0.245 ***	*0.037*	*
	6 months	-0.101 ***	*0.035*	-0.144 ***	*0.039*	
	1 year	-0.028	*0.023*	-0.003	*0.045*	
	2 years	0.017	*0.028*	-0.019	*0.046*	
	5 years	0.010	*0.041*	0.017	*0.051*	
	10 years	0.044	*0.042*	0.011	*0.049*	
	20 years	-0.008	*0.047*	-0.062	*0.046*	
communication on monetary policy	3 months	0.253 ***	*0.035*	0.250 ***	*0.018*	
	6 months	0.178 ***	*0.032*	0.176 ***	*0.021*	
	1 year	0.164 ***	*0.030*	0.123 ***	*0.025*	
	2 years	0.107 ***	*0.031*	0.153 ***	*0.026*	
	5 years	0.052	*0.036*	0.155 ***	*0.030*	**
	10 years	0.030	*0.040*	0.145 ***	*0.032*	**
	20 years	0.028	*0.036*	0.093 ***	*0.029*	
hearings, economic outlook	3 months	-0.748 ***	*0.203*	0.256 *	*0.154*	***
	6 months	0.411 **	*0.175*	0.153	*0.160*	
	1 year	0.875 ***	*0.167*	0.305 *	*0.174*	**
	2 years	0.943 ***	*0.163*	0.157	*0.190*	***
	5 years	0.757 ***	*0.198*	0.171	*0.172*	**
	10 years	1.160 ***	*0.202*	0.276	*0.194*	***
	20 years	0.388 *	*0.198*	0.127	*0.183*	
hearings, monetary policy	3 months	0.450 ***	*0.160*	-0.141	*0.185*	**
	6 months	-0.234	*0.164*	-0.043	*0.229*	
	1 year	-0.205	*0.171*	0.146	*0.249*	
	2 years	-0.440 ***	*0.148*	0.290	*0.220*	***
	5 years	-0.229	*0.173*	0.017	*0.226*	
	10 years	-0.388 **	*0.187*	-0.243	*0.226*	
	20 years	0.034	*0.171*	-0.596 **	*0.243*	**
speeches, economic outlook	3 months	-0.274 ***	*0.078*	-0.445 ***	*0.065*	*
	6 months	-0.228 ***	*0.065*	-0.504 ***	*0.077*	***
	1 year	-0.086	*0.058*	-0.421 ***	*0.084*	***
	2 years	-0.020	*0.063*	-0.206 ***	*0.079*	*
	5 years	0.007	*0.080*	-0.045	*0.089*	
	10 years	-0.006	*0.082*	-0.015	*0.092*	
	20 years	-0.018	*0.083*	-0.033	*0.088*	
speeches, monetary policy	3 months	0.051	*0.066*	0.347 ***	*0.023*	***
	6 months	0.100 **	*0.050*	0.257 ***	*0.027*	***
	1 year	0.019	*0.055*	0.243 ***	*0.033*	***
	2 years	0.080	*0.057*	0.287 ***	*0.036*	***
	5 years	-0.034	*0.061*	0.254 ***	*0.041*	***
	10 years	-0.083	*0.063*	0.196 ***	*0.046*	***
	20 years	-0.065	*0.059*	0.142 ***	*0.044*	***

Note: *, **, *** denotes significance at the 90%, 95% and 99% level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

Table 8a: Market reactions to macro announcements (I): mean equation

	maturity	Feb 1994 - April 1999		May 1999 - April 2004		Δ
consumer confidence	3 months	0.009	*0.024*	-0.010	*0.008*	
	6 months	0.088 ***	*0.027*	0.021	*0.015* **	
	1 year	0.120 ***	*0.030*	0.054 *	*0.030*	
	2 years	0.137 ***	*0.037*	0.066	*0.041*	
	5 years	0.149 ***	*0.041*	0.090 **	*0.038*	
	10 years	0.109 ***	*0.040*	0.088 **	*0.038*	
	20 years	0.099 **	*0.043*	0.060	*0.040*	
ISM survey	3 months	0.015 **	*0.006*	-0.005	*0.006* **	
	6 months	0.029 ***	*0.009*	0.020 **	*0.008*	
	1 year	0.062 ***	*0.013*	0.058 ***	*0.010*	
	2 years	0.086 ***	*0.016*	0.099 ***	*0.019*	
	5 years	0.095 ***	*0.017*	0.102 ***	*0.021*	
	10 years	0.077 ***	*0.017*	0.098 ***	*0.020*	
	20 years	0.067 ***	*0.015*	0.084 ***	*0.018*	
retail sales	3 months	0.067 ***	*0.015*	0.086 ***	*0.018*	
	6 months	0.012	*0.011*	0.010 *	*0.005* **	
	1 year	0.033 ***	*0.011*	0.004	*0.006*	
	2 years	0.052 ***	*0.015*	0.033 **	*0.013*	
	5 years	0.070 ***	*0.018*	0.067 ***	*0.015*	
	10 years	0.078 ***	*0.020*	0.059 ***	*0.016*	
	20 years	0.072 ***	*0.019*	0.045 ***	*0.016*	
industrial production	3 months	0.010	*0.012*	0.007	*0.005*	
	6 months	0.011	*0.014*	0.005	*0.005*	
	1 year	0.035 **	*0.015*	0.010	*0.010*	
	2 years	0.048 **	*0.019*	0.036 **	*0.014*	
	5 years	0.042 **	*0.019*	0.039 **	*0.016*	
	10 years	0.025	*0.017*	0.033 **	*0.015*	
	20 years	0.014	*0.017*	0.032 **	*0.015*	
productivity (preliminary)	3 months	0.022	*0.044*	0.002	*0.012*	
	6 months	-0.001	*0.059*	-0.002	*0.015*	
	1 year	0.023	*0.038*	-0.006	*0.045*	
	2 years	0.013	*0.048*	-0.008	*0.046*	
	5 years	0.034	*0.030*	-0.017	*0.038*	
	10 years	0.036	*0.090*	-0.048	*0.056*	
	20 years	0.014	*0.073*	-0.045	*0.036*	
unemployment rate	3 months	-0.100 ***	*0.029*	-0.032	*0.032*	
	6 months	-0.157 ***	*0.034*	-0.121 **	*0.052*	
	1 year	-0.111 ***	*0.042*	-0.100	*0.078*	
	2 years	-0.183 ***	*0.052*	-0.212 *	*0.119*	
	5 years	-0.169 ***	*0.056*	-0.180	*0.138*	
	10 years	-0.134 **	*0.055*	-0.178	*0.113*	
	20 years	-0.110 **	*0.055*	-0.132	*0.089*	
nonfarm payrolls	3 months	0.026 ***	*0.004*	0.018 ***	*0.003*	
	6 months	0.055 ***	*0.006*	0.023 ***	*0.003* ***	
	1 year	0.071 ***	*0.011*	0.047 ***	*0.008* *	
	2 years	0.078 ***	*0.013*	0.067 ***	*0.011*	
	5 years	0.091 ***	*0.014*	0.061 ***	*0.014*	
	10 years	0.073 ***	*0.015*	0.048 ***	*0.012*	
	20 years	0.066 ***	*0.014*	0.032 ***	*0.011* *	
CPI	3 months	0.018	*0.012*	0.005	*0.005*	
	6 months	0.014	*0.013*	0.017 ***	*0.006*	
	1 year	0.050 ***	*0.015*	0.029 ***	*0.009*	
	2 years	0.050 ***	*0.017*	0.035 ***	*0.012*	
	5 years	0.046 **	*0.018*	0.041 ***	*0.013*	
	10 years	0.034 *	*0.019*	0.022 *	*0.013*	
	20 years	0.030 *	*0.017*	0.017	*0.012*	

Note: Data for productivity available from 1998. *, **, *** denotes significance at the 90%, 95% and 99% level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

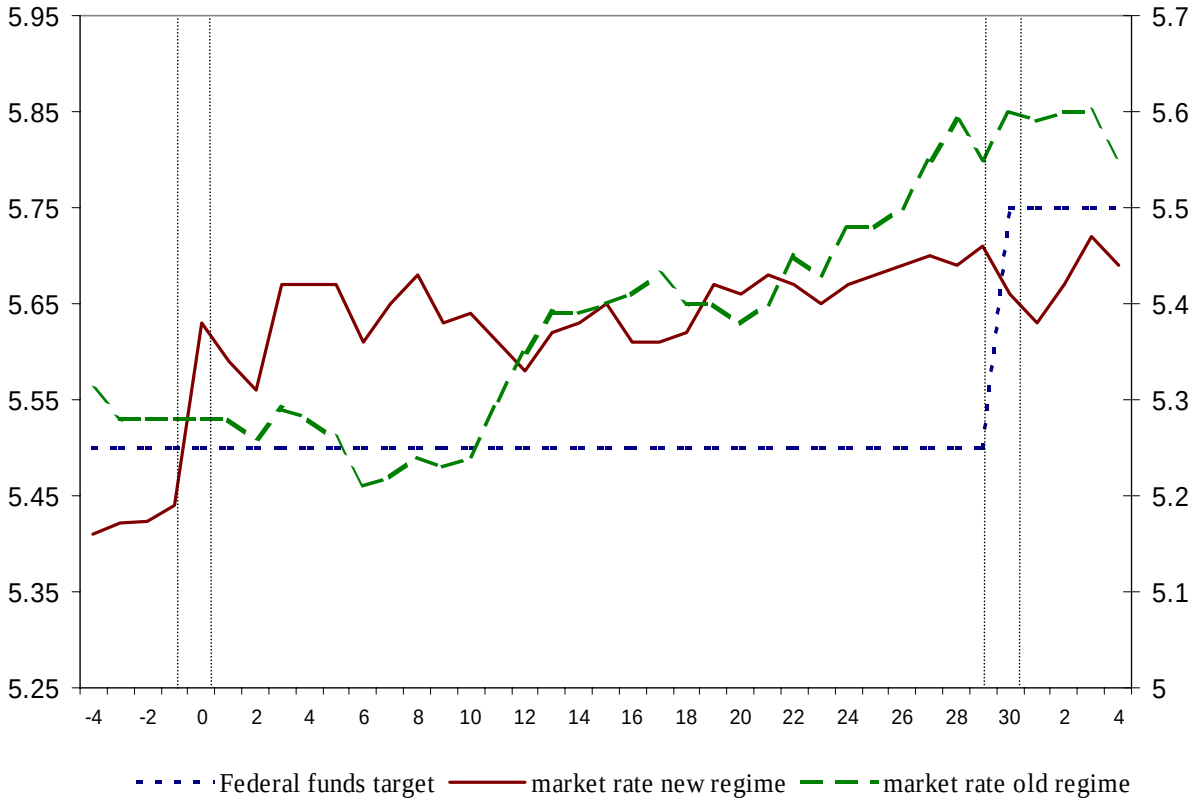
Table 8b: Market reactions to macro announcements (II): variance equation

	maturity	Feb 1994 - April 1999		May 1999 - April 2004		Δ
consumer confidence	3 months	0.636 *	*0.352*	-1.036 ***	*0.334*	***
	6 months	1.052 ***	*0.348*	-0.199	*0.344*	**
	1 year	2.097 ***	*0.250*	1.534 ***	*0.339*	
	2 years	1.537 ***	*0.259*	1.073 ***	*0.318*	
	5 years	1.479 ***	*0.287*	0.693 *	*0.372*	*
	10 years	1.409 ***	*0.312*	0.774 **	*0.380*	
	20 years	1.356 ***	*0.316*	1.383 ***	*0.325*	
ISM survey	3 months	0.435 ***	*0.114*	0.811 ***	*0.096*	**
	6 months	0.444 ***	*0.161*	0.910 ***	*0.093*	**
	1 year	-0.132	*0.133*	0.329 ***	*0.103*	***
	2 years	-0.265 *	*0.137*	0.825 ***	*0.102*	***
	5 years	-0.406 **	*0.158*	1.030 ***	*0.135*	***
	10 years	-0.329 **	*0.166*	0.800 ***	*0.163*	***
	20 years	-0.157	*0.157*	0.660 ***	*0.155*	***
retail sales	3 months	-0.697 ***	*0.187*	-0.153	*0.104*	**
	6 months	-0.327 **	*0.156*	0.156	*0.097*	***
	1 year	0.458 ***	*0.140*	0.366 ***	*0.103*	
	2 years	0.373 **	*0.150*	0.383 ***	*0.103*	
	5 years	-0.068	*0.175*	0.358 ***	*0.116*	**
	10 years	-0.250	*0.192*	0.324 ***	*0.115*	**
	20 years	-0.044	*0.183*	0.353 ***	*0.109*	*
industrial production	3 months	0.109	*0.191*	-0.717 ***	*0.169*	***
	6 months	0.166	*0.132*	-0.720 ***	*0.151*	***
	1 year	-0.333 ***	*0.106*	-0.625 ***	*0.148*	
	2 years	-0.323 ***	*0.123*	-0.439 ***	*0.147*	
	5 years	-0.549 ***	*0.152*	-0.448 ***	*0.166*	
	10 years	-0.528 ***	*0.162*	-0.455 ***	*0.172*	
	20 years	-0.522 ***	*0.156*	-0.287 **	*0.135*	
productivity (preliminary)	3 months	-2.960 ***	*0.809*	-0.635	*0.401*	**
	6 months	-1.819 **	*0.776*	-0.700 **	*0.320*	
	1 year	-3.813 ***	*0.756*	0.056	*0.368*	***
	2 years	-3.593 ***	*1.025*	-0.156	*0.276*	***
	5 years	-2.888 **	*1.164*	0.064	*0.325*	**
	10 years	-1.165	*0.869*	0.749 **	*0.298*	**
	20 years	-1.772 **	*0.826*	0.200	*0.335*	**
unemployment rate	3 months	-3.314 ***	*0.553*	4.568 ***	*0.216*	***
	6 months	-2.184 ***	*0.552*	5.125 ***	*0.245*	***
	1 year	-2.279 ***	*0.512*	4.812 ***	*0.261*	***
	2 years	-2.266 ***	*0.542*	2.679 ***	*0.295*	***
	5 years	-1.549 ***	*0.577*	0.640	*0.431*	***
	10 years	-1.025 *	*0.570*	-0.044	*0.675*	
	20 years	-0.755	*0.554*	-0.432	*0.680*	
nonfarm payrolls	3 months	0.588 ***	*0.070*	0.070	*0.079*	***
	6 months	0.756 ***	*0.067*	0.066	*0.069*	***
	1 year	1.062 ***	*0.049*	0.006	*0.085*	***
	2 years	1.074 ***	*0.049*	-0.052	*0.086*	***
	5 years	1.019 ***	*0.058*	0.000	*0.093*	***
	10 years	1.005 ***	*0.063*	0.005	*0.105*	***
	20 years	0.779 ***	*0.064*	-0.090	*0.092*	***
CPI	3 months	0.759 ***	*0.193*	0.214 *	*0.110*	**
	6 months	0.395 **	*0.165*	0.236 *	*0.126*	
	1 year	0.321 **	*0.147*	0.005	*0.130*	
	2 years	0.502 ***	*0.160*	0.063	*0.125*	**
	5 years	0.717 ***	*0.172*	-0.234 *	*0.132*	***
	10 years	0.825 ***	*0.183*	-0.041	*0.141*	***
	20 years	0.639 ***	*0.177*	-0.064	*0.128*	***

Note: Data for productivity available from 1998. *, **, *** denotes significance at the 90%, 95% and 99% level, respectively. Numbers in italics are standard errors. Δ denotes whether the parameters are different for the two subsamples.

Figure 1: Adjustment of market interest rates under alternative disclosure regimes

Comparison of 25 bp tightening on 25 March 1997 versus 2 February 2000



Note: Interest rates for the 25 March 1997 tightening episode are shown on the right-hand-side axis whereas those for the 2 February 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.

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