Market Set-Up in Advance of Federal Reserve Policy Rate Decisions

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May 27, 2014

Some keywords: FOMC; announcements; federal funds rate; anticipatory signals.
JEL classification: E43, E44, E58, G18.

Acknowledgements: We would like to thank seminar participants at American University, the Board of Governors of the Federal Reserve System, Maastricht University, McMaster University, the 14th Oxmetrics Users Conference and the University of Manchester Conference in honor of Denise R. Osborn for their many comments and discussions. We are also grateful to Michael Ehrmann, David Lucca, and especially Ricardo Rigobon for helpful conversations and suggestions. Possible remaining errors are our own. Michel van der Wel is grateful to Netherlands Organisation for Scientific Research (NWO) for a Veni grant; and for support from CREATES, funded by the Danish National Research Foundation.

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Abstract

This paper considers the uncertainty associated with upcoming Federal Open Market Committee (FOMC) announcements and the extent to which participants in the fed funds futures market prepare for such announcements before they actually occur. We demonstrate that markets set up well in advance of known announcement days, going back as far as six months prior to an FOMC meeting. As a result, there is often less variation in fed funds futures prices in the period immediately preceding an FOMC announcement, despite greater volume of activity, as the market has already incorporated anticipated signals. We find that macro announcements and central bank officials' speeches and congressional testimony are of comparable importance. In addition, while macro announcements have stronger effects when they are released during the Fed's "blackout" period, congressional testimony is more important when it coincides with days when important macro variables are released.

1 Introduction

This paper considers the expectation formation process in financial markets in advance of Federal Open Market Committee (FOMC) decisions concerning the federal funds target rate. Much of the literature on the effects of such announcements[1] has demonstrated that asset prices and volatilities only respond to the surprise component in these announcements, that is, when the actual target decision differs from the market's expectation (see, among others, Bomfim, 2003; Bernanke and Kuttner, 2005; Gürkaynak, Sack, and Swanson, 2005; Chulia-Soler, Martens, and van Dijk, 2010), mirroring the findings of a substantial body of work considering the effects of macroeconomic announcements (see, for example, Ederington and Lee, 1993; Jones, Lamont, and Lumsdaine, 1998; Balduzzi, Elton, and Green, 2001; Andersen, Bollerslev, Diebold, and Vega, 2003, 2007; Faust, Rogers, Wang, and Wright, 2007; Love and Payne, 2008; Beber and Brandt, 2010; Taylor, 2010). For the most part, this literature has focused on the market *reaction* to the announcement, rather than on anticipatory effects or market set-up in *advance* of the information arrival.

In earlier literature, the market price of federal funds futures right before the announcement is often interpreted as the market's expectation of the target rate decision. We argue that to fully identify how information shapes market expectation and perception, it is necessary to look much farther back in time, as a substantial amount of market set-up may occur well before the days immediately preceding an announcement of the FOMC decision. We therefore examine the dynamics of federal funds futures prices for a period of up to six months before a target rate decision is scheduled to be made. Specifically, we examine how these futures prices are affected by various forms of central bank communication, such as speeches and congressional testimony, and how those effects interact with scheduled announcements of macroeconomic variables. We consider such a long pre-decision period to allow for early anticipatory action whereby market participants set up well in advance of an actual FOMC decision. Such anticipatory set-up may be caused by, for example, a desire to hedge the added risk/uncertainty surrounding the future path of upcoming announcements. Alternatively, it may reflect early warning signals that the market believes provide information about the Fed's intentions. In addition, the Fed's convention of a "blackout period" (i.e., a period before the meetings whereby FOMC members curtail public speaking engagements), suggests that: (1) relatively more information about the Fed's intentions may be available before this period begins (through speeches and testimony by FOMC mem-

[1]Throughout this paper, we will use the terms "announcement" and "decision" interchangeably to refer to the announcement surrounding the FOMC decision.

bers), and (2) macro announcements during this period may have a greater effect than those released at other times since (in the absence of direct communication from the FOMC) these announcements serve as a predominant source of information to the market about the upcoming FOMC decision.

We address the following questions: (1) How far in advance does the market set up for an FOMC announcement and how does the uncertainty surrounding various upcoming events (in the form of scheduled macro announcements) affect the timing of such set-up? (2) How do central bank communications and macro announcements affect the market's expectation of the target rate decisions? (3) What is the interaction between scheduled macro announcements and central bank communications (e.g., which is more important, does the effect of one differ depending on the presence or absence of the other, etc)?

By focusing on the anticipatory set-up in advance of FOMC target rate decisions, this paper contributes to a large body of existing literature (discussed further in the next section), including research on the prediction of FOMC decisions, the information content of Fed funds futures prices, and the impact of Federal Reserve communications on financial markets. In each of these strands of the literature, some studies hint at the possibility of advance market set-up, but none provides a formal investigation as we conduct here. For example Gürkaynak, Sack, and Swanson (2005) find that changes in the Fed funds rate target are not sufficient to explain the effects of FOMC decisions (at least two factors are required). They define an additional factor, termed the "future path of policy", which is linked to the policy statements themselves. Similarly, Kuttner (2001) and Poole, Rasche, and Thornton (2002) note little evidence of anticipatory effects in Fed funds futures prices prior to FOMC actions. In contrast, Lucca and Moench (2014) find large anticipatory effects in the S&P500 index during the 24 hours immediately preceding scheduled FOMC announcements but no effects in fixed income markets or in anticipation of macro announcements. These studies, however, only consider a couple of days immediately preceding the announcement and do not consider an extended period in which the market may prepare for such announcements. A notable exception is Carlson, Craig, Higgins, and Melick (2006), who document that for the period 1999-2006 market participants' expectations of FOMC target rate decisions have been fairly accurate over horizons up to two to three months, especially compared to the period 1989-1994. While they hint at the possibility that more transparent FOMC communication may be an important driving force for this improved predictability, this is not backed up by a formal statistical analysis. This is exactly the purpose of our study.

In addition to its contribution to the literature, the topic has timely relevance for policymakers as market anticipation of the Fed's exit from quantitative easing grows. A similar

episode of heightened attention to Fed communications arose in the spring of 2004. After an extended period of benign economic conditions and Fed easing followed by nearly a year of the Fed being "on hold", market anxiety as to when the Fed would begin an inevitable tightening cycle was evident. Indeed minutes of the FOMC meetings during that time period indicate that committee members were aware of the market uncertainty and desired transparent communication. Once the tightening began, similar anxiety was observed as to when the tightening cycle would end (it ultimately ended after the June 2006 meeting).[2] The potential importance of these communications has been recognized by the Federal Reserve itself, through a series of decisions since 1994 designed to increase transparency.[3] Additionally, in 2005 the Federal Reserve announced it would shorten the length of time between its meetings and the release of the associated meeting minutes. The most recent change to the Fed's communication policy, on March 24, 2011, involved the announcement that Chairman Bernanke would hold regular press briefings (following four of the eight scheduled FOMC meetings) "to present the FOMC's current economic projections and to provide additional context for the FOMC's policy decisions." The press release noted that, "The introduction of regular press briefings is intended to further enhance the clarity and timeliness of the Federal Reserve's monetary policy communication." Such enhanced clarity might be expected to increase the extent of anticipatory set-up.

We propose a model to capture anticipatory set-up of financial market participants as they form their expectations of FOMC decisions concerning the federal funds target rate. We examine how these actions are shaped by scheduled FOMC and macroeconomic announcements, as well as Federal Reserve communications in the form of speeches and testimony of members of the Board of Governors of the Federal Reserve System. Our results indicate that the market prepares for FOMC announcements much farther in advance than had previously been demonstrated. We find strong evidence of anticipatory set-up going back as far as six months prior to an FOMC meeting. Furthermore, these effects decline as the FOMC meet-

[2]Perhaps the most notable example of the impact of Fed communication during this era occurred when both stocks and bonds rallied sharply following Dallas Fed President Richard Fisher's "eighth inning" statement in reference to where the Fed was in its tightening cycle – see, for example, Robb, Greg (2005), " 'Eighth inning' of cycle: Dallas Fed chief", *Market Watch*, June 1, 2005, available at `http://www.marketwatch.com/story/feds-fisher-nearing-end-of-rate-hike-cycle`, accessed 5 July 2013.

[3]Middeldorp (2011) notes an earlier reform, related to the consolidation of the documentation into the "Minutes of the FOMC"; February 1994, however, was the first time the FOMC issued a statement in conjunction with the meeting. A list of the key steps the Fed has taken to improve transparency is available on the Federal Reserve Bank of San Francisco's Ask Dr. Econ blog, available at `http://www.frbsf.org/education/publications/doctor-econ/2012/august/transparency-lessons-financial-crisis`, published August 19, 2012, accessed June 24, 2013.

ing nears: earlier FOMC decisions and surprises in macro announcements affect fed funds futures prices more strongly than more recent ones. Failure to look back far enough results in inference that attributes much less significance to both Fed communications and macro announcements in shaping fed funds futures prices.

Among the different information sources that we examine, we find that previous FOMC announcements are the most important drivers of fed funds futures prices. The relevance of macro announcements differs substantially across the (24) variables considered, with surprises in nonfarm payrolls having the strongest effects. Macro announcements generally have stronger effects when they are released during the black-out period that precedes an FOMC announcement, when Fed Board members typically curtail their public speaking engagements. Speeches and testimony by Fed Board members are of comparable importance to the most influential macro announcements. In addition, for speeches we find that these tend to lower the volatility of the expected fed funds rate, which may be interpreted as this type of Fed communication having a calming effect on the market. The market also seems to pay more attention to congressional testimony when it coincides with days when important macro variables are released.

The paper is organized as follows. The next section briefly discusses some of the related literature. Section 3 describes the data. Section 4 presents the baseline specification, considers market set-up from a variety of angles, and discusses the results. Section 5 contains robustness and sensitivity analyses. The final section concludes.

2 Related literature

Our paper relates to several strands in the literature on predictability of FOMC target rate decisions and Fed communication.

First, there is a large literature that investigates whether the FOMC target rate decisions are predictable via either macroeconomic announcements or Fed funds futures (e.g., Lange, Sack, and Whitesell, 2003; Hamilton, 2007, 2008; Hamilton, Pruitt, and Borger, 2011; Hamilton and Okimoto, 2011) or a combination of the two. For example, Gürkaynak, Sack, and Swanson (2005) note that Fed funds futures are better at predicting the resulting target rate than are other securities (as noted in Middeldorp, 2011).

In this literature there is some evidence that anticipatory effects build gradually and that Fed funds futures may not entirely capture the complexity associated with the path of financial market participants' expectations. For example, Söderström (2001) notes that

many changes to the effective Fed funds rate are unrelated to changes in the funds rate itself, implying that market participants change expectations due to other information (such as macro announcements or speeches).

There is also evidence that after the Fed's 1994 communication enhancements, the market has been able to predict Fed actions much farther in advance, in addition to being more accurate about what the action would be, see Carlson, Craig, Higgins, and Melick (2006). Also Poole and Rasche (2003) document that policy actions taken at scheduled FOMC meetings generate little if any news in the market. Furthermore they demonstrate (using a case study for the June 2002 FOMC meeting) that the market forms accurate expectations quite long before the actual target rate decision is announced.

A second relevant (and closely related to the first) literature concerns modeling and forecasting FOMC target rate decisions from macroeconomic and financial variables (see Dueker, 1999; Hamilton and Jordà, 2002; Dueker and Rasche, 2004; Hu and Phillips, 2004; Piazzesi, 2005; Kim, Jackson, and Saba, 2009; Hayo and Neuenkirch, 2010; Kauppi, 2010; Monokroussos, 2011, among others). Ordered probit models are often used for this purpose, to take into account that target rate decisions are discrete, occurring in multiples of 25 basis points (with few exceptions). In fact most studies are limited to modeling the sign of the target rate decisions (i.e. the direction of monetary policy), making no distinction between changes of different magnitudes. This is further motivated by the fact that relatively few decisions have actually involved changes of more than plus/minus 25 basis points, which obviously limits the possibility of successfully modeling a refined classification of the decisions. A dynamic version of the ordered probit model is often used to accommodate the inertia in monetary policy decisions (Rudebusch, 2002; Dueker and Rasche, 2004; van den Hauwe, Paap, and van Dijk, 2013). The information embedded in recent releases of various measures of inflation and output (in deviation from a target) is usually considered, as these are most directly related to the Federal Reserve's monetary policy goals. The minutes of FOMC meetings indicate, however, that a large number of other economic variables, reflecting developments in the labor market, housing market, and financial markets, also play a substantial role in the FOMC's considerations. For this reason, a variety of alternative macroeconomic and financial variables have been examined. These typically include established leading indicators (providing signals about future economic developments that are potentially useful for predicting FOMC decisions), asset prices such as stocks and interest rates (obviously these also have a forward-looking character), survey measures of consumer confidence and expectations, and professional forecasts for inflation, output and interest rates.

A final related literature concerns the financial market's response to a variety of other

Federal Reserve communications beyond the FOMC decision statement itself. These include speeches (Bernanke, Reinhart, and Sack, 2004) and testimonies by the seven-member Federal Reserve Board and twelve Federal Reserve Bank Presidents, and the subsequent release of the minutes from FOMC meetings (Blinder, Ehrmann, Fratzscher, de Haan, and Jansen, 2008, contains a survey). For example, Kohn and Sack (2004) document that congressional testimony by Chairman Greenspan had a considerable influence on short- and medium-term interest rates. Similarly, Ehrmann and Fratzscher (2007) show that financial markets respond to statements by FOMC members, especially statements by the Fed Chairman. Their results also suggest that the Fed's communication policy has improved the predictability of actual monetary policy decisions. Recent literature takes the approach of parsing the actual text of the speeches themselves (e.g., Lucca and Trebbi, 2009). Hayo, Kutan, and Neuenkirch (2012) consider the effects of both the delivery and the tone of speeches and testimonies on daily bond, stock, and foreign exchange data fluctuations, arguing that the higher frequency of such communications renders them an important source from which financial market participants glean information about the economy and the future path of monetary policy. They find that while central bank communications have a significant impact on the behavior of market participants, the effect is not any more pronounced than that of macro announcements. In addition, an excellent review of much of the research related to FOMC communication is contained in Middeldorp (2011), where it is noted that, "Communication reforms that allow market interest rates to anticipate monetary policy earlier than one meeting ahead can't be identified," a conclusion reached by examining the ability of Fed funds futures to predict the target rate.

3 Data

In this section we describe the data used for our analysis. We combine information from three sources: (1) Federal funds futures data from Bloomberg, (2) macroeconomic announcement data from Econoday, and (3) information on speeches, testimonies, and other important statements collected from the Federal Reserve's website. Scheduled FOMC meeting (and hence announcement) dates are known well in advance (e.g., via Bloomberg or the Federal Reserve's website), although at times there have been unscheduled meetings as well (see below).

The data are of a daily frequency, excluding weekends and holidays. It is necessary to use daily data since the timing of speeches is not random. Speeches tend to occur in clusters

because FOMC members generally refrain from speaking on monetary policy near the time of an FOMC announcement (the "blackout period"). Since not every month has an FOMC meeting, using lower frequency (i.e., monthly) data would induce a speech seasonality because months with a blackout period would have fewer speeches than the other months. Due to the blackout period, we also would expect that macro announcements are more important to market set-up in the days immediately preceding FOMC announcements while speeches may be more important earlier in the expectations-formation process.

3.1 Expected federal funds target rates[4]

The daily effective fed funds futures data come from Bloomberg and span the period July 31, 2001 – September 30, 2008. The fed funds futures contract has as underlying the average effective fed funds rate over the contract month. Each month in the year can be traded, and for each contract data are available for approximately two years preceding its end-month expiration. We obtain the open, high, low, close, volume, and open interest for each contract. Each of the prices (representing averages) can be translated to average effective fed funds rates for the contract month using 100 minus the contract price. We use the daily closing price to calculate the market expectation for the contract month on a particular day.[5]

The FOMC meets eight times a year, according to a pre-announced schedule. In addition, the Committee has occasionally convened at non-scheduled times as conditions have warranted. A complete list of meeting dates, the target rate that was decided at each meeting, and the market expectations of the target rate on the day immediately preceding the FOMC meeting is given in Table 1 for the period August 2001 until September 2008. The unexpected component of the decision is the difference between the actual and expected levels, with a positive number indicating a higher-than-expected target rate and a negative number indicating a lower-than-expected level.

[insert Table 1]

Table 1 shows that in general the market is very capable of predicting the target rate decision at scheduled FOMC meetings, cf. Poole and Rasche (2003). Most of the time the unexpected component (expressed in basis points, bps) is very small and below 5bps,

[4] As noted in the introduction, earlier literature has often interpreted the market price of fed funds futures as the market's expectation of the underlying security; we follow that convention for ease of discussion although we emphasize that we are agnostic regarding this interpretation and recognize a number of reasons why departures from such expectations may occur.

[5] Below we describe in detail how this market expectation is obtained.

in absolute magnitude. This is particularly true during the calmer times between August 2003 and June 2007. Cases where the market was surprised by the target rate decision are November 6, 2002, when the target rate was cut by 50bps rather than the expected 25bps; June 25, 2003, when the Fed ended its easing cycle; and the period of the financial crisis (from the unexpected intermeeting decision on August 17, 2007 onwards). Even with these big moves, over our sample the average unexpected component of the scheduled meetings is 1 bp; the average absolute unexpected component 4 bps. These low numbers confirm the market's ability to anticipate the target rate decision quite well in the near-term, as documented in the literature.

For each scheduled FOMC meeting date in the period January 2002-September 2008 we construct an associated market expectation of the target rate for every day preceding the meeting back to 124 trading days prior, using the following procedure.[6] First, for each scheduled FOMC meeting we select the relevant fed funds futures contract to use. An important consideration here is that the fed funds contracts represent the *average* effective fed funds rate over the relevant contract month. Hence, for months with (scheduled) FOMC meetings, the futures price reflects the weighted average of (market expectations of) pre- and post-meeting target rates. For that reason, we use the futures contract for the month following the FOMC meeting if there is no (scheduled) FOMC meeting in that next month. We can readily use a rate based on this contract without dealing with possibly different pre- and post-announcement target rates.[7] For example, for the January 20, 2002, meeting we use the 2002-February futures contract to obtain the market's expectation of the target rate after the January meeting. If, however, the month following the (scheduled) FOMC meeting contains another FOMC meeting, we use the futures contract corresponding to the actual month of the meeting.[8] For example, for the November 6, 2002, meeting we use the

[6]We choose 124 trading days because it balances our desire to look as far back as possible to capture potential set-up effects with the reality of limited trading activity in the farther out contracts. When there is limited trading activity, price accuracy is impaired. Although for some months there is ample trading activity even beyond 124 trading days, our choice of look-back period enables us to have a balanced sample for all FOMC events we consider.

[7]Carlson, Craig, Higgins, and Melick (2006) limit their analysis to such "clean" contracts, effectively discarding approximately half of the scheduled FOMC meetings.

[8]Kuttner (2001) notes that because the futures contract represents the average effective fed funds rate (FFR) over the month of the contract, an announcement that arrives towards the end of the month will not have much impact in the current contract. This is a second reason to use the next full-month contract when there are no FOMC meetings the next month (typically the case for FOMC meetings near the end of the month). Kuttner (2001) contains an excellent description of some of the technical nuances related to using effective fed funds futures data; the reader is referred to that article for more thorough discussion. These nuances include: (a) the reference point for each contract is the average over the month rather than at a single point in time, (b) the contract is based on the effective fed funds rate rather than the actual FOMC

2002-November contract as on December 10, 2002, there is also an FOMC meeting.

In case the contemporaneous futures contract is used, we follow the procedure of Kuttner (2001) to extract the expected post-meeting FOMC target rate. We can write the effective fed funds rate in month l (denoted with FFR_l) as the average of the proportion of days in month l (P_l) before the FOMC meeting of interest, i, times the previous target rate TR_{i-1} and the remaining proportion of days $(1 - P_l)$ times the target rate after FOMC meeting i (TR_i). Given the previous target rate, the expectation of the post-FOMC meeting i target rate is calculated by solving

$$P_l TR_{i-1} + (1 - P_l)TR_i = FFR_l,$$

to get

$$TR_i = \tfrac{1}{1-P_l} FFR_l - \tfrac{P_l}{1-P_l} TR_{i-1}. \tag{1}$$

So in order to calculate the day t expected target rate at FOMC meeting i for the case when we use the current month's contract, we subtract the scaled previous target rate from the day t futures-implied target rate. When day t is before the i-th FOMC meeting but after the $(i-1)$-th meeting, we use the actual target rate after announcement $(i-1)$ for TR_{i-1}. When, however, day t is also before the $(i-1)$-th meeting, we use the expected $(i-1)$-th target rate and thus follow a recursive procedure. For example, for the November 6, 2002, meeting we use (1) with the actual previous target rate (1.75%) on all days between the date of the previous meeting, that is, from September 24 until November 6. To infer the market's expectation of the November 6 post-meeting rate on days before September 24, we use the expected September 24 post-meeting target rate computed from (1). This more involved procedure when using the contemporaneous futures contract explains our preference to use next month's contract in case no meeting is scheduled for that month. In practice, of the 54 scheduled FOMC meetings in our sample we are able to use the next 'full-month' contract 27 times (exactly half).[9]

target rate, (c) how to deal with multiple signals that arise as a result of the term structure of the futures contracts, (d) the use of futures info as a proxy for market expectations since the latter are not observable, (e) how maturity roll affects the embedded time-varying risk premium and how to correct for this.

[9]This is to be expected as the FOMC meets eight times a year, such that there are four meetings for which no meeting is scheduled during the next month.

3.1.1 An example of market set-up

As an example of how market expectations are shaped in advance of an FOMC announcement, consider the beginning of the tightening cycle that resulted from the Fed's June 30, 2004 meeting, shown in Figure 1. This figure shows the market's expectation of the June 30, 2004 target rate, as inferred from the 2004-July fed funds futures contract.[10] After nearly a year of being "on hold", speculation began to arise as to when the Fed would begin tightening. By March 2004, some market participants and the press started worrying that the Fed was "behind the curve" and would wait too long to hike, potentially giving rise to inflation. The top half of the figure shows how the expected target rate evolved in the 124 days leading up to the announcement that the Fed would increase the target rate from 1% to 1.25%. Despite the overall increase to the actual target rate by the time the Fed had its meeting, there was significant volatility in the rate due to uncertainty as to the timing of the increase, as illustrated in the daily fluctuations in the rate, shown in the bottom half of the figure.

[insert Figure 1]

From this picture, we observe that six months prior to the June 30, 2004 meeting, which corresponds with January 5, the market's expectation of the target rate was rather close to the eventual level of 1.25%. Although over all days the mean change in the expected rate was -0.1bps and the median change was zero, there are a number of days with much larger changes, suggesting increased uncertainty and market nervousness. For example, two large drops occurred on January 6 and 9, corresponding to a manufacturing release that was below market expectations and much softer nonfarm payrolls (1,000 versus the market expectation of 130,000), lowering the expected target rate to around 1.1%. It remained fairly stable at that level until the end of the month when it began to rise, but sharply decreased again when the FOMC announced (after its meeting on January 28) that it would leave the target rate unchanged. Over the following month, the market expectations of the target rate gradually declined again to around 1%, the current level at the time. A large increase (2bps) in the expected target rate occurred with 86 days to go, on March 2nd. On that day, both then-Chairman Greenspan and then-Governor Bernanke made speeches. While

[10] At first glance, the fluctuations in this figure may seem to be at odds with the information given in Table 1. It is important to recognize that Table 1 contains the expected fed funds futures on the day immediately preceding each FOMC meeting date (i.e., corresponding to the "-1" point in each of 54 distinct figures like Figure 1, one for each meeting) while Figure 1 is for a single meeting date (June 30, 2004) and shows the expected fed funds futures on 124 distinct days preceding that specific meeting date.

neither directly addressed the Fed's intentions regarding the policy rate, Greenspan's speech referenced inflation in import prices as a result of a weaker dollar and Bernanke's discussed historic episodes where Fed tightening may have made matters worse.

Three days later, on March 5th, a nonfarm payrolls release (an actual increase in the number of jobs of 21,000 versus a consensus estimate of 125,000) sent the expected target rate down by 6bps, as the market wondered whether the Fed might ease further, rather than tighten. From March 7 until March 15, there was no change in the expected target rate; it is episodes like this that lead us to speculate that the market prepares for FOMC meetings well in advance, given the weak employment data. On March 16th, the Fed left the policy rate unchanged at 1%, resulting in a further 1bp decline in the expected target rate. There were three large changes in April, on the 2nd, 13th, and 14th. On April 2, nonfarm payrolls again resulted in a large surprise, this time to the upside as the release was an increase in the number of jobs of 308,000 versus a consensus estimate of 120,000. The expected target rate rose 3.5bps on speculation that the positive economic news increased the likelihood the Fed would tighten. The large changes on April 13 and 14 were a reflection of the arrival of a large chunk of economic news, with higher-than-expected retail sales, business inventories, and budget deficit on the 13th. In addition, both PPI and CPI came in higher than expected on April 14; no doubt accelerating the market's expectations of Fed tightening.

The largest change in the expected target rate occurred on May 6, 2 days after the May 4 meeting and 39 days prior to the June 30 meeting. On this day, the minutes from the Fed's March 16 meeting were released.[11] These minutes made reference to the perception that the Fed was "behind the curve" and also acknowledged the market's concerns about inflation despite the Fed's internal models showing few signs. From this point on, the expected target rate moved closer to the eventual 1.25% level and away from the then-prevailing 1% rate as the market clearly believed the Fed would raise the policy rate at its June 30 meeting. On June 1, 21 trading days before the next FOMC meeting the expected target rate reached the eventual rate for the first time and stayed above that level for the remaining days. Concerns that the Fed had waited too long and inflation would rise too quickly led the market to briefly consider the possibility that the Fed would hike by more than 25bps in its first instance of tightening. Two more large moves followed (in opposite directions) on June 11 and 14 (12 and 11 days prior to the meeting, respectively).

This figure motivates our model and analysis of the interplay between macro announcements and Federal Reserve communications. In particular, it illustrates that much of the

[11] In addition, three Board members gave speeches: Chairman Greenspan, and Governors Bies and Olson.

market set-up occurs well before the actual FOMC announcement. In the last 10 days prior to the meeting, the expected target rate barely moved. One might interpret this as evidence that the Fed's communication about its intentions was understood by the market by the time its decision was announced.

3.1.2 Market set-up over the sample

Another way to characterize the potential market set-up is by considering the average absolute change in the expected target rate in the days leading up to an FOMC decision. In Figure 2(a) we present the average absolute change in expected target rate, shown in event-time for the period of 124 trading days prior to an FOMC announcement day.[12] Despite substantial day-to-day variation, a clear downward trend is visible from this graph. The large upward spikes between the 70 and 65 days preceding and again between the 40 and 30 days preceding correspond to previous FOMC decision days. It is also clear that the FOMC decisions themselves (i.e. day 0) show substantial changes in the expected target rate. This is largely driven by the days when an actual rate change occurred; on days when there is no change, the effect is much smaller. Note that this figure does not take macroeconomic announcements into effect - presumably many of the fluctuations are largely driven by those. Because the FOMC calendar does not correspond to the periodicity of any of the macro events (i.e., weekly, monthly, quarterly), however, the trend is still apparent.

[insert Figure 2]

As noted above, on many days the expected target rate does not change. Figure 2(b) shows the number of preceding days with no changes, for each FOMC decision. The total number of 124 days prior to the FOMC meeting are divided into five bins of equal length. This graph largely corroborates the inference from Figures 1 and 2(a). It is apparent from this figure that there is no change in expected target rate in a larger proportion of trading days in the 25 days immediately before an FOMC meeting than in earlier subperiods. In fact, across the 54 FOMC decisions in our sample, the average number of zero-change trading days declines from 15.3, 10.1, 6.1, 4.3 to 2.4 for the subperiods corresponding with 1-25, 26-50, 51-75, 76-100 and 101-124 days prior to the meeting. Again this suggests that the market sets up for FOMC decisions well before the actual decision is made. To the best of our knowledge, we are the first to demonstrate such a large lead time.

[12] For example, the value corresponding to -57 is computed by summing the absolute change in expected target rate 57 days prior to each of the FOMC meetings and dividing by the total number of meetings (54).

In contrast, the data also indicate that trading volume in Fed funds futures substantially increases in the days leading up to an FOMC announcement, see Figure 3. Average volume on the day of an FOMC decision is markedly more than that of any other day (more than double the next highest average). It is interesting that in the lead-up to the FOMC decision, average absolute changes in expected target rate decline even as volume increases, suggesting a convergence of market opinion (i.e., a reduction in uncertainty as to the Fed's intention). While one might interpret the large spikes in both average absolute change in expected target rate and volume as suggesting the market was caught unawares, an alternative interpretation is that as soon as the FOMC decision is revealed, the market repositions in preparation for the next meeting.

[insert Figure 3]

3.2 Speeches and testimony

The speech and testimony data are collected from the Federal Reserve's website[13] for each of the 11 individuals that served on the Federal Reserve Board during the sample period. Speeches and testimony are treated separately in our model, since the latter are often viewed by the markets with particular scrutiny and contain extensive Q&A (as well as a transcript). Note that in two cases (Bernanke, Kohn), a Governor became Chair or Vice-Chair; we treat these positions as separate from the earlier roles. The terms of all 11 Governors, Vice-chairs, and Chairmen are shown in Figure 4(a) while the distribution of speeches and testimonies for each Board member is given in Figure 4(b).[14] Over our sample period, the average number of speeches by Board members is about 72 per year.

[insert Figure 4]

Evidence of a so-called "blackout period" is shown in Figure 5. This figure contains the total number of announcements, speeches, and testimonies, again shown in event-time for the period of 124 trading days prior to an FOMC announcement day. While the numbers fluctuate across days, there is a notable drop-off in the number of speeches and testimonies

[13] `http://www.federalreserve.gov`. Following the delineation on this website there are three distinct types of public addresses considered: speeches, testimony, and the semi-annual Monetary Policy Report to the Congress. Public addresses that on the Federal Reserve's website were designated as either "opening remarks" or "dedication remarks" are not included in the sample.

[14] Kelley was also a Governor at the beginning of our sample but left in 2001 and hence is not included in our speech dataset. Similarly Duke joined in August 2008 but did not deliver any speeches or testimony during our sample period. We also do not include speeches by the 12 Reserve Bank Presidents.

in the 10-15 days right before an FOMC meeting. The same pattern can be observed 35-45 days before, due to the black-out period before the previous scheduled FOMC meeting. This pattern suggests that in the lead-up to an FOMC meeting, the macro announcements may take on greater significance as the market seeks guidance from economic information in the absence of Federal Reserve communication, something we explore in section 4.2.2.

[insert Figure 5]

3.3 Macroeconomic announcements

We obtain data on 24 macroeconomic announcements from Econoday. For each of the announcements the data set records both a consensus expectation among market participants and the actual first released number. Our selection of macroeconomic variables follows Andersen, Bollerslev, Diebold, and Vega (2003) and includes GDP, employment, price indices and income numbers. A full list of the indicators and the time of their public releases is given in Table 2. There are three frequencies at which the variables are released: quarterly (the GDP figures), weekly (the initial unemployment claims number on Thursdays) and monthly (all other variables). The two rightmost columns in the table give the average surprise and average absolute surprise for each macroeconomic variable, in standard deviation units (for comparability across variables), where for each announcement the surprise is defined as the actual release minus the consensus estimate. Comparing the two columns, it is apparent that the magnitude of the surprise is often quite large, with the average absolute surprise ranging from one-half to nearly one full standard deviation. Yet for most series there is little evidence of systematic bias, as the average surprise is near zero. There are a few series, however, where the market's expectations systematically differs from the actual release, for example, the GDP advance number, nonfarm payrolls, personal consumption expenditures and the NAPM index.

We consider the uncertainty associated with these announcements in two ways: (1) as a dummy variable to denote the occurrence of a macro release on a given day, (2) as a surprise.[15] The first characterization (dummy) can be viewed as an attempt to measure general

[15]Our choice of these two characterizations reflects our desire to place our findings in the context of earlier research (e.g. Andersen, Bollerslev, Diebold, and Vega, 2003, 2007) while at the same time recognizing the empirical challenges associated with using surprise data constructed from surveys. In particular, Rigobon and Sack (2004, 2008) emphasize a number of factors that may lead to biased estimates when using surprise data, as a result of lack of identification and errors-in-variables. These include the time interval between the consensus estimate and the actual release; the use of multiple announcements, some of which occur on the same day; and the endogeneity between the determination of expectations and asset prices. We note that

market nervousness or uncertainty. The second (surprise, i.e., a deviation from expectation) recognizes the likelihood that a larger deviation from expectation generates greater volatility than a smaller one. Since measurement units vary across macro variables, we follow the convention adopted in the literature (e.g. Andersen, Bollerslev, Diebold, and Vega, 2003; Rigobon and Sack, 2008) and standardize the surprises by dividing each of them by their sample standard deviation. This standardization facilitates comparison across announcement surprises and does not affect the statistical significance of the response estimates nor the fit of the regressions.

[insert Table 2]

4 An analysis of market set-up

We analyze our research questions concerning the market set-up in advance of an FOMC decision by relating the expected fed funds target rates to information conveyed by macroeconomic announcements and Fed communication in the form of previous FOMC decisions, and speeches and testimony by Fed Board members. We start with a baseline specification in which the effects of these variables on the expected target rate are assumed to be constant throughout the six-month period before the FOMC decision that we consider. This is followed by a more detailed investigation where the effects are allowed to vary over time in a number of different ways.[16]

4.1 Baseline specification

Using the procedure described in Section 3.1, we construct the expected fed funds target rate, denoted $\mathsf{E}f_{i,j,t}$, after FOMC decision i at the close of day t, which is j trading days (excluding weekends and holidays) prior to the announcement of interest.[17] Here $i = 1, 2, \ldots, I = 54$

these criticisms are not unique to our study but apply to all previous literature that has adopted a similar approach. Nonetheless, in recognition of these concerns, we have replicated all results using dummy variables rather than surprises and find the results to be qualitatively unchanged. We further discuss sensitivity of our results to these issues in section 5. We thank Ricardo Rigobon for his extensive discussions on these details as they relate to our paper.

[16] In the discussion of the results in this section and the next, we occasionally refer to results of additional analyses we conducted. For all such instances these detailed results are available in the Web Appendix.

[17] Technically only two of these subscripts are necessary: i identifies the announcement number in our sample. The date of the FOMC meeting at which this decision is made together with the index j for the number of days left until this meeting produces the calendar date t. For notational convenience, we also include t as a third subscript to denote the actual date.

(the total number of scheduled FOMC announcements in the sample) and $j = 0, 1, \ldots, J = 124$ (trading days, corresponding with a calendar period of approximately six months).

We relate the absolute change in the expected federal funds rate to macroeconomic announcements and speeches using a linear regression. We use the absolute value of the change in the expected target rate since we do not have information on the tone of the speeches and therefore cannot distinguish between a positive and negative change. Our baseline regression model is given by:

$$|\Delta \mathsf{E} f_{i,j,t}| = \alpha + \sum_{m=0}^{M} \theta_m D^F_{m,i,t} + \theta_u D^U_t + \sum_{k=1}^{K} \kappa_k D^S_{k,t} + \sum_{l=1}^{L} \lambda_l D^T_{l,t} + \sum_{n=1}^{N} \gamma_n |S_{n,t}| + \varepsilon_{i,j,t}, \quad (2)$$

where Δ is the first-difference operator between two consecutive trading days. Important information for the expected target rate after meeting i presumably is gleaned from previous target rate decisions due to the path dependence noted by (Gürkaynak, Sack, and Swanson, 2005). For that reason we include dummies $D^F_{m,i,t}$, $m = 0, 1, \ldots, M = 4$, which are equal to 1 if the m-th scheduled FOMC meeting prior to meeting i occurred on day t. We set $M = 4$ because this is the maximum number of prior FOMC meetings during the period of 124 trading days we consider. We include a separate dummy variable D^U_t for unscheduled FOMC meetings, given that their impact presumably is different from scheduled FOMC decisions. The information in speeches and testimony is included in the form of two sets of dummy variables. Specifically, $D^S_{k,t}$ is a dummy that is equal to 1 if there was a speech by Fed official k on day t (and zero otherwise), $k = 1, 2, \ldots, K = 11$. $D^T_{l,t}$, $l = 1, 2, \ldots, L = 3$, is a dummy that is equal to 1 if there was a testimony of type l on day t. We distinguish three types of testimony: (1) the so-called Humphrey-Hawkins testimony to Congress by the Fed chairman related to the semi-annual Monetary Policy Report, (2) other testimony by the Fed chairman, and (3) testimony by other Board members. In contrast to the treatment of speeches where we assign a separate dummy variable to the speeches of each Board member, it is necessary to group the testimony into these types due to the lower frequency with which Board members give congressional testimony. Finally, $|S_{n,t}|$ is the absolute surprise of macro announcement n ($n = 1, 2 \ldots, N = 24$) on day t (and 0 if there is no such announcement). The reason for using the absolute value of the macro surprises is for comparison with the Fed communications variables where we lack information on the tone of the speeches and testimony. This regression is combined with the error specification

$$\varepsilon_{i,j,t} = \omega_j + \eta_{i,j,t}, \quad (3)$$

which includes 'fixed effects' ω_j for each day j prior to the announcements. Note that because we consider up to 124 trading days before an FOMC meeting, the data structure we employ creates overlapping observations. We control for this by using heteroskedasticy and autocorrelation consistent standard errors throughout the entire analysis.

Estimation results for the baseline model in (2)-(3) are shown in Table 3. For comparison purposes we note that the federal funds rate moves an average of 1.6bps on days without any information events (i.e., no FOMC decisions, speeches, testimony, or macro announcement).[18] Not surprisingly, previous FOMC meetings have a large and significant effect on the expected target rate. Consistent with the idea that the market sets up for FOMC meetings well in advance of the actual decision, the effect of the four previous FOMC meetings increases the farther back one goes. On average, the fed funds rate changes by 2.17bps more on the day of the FOMC meeting itself and 1.60, 2.16, 2.47, and 3.92bps more on days corresponding to the first, second, third and fourth preceding FOMC meetings. We also observe a substantially larger effect when the market is caught by surprise via an unscheduled FOMC decision, consistent with the results of Ehrmann and Fratzscher (2009). On average, unscheduled FOMC announcements shift the expected fed funds futures by more than an additional 22bps.

[insert Table 3]

Several macro announcements have an economically and statistically significant effect on the expected fed funds rate. The largest effect comes from nonfarm payrolls, on average a 2.55bps change (similar in magnitude to the scheduled FOMC meetings) in response to a one standard deviation surprise. This is in line with previous literature, which generally has concluded that nonfarm payroll employment is the 'king' of macro announcements (Andersen, Bollerslev, Diebold, and Vega, 2007). A one standard deviation surprise in retail sales, durable goods, PPI, and NAPM each increases the change in expected fed funds by between 0.5 and 0.8bps. The negative sign of the significant coefficient on final GDP bears mention – on days that these data are released, the federal funds rate changes on average by 0.5bps less than on non-announcement days. These releases occur on the same day as other releases; hence the negative coefficient likely reflects the lower periodicity of the GDP final release. Surprisingly the effect of a surprise in PPI is larger than that of CPI; this may reflect the fact that over the sample period PPI was announced before CPI 84% of the time.

[18]For purposes of presentation and interpretation, coefficients and standard errors have been multiplied by 100. Therefore, a coefficient of 2.17 means that on average the change in the expected federal funds rate is 2.17bps larger than on an average (non-event) day.

It is noteworthy in part because the Federal Reserve typically focuses its attention on CPI (specifically core CPI, that is excluding food and energy). The results suggest that despite this importance to the Fed, the market does not wait for the CPI release, but rather reacts to the earlier PPI release. The correlation between changes in these two inflation measures is 0.82 over the time period we examine. Weekly unemployment claims numbers are also significant, although the effect (0.3bps) is not as large as for the other macro variables.

Congressional testimony of the Chair of the Federal Reserve as part of the semi-annual Monetary Policy Report to Congress (i.e., the Humphrey-Hawkins testimony) increases the change in the federal funds rate by almost 0.8bps, a magnitude similar to that of a one standard deviation surprise in the most important macro variables (except nonfarm payrolls) we consider. Other testimony by the Fed chairman has a comparable impact on the expected target rate. Testimony by other FOMC members does not have a significant effect.

The estimation results also reveal interesting effects of FOMC members' speeches. In particular, large changes in the fed funds rate accompany the speeches of Meyer and Mishkin (5.5bps and 1.7bps, respectively). In contrast, there is evidence that speeches of Bies and Bernanke before he became Chairman helped to calm the markets, with a 20-25% lower-than-average change to the fed funds rate on days of these speeches. Kohn similarly had a calming effect on the fed funds rate as Governor, but his speeches as Vice-Chairman corresponded to a 1.4bps increase in fed funds rate volatility. We emphasize that these effects may as much reflect the differences in calendar time as to when the speeches and testimonies occurred; for example, all of Meyer's speeches were in 2001, a particularly volatile time.[19]

The final set of estimates correspond to ω_j, for $j = -124, -123, \ldots, -2, -1, 0$, the fixed effects for each of the days before the FOMC announcement. They are summarized graphically in Figure 6.[20]

[insert Figure 6]

These estimates confirm our hypothesis that the market sets up for an FOMC meeting well in advance of the actual meeting: on average changes in fed funds futures clearly dampen as the FOMC decision day approaches. The average change in the fed funds rate over the nearest 25 days is 0.59bps while the average over the preceding 25 days is 1.01bps. The averages over the next two 25-day intervals (-51 to -75 and -76 to -100) are 1.55bps

[19]Measuring volatility by means of the average absolute value of the daily change in the effective fed funds rate, we find that this is equal to 7.79bps during the second half of 2001. This contrasts with values of 3.57, 2.84, 2.14, 3.28 and 2.18 for the years 2002,...,2006. Volatility increased again in 2007 and 2008 to values of 4.73 and 8.06, respectively.

[20]The complete set of estimates and associated standard errors are in Table A.1 in the Web Appendix.

and 2.11bps, respectively. During the farthest back interval we consider (100 to 124 days before the FOMC), the average change in fed funds rate is 2.78bps, nearly five times the change in the period immediately preceding the FOMC meeting. In addition, in the 25 days leading up to the FOMC, only half of the dummy variables are significantly different from zero, while in the 100 days prior to that, all except one are. An alternative interpretation of the declining magnitude of the estimates is that there exists information in addition to that considered in our model that is important to the expectations formation process but becomes less important as the decision day approaches. We consider the possibility of such time-varying effects subsequently.

4.2 Effects of macro surprises

The results from our baseline model specification suggest that the effects of macroeconomic surprises are smaller than the effects of Federal Reserve communication (in particular as measured by FOMC statements but also in the form of speeches and testimony of Board members). This is not to say that macro announcements are completely irrelevant. On the contrary, when we re-estimate the model in (2) omitting the macro surprises $S_{n,t}$, $n = 1, \ldots, N$, we find that the estimates of ω_j for values of j up to 25, approximately, are much more significant.[21] These indicators are no doubt proxying for important macro announcements that occur in the month leading up to the FOMC announcement.[22] Thus we view this result as indirect evidence for the importance of including macroeconomic surprises in the specification.

This also motivates an examination of the effects of macro surprises in more detail, in particular whether these effects vary over (event) time. Recall that the effects of a macro surprise are assumed constant in the baseline specification (2). There may in fact be several mechanisms that could lead to time-varying effects of macro announcements. First, if market expectations are shaped mostly well in advance of an FOMC meeting, it may be that macro surprises have a larger impact the longer before the FOMC decision they occur. On the other hand, macro announcements may also have a larger impact immediately prior to an FOMC meeting due to the blackout period, where there is little Federal Reserve communication. Also, macro announcements may be looked upon differently if they occur at the same time

[21] There is little change to the other variables in the model when the macro surprises are omitted, i.e., the results for prior FOMC meetings, as well as speech and testimony dummies, are qualitatively similar to the baseline specification. Detailed results are available in Table A.2 in the Web Appendix.

[22] The same finding emerges when we re-estimate the baseline specification but omit the dummy variables for speeches and testimony, see Table A.3 in the Web Appendix.

as a speech or testimony by an FOMC member. The market may pay less (or more) attention to a macroeconomic surprise if later in the day a Federal Reserve official is speaking or testifying before Congress, believing that the Fed communication may provide helpful interpretative information regarding the surprise. We consider each of these mechanisms in turn, and investigate whether there are time-varying effects of macroeconomic surprises (a) in conjunction with the number of days before an FOMC announcement, (b) during the "blackout" period, and (c) in conjunction with Fed communication. The intuition behind these three variations is to allow for the possibility that following a macroeconomic surprise, the market will set up for the FOMC announcement differently depending on what other information might be available. In all three cases, there is little qualitative change to the coefficients on the dummies for prior FOMC meetings, speeches, or testimony. We therefore focus our remarks below on the coefficients related to the macroeconomic surprises.

4.2.1 Market set-up and macro surprises

To examine the extent and timing of market set-up in response to macro announcements, we divide the complete 124-day period before an FOMC meeting into five sub-periods according to the preceding FOMC meetings. The effects of the macro announcements are allowed to vary (unrestrictedly) across these sub-periods. Thus, we allow for different effects of macroeconomic releases that occurred (1) since the most recent FOMC meeting, (2) more than one but less than two FOMC meetings ago, (3) more than two but less than three meetings ago, (4) more than three but less than four meetings ago, and (5) more than four (but less than five) meetings ago.[23]

A first impression of the relevance of this type of time-variation in the effects of macro announcements is obtained by pooling all releases of the different variables and only considering their occurrence and not their 'content' or surprise. That is, in the baseline specification (2) we replace the 24 macro surprise variables $|S_{n,t}|$ with a single 'macro announcement dummy' that takes the value 1 on days with a macro announcement and zero otherwise. We then estimate a specification in which the coefficient of this dummy is allowed to be different across the different sub-periods of the 124 trading days prior to the FOMC meeting. Figure 7 shows the resulting coefficients together with two standard error bands, which provides strong evidence of set-up effects. Contrary to intuition of a decay in effect, we find that the

[23] An alternative interpretation is that this specification allows a given macroeconomic announcement on day t to have different effects on the expected target rates after each of the next four FOMC meetings. Note that in the baseline specification in (2) the effects on all future FOMC decisions are restricted to be the same.

effect increases monotonically as we go farther back in time. While the impact of macro announcements that have occurred since the most recent FOMC meeting averages 0.19bps and is not significantly different from zero, macro announcements that occurred more than four meetings ago increase the change in the fed funds rate by an average 1.3bps.

[insert Figure 7]

Next we return to the baseline specification in (2)-(3) and again consider the effect of surprises of individual macro announcements, but with the magnitude of these effects varying across sub-periods. Table 4 reports the estimates of the five coefficients for each of the macro surprises; for ease of interpretation we also display them graphically in Figure 8.[24] Although not always monotonic, in general the effects of macro announcements are larger when one goes farther back in time. For example, for nonfarm payrolls we find that a one standard deviation surprise (on average) in the releases leading up to an FOMC announcement moves the fed funds future by just over half a basis point, whereas similar surprises in the releases occurring more than four FOMC announcements earlier have an effect of almost 6.5bps. These results echo the evidence from the baseline specification that the fed funds futures market shows signs of anticipatory movement much earlier than considered in previous literature.

[insert Table 4]

[insert Figure 8]

4.2.2 Macro announcements during blackout periods

Next we examine whether the effect of macroeconomic surprises is different when they arrive during the Fed's blackout period versus during other parts of the FOMC meeting cycle. Based on the pattern in the number of speeches observed in Figure 5, we assume that the blackout period corresponds with the ten weekdays leading up to an FOMC announcement.[25] Table

[24] There are no GDP (preliminary) announcements before the 5-th FOMC meeting prior to the current one, and therefore no coefficient is estimated for this variable.

[25] While to our knowledge there is no official definition of the exact convention of timing that the Fed uses, we do have first-hand evidence of reference to a "blackout" period and hence adhere to that terminology in this paper. Our examination of this period is related to earlier research by Ehrmann and Fratzscher (2009) who refer to a similar period as "Purdah", a reference to the religious practice of female seclusion, and define it to be the ten-day period spanning seven days before and three days following both FOMC announcements and Humprey-Hawkins testimony. Noting some instances of communication during these Purdah periods, they find greater effects on the financial markets and increased market volatility during these episodes,

5 shows the estimation results for a specification that allows the coefficients on the macro announcements to differ during blackout periods versus non-blackout periods.[26] Because there are fewer releases that occur during blackout periods than during non-blackout periods, the standard errors are larger on many of the coefficients in the blackout period. Consistent with the idea that macro announcements carry more weight in the absence of central bank communications, however, the magnitude of the effect of a one standard deviation surprise is larger during the blackout period than in the non-blackout period for 17 of the 24 variables, and in many cases substantially so.[27] For example, for retail sales the effect of a surprise more than doubles, from 0.6bps in the non-blackout period to 1.4bps during the blackout period. The effect of a one standard deviation surprise in nonfarm payrolls increases by around 30%, from 2.2 to 2.9bps. In addition, a one standard deviation surprise in PPI is only significant during the blackout period, and the magnitude of the effect is ten times that of a surprise during the non-blackout period. Finally, the type of information that the market focuses on appears to differ in the two periods; surprises in PPI, CPI, and unemployment are only significant during the blackout period while surprises associated with underlying economic conditions (consumer credit, new home sales, business inventories, ISM manufacturing) have significant effects only during non-blackout periods.

[insert Table 5]

4.2.3 Interaction between macro announcements and Fed communication

Using a similar approach as in the previous section we consider whether macroeconomic surprises have more of an effect on days where there is a speech or testimony or on days without. The results are reported in Table 6. For 15 of the 24 macro surprises, the effect on the fed funds futures is larger in magnitude on days where a speech or testimony occurred than on days without one. There is also modest evidence that the market receives the macroeconomic news more calmly when it occurs on a day with a Federal Reserve speech

although they do not specifically examine the effects of macro announcements. For robustness we also consider their definition (i.e., from -7 to $+3$ days) rather than the one we use (from -10 to 0 days) and find the results to be qualitatively similar. Using their definition, however, a few of the macro announcements no longer have significant effects, namely industrial production, new home sales, and retail sales during the Purdah period and new home sales during the non-Purdah period. See Table A.4 in the Web Appendix.

[26] We distinguish between blackout and non-blackout periods throughout the complete 124 day lookback period, and not just for the 10 days before the particular i-th FOMC announcement. Results for the latter case are qualitatively similar.

[27] Evidence for this also has been documented in Ehrmann and Sondermann (2012) who find that the response of British government bond yields to macro announcements increases as the time since the latest release of the Bank of England's Inflation Report grows.

or testimony; 11 coefficients have negative signs versus 8 when there is not a speech or testimony. When split in this way, more macroeconomic surprises are seen to have an effect. For example, the coefficients on GDP (preliminary), capacity utilization, business inventories, government purchases, and the trade balance are all statistically significant when the release coincides with a day in which a Fed speech or testimony occurs.

[insert Table 6]

4.3 Effects of speeches and testimonies

Our baseline model identifies a number of speech and testimony variables that are highly significant in determining changes in fed funds futures. We next consider whether the effects of these specific types of Federal Reserve communication differ according to whether the day they are given coincides with an important macroeconomic release. Results are reported in Table 7. We find that the effects of Bernanke (when Governor), Meyer, and Gramlich speeches were larger on non-release days than on days with a macro release; for all other officials, the speech effects are larger on release days. Interestingly, we find a significant effect of testimony only for the days that also had a macroeconomic release, although we note larger standard errors on the non-release days. The magnitude of the effect from the testimony of the Federal Reserve Chairman is more than 35% greater on a macro release day than on a non-macro release day, suggesting greater market attention to congressional testimony following a macroeconomic surprise.

[insert Table 7]

We next consider whether the magnitude of the speech and testimony effects varies over the six-month period before an FOMC meeting according to the five sub-periods determined by the preceding FOMC meetings.[28] As for the macro surprises in Section 4.2.1, we find that the effects of speeches and testimony are generally greater when one goes farther back in time, particular for Kohn (when Vice-Chair) and Meyer. For Gramlich and Mishkin, only speeches delivered since the most recent FOMC meeting are significant, suggesting less salience. Interestingly, neither Bernanke's speeches nor any congressional testimony is significant once interacted with the subperiod indicators.

Finally, we acknowledge that the timing of both macro announcements and Fed communications varies throughout the day, so that in some cases there is a possibility that

[28] See Table A.5 in the Web Appendix.

some of these events occurred after the close of the Fed funds futures market. To consider the sensitivity of our results to this timing, we first re-estimate the model excluding the contemporaneous FOMC meeting from the specification because during our sample period, the FOMC announcement that coincides with the end of the meeting typically occurred at around 2:15pm, near the close of the Fed funds futures market. The results are virtually unchanged; in addition to no change in sign, there is very little change to the magnitude of any of the coefficients.[29] Next, because we do not have the exact time (or time zone) of the speeches and testimonies, to ensure that these variables chronologically preceded the change in the futures price (our dependent variable) we re-estimate the model lagging the dummy variables for speeches and testimony by one day.[30] In this case, the results regarding Federal Reserve communications are qualitatively unchanged with a few notable exceptions: (1) the coefficients on both Bernanke and Kohn as governor remain negative but double in magnitude, indicating that markets were calmed by their speeches, (2) in contrast, the coefficient on Bernanke while chair is positive (although less than in the baseline specification) and becomes highly significant suggesting greater volatility on days following his speeches, (3) the coefficient on the Humphrey-Hawkins indicator changes sign (from positive to negative) and remains highly significant. Since we know the bulk of the Humphrey-Hawkins testimony occurs prior to the close of that day's fed funds futures market, one interpretation of this change in sign is that it provides evidence of overshooting; while on average changes in fed funds futures are 0.78bps higher on Humphrey-Hawkins days than non-Humphrey-Hawkins days, the day following they are on average 1.16bps lower.[31]

5 Robustness and sensitivity analysis

In this section we examine a number of additional issues that allow us to assess the robustness of the empirical results documented in the previous section. Specifically, we consider (1) a particular specification for time-varying volatility in the fed funds futures, (2) the length of the period before the FOMC decision, and (3) additional specifications where we use dichotomous dummy variables instead of absolute surprises for the macroeconomic variables

[29] See Table A.6 in the Web Appendix.

[30] See Table A.7 in the Web Appendix.

[31] In addition, we also re-estimate the model lagging all explanatory variables (including the macro announcement surprises) by one day. In this case, while many of the coefficients on the macroeconomic variables are less significant, the coefficients on new home sales and housing starts are now significant and negative, indicating a reduction in volatility on the days following these announcements. When lagged, neither consumer confidence nor NAPM are significant at the 5% level of significance. See Table A.8 in the Web Appendix.

and include volume as explanatory variable.

5.1 Time-varying volatility

Our analysis so far implicitly assumes that the volatility of the fed funds futures is constant over time (apart from the effects of macro announcements and Fed communication). This may be unrealistic, as our sample period is quite varied in terms of economic conditions, starting with the aftermath of the burst of the dot-com bubble and 9/11 and ending with the first part of the financial crisis and Great Recession, with a relatively calm period in between. Also in terms of the target rate itself, our sample period includes prolonged sub-periods with a (close to) stable target rate with the Fed being on hold, as well as periods of easing and tightening monetary policy with substantial changes in the target rate. Obviously, the volatility of the fed funds futures may be quite different during these sub-periods, and failing to account for this may influence our results. We examine whether this issue is relevant by extending the error specification in (3) to

$$\varepsilon_{i,j,t} = \omega_j + \delta_i + \eta_{i,j,t}, \tag{4}$$

where δ_i, $i = 1, 2, \ldots, 54$ are fixed effects for each FOMC meeting. The estimation results[32] show that including these effects decreases the impact of the contemporaneous FOMC meeting by quite a lot (about 40%); this variable is now only significant at the 10% significance level. The impact of the previous FOMC meetings does not change. The impact of speeches is dramatically reduced; only those of Vice-Chair Kohn and Governor Meyer remain significant. In contrast, the effects of congressional testimony appear to be more robust. The coefficients for Humphrey-Hawkins and other testimonies of the Fed Chair are of similar magnitude as in the baseline specification and remain highly significant. The effect of the testimony of other Governors now also is significant at the 1% level, while its magnitude is about 50% larger. As this coefficient is negative it means that on days that other Governors testify before Congress, the federal funds rate moves on average 0.38bps less than on other days.

For the macro surprises, for the most part the results are qualitatively similar with three exceptions. The final GDP surprise is no longer significant and factory orders are only significant at the 90% level of confidence. In contrast, consumer credit is more significant (and negative at 5% level).

[32] See Table A.9 in the Web Appendix.

These different effects on speeches on the one hand and on testimony and macro announcements on the other hand may not be completely surprising. Recall from Figure 4 that most of the individual Board members served only during part of our sample period. Hence, the significant effects of their speeches found in the baseline specification in Table 3 may well be due to neglected time-varying volatility. Testimony and macro announcements, however, occurred during the complete sample period, such that their effects obtained with the baseline specification may be more stable and not proxying for heteroskedasticity in the fed funds futures.

Figure 9 shows the estimated values of δ_i along with associated 95% confidence bands. The chart clearly shows the increased effect of FOMC meetings post-crisis; The meetings since October 2007 are associated with a significantly larger average magnitude of the change in the federal funds rate. The largest increase in δ_i, more than 6.5bps, occurred in response to the March 18, 2008 meeting that occurred immediately after Bear Stearns was sold to JP Morgan Chase. We identify similarly significant effects (albeit smaller in absolute magnitude) prior to December 2003, when the Fed was nearing the end of its easing cycle. Interestingly, for most FOMC announcements between October 2003 and August 2007, the values of δ_i are not statistically significantly different from zero, suggesting the market had already incorporated/anticipated the results of the meetings. Two interesting exceptions occur. First, for a brief period of about six months following the June 30, 2004 meeting, the values of δ_i are again highly significant, perhaps a reflection of market uncertainty regarding the pace of tightening. Second, significant meeting effects also are found for the second half of 2006, possibly indicating that the market was not completely convinced that the period of tightening had actually ended.

[insert Figure 9]

5.2 Shorter lookback period

The main conclusion that emerges from our analysis is that the market sets up well in advance of an FOMC meeting, This is demonstrated by the significant 'trading day' effects we find up to six months prior to such meetings, as well as the stronger reaction to macro announcements the longer before the meeting these occur. As noted in the introduction, because most previous literature has considered much shorter time horizons, it is possible that the effects of both macro announcements and Fed communications have been underestimated. To consider this possibility, we re-estimate our baseline model in (2)-(3) using only the most

recent 20 business days' worth of information.[33] We find that failure to control for the longer horizon leads to inference that attributes too much weight to the days nearest to the FOMC meeting. In particular, the estimated trading day fixed effects for the first 20 days of ω_j (not shown) are smaller and less significant when we consider 124 days before the meeting. There is no qualitative change to inference regarding the effect of the FOMC meeting itself but the impact of the unscheduled meetings is much larger (51bps rather than 22bps). In contrast, the effects of speeches are mitigated for most individuals and none of the testimony variables is significant, in particular the speeches of then-Governor Bernanke are no longer significant. In contrast, Governor Gramlich's speeches are highly significant. In addition to the speeches and testimony, the macroeconomic surprises are also much less significant; only final GDP and nonfarm payrolls have a significant effect on the change in the fed funds rate. The diminished effects of macro surprises is in fact not surprising given the results in Section 4.2.1, which already show that macroeconomic announcements since the most recent FOMC meeting generally have small (and mostly insignificant) effects on the expected target rate.

These results suggest the effects of both macro announcements and Fed communications that have been documented in previous literature have indeed been underestimated. Indeed the effect is incorporated much earlier than previously thought; even looking back up to 20 days prior to the FOMC meeting we find little effect. In contrast, our baseline specification shows strong effects of anticipatory set-up far in advance.

5.3 Further robustness checks

As noted in section 3.3 considerable debate exists as to the appropriateness of including macroeconomic surprises in the estimation. In particular, we are aware that our finding that the effects of macroeconomic surprises are smaller than the effects of Federal Reserve communication may reflect the downward bias that Rigobon and Sack (2008) highlight (a result of the errors-in-variables that arises from the measurement of the expectation used to calculate the surprise). In addition, studies such as Andersen, Bollerslev, Diebold, and Vega (2007) suggest that it is the mere occurrence of a macroeconomic announcement, and not so much its content, that affects volatility in financial markets. To consider these possibilities, the baseline model is re-estimated using dummy variables for each macro announcement rather than the absolute surprise. The announcements for personal income and consumer credit are omitted due to multicollinearity with personal consumption expenditures and nonfarm

[33] See Table A.10 in the Web Appendix.

payrolls, respectively since these announcements occur on the same day. The results[34] for the most part are qualitatively unchanged with the following exceptions: (1) the coefficients on retail sales, factory orders, and consumer confidence are no longer significant, (2) the coefficient on CPI is highly significant (at the 1% level), and (3) the magnitude of most coefficients is higher when dummy variables are used instead of surprises. There is no change to the significance or inference with respect to FOMC meetings or speeches and testimonies. Taken together, these results indicate that if anything, the baseline specification understates the role of macro announcements. However, the main conclusion of our results, that there is substantial evidence of anticipatory setup, is robust to the choice of surprise versus dummy variables to characterize the macro announcements.

Because there is such a large spike in volume on days of FOMC announcements (Figure 3), we consider the effects of volume on changes in fed funds futures. Indeed once volume is included in the regression, the coefficient on the dummy for the contemporaneous FOMC meeting is no longer significant while the coefficient on volume is.[35] The effects of previous FOMC meetings are still monotonic and significant, in addition there is no qualitative change to the effects of the macro announcements or the speeches. The coefficient on the Humphrey-Hawkins variable is no longer significant while the coefficient on testimony by other governors becomes significant.

Finally, as discussed in Section 3.1.2, the expected target rate does not change for about 30% of the observations in our dataset. We examine whether and how such a large fraction of zero values for the dependent variable in our model in equation (2) affects the results by (i) estimating a Tobit model based on the complete sample, and (ii) re-estimating the model using only the sub-sample with non-zero values for the dependent variable. In both cases, we find results that are remarkably similar to the ones reported in Table 3.[36] For all three groups of explanatory variables (FOMC announcements, speeches and testimony, and macro announcements), there are no noteworthy changes in the magnitude and significance of the coefficient estimates.

6 Conclusion

The main contribution of this paper is to examine the anticipatory set-up of financial market participants during an extensive period of six months before a particular FOMC target

[34] See Table A.11 in the Web Appendix.
[35] See Table A.12 in the Web Appendix.
[36] See Tables A.13 and A.14 in the Web Appendix.

rate decision is made. For the most part previous research only considered the market's expectation immediately prior to these events and the ensuing reaction. As the Federal Reserve nears the end of the large-scale quantitative easing that it launched in response to the recent financial crisis, there is renewed interest in the role that Fed communications and interpretations of other sources of information (such as macro announcements) play in shaping financial market participants' actions.

We find convincing evidence of financial market set-up well in advance of an FOMC meeting. Prior FOMC announcements, macro-economic surprises, and the speeches and testimony of Board members generate large moves in fed funds futures. For both macro announcements and prior FOMC decisions we find that their impact is larger the farther in the past they occur, indicating that the set-up effects decline as the meeting approaches. This is also suggested by the fact that we document a larger proportion of days immediately preceding the FOMC meeting where the daily change in the futures is zero than in days farther back, suggesting heightened market convergence relative to those earlier periods. Our analysis demonstrates the importance of considering the path of macro announcements and Federal Reserve communications as drivers for the fluctuations in fed funds futures prices. We find both that inference on the effects of macro announcements is similar whether or not speeches and testimonies are included and that inference of the effects of the speeches and testimonies remains the same with or without macro announcements. Taken together these results suggest that in some sense the information sets may be orthogonal and emphasize the benefits of including both types of information in the model.

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Table 1: FOMC Announcements

Meeting			FOMC target rate		
Year	Date		Actual	Expected	Unexpected (bps)
2001	8/21		3.5	3.47	3.5
	9/17	U	3		
	10/2		2.5	2.46	4.2
	11/6		2	2.14	−13.8
	12/11		1.75	1.76	−1.0
2002	1/30		1.75	1.73	2
	3/19		1.75	1.78	−3
	5/7		1.75	1.76	−1
	6/26		1.75	1.77	−2
	8/13		1.75	1.67	8
	9/24		1.75	1.69	6
	11/6		1.25	1.46	−21
	12/10		1.25	1.22	3
2003	1/29		1.25	1.23	2
	3/18		1.25	1.17	8
	5/6		1.25	1.20	5
	6/25		1	0.87	13
	8/12		1	1.00	0
	9/16		1	1.01	−1
	10/28		1	1.01	−1
	12/9		1	1.01	−1
2004	1/28		1	1.00	0
	3/16		1	1.00	0
	5/4		1	1.02	−2
	6/30		1.25	1.27	−2
	8/10		1.5	1.50	0
	9/21		1.75	1.75	0
	11/10		2	2.01	−1
	12/14		2.25	2.25	0
2005	2/2		2.5	2.52	−2
	3/22		2.75	2.77	−2
	5/3		3	3.03	−3
	6/30		3.25	3.26	−1
	8/9		3.5	3.55	−5
	9/20		3.75	3.73	2
	11/1		4	4.01	−1
	12/13		4.25	4.28	−3
2006	1/31		4.5	4.50	0
	3/28		4.75	4.76	−1
	5/10		5	5.06	−6
	6/29		5.25	5.28	−3
	8/8		5.25	5.30	−5
	9/20		5.25	5.25	0
	10/25		5.25	5.25	0
	12/12		5.25	5.23	2
2007	1/31		5.25	5.25	0
	3/21		5.25	5.25	0
	5/9		5.25	5.24	1
	6/28		5.25	5.25	0
	8/7		5.25	5.22	3
	8/17	U	5.25	4.88	37
	9/18		4.75	4.60	15
	10/31		4.5	4.52	−2
	12/11		4.25	4.12	13
2008	1/22	U	3.5	4.13	−63
	1/30		3	3.06	−6
	3/18		2.25	1.89	36
	4/30		2	2.05	−5
	6/25		2	2.03	−3
	8/5		2	2.02	−2
	9/16		2	1.83	17

Note: This table provides an overview of the FOMC announcements during the period January 2002 - September 2008. For each FOMC decision, we list the actual fed funds target rate as announced after the meeting and the expected post-FOMC meeting target rate. This expected post-FOMC meeting target rate is based on the closing price of the fed fund futures contracts on the day preceding the meeting. 'Unexpected' is defined as the difference between the actual and expected post-FOMC meeting rates in basis points (bps). A "U" following the date denotes that the FOMC announcement was unscheduled.

Table 2: Macroeconomic Announcements

		Time	Number of announcements	Average Surprise	Average Absolute Surprise
Quarterly					
1	GDP advance	8:30 a.m.	19	−0.67	0.96
2	GDP preliminary	8:30 a.m.	19	0.07	0.75
3	GDP final	8:30 a.m.	18	−0.21	0.64
Monthly					
Real Activity					
4	Nonfarm payroll employment	8.30 a.m.	85	−0.29	0.78
5	Retail sales	8.30 a.m.	85	0.05	0.63
6	Industrial production	9.15 a.m.	84	−0.16	0.82
7	Capacity utilization	9.15 a.m.	84	−0.13	0.80
8	Personal income	8.30 a.m.	85	0.12	0.58
9	Consumer credit	3.00 p.m.	81	0.01	0.76
Consumption					
10	Personal consumption exp.	8.30 a.m.	85	−0.20	0.68
11	New home sales Investment	10.30 a.m.	93	0.09	0.75
Investment					
12	Durable goods orders	8.30 a.m.	85	−0.06	0.71
13	Construction spending	10.00 a.m.	86	−0.10	0.76
14	Factory orders	10.00 a.m.	85	0.03	0.73
15	Business inventories[a]	10.00 a.m.	83	0.13	0.77
Goverment Purchases					
16	Government budget deficit	2.00 p.m.	80	0.03	0.51
Net Exports					
17	Trade balance	8.30 a.m.	86	−0.02	0.79
Prices					
18	Producer price index	8.30 a.m.	83	0.08	0.76
19	Consumer price index	8.30 a.m.	85	−0.11	0.76
Forward-looking					
20	Consumer confidence index	10.00 a.m.	85	−0.04	0.76
21	NAPM index[b]	10.00 a.m.	86	0.25	0.83
22	Housing starts	8.30 a.m.	85	0.15	0.81
23	Index of leading indicators	10.00 a.m.	84	−0.18	0.71
Weekly					
24	Initial unemployment claims	8.30 a.m.	367	−0.05	0.73

Notes: This table provides an overview of the scheduled macroeconomic announcements that are included in the analysis. For each macro variable, the table shows the time of the announcement (in terms of the US Eastern Time zone), the number of observations during the period July 2001 - September 2008, the average surprise (defined as the actual release minus the consensus estimate) and average absolute surprise. All surprises are standardized using their sample standard deviation.
[a]: Earlier part of sample (before 2005) often at 8:30 a.m.
[b]: Latest part of sample at 9:45 a.m. (since January 2007).

Table 3: Results - baseline specification

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	2.170***	0.577	GDP (advance)	0.124	0.234
Previous	1.600***	0.510	GDP (preliminary)	−0.258	0.213
2nd previous	2.160***	0.541	GDP (final)	−0.507***	0.130
3rd previous	2.470***	0.625	Nonfarm payrolls	2.554***	0.252
4th previous	3.920***	0.880	Retail sales	0.665***	0.188
Unscheduled (θ_u)	22.840***	7.583	Industrial Production	−0.113	0.229
			Capacity Utilization	−0.098	0.261
Speeches (κ_k)			Personal Income	0.088	0.183
Greenspan	−0.049	0.144	Consumer Credit	−0.245*	0.148
Bernanke (Governor)	−0.348**	0.165	Pers. Consump. Exp.	−0.188	0.163
Bernanke (Chair)	0.383	0.248	New Home Sales	−0.013	0.144
Ferguson	−0.302*	0.162	Durable Goods	0.730***	0.217
Kohn (Governor)	−0.389*	0.201	Constr. Spending	−0.024	0.158
Kohn (Vice-Chair)	1.446***	0.327	Factory Orders	−0.272**	0.134
Meyer	5.546***	1.894	Business Inventories	0.207	0.162
Gramlich	−0.095	0.264	Government Purchases	0.105	0.175
Olson	−0.189	0.184	Trade Balance	0.006	0.177
Bies	−0.426***	0.123	Producer Price Index	0.791***	0.246
Mishkin	1.693***	0.551	Consumer Price Index	0.488	0.306
Kroszner	0.567*	0.322	Consumer Confidence	0.466***	0.174
Warsh	−0.084	0.462	ISM Manufacturing (NAPM)	0.693***	0.182
			Housing Starts	0.023	0.120
Testimony (λ_l)			Leading Indicators	0.202	0.168
Humphrey-Hawkins	0.788**	0.322	Initial Unemployment	0.314***	0.105
Testimony - Chair	0.682***	0.229			
Testimony - Others	−0.248	0.159			

Note: The table shows coefficient estimates in the baseline regression model given by:

$$|\Delta \mathsf{E} f_{i,j,t}| = \alpha + \sum_{m=0}^{M} \theta_m D^F_{m,i,t} + \theta_u D^U_t + \sum_{k=1}^{K} \kappa_k D^S_{k,t} + \sum_{l=1}^{L} \lambda_l D^T_{l,t} + \sum_{n=1}^{N} \gamma_n |S_{n,t}| + \varepsilon_{i,j,t},$$

where $\mathsf{E} f_{i,j,t}$ is the expected fed funds target rate after FOMC decision i at the close of day t, which is j trading days prior to the announcement, and Δ is the first-difference operator. $D^F_{m,i,t}$, $m = 0, 1, \ldots, M = 4$ are equal to 1 if the m-th scheduled FOMC meeting prior to meeting i occurred on day t. D^{FU}_t is a dummy variable for unscheduled FOMC meetings. $D^S_{k,t}$ is a dummy that is equal to 1 if there was a speech by Fed official k on day t (and zero otherwise), $k = 1, 2, \ldots, K = 17$. $D^T_{l,t}$, $l = 1, 2, 3$, is a dummy that is equal to 1 if there was a testimony of type l on day t. Three types of testimony are distinguished: (i) the so-called Humphrey-Hawkins testimony to Congress by the Fed chairman related to the semi-annual Monetary Policy Report, (ii) other testimony by the Fed chairman, and (iii) testimony by other Board members. $|S_{n,t}|$ is the absolute surprise of macro announcement n ($n = 1, 2 \ldots, N = 24$) on day t (and 0 if there is no such announcement). The regression is combined with the error specification $\varepsilon_{i,j,t} = \omega_j + \eta_{i,j,t}$, which includes 'fixed effects' ω_j for each day j prior to announcement i. The model is estimated using the 54 FOMC announcements during the period January 2002 - September 2008, with $j = 1, 2, \ldots, 124$ indicating the j-th trading day prior to an FOMC announcement day (excluding weekends and holidays). Reported standard errors are heteroskedasticity and autocorrelation consistent. The superscripts ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 4: Time-varying effects of macro surprises

	m:	-5	-4	-3	-2	-1
GDP (advance)		4.698***	−0.130	0.116	0.377	−0.140
GDP (preliminary)			−0.453	−0.205	−0.120	−0.263
GDP (final)		−1.170***	−0.585***	−0.176	−0.389*	−0.516***
Nonfarm payrolls		6.482***	4.127***	2.887***	2.007***	0.572***
Retail sales		1.822	0.732**	0.831**	0.722***	0.135
Industrial Production		−1.570	−0.100	−0.191	−0.234	0.160
Capacity Utilization		0.937	−0.435	−0.271	0.140	0.033
Personal Income		1.223	0.187	0.222	0.217	−0.148
Consumer Credit		0.547	−0.245	−0.430	−0.136	−0.242*
Pers. Consump. Exp.		−0.073	−0.337	−0.267	−0.235	0.021
New Home Sales		1.793	0.009	−0.143	−0.086	−0.053
Durable Goods		−1.406	1.082**	1.090**	0.622**	−0.040
Constr. Spending		−1.469	0.112	0.000	−0.038	−0.123
Factory Orders		−1.375	−0.329	−0.356	−0.157	−0.180
Business Inventories		0.071	0.503	0.647**	0.232	−0.320
Government Purchases		0.736**	0.185	−0.026	0.096	0.110
Trade Balance		−0.399	−0.128	0.218	0.014	−0.066
Producer Price Index		4.917***	1.207**	0.733	0.636	0.462
Consumer Price Index		0.311	0.988	0.486	0.165	0.427
Consumer Confidence		0.675	1.022**	0.637	0.347	0.005
ISM Manufacturing (NAPM)		2.033***	1.187**	0.728*	0.484	0.268
Housing Starts		0.551	0.320	0.053	0.064	−0.358**
Leading Indicators		0.310	0.348	0.287	0.198	−0.007
Initial Unemployment		1.150*	0.483*	0.367**	0.287*	0.090

Note: The table shows estimation results from the baseline specification in (2)-(3) but with the coefficients on the absolute macro surprises allowed to differ depending on how many FOMC meetings ago the macro announcement occurred. Coefficients reported in the column labeled m, $m = -5, -4, \ldots, -1$ correspond to macro surprises that occurred between the $|m|$-th and $|(m-1)|$-th FOMC meeting prior to meeting i (where the 0-th previous meeting is meeting i itself). The model is estimated using the 54 FOMC announcements during the period January 2002 - September 2008, using 124 trading day prior to an FOMC announcement day (excluding weekends and holidays). The superscripts ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 5: Macro surprises during blackout periods

Dummy variables			Continuous variables	Blackout		Not Blackout	
	Coeff.	Std.Err.		Coeff.	Std.Err.	Coeff.	Std.Err.
FOMC meetings			**Macro announcements**				
Current	2.050***	0.553	GDP (advance)	0.348	0.265	−0.395	0.291
Previous	1.526***	0.478	GDP (preliminary)	−0.590	0.404	−0.237	0.236
2nd previous	2.052***	0.505	GDP (final)	−0.485**	0.198	−0.502***	0.159
3rd previous	2.366***	0.586	Nonfarm payrolls	2.858***	0.425	2.221***	0.333
4th previous	3.681***	0.839	Retail sales	1.422**	0.597	0.629***	0.200
Unscheduled	22.839***	7.603	Industrial Production	−0.866*	0.508	−0.169	0.243
			Capacity Utilization	1.277*	0.748	−0.226	0.254
Speeches			Personal Income	−0.239	0.171	0.308	0.265
Greenspan	−0.082	0.148	Consumer Credit	−0.072	0.336	−0.436***	0.118
Bernanke (Governor)	−0.321*	0.165	Pers. Consump. Exp.	−0.055	0.156	−0.189	0.224
Bernanke (Chair)	0.298	0.217	New Home Sales	0.429*	0.252	−0.396**	0.166
Ferguson	−0.237	0.163	Durable Goods	1.183***	0.283	0.435*	0.227
Kohn (Governor)	−0.285	0.200	Constr. Spending	−0.083	0.233	−0.020	0.208
Kohn (Vice-Chair)	1.537***	0.324	Factory Orders	−0.512**	0.248	−0.144	0.155
Meyer	5.277***	1.960	Business Inventories	0.121	0.381	0.362**	0.174
Gramlich	−0.250	0.261	Government Purchases	1.058***	0.188	−0.312***	0.080
Olson	−0.171	0.179	Trade Balance	−0.341	0.418	0.121	0.194
Bies	−0.442***	0.128	Producer Price Index	2.763***	0.710	0.246	0.176
Mishkin	1.670***	0.536	Consumer Price Index	1.964*	1.037	0.057	0.149
Kroszner	0.706*	0.335	Consumer Confidence	0.771**	0.332	0.458**	0.205
Warsh	−0.081	0.471	ISM Manufacturing (NAPM)	0.179	0.215	0.904***	0.252
			Housing Starts	−0.220	0.285	0.097	0.133
Testimony			Leading Indicators	0.594*	0.319	0.111	0.203
Humphrey-Hawkins	0.973***	0.324	Initial Unemployment	0.663***	0.202	0.193*	0.109
Testimony - Chair	0.663***	0.228					
Testimony - Others	−0.160	0.157					

Note: The table shows estimation results from the baseline specification in (2)-(3) but with the coefficients on the absolute macro surprises allowed to differ to differ during blackout periods versus non-blackout periods. The blackout period is defined as the period of ten weekdays leading up to an FOMC announcement. The model is estimated using the 54 FOMC announcements during the period January 2002 - September 2008, using 124 trading day prior to an FOMC announcement day (excluding weekends and holidays). Reported standard errors are heteroskedasticity and autocorrelation consistent. The superscripts ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 6: Macro surprises and speeches and testimony

Dummy variables			Continuous variables	No S&T		S&T	
	Coeff.	Std.Err.		Coeff.	Std.Err.	Coeff.	Std.Err.
FOMC meetings			**Macro announcements**				
Current	2.180***	0.573	GDP (advance)	0.186	0.237	−1.857*	0.985
Previous	1.600***	0.503	GDP (preliminary)	0.051	0.445	−0.454***	0.153
2nd previous	2.190***	0.535	GDP (final)	−0.509***	0.135	−0.528	0.587
3rd previous	2.500***	0.620	Nonfarm payrolls	2.796***	0.315	2.020***	0.400
4th previous	3.960***	0.866	Retail sales	0.832***	0.161	0.151	0.582
Unscheduled	22.830***	7.594	Industrial Production	0.005	0.318	0.260	0.431
			Capacity Utilization	0.378	0.312	−1.447**	0.597
Speeches			Personal Income	0.075	0.208	0.456	0.510
Greenspan	−0.073	0.136	Consumer Credit	−0.423***	0.162	0.075	0.250
Bernanke (Governor)	−0.288	0.180	Pers. Consump. Exp.	−0.274	0.200	−0.077	0.212
Bernanke (Chair)	0.500**	0.233	New Home Sales	0.032	0.208	−0.245	0.185
Ferguson	−0.268	0.177	Durable Goods	1.097***	0.229	−0.265	0.205
Kohn (Governor)	−0.342	0.214	Constr. Spending	0.064	0.171	−0.483	0.484
Kohn (Vice-Chair)	1.604***	0.353	Factory Orders	−0.166	0.224	−0.495***	0.123
Meyer	5.307***	1.910	Business Inventories	−0.153	0.157	1.009**	0.431
Gramlich	0.036	0.263	Government Purchases	0.161	0.193	−1.214**	0.475
Olson	−0.170	0.184	Trade Balance	−0.485***	0.168	1.405**	0.577
Bies	−0.343**	0.138	Producer Price Index	0.934***	0.276	0.381	0.538
Mishkin	1.756***	0.517	Consumer Price Index	−0.295	0.238	1.362*	0.699
Kroszner	0.653**	0.318	Consumer Confidence	−0.017	0.150	1.579***	0.362
Warsh	−0.138	0.452	ISM Manufacturing (NAPM)	0.888***	0.193	0.573	0.459
			Housing Starts	0.011	0.172	0.295	0.237
Testimony			Leading Indicators	0.396*	0.204	−0.267	0.254
Humphrey-Hawkins	0.891**	0.354	Initial Unemployment	0.387***	0.134	0.191	0.131
Testimony - Chair	0.670***	0.236					
Testimony - Others	−0.213	0.174					

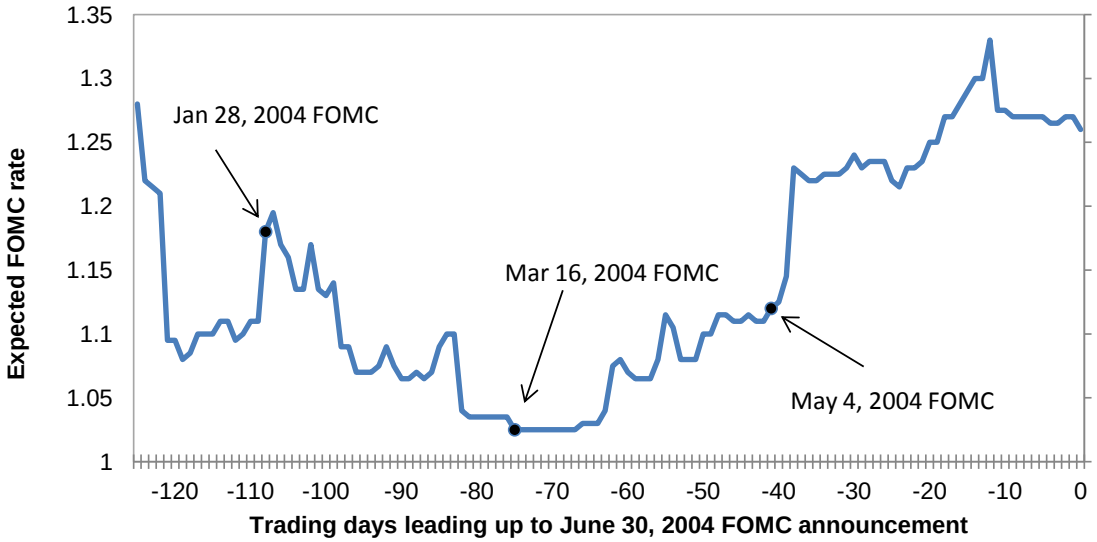
Note: The table shows estimation results from the baseline specification in (2)-(3) but with the coefficients on the absolute macro surprises allowed to differ depending on whether or not the macro announcement coincided with Fed communication. Columns headed S&T (No S&T) show coefficient (estimates and standard errors) on macro surprises announced on days with (without) a speech or testimony by an FOMC member. The model is estimated using the 54 FOMC announcements during the period January 2002 - September 2008, using 124 trading day prior to an FOMC announcement day (excluding weekends and holidays). Reported standard errors are heteroskedasticity and autocorrelation consistent. The superscripts ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 7: Speeches and testimony and macro surprises

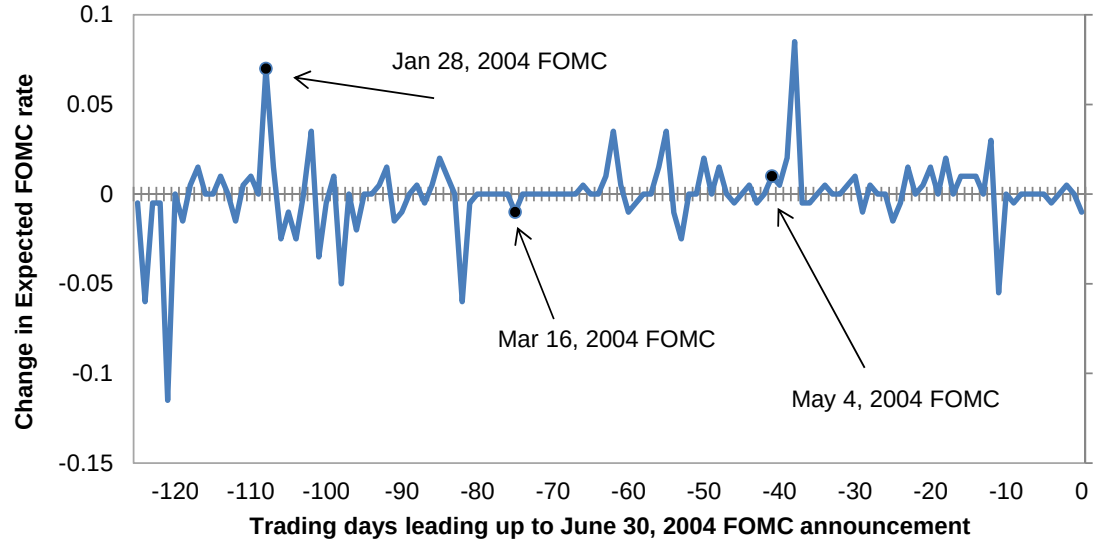
Dummy variables					Continuous variables		
	Coeff.	Std.Err.	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings					**Macro announcements**		
Current	2.170***	0.578			GDP (advance)	0.138	0.234
Previous	1.597***	0.511			GDP (preliminary)	−0.314	0.221
2nd previous	2.158***	0.542			GDP (final)	−0.508***	0.130
3rd previous	2.470***	0.625			Nonfarm payrolls	2.535***	0.255
4th previous	3.935***	0.882			Retail sales	0.676***	0.184
Unscheduled	22.862***	7.586			Industrial Production	−0.134	0.235
					Capacity Utilization	−0.093	0.263
Speeches	No MA		MA		Personal Income	0.085	0.183
Greenspan	−0.219	0.139	0.165	0.222	Consumer Credit	−0.290*	0.150
Bernanke (Governor)	−0.444**	0.212	−0.345*	0.207	Pers. Consump. Exp.	−0.195	0.163
Bernanke (Chair)	0.321	0.283	0.413	0.362	New Home Sales	−0.031	0.144
Ferguson	−0.015	0.165	−0.437*	0.231	Durable Goods	0.735***	0.219
Kohn (Governor)	−0.204	0.229	−0.553*	0.295	Constr. Spending	−0.040	0.158
Kohn (Vice-Chair)	−0.175	0.300	1.579***	0.329	Factory Orders	−0.264*	0.139
Meyer	11.950***	2.150	4.138**	1.778	Business Inventories	0.240	0.162
Gramlich	−1.149***	0.280	0.172	0.318	Government Purchases	0.103	0.174
Olson	−0.352	0.222	−0.107	0.257	Trade Balance	0.000	0.168
Bies	−0.067	0.167	−0.563***	0.151	Producer Price Index	0.764***	0.244
Mishkin	0.428	0.358	2.585***	0.756	Consumer Price Index	0.492*	0.299
Kroszner	0.600*	0.350	0.682*	0.414	Consumer Confidence	0.463***	0.174
Warsh	−1.486***	0.254	2.531***	0.567	ISM Manufacturing (NAPM)	0.693***	0.180
					Housing Starts	0.044	0.118
Testimony					Leading Indicators	0.217	0.168
Humphrey-Hawkins	−0.376	0.450	0.856**	0.382	Initial Unemployment	0.291***	0.108
Testimony - Chair	0.551	0.455	0.768***	0.258			
Testimony - Others	0.014	0.273	−0.405**	0.182			

Note: The table shows estimation results from the baseline specification in (2)-(3) but with the coefficients on the speeches and testimony dummies allowed to differ depending on whether or not the Fed communication coincided with macro announcements. Columns headed MA (No MA) show coefficients (estimates and standard errors) on speeches and testimony given on days with (without) macro announcements. The model is estimated using the 54 FOMC announcements during the period January 2002 - September 2008, using 124 trading day prior to an FOMC announcement day (excluding weekends and holidays). Reported standard errors are heteroskedasticity and autocorrelation consistent. The superscripts ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Figure 1: Expected target rate for the FOMC announcement on June 30, 2004



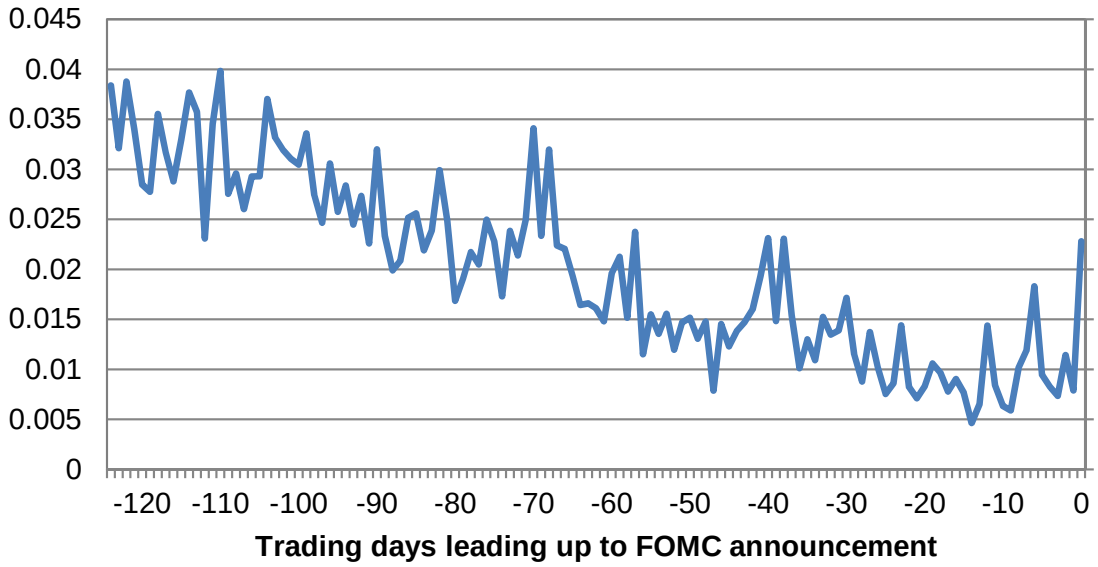
(a) Expected target rate



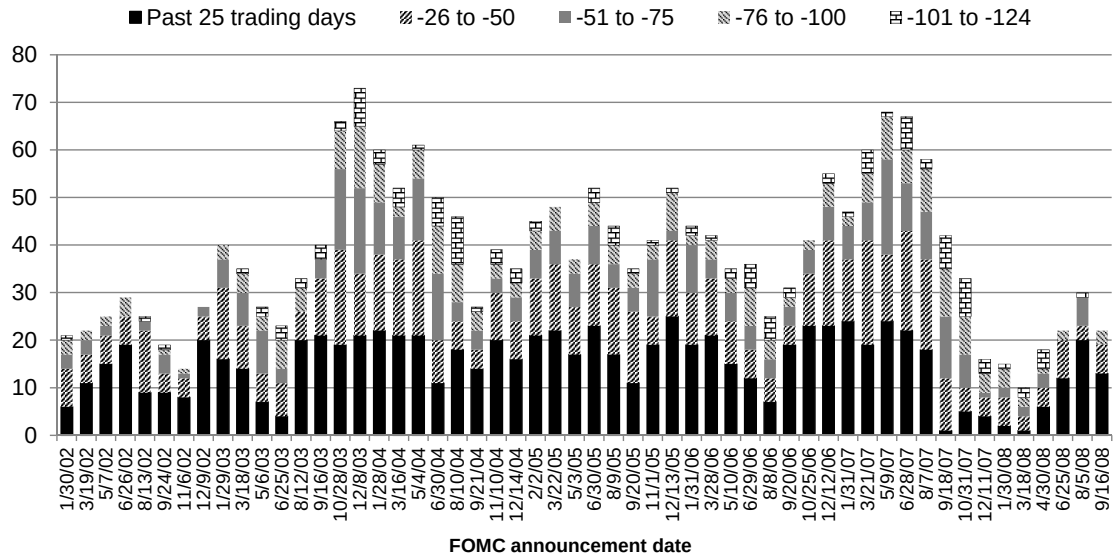
(b) Change in expected target rate

Note: This figure shows the market's expectation of the fed funds target rate after the FOMC announcement on June 30, 2004 on the 124 trading days (excluding weekends and holidays) before the announcement. At the June 30, 2004 meeting, the FOMC decided to increase the target rate from 1 to 1.25 percent. The expected target rate on each day prior is obtained from the closing price of fed funds futures contract for July 2004. Panel (a) shows the expected target rate, panel (b) shows the daily change in the expected target rate.

Figure 2: Changes in expected target rate on pre-announcement days



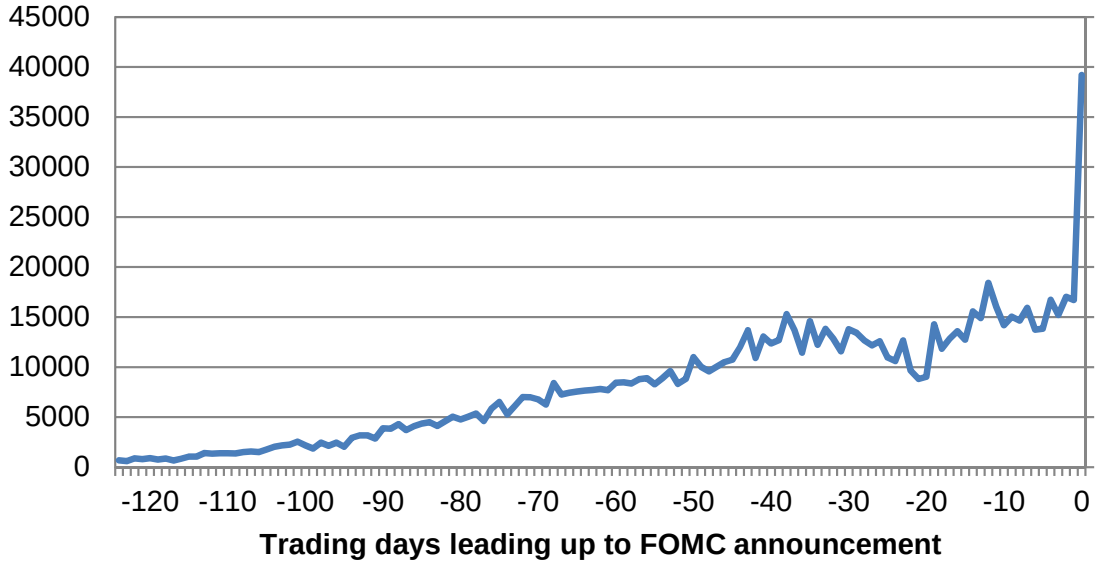
(a) Average absolute change



(b) Number of days with no change

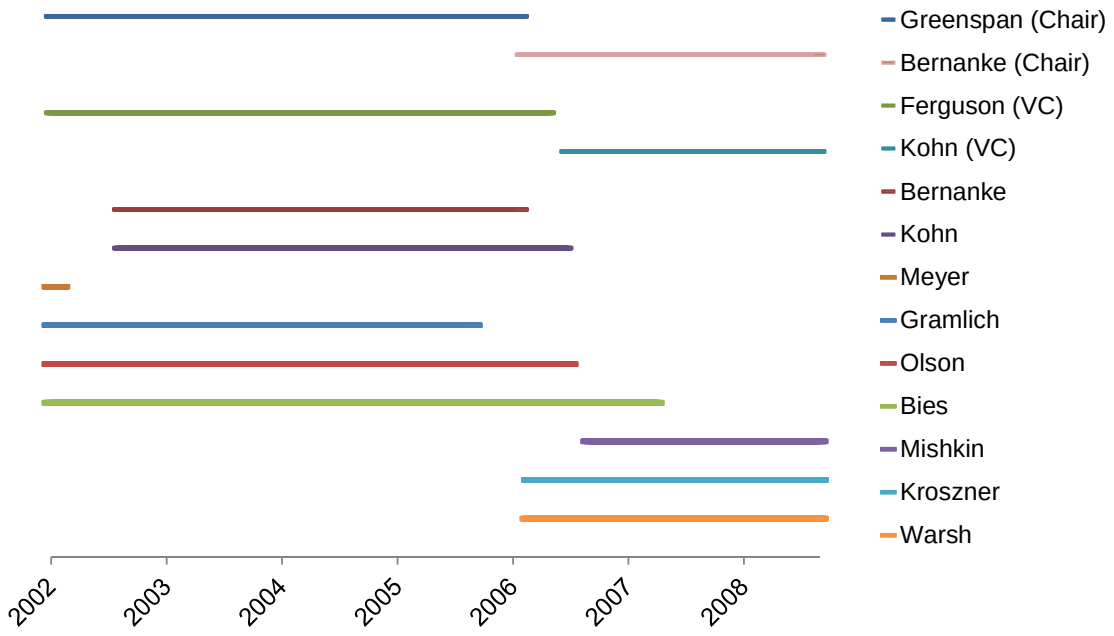
Note: Panel (a) shows the average absolute change in the expected target rate in event-time for the period of 124 trading days prior to an FOMC announcement day (excluding weekends and holidays). Panel (b) shows the number of days on which the expected target rate did not change in the period of 124 trading days prior to an FOMC announcement. The number of no-change days is shown separately for each FOMC announcement during the period January 2002 - September 2009. The period of 124 trading days prior to an announcement is divided into five sub-periods of 25 days each.

Figure 3: Trading volume fed funds futures preceding FOMC announcements

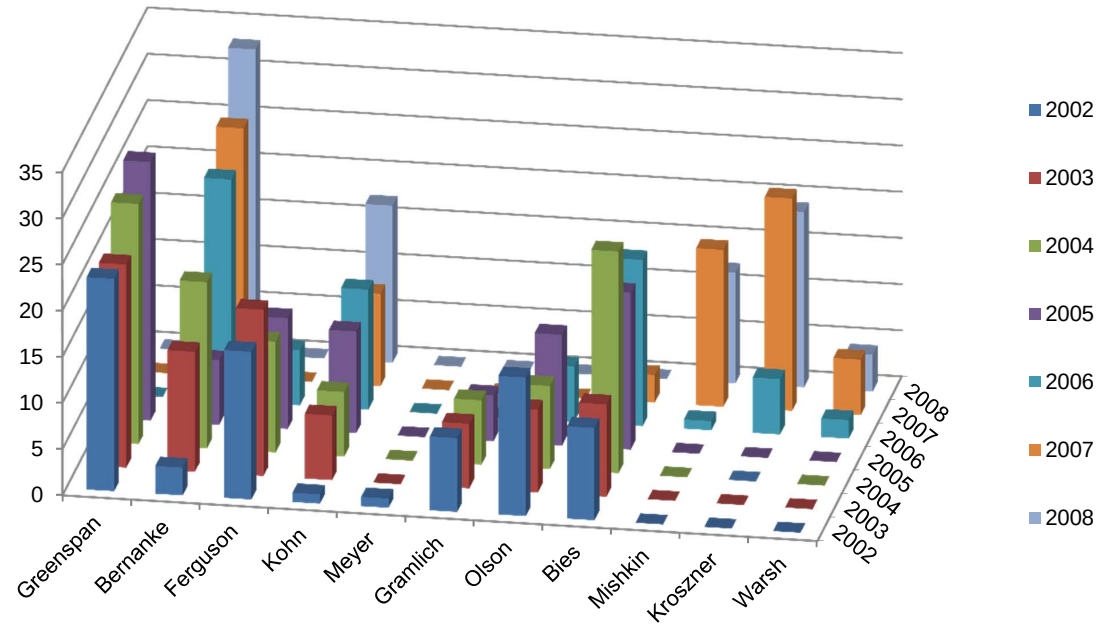


Note: The figure shows the average trading volume in Fed Funds futures in event-time for the 124 trading days prior to an FOMC announcement day (excluding weekends and holidays).

Figure 4: Board members' terms, speeches and testimonies



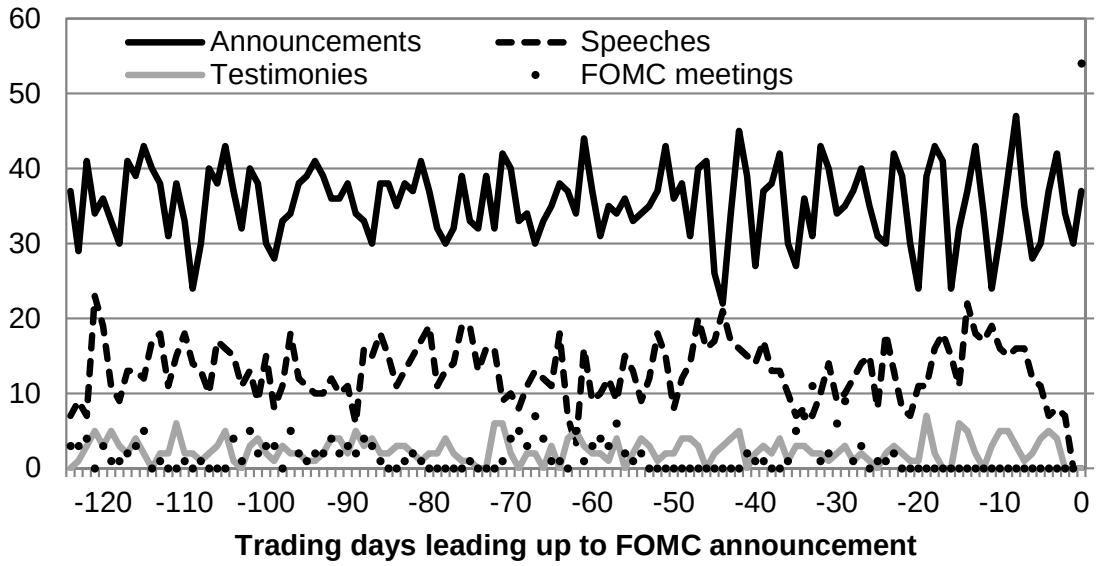
(a) Board membership



(b) Speeches and testimonies

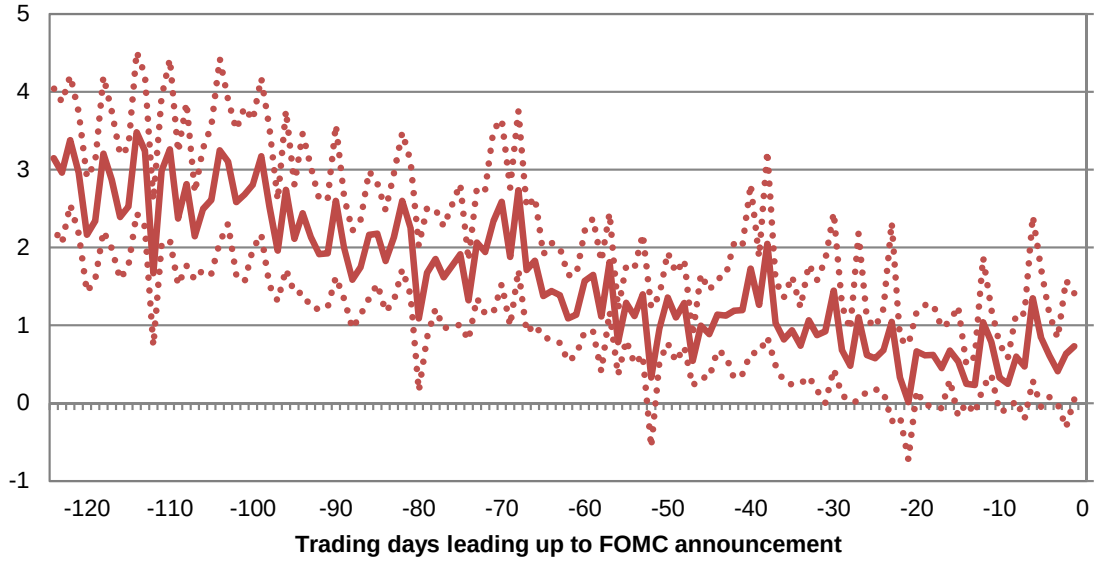
Note: Panel (a) shows the composition of the Federal Reserve Board during the period January 2002 - September 2008. Panel (b) shows the number of speeches and testimonies given by each of the Board members, by year.

Figure 5: Number of macro announcements, speeches, testimonies, and prior FOMC meetings



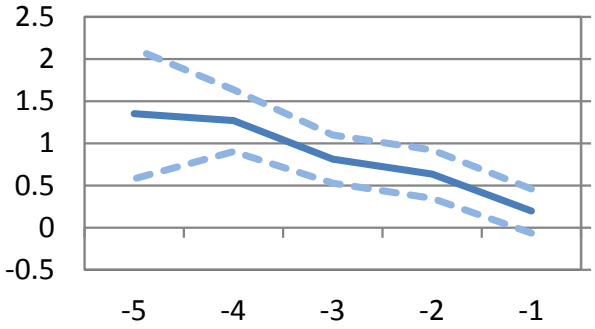
Note: The figure shows the number of macroeconomic announcements, speeches, testimonies, and prior FOMC meetings in event-time for the 124 trading days prior to an FOMC announcement day (excluding weekends and holidays).

Figure 6: Trading day effects



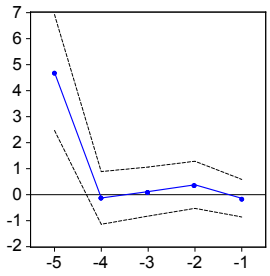
Note: The figure shows the estimates of the trading day effect coefficients ω_j in the baseline specification (2)-(3), estimated using the 54 FOMC announcements during the period January 2002 - September 2008, with $j = 1, 2, \ldots, 124$ indicating the j-th trading day prior to an FOMC announcement day (excluding weekends and holidays). The estimates of ω_j (solid line) are shown together with two standard error bands (dashed lines).

Figure 7: Aggregate setup effects of macroeconomic announcements

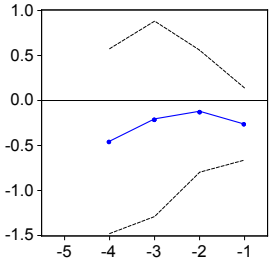


Note: The figure shows the coefficients on dummy variables for macro announcements that have occurred: (i) since the most recent FOMC meeting, (ii) more than one but less than two FOMC meetings ago, (iii) more than two but less than three meetings ago, (iv) more than three but less than four meetings ago, and (v) more than four but less than five meetings ago. These correspond to the labels -1, -2, -3, -4, and -5, respectively, on the horizontal axis. The coefficient estimates (solid line) are shown together with two standard error bands (dashed lines).

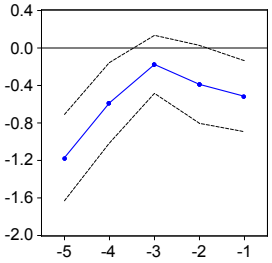
Figure 8: Time-varying effects of macro announcements



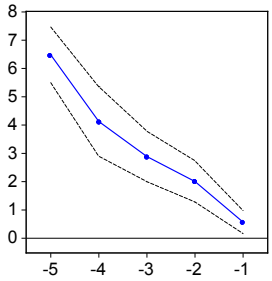
(a) GDP (advance)



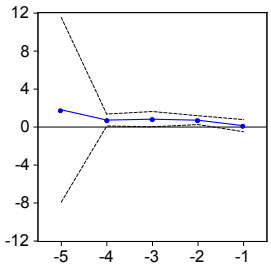
(b) GDP (preliminary)



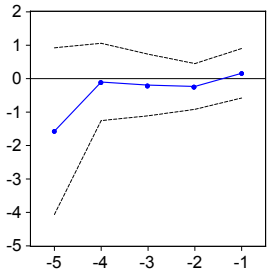
(c) GDP (final)



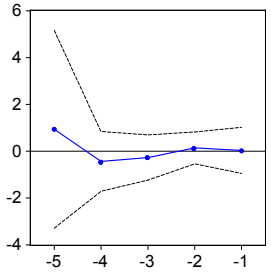
(d) Nonfarm payrolls



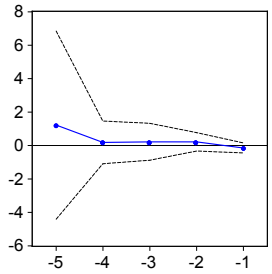
(e) Retail sales



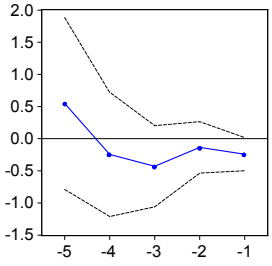
(f) Industrial production



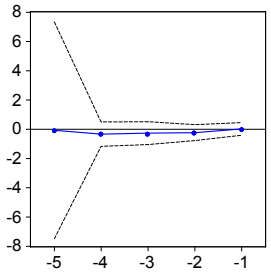
(g) Capacity utilization



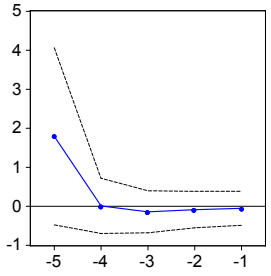
(h) Personal income



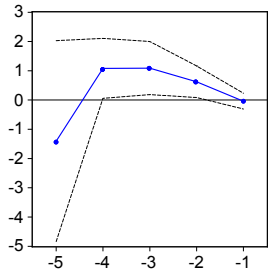
(i) Consumer credit



(j) Personal consumption exp.

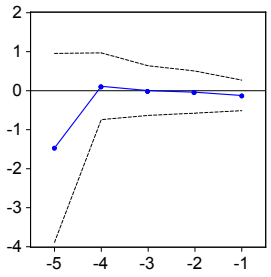


(k) New home sales

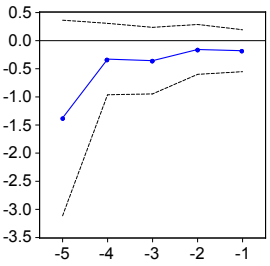


(l) Durable goods orders

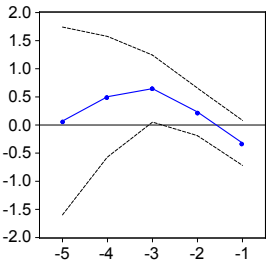
Figure 8: (continued) Time-varying effects of macro announcements



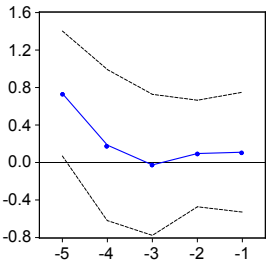
(m) Construction spending



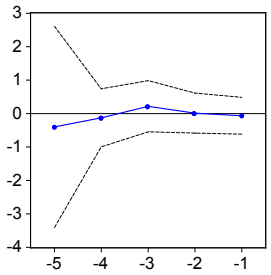
(n) Factory orders



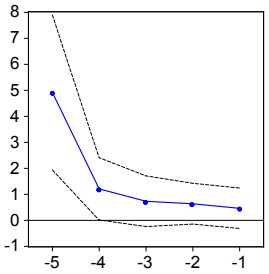
(o) Business inventories



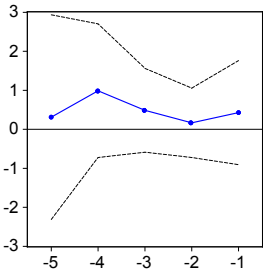
(p) Government budget deficit



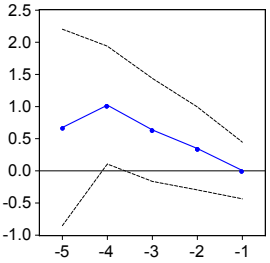
(q) Trade balance



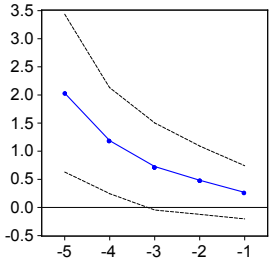
(r) Producer price index



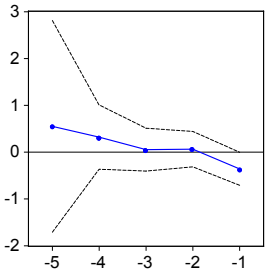
(s) Consumer price index



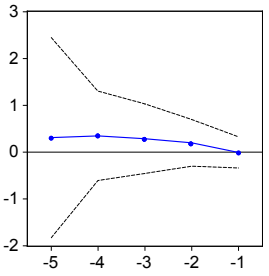
(t) Consumer confidence index



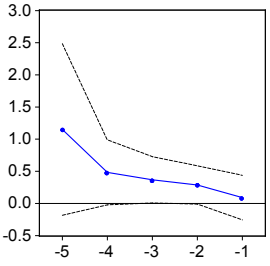
(u) NAPM index



(v) Housing starts



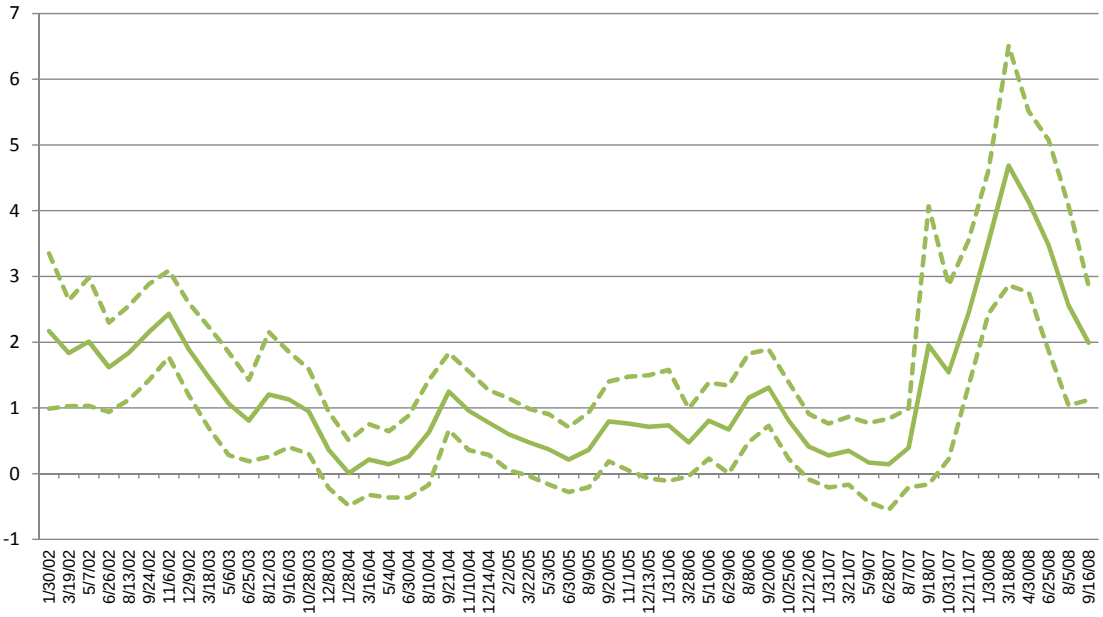
(w) Index of leading indicators



(x) Initial unemployment claims

Note: The graphs show the coefficients on the absolute surprise in macro announcements, in the specification where these are allowed to differ depending on the number of FOMC announcements ago they occur. The coefficient estimates (solid line) are shown together with two standard error bands (dashed lines).

Figure 9: FOMC meeting effects



Note: The figure shows the estimates of the FOMC meeting effect coefficients δ_i in the specification (2) with (4), estimated using the 54 FOMC announcements during the period January 2002 - September 2008. The coefficient estimates (solid line) are shown together with two standard error bands (dashed lines).

Market Set-Up in Advance of Federal Reserve Policy Rate Decisions

Web Appendix with Additional Results

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May 31, 2014

Table A.1: Trading day fixed effects - baseline specification

j	Coeff.	Std.Err.	j	Coeff.	Std.Err.	j	Coeff.	Std.Err.	j	Coeff.	Std.Err.
1	0.730	0.342	32	0.874	0.354	63	1.387	0.307	94	2.441	0.511
2	0.633	0.474	33	1.063	0.361	64	1.440	0.309	95	2.111	0.348
3	0.410	0.213	34	0.739	0.244	65	1.377	0.268	96	2.741	0.510
4	0.609	0.266	35	0.935	0.348	66	1.829	0.409	97	1.960	0.323
5	0.843	0.445	36	0.818	0.269	67	1.711	0.401	98	2.523	0.506
6	1.347	0.529	37	1.030	0.271	68	2.736	0.511	99	3.174	0.502
7	0.471	0.338	38	2.046	0.598	69	1.880	0.443	100	2.807	0.415
8	0.597	0.282	39	1.264	0.308	70	2.588	0.530	101	2.681	0.561
9	0.248	0.165	40	1.728	0.543	71	2.340	0.586	102	2.583	0.466
10	0.327	0.218	41	1.196	0.411	72	1.944	0.400	103	3.103	0.400
11	0.787	0.211	42	1.189	0.436	73	2.063	0.356	104	3.248	0.590
12	1.038	0.418	43	1.126	0.258	74	1.322	0.257	105	2.612	0.474
13	0.234	0.183	44	1.139	0.230	75	1.913	0.452	106	2.496	0.389
14	0.248	0.121	45	0.887	0.282	76	1.764	0.392	107	2.146	0.281
15	0.540	0.354	46	0.997	0.331	77	1.618	0.327	108	2.814	0.523
16	0.674	0.186	47	0.545	0.161	78	1.853	0.319	109	2.373	0.427
17	0.452	0.259	48	1.286	0.280	79	1.675	0.416	110	3.262	0.582
18	0.619	0.327	49	1.101	0.285	80	1.089	0.466	111	2.987	0.475
19	0.616	0.322	50	1.356	0.291	81	2.252	0.430	112	1.670	0.467
20	0.666	0.253	51	0.960	0.214	82	2.601	0.441	113	3.242	0.486
21	0.013	0.369	52	0.330	0.448	83	2.130	0.407	114	3.481	0.520
22	0.329	0.250	53	1.398	0.388	84	1.827	0.326	115	2.526	0.380
23	1.044	0.639	54	1.120	0.309	85	2.178	0.324	116	2.391	0.399
24	0.680	0.266	55	1.289	0.239	86	2.163	0.409	117	2.873	0.441
25	0.576	0.199	56	0.784	0.212	87	1.748	0.306	118	3.206	0.496
26	0.618	0.231	57	1.811	0.317	88	1.587	0.315	119	2.343	0.377
27	1.103	0.539	58	1.114	0.354	89	1.995	0.328	120	2.164	0.368
28	0.482	0.232	59	1.647	0.364	90	2.600	0.489	121	2.961	0.390
29	0.681	0.287	60	1.572	0.324	91	1.925	0.347	122	3.381	0.414
30	1.445	0.503	61	1.137	0.258	92	1.915	0.354	123	2.963	0.454
31	0.922	0.460	62	1.090	0.277	93	2.132	0.451	124	3.146	0.451

Note: The table shows estimates of the trading day 'fixed effects' ω_j, $j = 1, 2, \ldots, 124$, in the baseline regression model given by:

$$|\Delta \mathsf{E} f_{i,j,t}| = \alpha + \sum_{m=0}^{M} \theta_m D^F_{m,i,t} + \theta_u D^U_t + \sum_{k=1}^{K} \kappa_k D^S_{k,t} + \sum_{l=1}^{L} \lambda_l D^T_{l,t} + \sum_{n=1}^{N} \gamma_n |S_{n,t}| + \varepsilon_{i,j,t},$$

with

$$\varepsilon_{i,j,t} = \omega_j + \eta_{i,j,t},$$

estimated using the 54 scheduled FOMC announcements during the period January 2002 - September 2008, with $j = 1, 2, \ldots, 124$ indicating the j-th trading day prior to an FOMC announcement day (excluding weekends and holidays). Reported standard errors are heteroskedasticity and autocorrelation consistent. See Table 3 in the paper for comparison and notes of further details.

Table A.2: Results - using only speeches and testimony

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	2.281***	0.588	GDP (advance)		
Previous	1.513***	0.525	GDP (preliminary)		
2nd previous	2.009***	0.560	GDP (final)		
3rd previous	2.341***	0.642	Nonfarm payrolls		
4th previous	3.863***	0.908	Retail sales		
Unscheduled (θ_u)	19.282***	6.449	Industrial Production		
			Capacity Utilization		
Speeches (κ_k)			Personal Income		
Greenspan	0.085	0.153	Consumer Credit		
Bernanke (Governor)	−0.413***	0.153	Pers. Consump. Exp.		
Bernanke (Chair)	0.361	0.243	New Home Sales		
Ferguson	−0.286*	0.152	Durable Goods		
Kohn (Governor)	−0.401**	0.188	Constr. Spending		
Kohn (Vice-Chair)	1.387***	0.328	Factory Orders		
Meyer	5.654***	1.835	Business Inventories		
Gramlich	0.031	0.245	Government Purchases		
Olson	−0.266	0.179	Trade Balance		
Bies	−0.375***	0.133	Producer Price Index		
Mishkin	1.466***	0.542	Consumer Price Index		
Kroszner	0.313	0.308	Consumer Confidence		
Warsh	−0.209	0.460	ISM Manufacturing (NAPM)		
			Housing Starts		
Testimony (λ_l)			Leading Indicators		
Humphrey-Hawkins	0.622*	0.320	Initial Unemployment		
Testimony - Chair	0.653***	0.231			
Testimony - Others	−0.318**	0.156			

Note: The table shows estimation results when the absolute surprises of the macroeconomic announcements are omitted from the baseline specification in equations (2)-(3) in the paper. See Table 3 in the paper for comparison and notes of further details.

Table A.3: Results - using only macroeconomic announcements

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	2.170***	0.578	GDP (advance)	0.073	0.236
Previous	1.577***	0.508	GDP (preliminary)	−0.327	0.214
2nd previous	2.127***	0.539	GDP (final)	−0.543***	0.131
3rd previous	2.435***	0.624	Nonfarm payrolls	2.585***	0.252
4th previous	3.910***	0.881	Retail sales	0.705***	0.180
Unscheduled (θ_u)	22.791***	7.581	Industrial Production	−0.046	0.213
			Capacity Utilization	−0.109	0.255
Speeches (κ_k)			Personal Income	0.084	0.181
Greenspan			Consumer Credit	−0.350**	0.147
Bernanke (Governor)			Pers. Consump. Exp.	−0.192	0.166
Bernanke (Chair)			New Home Sales	−0.026	0.146
Ferguson			Durable Goods	0.734***	0.214
Kohn (Governor)			Constr. Spending	0.002	0.162
Kohn (Vice-Chair)			Factory Orders	−0.210	0.129
Meyer			Business Inventories	0.232	0.159
Gramlich			Government Purchases	0.099	0.176
Olson			Trade Balance	0.009	0.191
Bies			Producer Price Index	0.791***	0.241
Mishkin			Consumer Price Index	0.504	0.322
Kroszner			Consumer Confidence	0.490***	0.183
Warsh			ISM Manufacturing (NAPM)	0.667***	0.190
			Housing Starts	0.053	0.123
Testimony (λ_l)			Leading Indicators	0.209	0.165
Humphrey-Hawkins			Initial Unemployment	0.278***	0.101
Testimony - Chair					
Testimony - Others					

Note: The table shows estimation results when the dummies for speeches and testimony are omitted from the baseline specification in equations (2)-(3) in the paper. See Table 3 in the paper for comparison and notes of further details.

Table A.4: Results - using Ehrmann-Fratzscher (2009) definition of blackout period

Dummy variables			Continuous variables	Blackout		Not Blackout	
	Coeff.	Std.Err.		Coeff.	Std.Err.	Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)				
Current	2.147***	0.567	GDP (advance)	0.405	0.286	−0.368	0.403
Previous	1.654***	0.501	GDP (preliminary)			−0.255	0.213
2nd previous	2.201***	0.519	GDP (final)	−0.471**	0.194	−0.462***	0.158
3rd previous	2.511***	0.605	Nonfarm payrolls	3.925***	0.441	1.816***	0.239
4th previous	3.773***	0.869	Retail sales	0.849	0.539	0.698***	0.195
Unscheduled (θ_u)	22.832***	7.594	Industrial Production	0.303	0.564	−0.403	0.256
			Capacity Utilization	0.420	0.705	−0.117	0.256
Speeches (κ_k)			Personal Income	−0.175	0.128	0.597	0.405
Greenspan	0.001	0.142	Consumer Credit	−0.026	0.206	−0.278	0.182
Bernanke (Governor)	−0.240	0.157	Pers. Consump. Exp.	−0.157	0.131	−0.179	0.270
Bernanke (Chair)	0.283	0.228	New Home Sales	0.365	0.234	−0.264	0.184
Ferguson	−0.212	0.161	Durable Goods	−0.081	0.221	0.945***	0.254
Kohn (Governor)	−0.328*	0.198	Constr. Spending	−0.206	0.198	−0.018	0.229
Kohn (Vice-Chair)	1.558***	0.328	Factory Orders	−0.870***	0.194	0.021	0.183
Meyer	5.550***	1.900	Business Inventories	−0.147	0.267	0.578**	0.238
Gramlich	−0.092	0.261	Government Purchases	0.795***	0.279	−0.212**	0.093
Olson	−0.194	0.180	Trade Balance	−0.208	0.223	0.183	0.238
Bies	−0.522***	0.127	Producer Price Index	1.682***	0.513	0.209	0.206
Mishkin	1.763***	0.539	Consumer Price Index	1.882**	0.872	−0.108	0.152
Kroszner	0.651*	0.338	Consumer Confidence	0.954***	0.348	0.339*	0.191
Warsh	−0.100	0.466	ISM Manufacturing (NAPM)	0.405	0.310	0.731***	0.204
			Housing Starts	−0.261	0.334	0.191	0.133
Testimony (λ_l)			Leading Indicators	0.660**	0.296	0.097	0.199
Humphrey-Hawkins	0.896***	0.310	Initial Unemployment	0.664**	0.264	0.180*	0.099
Testimony - Chair	0.674***	0.225					
Testimony - Others	−0.179	0.158					

Note: The table shows estimation results from the modified baseline specification in equations (2)-(3) in the paper, allowing the coefficients on the absolute macroeconomic surprises to be different during the blackout period versus the non-blackout period (presented in Table 5), where the blackout period is redefined as the period from seven business days before an FOMC meeting until three business days thereafter, as in Ehrmann and Fratzscher (2009). See Table 5 in the paper for comparison and notes of further details.

Table A.5: Time-varying effects of speeches and testimony

m:	-5	-4	-3	-2	-1
Speeches (κ_k)					
Greenspan		-0.036	0.207	-0.126	-0.212
Bernanke (Governor)		-0.390	-0.359	-0.387	-0.249
Bernanke (Chair)		-0.082	0.729	0.328	0.470
Ferguson		-0.138	-0.305	-0.334^{*}	-0.365
Kohn (Governor)		-0.212	-0.474	-0.497	-0.357
Kohn (Vice-Chair)		2.624^{***}	1.887^{***}	0.875^{**}	0.813^{*}
Meyer		8.706^{*}	5.346^{**}	4.142^{***}	1.090
Gramlich		0.075	0.154	-0.209	-0.460^{**}
Olson		-0.080	-0.197	-0.198	-0.292
Bies		-0.437	-0.589^{**}	-0.279	-0.373^{**}
Mishkin		1.203	1.749	1.524	2.225^{**}
Kroszner		0.410	0.525	0.715	0.648
Warsh		-0.521	-0.480	0.568	-0.091
Testimony (λ_l)					
Humphrey-Hawkins		1.478^{*}	0.761	0.917^{*}	0.105
Testimony - Chair	1.817	0.986^{*}	0.605	0.759^{*}	0.321
Testimony - Others	-0.253	-0.163	-0.343	-0.285	-0.175

Note: The table shows estimation results from the baseline specification in equations (2)-(3) in the paper but with the coefficients on the speech and testimony dummy variables allowed to differ depending on how many FOMC meetings ago the macro announcement occurred. Coefficients reported in the column labeled m, $m = -5, -4, \ldots, -1$ correspond to speeches and testimony that occurred between the $|m|$-th and $|(m-1)|$-th FOMC meeting prior to meeting i (where the 0-th previous meeting is meeting i itself). Speeches and the Humphrey-Hawkins testimony between the 5-th and 3-rd prior meeting are combined in the category '-4'. The model is estimated using the 54 FOMC announcements during the period January 2002 - September 2008, using 124 trading day prior to an FOMC announcement day (excluding weekends and holidays). The superscripts ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table A.6: Results - omitting the FOMC announcement day

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current			GDP (advance)	0.053	0.224
Previous	1.603***	0.513	GDP (preliminary)	−0.263	0.212
2nd previous	2.166***	0.543	GDP (final)	−0.496***	0.128
3rd previous	2.474***	0.628	Nonfarm payrolls	2.553***	0.251
4th previous	3.934***	0.884	Retail sales	0.677***	0.185
Unscheduled (θ_u)	22.840***	7.584	Industrial Production	−0.100	0.228
			Capacity Utilization	−0.095	0.260
Speeches (κ_k)			Personal Income	0.090	0.183
Greenspan	−0.050	0.145	Consumer Credit	−0.249*	0.149
Bernanke (Governor)	−0.352**	0.165	Pers. Consump. Exp.	−0.199	0.163
Bernanke (Chair)	0.377	0.248	New Home Sales	−0.061	0.138
Ferguson	−0.294*	0.162	Durable Goods	0.734***	0.217
Kohn (Governor)	−0.391*	0.201	Constr. Spending	−0.015	0.159
Kohn (Vice-Chair)	1.452***	0.327	Factory Orders	−0.258*	0.139
Meyer	5.542***	1.893	Business Inventories	0.218	0.162
Gramlich	−0.089	0.264	Government Purchases	0.106	0.175
Olson	−0.189	0.184	Trade Balance	0.036	0.178
Bies	−0.426***	0.123	Producer Price Index	0.698***	0.235
Mishkin	1.690***	0.550	Consumer Price Index	0.492	0.308
Kroszner	0.564*	0.321	Consumer Confidence	0.482***	0.175
Warsh	−0.079	0.462	ISM Manufacturing (NAPM)	0.720***	0.184
			Housing Starts	−0.007	0.122
Testimony (λ_l)			Leading Indicators	0.200	0.168
Humphrey-Hawkins	0.803**	0.322	Initial Unemployment	0.318***	0.105
Testimony - Chair	0.681***	0.229			
Testimony - Others	−0.247	0.159			

Note: The table shows estimation results from the baseline specification in equations (2)-(3) in the paper when the day of the FOMC announcement ($j = 0$) itself is omitted from the estimation. See Table 3 in the paper for comparison and notes of further details.

Table A.7: Results - lagging speeches and testimony

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	2.174***	0.580	GDP (advance)	0.018	0.237
Previous	1.628***	0.513	GDP (preliminary)	−0.441*	0.252
2nd previous	2.157***	0.541	GDP (final)	−0.540***	0.143
3rd previous	2.447***	0.628	Nonfarm payrolls	2.527***	0.238
4th previous	3.664***	0.861	Retail sales	0.705***	0.175
Unscheduled (θ_u)	22.817***	7.594	Industrial Production	−0.062	0.216
			Capacity Utilization	−0.061	0.260
Speeches (κ_k)			Personal Income	0.029	0.186
Greenspan	0.278	0.178	Consumer Credit	−0.314**	0.146
Bernanke (Governor)	−0.664***	0.154	Pers. Consump. Exp.	−0.138	0.173
Bernanke (Chair)	0.881***	0.255	New Home Sales	0.002	0.148
Ferguson	−0.036	0.177	Durable Goods	0.758***	0.215
Kohn (Governor)	−0.605***	0.165	Constr. Spending	−0.005	0.166
Kohn (Vice-Chair)	0.108	0.310	Factory Orders	−0.257*	0.132
Meyer	−0.526	0.439	Business Inventories	0.253	0.159
Gramlich	−0.167	0.203	Government Purchases	0.104	0.173
Olson	0.053	0.168	Trade Balance	0.032	0.187
Bies	−0.127	0.145	Producer Price Index	0.621***	0.234
Mishkin	0.087	0.288	Consumer Price Index	0.501	0.328
Kroszner	0.887**	0.378	Consumer Confidence	0.472**	0.184
Warsh	0.286	0.380	ISM Manufacturing (NAPM)	0.723***	0.193
			Housing Starts	0.072	0.122
Testimony (λ_l)			Leading Indicators	0.297*	0.163
Humphrey-Hawkins	−1.162***	0.289	Initial Unemployment	0.301***	0.104
Testimony - Chair	−0.297	0.214			
Testimony - Others	0.312	0.206			

Note: The table shows estimation results from the baseline specification in equations (2)-(3) in the paper when the speech and testimony dummy variables are lagged by one day. See Table 3 in the paper for comparison and notes of further details.

Table A.8: Results - lagging all explanatory variables

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	2.326***	0.590	GDP (advance)	−0.024	0.277
Previous	−0.046	0.266	GDP (preliminary)	0.081	0.395
2nd previous	0.006	0.282	GDP (final)	0.057	0.313
3rd previous	0.157	0.434	Nonfarm payrolls	−0.445***	0.131
4th previous	−0.506	0.519	Retail sales	0.966***	0.260
Unscheduled (θ_u)	5.445***	1.382	Industrial Production	−0.293	0.217
			Capacity Utilization	0.023	0.234
Speeches (κ_k)			Personal Income	−0.145	0.115
Greenspan	0.241	0.195	Consumer Credit	0.055	0.126
Bernanke (Governor)	−0.681***	0.162	Pers. Consump. Exp.	−0.287*	0.165
Bernanke (Chair)	0.449*	0.238	New Home Sales	−0.590***	0.093
Ferguson	−0.013	0.173	Durable Goods	0.145	0.180
Kohn (Governor)	−1.040***	0.168	Constr. Spending	−0.052	0.146
Kohn (Vice-Chair)	0.130	0.341	Factory Orders	0.188	0.147
Meyer	−0.732	0.531	Business Inventories	−0.072	0.184
Gramlich	−0.283	0.206	Government Purchases	−0.181	0.136
Olson	0.055	0.201	Trade Balance	0.174	0.191
Bies	−0.194	0.149	Producer Price Index	−0.054	0.159
Mishkin	0.167	0.311	Consumer Price Index	0.385*	0.222
Kroszner	0.489	0.372	Consumer Confidence	0.243*	0.133
Warsh	0.131	0.384	ISM Manufacturing (NAPM)	0.332	0.243
			Housing Starts	−0.395***	0.123
Testimony (λ_l)			Leading Indicators	−0.121	0.195
Humphrey-Hawkins	−0.689**	0.295	Initial Unemployment	0.582***	0.096
Testimony - Chair	−0.454**	0.190			
Testimony - Others	0.179	0.204			

Note: The table shows estimation results from the baseline specification in equations (2)-(3) in the paper when both the speech and testimony dummy variables as well as the macroeconomic surprises are lagged by one day. See Table 3 in the paper for comparison and notes of further details.

Table A.9: Results - allowing for FOMC meeting effects

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	0.940*	0.546	GDP (advance)	0.132	0.190
Previous	1.583***	0.476	GDP (preliminary)	−0.054	0.225
2nd previous	2.129***	0.497	GDP (final)	−0.189	0.135
3rd previous	2.443***	0.580	Nonfarm payrolls	2.696***	0.253
4th previous	3.809***	0.803	Retail sales	0.628***	0.169
Unscheduled (θ_u)	20.837***	7.336	Industrial Production	−0.084	0.222
			Capacity Utilization	−0.053	0.244
Speeches (κ_k)			Personal Income	0.099	0.190
Greenspan	0.130	0.138	Consumer Credit	−0.321**	0.149
Bernanke (Governor)	0.166	0.153	Pers. Consump. Exp.	−0.163	0.173
Bernanke (Chair)	0.064	0.224	New Home Sales	0.175	0.138
Ferguson	−0.145	0.140	Durable Goods	0.645***	0.209
Kohn (Governor)	0.153	0.183	Constr. Spending	−0.043	0.161
Kohn (Vice-Chair)	0.871**	0.342	Factory Orders	−0.226*	0.127
Meyer	4.673**	1.877	Business Inventories	0.190	0.156
Gramlich	−0.061	0.259	Government Purchases	0.088	0.129
Olson	−0.111	0.178	Trade Balance	0.069	0.170
Bies	−0.034	0.110	Producer Price Index	0.674***	0.231
Mishkin	0.376	0.490	Consumer Price Index	0.413	0.278
Kroszner	−0.071	0.296	Consumer Confidence	0.396**	0.168
Warsh	−0.493	0.433	ISM Manufacturing (NAPM)	0.765***	0.179
			Housing Starts	0.123	0.114
Testimony (λ_l)			Leading Indicators	0.075	0.142
Humphrey-Hawkins	0.781***	0.287	Initial Unemployment	0.201**	0.090
Testimony - Chair	0.598***	0.221			
Testimony - Others	−0.377**	0.164			

Note: The table shows estimation results from the specification in equations (2) and (4) in the paper, allowing for FOMC meeting effects to accommodate time-varying volatility (see also Figure 9 in the paper). See Table 3 in the paper for comparison and notes of further details.

Table A.10: Results - using 20-day lookback period

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	2.244***	0.574	GDP (advance)	0.046	0.438
Previous			GDP (preliminary)	−0.143	0.225
2nd previous			GDP (final)	−0.543**	0.261
3rd previous			Nonfarm payrolls	0.554**	0.262
4th previous			Retail sales	0.254	0.297
Unscheduled (θ_u)	51.245***	0.212	Industrial Production	−0.181	0.556
			Capacity Utilization	0.338	0.773
Speeches (κ_k)			Personal Income	−0.094	0.260
Greenspan	−0.011	0.276	Consumer Credit	−0.151	0.172
Bernanke (Governor)	−0.186	0.348	Pers. Consump. Exp.	−0.044	0.298
Bernanke (Chair)	0.832	0.562	New Home Sales	0.111	0.298
Ferguson	−0.021	0.302	Durable Goods	0.061	0.161
Kohn (Governor)	−0.196	0.299	Constr. Spending	−0.003	0.228
Kohn (Vice-Chair)	1.187*	0.659	Factory Orders	−0.140	0.254
Meyer	1.667**	0.843	Business Inventories	−0.283	0.265
Gramlich	−0.477**	0.230	Government Purchases	0.232	0.427
Olson	−0.139	0.279	Trade Balance	−0.056	0.402
Bies	−0.405**	0.168	Producer Price Index	0.652	0.582
Mishkin	4.395***	1.251	Consumer Price Index	0.850	1.019
Kroszner	1.321	1.037	Consumer Confidence	0.033	0.274
Warsh	0.107	0.768	ISM Manufacturing (NAPM)	0.151	0.285
			Housing Starts	−0.147	0.198
Testimony (λ_l)			Leading Indicators	0.241	0.229
Humphrey-Hawkins	0.024	0.458	Initial Unemployment	0.006	0.134
Testimony - Chair	0.075	0.244			
Testimony - Others	−0.124	0.310			

Note: The table shows estimation results from the baseline specification in equations (2)-(3) in the paper when the lookback period is limited to 20 business days prior to the FOMC meeting. See Table 3 in the paper for comparison and notes of further details.

Table A.11: Results - using dummies for macroeconomic announcements

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	2.050***	0.578	GDP (advance)	0.509*	0.293
Previous	1.542***	0.512	GDP (preliminary)	0.546*	0.308
2nd previous	2.166***	0.541	GDP (final)	−0.866***	0.207
3rd previous	2.451***	0.624	Nonfarm payrolls	2.538***	0.222
4th previous	3.977***	0.899	Retail sales	0.081	0.151
Unscheduled (θ_u)	22.957***	7.583	Industrial Production	−0.274	0.175
			Capacity Utilization	0.224	0.180
Speeches (κ_k)			Personal Income		
Greenspan	0.076	0.151	Consumer Credit		
Bernanke (Governor)	−0.474***	0.170	Pers. Consump. Exp.	0.215	0.171
Bernanke (Chair)	0.427*	0.251	New Home Sales	−0.230	0.152
Ferguson	−0.314**	0.160	Durable Goods	0.627***	0.173
Kohn (Governor)	−0.358*	0.186	Constr. Spending	−0.079	0.166
Kohn (Vice-Chair)	1.015***	0.305	Factory Orders	−0.090	0.137
Meyer	5.745***	1.896	Business Inventories	0.062	0.165
Gramlich	−0.212	0.256	Government Purchases	−0.030	0.144
Olson	−0.243	0.182	Trade Balance	0.089	0.195
Bies	−0.453***	0.130	Producer Price Index	0.919***	0.195
Mishkin	1.863***	0.559	Consumer Price Index	0.628***	0.195
Kroszner	0.353	0.338	Consumer Confidence	0.172	0.136
Warsh	−0.280	0.391	ISM Manufacturing (NAPM)	0.309**	0.135
			Housing Starts	0.247	0.154
Testimony (λ_l)			Leading Indicators	0.107	0.142
Humphrey-Hawkins	0.647**	0.327	Initial Unemployment	0.425***	0.102
Testimony - Chair	0.662***	0.231			
Testimony - Others	−0.318**	0.160			

Note: The table shows estimation results when dummy variables $D^A_{n,t}$ (that is equal to 1 if there was an announcement of macro variable n ($n = 1, 2 \ldots, N = 24$) on day t and 0 if there was no such announcement) for the macroeconomic announcements are included in the baseline specification in equations (2)-(3) in the paper, instead of the absolute surprises $|S_{n,t}|$. See Table 3 in the paper for comparison and notes of further details.

Table A.12: Results - including volume

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	0.192	0.587	GDP (advance)	−0.078	0.229
Previous	1.109**	0.503	GDP (preliminary)	−0.340*	0.206
2nd previous	2.022***	0.543	GDP (final)	−0.482***	0.139
3rd previous	2.430***	0.625	Nonfarm payrolls	2.301***	0.261
4th previous	3.932***	0.883	Retail sales	0.631***	0.196
Unscheduled (θ_u)	21.991***	7.419	Industrial Production	−0.090	0.228
			Capacity Utilization	−0.158	0.257
Speeches (κ_k)			Personal Income	0.043	0.178
Greenspan	0.044	0.143	Consumer Credit	−0.257*	0.147
Bernanke (Governor)	−0.290*	0.166	Pers. Consump. Exp.	−0.096	0.158
Bernanke (Chair)	0.185	0.244	New Home Sales	−0.041	0.138
Ferguson	−0.257*	0.156	Durable Goods	0.735***	0.212
Kohn (Governor)	−0.506***	0.190	Constr. Spending	−0.108	0.160
Kohn (Vice-Chair)	1.104***	0.336	Factory Orders	−0.260**	0.132
Meyer	5.586***	1.881	Business Inventories	0.158	0.162
Gramlich	−0.019	0.264	Government Purchases	0.099	0.168
Olson	−0.154	0.180	Trade Balance	−0.020	0.168
Bies	−0.473***	0.122	Producer Price Index	0.787***	0.244
Mishkin	1.694***	0.557	Consumer Price Index	0.467	0.305
Kroszner	0.355	0.324	Consumer Confidence	0.482***	0.172
Warsh	−0.182	0.452	ISM Manufacturing (NAPM)	0.618***	0.179
			Housing Starts	0.001	0.120
Testimony (λ_l)			Leading Indicators	0.214	0.166
Humphrey-Hawkins	0.561	0.356	Initial Unemployment	0.282***	0.105
Testimony - Chair	0.540**	0.222			
Testimony - Others	−0.323**	0.157	Volume	0.051***	0.009

Note: The table shows estimation results when volume (in 000s) is included as an additional explanatory variable in the baseline specification in equations (2)-(3) in the paper. See Table 3 in the paper for comparison and notes of further details.

Table A.13: Results - Tobit specification

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	0.847	0.604	GDP (advance)	−0.056	0.253
Previous	2.041***	0.526	GDP (preliminary)	−0.629**	0.272
2nd previous	2.681***	0.537	GDP (final)	−0.855***	0.287
3rd previous	2.868***	0.629	Nonfarm payrolls	3.113***	0.252
4th previous	4.262***	0.874	Retail sales	0.853***	0.179
Unscheduled (θ_u)	24.111***	7.619	Industrial Production	0.096	0.251
			Capacity Utilization	−0.155	0.283
Speeches (κ_k)			Personal Income	−0.021	0.190
Greenspan	0.124	0.161	Consumer Credit	−0.241	0.166
Bernanke (Governor)	−0.449**	0.212	Pers. Consump. Exp.	−0.100	0.178
Bernanke (Chair)	0.684**	0.273	New Home Sales	−0.024	0.150
Ferguson	−0.286	0.193	Durable Goods	0.919***	0.215
Kohn (Governor)	−0.538**	0.249	Constr. Spending	0.217	0.169
Kohn (Vice-Chair)	2.182***	0.334	Factory Orders	−0.238	0.148
Meyer	6.153***	1.892	Business Inventories	0.495***	0.167
Gramlich	0.078	0.280	Government Purchases	0.188	0.191
Olson	−0.103	0.213	Trade Balance	−0.033	0.188
Bies	−0.484***	0.158	Producer Price Index	0.990***	0.248
Mishkin	2.097***	0.565	Consumer Price Index	0.506	0.319
Kroszner	0.982***	0.337	Consumer Confidence	0.695***	0.179
Warsh	−0.402	0.539	ISM Manufacturing (NAPM)	1.064***	0.190
			Housing Starts	0.011	0.128
Testimony (λ_l)			Leading Indicators	0.444**	0.174
Humphrey-Hawkins	1.215***	0.333	Initial Unemployment	0.476***	0.107
Testimony - Chair	0.928***	0.237			
Testimony - Others	−0.028	0.189			

Note: The table shows estimation results using a Tobit specification instead of the linear regression in the baseline specification in equations (2)-(3) in the paper. See Table 3 in the paper for comparison and notes of further details.

Table A.14: Results - using observations with nonzero changes in the expected target rate only

Dummy variables			Continuous variables		
	Coeff.	Std.Err.		Coeff.	Std.Err.
FOMC meetings (θ_m)			**Macro announcements** (γ_n)		
Current	4.199***	0.950	GDP (advance)	0.471	0.343
Previous	2.402***	0.717	GDP (preliminary)	−0.433	0.383
2nd previous	2.020***	0.573	GDP (final)	−0.692***	0.171
3rd previous	2.165***	0.626	Nonfarm payrolls	2.561***	0.275
4th previous	3.904***	0.865	Retail sales	0.625***	0.197
Unscheduled (θ_u)	22.017***	7.361	Industrial Production	−0.149	0.307
			Capacity Utilization	−0.139	0.362
Speeches (κ_k)			Personal Income	0.444	0.349
Greenspan	−0.186	0.183	Consumer Credit	−0.331	0.204
Bernanke (Governor)	−0.469**	0.226	Pers. Consump. Exp.	−0.419*	0.216
Bernanke (Chair)	0.459	0.310	New Home Sales	0.067	0.189
Ferguson	−0.321	0.202	Durable Goods	0.905***	0.237
Kohn (Governor)	−0.600**	0.269	Constr. Spending	−0.152	0.200
Kohn (Vice-Chair)	0.992***	0.361	Factory Orders	−0.385**	0.189
Meyer	5.002***	1.888	Business Inventories	0.104	0.197
Gramlich	−0.265	0.326	Government Purchases	0.315	0.254
Olson	−0.330	0.232	Trade Balance	0.078	0.242
Bies	−0.502***	0.162	Producer Price Index	0.971***	0.304
Mishkin	1.768***	0.588	Consumer Price Index	0.950**	0.434
Kroszner	0.547	0.406	Consumer Confidence	0.511**	0.223
Warsh	0.408	0.641	ISM Manufacturing (NAPM)	0.743***	0.218
			Housing Starts	0.202	0.183
Testimony (λ_l)			Leading Indicators	0.088	0.202
Humphrey-Hawkins	0.566	0.389	Initial Unemployment	0.324**	0.126
Testimony - Chair	0.847***	0.277			
Testimony - Others	−0.523***	0.201			

Note: The table shows estimation results from the baseline specification in equations (2)-(3) in the paper, using only observations with nonzero changes in the expected target rate. See Table 3 in the paper for comparison and notes of further details.