Policy, News and Noise: Do Funds Rate Surprises Matter Anymore?

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PRELIMINARY

Abstract

What explains the day-to-day volatility in the expected federal funds rate? This paper proposes a decomposition of the variance of changes in federal funds rate into components associated with unexpected policy actions, macroeconomic data releases, and various forms of communication. Except during periods of drastic rate cuts, markets have in recent years rarely been surprised by the FOMC's decisions and expectations have become more stable between meetings, reflecting a trend towards greater transparency. Key macroeconomic data releases and speeches by the Fed chair strongly influence policy expectations. Minutes, speeches and testimony have had mixed success in guiding expectations towards the proximate meeting's target, and on occasion moved expectations in the wrong direction. Macro data releases exert a strong influence on policy expectations, but other sources of information also have significant effects.

Keywords: Monetary policy, federal funds rate, transparency

JEL classification: E43, E44, E61, G14

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1 Introduction

Much has been written about monetary policy surprises, and their effects on financial markets and the real economy. The Federal Open Market Committee (FOMC) has become more predictable over the years, however, and surprise actions have become rarer. But predictable does not necessarily mean predetermined: various sorts of news, including macroeconomic data releases and Fed communication, surely lead to revisions in policy expectations. This paper's goal is to assess the predictability of Fed policy and the extent to which the one- or two-meeting ahead target rate is known in advance. It also aims to quantify the contributions of policy surprises and news to the revision of expectations between FOMC meetings. We depart from most previous work in its analysis of the evolution of policy expectations *throughout* the inter-meeting period, rather than focus narrowly on the policy surprises occurring at FOMC meetings, or on a limited set of communication "events."

Our analysis has a lot to say about central bank transparency, which we associate with the predictability of policy actions. A crucial (but arguably underappreciated) point is that transparency comes in two forms. The first is forward guidance, broadly defined: communicating with some degree of specificity the likely interest rate target ahead of time. A central bank could be transparent in this sense even if it were vague about the policy rule or set policy on the basis of discretion; so long as it telegraphed its intentions in advance of the interest rate decisions, its actions would not surprise market participants.

The second form of transparency comes from clarity about the policy rule. In this case, the central bank does not give specific indications as to the next policy action, but it communicates the policy rule with sufficient clarity that market participants know how policy will respond to incoming macroeconomic data. Comparing the responses of policy expectations to statements and speeches with those to macroeconomic data releases will provide some insight as to the relative importance of the two forms of transparency.

This paper relates to a vast literature on the information content of Fed policy actions and pronouncements. Much of the literature, building on early work by Kuttner (2001), Bernanke & Kuttner (2005), Gürkaynak (2005), Gürkaynak *et al.* (2005a) and Gürkaynak *et al.* (2005b), examines financial markets' responses to surprise target rate changes and the announcements that accompany them. A number of recent papers, including Swanson (2023), Swanson & Jayawickrema (2023) and Altavilla *et al.* (2025), have looked at markets' responses to Fed communication, such as speeches, minutes and congressional testimony, associated with days other than those of FOMC meetings. And it also speaks to the literature on central bank communication, transparency, and policy predictability such as Swanson (2006) and Middeldorp (2011).

The paper also relates to research on the relationship between economic news and long-term interest rates, including the work of Gürkaynak *et al.* (2005b), Hamilton *et al.* (2011), Altavilla *et al.* (2017) and Hanson *et al.* (2018), focused on the response of long-term rates to news. But our effort is more closely linked to the relatively sparse literature on how news affects expectations of the funds rate target, such as Hamilton *et al.* (2011). It is also in the same spirit as Fatum & Scholnick (2006), one of the rare papers that looks at the financial market response (in this case, the foreign exchange market) to shifts in policy expectations that occur *between* FOMC meetings.

The main findings are as follows. First, funds rate surprises have become smaller and less frequent since the 1990s. Second, inter-meeting expectations have become less volatile. Both findings are symptomatic of increasing transparency. Third, macroeconomic data releases and speeches by the Chair significantly influence inter-meeting revisions in expectations; but because the former are much more frequent than the latter, policy rule clarity makes the larger contribution to overall transparency. Fourth, bond yields respond strongly to expectations revisions associated with surprise policy actions, macroeconomic data releases and policy-related announcements—and also to the frequent shifts in expectations with no obvious connection to macro news or policy announcements. Fifth, some of the variance in policy expectations attributed to Fed communication comes from instances in which markets misinterpreted the communication.

The road map for the remainder of the paper: Section 2 introduces the decomposition of the target rate chances. Section 3 uses the decomposition proposed in section 2 to assess the contributions of different types of days to meeting-to-meeting changes in the funds rate target. The section also use these results to distinguish different nature and degree of policymaking transparency. Section 4 examines the day-to-day changes in the expected target (expectations revisions) on non-policy days and section 5 concludes.

2 Decomposing target rate changes

Our focus is on the expectations of policy actions at specific meetings. The dates of the FOMC meetings do not line up with calendar dates, however. Therefore, the decomposition of meeting-to-meeting change in the funds rate target requires defining time indexes representing the (irregularly) spaced meetings, and (varying) days between meetings. We will start by introducing the notation needed to keep track of meetings, days between meetings, and calendar dates.

The variables and indexes are defined as follows:

- i is the index corresponding to the upcoming meeting.
- T_i = target FF rate set at the upcoming meeting.

- $\hat{T}^h_{i,d}$ = the market's expected target funds rate set at meeting $i+h$, d days after meeting $i-1$. With $h=0$, the expectation pertains to the upcoming meeting; with $h=1$, the expectation is for the *following* meeting.
- D = the number of days between FOMC meetings. Strictly speaking, since the number of days between cycles varies, D should be indexed D_i; but to keep things simple (and avoid the typographic misdemeanor of a double subscript) the i subscript will be suppressed.

Keeping track of meetings, horizons, and days in between meetings gets a little complicated, so a concrete example might help. Suppose "1" represents the meeting that occurred on September 18, 2024; meeting "2" is the one scheduled for November 7. From September 18 through November 6, the "upcoming" meeting is the one taking place on November 7 ($i=2$). The target rate set at the November 7 meeting is T_2. The market's expectation of the November 7 funds rate target ($h=0$), zero days ($d=0$) after the September 18 meeting (at the close of business *after* the announcement of the new target) is $\hat{T}^0_{2,0}$. The market's expectation as of the close of business the next day, the 19th is $\hat{T}^0_{2,1}$. Since there are 35 business days between September 18 and November 7 ($D=35$), $\hat{T}^0_{2,35}$ would represent the expected funds rate target as of November 6.

Keeping track of the timing for the "following" meeting ($h=1$) is slightly more complicated, as a third meeting date comes into play. Continuing with the same example, with November 7 as the "upcoming" meeting ($i=2$): with $h=1$, $\hat{T}^1_{2,d}$ represents the expected target for the December meeting, d days following the September meeting. With $d=0$, $\hat{T}^1_{2,0}$ is the expected December 18 target rate, as of the close of business on September 18, $\hat{T}^1_{2,1}$ is the expectation as of September 19, and $\hat{T}^1_{2,35}$ is the expectation as of November 6.

2.1 Expectations of the upcoming meeting's target

With the complicated notation out of the way, we can now show how the change in the funds rate target from one meeting to the next can be broken down into three pieces, each with its own interpretation. To fix ideas, we will start with a simple example with $i=2$ and $D=3$ (three days between meetings 1 and 2). Let's look at the expected funds rate target set at the "upcoming" meeting, $h=0$. The breakdown is as follows:

$$\begin{aligned}[T_2 - T_1] \;=\; & [\hat{T}^0_{2,0} - T_1] + \\ & [\hat{T}^0_{2,1} - \hat{T}^0_{2,0}] + [\hat{T}^0_{2,2} - \hat{T}^0_{2,1}] + [\hat{T}^0_{2,3} - \hat{T}^0_{2,2}] + \\ & [T_2 - \hat{T}^0_{2,3}] \end{aligned} \tag{1}$$

It is trivial to verify that all the terms involving the $\hat{T}$s on the right-hand-side cancel, leaving only $T_2 - T_1$.

The terms' interpretation is far more interesting than the math.

- The term on the left-hand side of the equation on the first line [orange brackets] is, of course, the actual target rate change.
- The term on the right-hand side of the equation on the first line [blue brackets] is the expected (as of the the end of meeting 1) change in the target from meeting 1 to meeting 2.
- The terms on the second line [green brackets] are the revisions in the expected target on days between meetings. The revisions are presumably caused by the arrival of new information ("news"); although, as we will see in section 4, many occur without any identifiable cause ("noise").
- The term on the third line [red brackets]) is the meeting-day "surprise," the object of interest in Kuttner (2001).

Generalizing the three-day example 1 to the D-day case is straightforward:

$$[T_i - T_{i-1}] = [\hat{T}^0_{i,0} - T_{i-1}] + \sum_{d=1}^{D} [\hat{T}^0_{i,d} - \hat{T}^0_{i,d-1}] + [T_i - \hat{T}^0_{i,D}] \tag{2}$$

2.2 Expectations of the following meeting's target

We can define an analogous breakdown for the "following" meeting ($h = 1$). This is a bit more subtle, however; because the "following" meeting is always one meeting away, the target set at that meeting is not observed during the time span corresponding to the expectations of interest. Concretely, returning to the example from before: from September 18 through November 6, with $h = 1$ we're looking at expectations for the target rate set at the December 18 meeting; then, on November 7, we are looking at expectations of the rate set at the January 30 meeting, etc. We never get to compare the *actual* target with its expectation. What we do instead is break down the change in the *expectation* of the following month's target, after the preceding month's target has been announced.

Again, to fix ideas, let's look at a simple example with $D = 3$ (three days between meetings) We are interested in the expectation of the *following* meeting's target, $h = 1$. The decomposition is as follows:

$$[\hat{T}^0_{3,0} - \hat{T}^0_{2,0}] \quad = \quad [\hat{T}^1_{2,0} - \hat{T}^0_{2,0}] + \tag{3}$$

$$[\hat{T}^1_{2,1} - \hat{T}^1_{2,0}] + [\hat{T}^1_{2,2} - \hat{T}^1_{2,1}] + [\hat{T}^1_{2,3} - \hat{T}^1_{2,2}] +$$
$$[\hat{T}^0_{3,0} - \hat{T}^1_{2,3}]$$

The interpretation is a little more subtle, compared with the breakdown of changes in the upcoming target.

- The term on the left-hand side of the first line [orange brackets] is the change in the expected target from meeting "2" to meeting "3," as of the conclusions of meetings "1" and "2" respectively.
- The term on the right-hand side of the first line [blue brackets] is the expected change in the expected target from meeting "2" to meeting "3," both expectations as of the end of the day of FOMC meeting "1."
- The terms on the second line [green brackets] are revisions in the expected meeting "3" target occurring on days between meetings "1" and "2."
- The term on the third line [red brackets] is the revision in the expectation of the meeting "3" target occurring on the date of FOMC meeting "2." This term is analogous to the meeting-day target rate surprise of Kuttner (2001), in the sense that it represents the new information about monetary policy that results from the action taken at the FOMC meeting; however it pertains to expectations of the following meeting's target, as opposed to the rate set at the current meeting.

Generalizing the three-day example, equation 4, to the D-day case is straightforward:

$$[\hat{T}^0_{t+1,0} - \hat{T}^0_{t,0}] = [\hat{T}^1_{i,0} - \hat{T}^0_{i,0}] + \sum_{d=1}^{D} [\hat{T}^1_{i,d} - \hat{T}^1_{i,d-1}] + [\hat{T}^0_{i+1,0} - \hat{T}^1_{i,D}] \tag{4}$$

2.3 Calculating meeting-specific expectations

Following Kuttner (2001) and its successors, we use the prices of federal funds futures contracts to calculate the expected funds rate targets for specific meetings (the $\hat{T}$'s in equations 2 and 4). Focusing on the meeting-specific targets (the $\hat{T}$s), rather than on the "raw" futures-implied funds rate, provides a cleaner and more precise measure of policy expectations. One reason for this is that the futures-implied rate corresponds to the monthly average of the daily effective federal funds rates. Consequently, a policy change that is expected to occur on the first of the month will have twice the impact on the futures-implied rate as one that is expected to occur halfway through the month.

In fact, depending on when it arrives relative to the FOMC dates and calendar months, new information relevant to policy expectations may have no effect on the futures-implied rate. For example, suppose a new piece of information arrived that led market participants to revise up their assessment of the likelihood of a rate hike. If the information arrived before the FOMC date (September 18, say), it would be incorporated into the futures-implied funds rate. If it arrived *after* the FOMC meeting, on the other hand, it would have no effect on the rate implied by the September futures contract (assuming investors assumed the Fed would not change the target rate between meetings). Nor would it affect the rate implied by the October contract, since no FOMC meeting is scheduled for that month. This is why we go to the trouble of backing meeting-specific target expectations using futures contracts with a range of settlement dates.

Our procedure for calculating the expected target using futures data for the month in which the meeting occurs is as follows. Let F_t^k represent funds rate implied by the price of the k-month-ahead futures contract on the tth day of the month. Since the contract is based on the average effective funds rate over the month, the market price will reflect a convex combination of the expected pre- and post-meeting rates. Specifically, suppose an FOMC meeting is scheduled on the nth day of a month that contains m days. Let $\bar{r}_{t<n}$ represent the average funds rate on the days prior to the meeting, and $\hat{r}_{t\geq n}$ the average on the day of and days following the meeting. The expected funds rate implied by the market futures prices will be:

$$F_t^k = \left(\frac{n-1}{m}\right)\bar{r}_{t<n} + \left(\frac{m-n+1}{m}\right)\hat{r}_{t\geq n} \quad . \tag{5}$$

The weights in the convex combination depend on the day of the meeting, n, and the number of days in the month, m. Note that the a change in the target occurring on day n is reflected in that day's effective funds rate. Consequently, a change occurring on the 15th of a 30-day month will apply to 16 days.

The average effective funds rate is usually very close to the target, making it possible to rewrite equation 5 in terms of the prevailing and expected post-meeting target rates,

$$F_t^k = \left(\frac{n-1}{m}\right)T_{i,pre} + \left(\frac{m-n+1}{m}\right)\hat{T}_{i,post}^0 \quad . \tag{6}$$

This equation can then be used to back out the market's expectation of the upcoming post-meeting funds rate target for days in the month leading up to the meeting,

$$\hat{T}_{i,post}^0 = \phi(F_t^k - T_{i,pre}) + T_{i,pre} \quad . \tag{7}$$

The ϕ is a scale factor, defined as the ratio of the number of days in the month to the number of

days in the month to which the post-meeting target rate applies, $m/(m-n+1)$. For example, for an FOMC meeting occurring on December 14, $m_i = 31$ and $d_i = 14$, implying $\phi = 31/18 = 1.72$. Thus, the change from one day to the next of the expected upcoming target can be expressed in terms of the price of the current month futures contract,

$$\hat{T}^0_{i,t} - \hat{T}^0_{i,t-1} = \phi(F^0_t - F^0_{t-1}) \ . \tag{8}$$

Kuttner's (2001) meeting-day policy surprise is a special case of equation 8 with $t = n$.[1]

Scaling the change in the current-month futures price, as in equation 8, is only needed when FOMC meetings occur in two consecutive months (e.g. in November, when there is another meeting in December). When there *is* no meeting in the subsequent month, we can simply use the change in the price of the one-month-ahead futures contract to calculate the revision in expectations,

$$\hat{T}^0_{i,t} - \hat{T}^0_{i,t-1} = F^1_t - F^1_{t-1} \ . \tag{9}$$

Since meetings close to the end of the month only occur when there is no meeting in the subsequent month, using the one-month-head contract whenever possible avoids the problem associated with a large ϕ.[2] It does, however, require keeping track of which months have meetings and which do not, which varies from year to year.

These calculations apply to the days leading up to the "*i*th" ("upcoming") meeting. Complicating matters is the fact that what counts as the "*i*th" meeting changes after the meeting. For example, in the days leading up to the September 18th meeting, the *i* represents that meeting. However, after the September 18 meeting occurs, the *i*th meeting becomes the one scheduled for November 7, and so different futures contracts come into play. There's a lot to keep track of. Table 8 in the appendix lays out which contract is used for calculating the $\hat{T}^0$s, depending on where the day falls relative to the current FOMC meeting, and the timing of the two subsequent meetings. But regardless of which futures contract is used to calculate it, later, we will refer to the revision in the expectation of "upcoming-meeting" target rate as *exprev1*.

A similar procedure is used to calculate the expected "following meeting" (T^1) funds rate target. The same principles apply: the unscaled market-implied implied funds rate for the month after the FOMC meeting is used when that month contains no meeting; when it does, the scaled implied

[1] The derivation ignores the possibility of a risk premium in fed funds futures. Piazzesi & Swanson (2008) found that a risk premium is in fact present—but it is primarily associated with the business cycle, and consequently would disappear in daily first differences.

[2] It does, however, assume that market participants aren't expecting a target rate change *between* meetings. That is problematic during the early part of the sample, but except during the financial crisis and Covid periods, it's a reasonable assumption since the mid-1990s.

rate is used. This requires keeping track of the meeting schedule for the current and subsequent four months, and uses fed funds futures contracts going out four months. The calculations become complicated and tedious. Table 9 in the appendix enumerates the 12 possible meeting sequences and the futures contracts used in each case. We will refer to the revision in the expectation of the "following-meeting" target rate as *exprev2*.

2.4 What market participants know and how do they know it

The decomposition outlined above, and defined by equations 2 and 4, allows us to distinguish three different (but not mutually exclusive) ways in which market participants form expectations.

Consider first the case of "foreordained" policy. In this scenario, there is no uncertainty regarding the path of future policy, at least at some horizon. Market participants know exactly what the Fed is going to do ahead of time. News arriving between meetings do not affect expectations, and there is no surprise on the day of the meeting. In this polar case, the terms in equations 2 and 4 representing the inter-meeting expectations revisions [green brackets] and the meeting-day surprise [red brackets] would be zero. The only nonzero terms in the equations are those in the [blue brackets], which represent the expected rate change as of the conclusion of the preceding meeting.

The second case is "data driven" policy. Market participants don't know with certainty whether there will be a target rate change at the upcoming and following meetings. Instead, they adjust their expectations on the basis of new information arriving between meetings. Indeed, if the Fed consistently followed a well-understood reaction function, market participants would know enough by the day before the FOMC meeting to be able to predict the outcome with perfect accuracy, and there would be no red-bracketed meeting-day surprise. The FOMC cycle begins with market participants having some expectation of a forthcoming target rate change, so the blue-bracketed term would be nonzero; but incoming data would lead them to revise their expectations. In equations 2 and 4, inter-meeting expectation revision terms in the [green brackets] play a large role, while the surprise term in [red brackets] is zero.

In the "shocking" scenario, market participants have little or no information about Fed's likely action, as of the conclusion of the previous meeting; nor do they understand how the Fed is likely to respond to incoming data. The terms in the [green brackets] are zero; target rate surprises, in [red brackets], are frequent.

These three cases map neatly into how we typically think about central bank transparency. Naturally, the "shocking" scenario describes a central bank with very little transparency. It doesn't tip its hand about future policy, nor does it communicate how incoming news is likely to affect the

target rate. Frequent surprises are therefore a hallmark of an opaque central bank.

The other two cases reflect different ways in which a central bank could achieve transparency. Simply announcing the target in advance is one way to do it, achieving transparency by making the funds rate path "foreordained." This is essentially what the Fed did during periods of strong forward guidance (e.g. the September 21, 2011, announcement that the FOMC will target "exceptionally low levels of the federal funds rate at least through mid-2013"). Alternatively, a central bank could implement a fully transparent policy by consistently following a well-defined and non-discretionary rule or reaction function, and revealing the rule's parameters. This corresponds to the "data driven" regime. In section 3.2, we will quantify the degree and nature of the Fed's transparency, framed in this way.

3 Taking the decomposition to the data

In this section, we use the decomposition proposed in section 2 to assess the contributions of the three terms in equations 2 and 4 to meeting-to-meeting changes in the funds rate target. The results are used to characterize the nature and degree of policymaking transparency and describe its evolution over two decades.

3.1 The evolution of funds rate expectations, in pictures

Figure 1 shows the "upcoming-meeting" decomposition from June 1989, when futures data become available, through May 2025. Figure 2 presents the "following-meeting" decomposition. The shaded areas are periods during which the Fed was cutting the funds rate target (*not* NBER recessions). The plots tell similar stories.

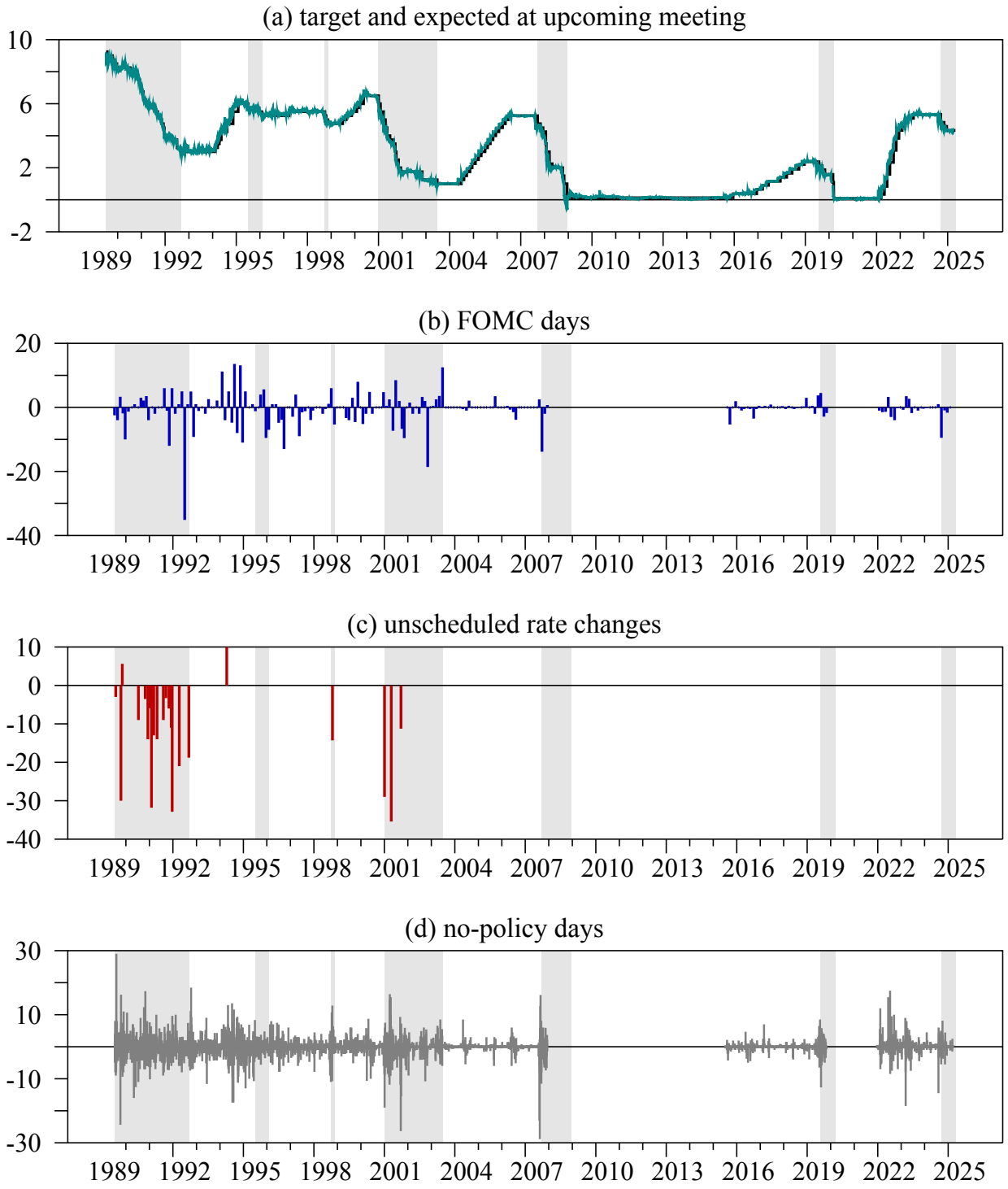
In panel (a), the black line is the funds rate target, and the blue (grey) line is the futures-implied expected target at the subsequent meeting. In panel (b), the bars represent the meeting-day surprises. Panel (c) shows the unscheduled inter-meeting changes, a subset of the (2) term in equation 2. The bars in panel (d) are the day-to-day revisions in next-meeting expectations on days with no FOMC meetings or unscheduled target rate changes, from equation 8.

One feature that jumps out of the figure that the surprises associated with unscheduled inter-meeting changes in the target rate are far larger than those occurring at FOMC meetings.[3] Clearly, in these cases the expectation revisions are to a large extent the result of macro news rather than the information conveyed by the policy announcement.[4]

[3]This was a period when the FOMC's instructions to the Desk sometimes included an "asymmetric directive," which essentially authorized the Desk to change the target funds rate in response to incoming data. Bernanke & Kuttner (2005) includes a discussion of how the unscheduled inter-meeting rate changes distort the measured response of stock prices to policy surprises.

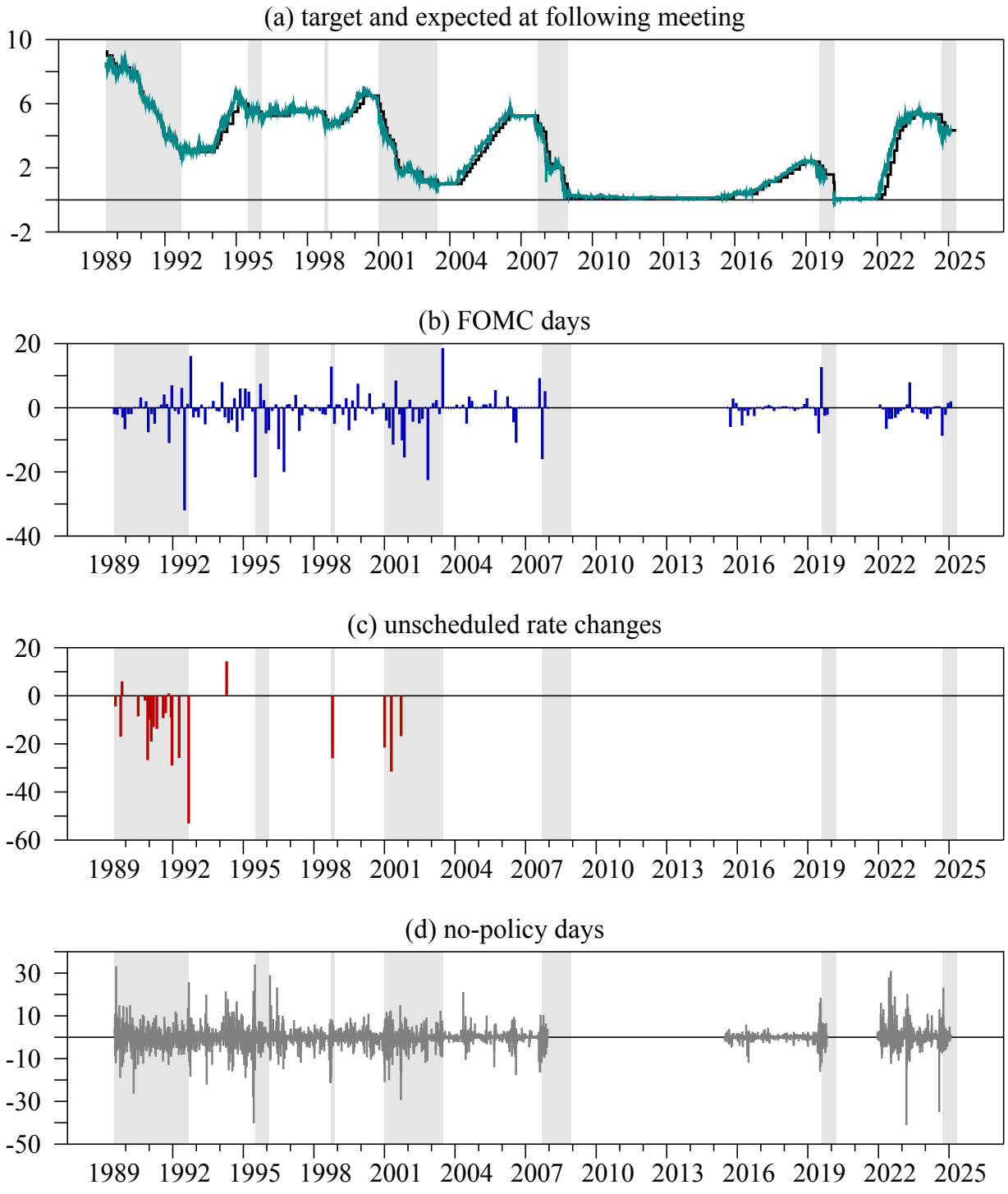
[4]Even so, Gürkaynak *et al.* (2005a) (figure 2) found that four of these observations were associated with negative

Figure 1: Upcoming-meeting expected and actual funds rate target



Note: Shaded areas denote periods of rate cuts.

Figure 2: Following-meeting expected and actual funds rate target



Note: Shaded areas denote periods of rate cuts.

The figure also shows that the volatility of inter-meeting expectation revisions has generally decreased over time, at least up until the financial crisis. In the late 1980s and early 1990s, day-to-day shifts in expectations (black bars) are frequent and large, some in the neighborhood of 10–15 basis points. There are many instances in which expectations initially overshoot the new target, but converge as the FOMC meeting date draws near.

Zooming in on the 1994–96 (figure 3) and 2004–06 (figure 4) tightening cycles clearly shows how expectation formation has evolved over time. The black line in the top portion of the figure shows the target rate, and the light blue line shows the futures-implied expectation for the upcoming meeting. If expectations converge to the correct target during the inter-meeting period, we should see the blue line converge to the black target rate as the FOMC meeting nears. The gap between the two lines on the day of the FOMC meeting is the policy surprise.

Convergence is evident in both figures. However, the meeting-day surprises (dark blue bars in the lower portion of the plots) are larger and more frequent in the 1994–96 period (which also includes one surprise associated with an unscheduled inter-meeting rate change). There are instances in which expectations initially overshoot the new target, but converge as the FOMC meeting date draws near. By contrast, the meeting-day surprises are virtually nonexistent in the 2004–06 period, during which the Fed raised the funds rate target from 1% to 5.25% in a sequence of 17 consecutive 25 basis point hikes, with no unscheduled inter-meeting changes. The expected funds rate target moves up in lockstep with the target, with the jumps occurring as the meeting relevant for expectation formation advances. The only notable exception is at the end of the tightening cycle, when market participants were unsure about whether the final rate hike would occur; and if so, whether it would be the last.

3.2 Quantifying transparency

In this section, we put some numbers on the relative importance of inter-meeting expectations and surprises in the evolution of the funds rate target, i.e. the magnitudes of the three (sets of) terms defined in equations 2 and 4. One metric is the standard deviation of the three terms. But because the overall level of macroeconomic volatility, and hence the magnitude of funds rate changes, varies over time, it is also informative to look at the terms' *shares* of the overall variance of funds rate changes.

If the federal funds market is efficient, expectation revisions and surprises should be unforecastable, and thus serially uncorrelated. The sums of the squared terms in equation 2 should

policy surprises, albeit of a smaller magnitude, based on a 30-minute event window that excluded the time of the data release.

Figure 3: Expected and actual funds rate target 1994-1996

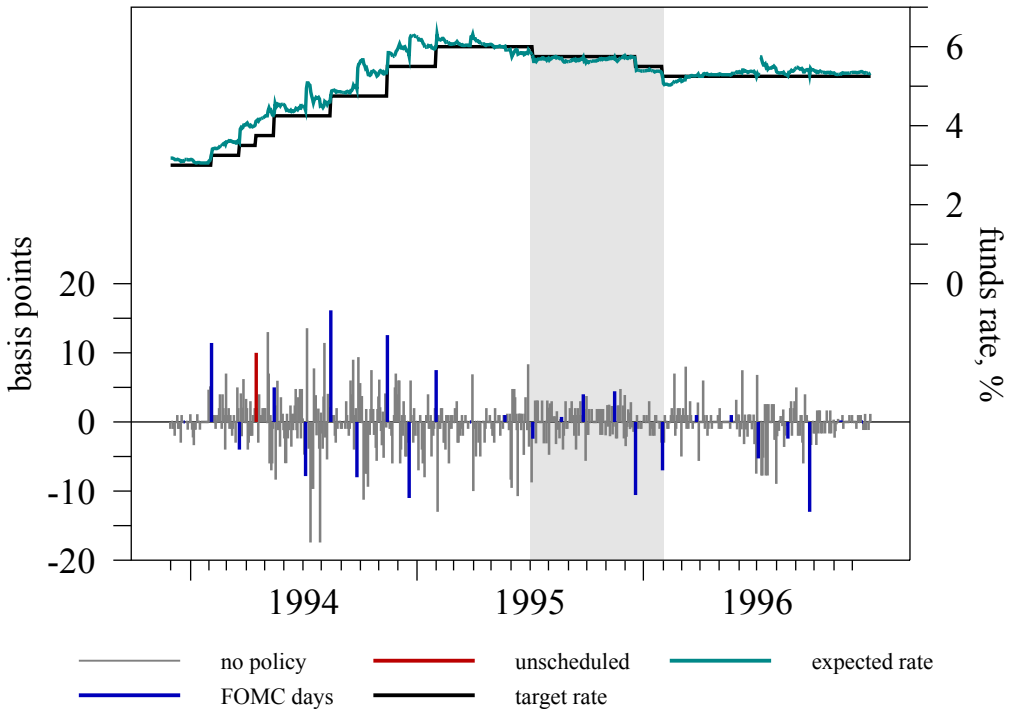
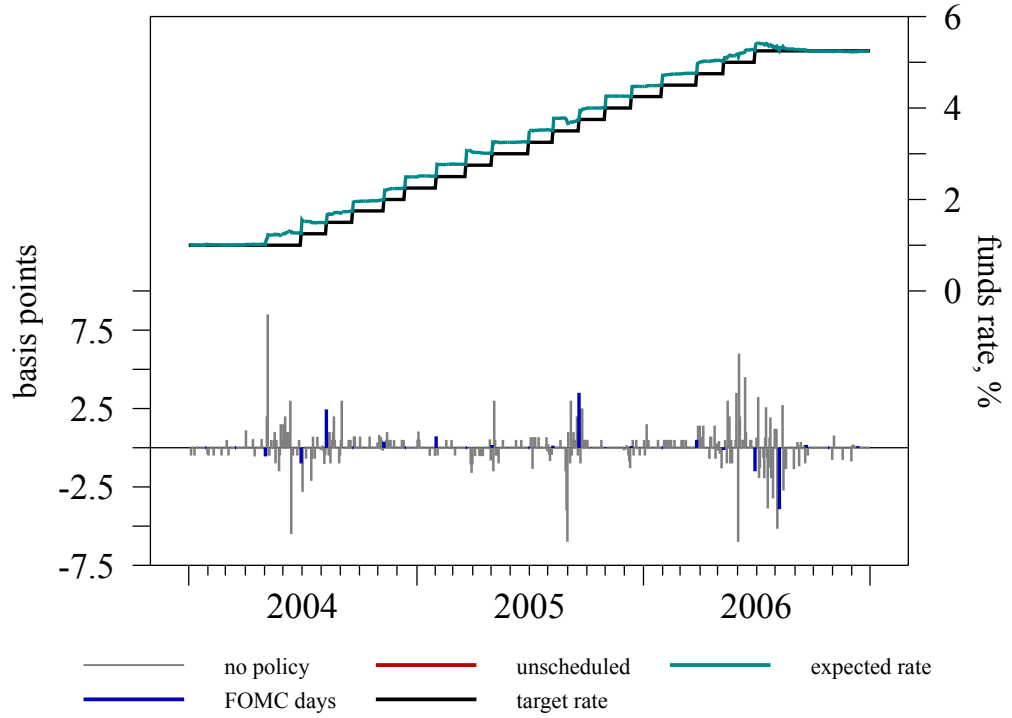


Figure 4: Expected and actual funds rate target 2004-2006



therefore sum to the overall variance of the "upcoming-meeting" ($h = 0$) funds rate changes,

$$\text{Var}(T_i - T_{i-1}) = \text{Var}(\hat{T}^h_{i,0} - T_{i-1}) + \text{Var}(\hat{T}^h_{i,D} - \hat{T}^h_{i,0}) + \text{Var}(T_i - \hat{T}^h_{i,D}) \ . \tag{10}$$

Similarly, the day-to-day expectations revisions should be uncorrelated, which implies that the revision from day 0 to day D can be expressed as the sum of the daily revisions,

$$\text{Var}(\hat{T}^h_{i,D} - \hat{T}^h_{i,0}) = \sum_{d=1}^{D} \text{Var}(\hat{T}^h_{i,d} - \hat{T}^h_{i,d-1}). \tag{11}$$

Dividing the each term on the right-hand side of equation 10 by the overall variance yields a model-free variance decomposition we will use to understand how policy expectations evolve between meetings. An analogous decomposition is used for the "following-meeting" ($h = 1$) case.

The variance decomposition gives us a metric for assessing transparency. The defining feature of "foreordained" policy is a large contribution of the first term on the right-hand side of the equation, which would say that the primary source of variance consists of the change in the target expected at the close of the preceding meeting. With "data driven" policy, most of the variance will come from day-to-day expectations revisions, the second term. If policy tends to be "shocking," the third term will make a large contribution.

3.3 Results

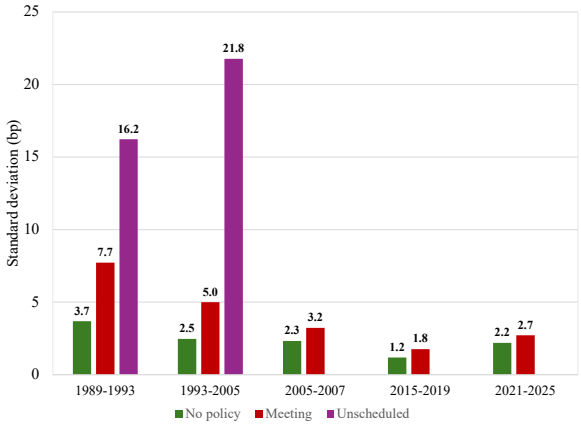
Our dataset spans June 1989 through May 2025. However, to account for the possibility of changes in the volatility of expectations revisions, and changes in the three contributions to the overall variance, we break the sample down into five sub-periods. The first is June 1989 through January 1993, before the Fed started explicitly announcing its funds rate target or publishing any minutes. The second runs from February 1993 through December 2004, during which time the meeting minutes were published *after* the following meeting. The third period begins in January 2005, when the minutes began to be published approximately three weeks after the most recent meeting, and goes through mid-December 2007, the onset of the global financial crisis.[5] The fourth is the pre-Covid period June 2015, when market participants began to expect a "liftoff," through October 2019.[6] The last sub-period goes from mid-December 2021, when markets again began to anticipate a non-zero funds rate, through May 2025.

[5]The zero lower bound wasn't reached until the end of 2008, so in principle we could have included 2008 in the calculations. However, there were episodes in which market participants anticipated unscheduled rate cuts. This distorts the calculation of the expected target rate, which assumes rate changes are expected to occur at FOMC meetings.

[6]The target wasn't cut to zero until March of 2020, but the cancellation of the March meeting invalidates the calculation of the expected target.

Figure 5: Expectation revisions for the upcoming meeting

(a) Standard deviation



(b) Variance decomposition

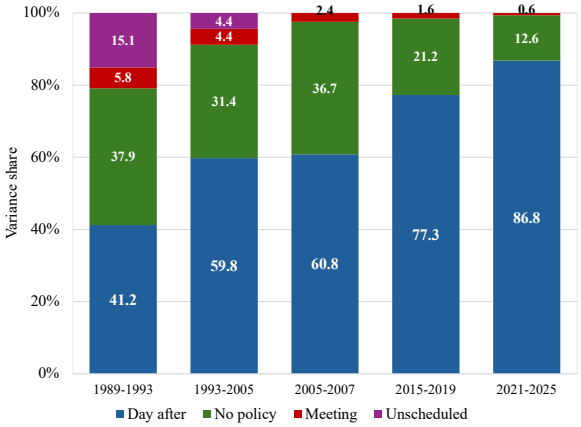
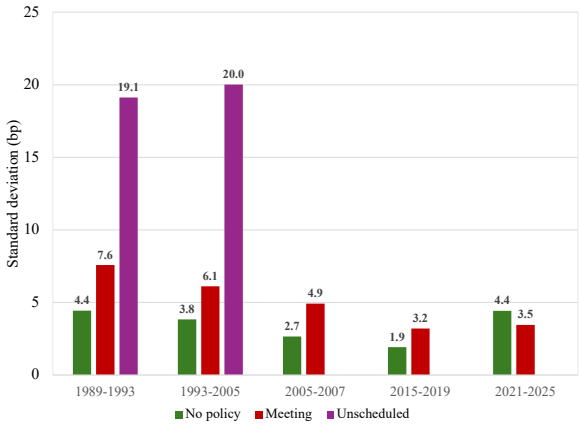
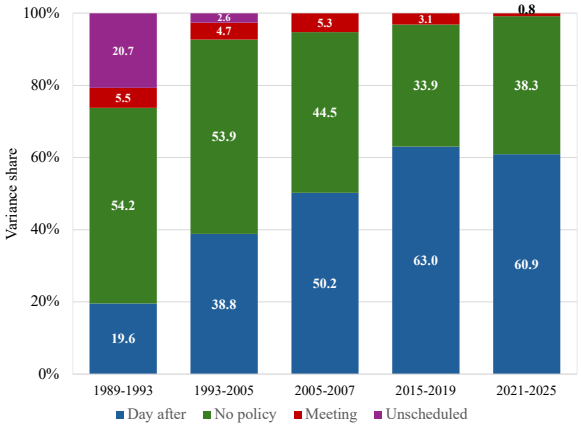


Figure 6: Expectation revisions for the following meeting

(a) Standard deviation



(b) Variance decomposition



Panel (a) of figure 5 shows the standard deviations of the expectations revisions for the five periods, and panel (b) shows the contributions to the variance of funds rate changes, as defined by equation 10. Unscheduled funds rate changes broken out separately. Four findings stand out.

First, as gauged by the standard deviations in panel (a), the expectations revisions associated with unscheduled rate changes (violet bars), which only occur in the pre-2005 period, are far larger than those occurring between or at FOMC meetings. And as shown in panel (b), the 17 unscheduled actions account for roughly 15% of the variance of the expectations revisions in the 1989–93 period. Although the standard deviations for the two sub-periods are comparable, with only five unscheduled changes in the 1993–2005 sub-period contribute a far smaller 4.4%.

Second, the meeting-day surprises, the focus of the most existing research, is small and diminishing. The standard deviation of upcoming meeting surprises (red bars) is nearly 8 bp in the first subsample, but declines steadily through 2019, before increasing slightly in the most recent period. Even in the first sub-period, they account for only 6% of the meeting-to-meeting funds rate variance. Their relative importance has decreased monotonically throughout, and in the most recent sub-period meeting-day surprises contribute only 0.6% of the variance.

Third, while small individually (less than 4 bp throughout), inter-meeting fluctuations in policy expectations (green bars) account for a larger share of the meeting-to-meeting variance than the meeting-day surprises. Their contribution has also declined over time, however, from nearly 38% in the 1989–93 period to less than 13% in the post-Covid 2021–25. (Section 4 below explores the sources of this variance.)

Fourth, changes in the expected target on the day after FOMC meetings (i.e. when the "following" meeting becomes "upcoming") makes the largest contribution to meeting-to-meeting changes in the funds rate (blue bars). Moreover, the share increases monotonically, rising from 41.2% in 1989–93 to 86.8% in 2021–25.

The general picture is similar for expectations revisions for the "following" meeting. Unscheduled changes are large; but, except in the 1989–93 sub-period, they make a small contribution to the overall variance. The contribution of meeting-day expectations revisions is small, and near zero in the post-2021 period. However, the "following" meeting is somewhat less foreordained, with only 61% of the variance attributable to the day-after target rate adjustment in the post-Covid period, compared to 87% for the "upcoming" meeting. The share attributable to inter-meeting revisions is correspondingly larger: in the post-Covid period, they are 38.3% for the "following" meeting, versus 12.6% for the "upcoming" meeting.

Taken together, these four findings imply that the "upcoming" funds rate target has become largely "foreordained," presumably because the FOMC now clearly telegraphs its intentions for the

next meeting. Surprises have been rare and small; and the small share of variance associated with day-to-day expectations between meetings indicates very little data dependence. This is consistent with an increase in transparency coming from forward guidance, broadly interpreted—the precise communication of the likely next policy action. Taken together, these four findings imply that target rate changes have become largely "foreordained." (Recall that if market participants knew ahead of time exactly what was going to happen at the next meeting, the variance share would be 100%.)

The "following" meeting's target has also become increasingly "foreordained," albeit less so than for the "upcoming" meeting. This suggests that market participants have a clear understanding of the FOMC's policy rule, specifying its likely reaction to inter-meeting news, which could consist of either new economic information (data releases, etc.) *or* Fed communication (minutes, speeches, etc.).

Another feature of the expectations revisions in figures 1 and 2 is the tendency of the falling-rate periods (indicated by the shaded areas) to be associated with more volatile expectations. To confirm and quantify this observation, we performed the same calculations as above, partitioning the 1989–2005 sample according to whether or not the Fed is cutting the funds rate target.[7]

Panel (a) of table 1 reports the statistics for periods of a steady or rising funds rate target and panel (b) does the same for periods during which the funds rate is being cut. All but one of the unscheduled rate changes were rate cuts, so the contributions of these actions to the variance of expectations revisions (13.5% and 12.5% for "upcoming" and "following" meetings) than during periods of steady or rising rates (0.1% and 0.2%). Similarly, the standard deviation of meeting-day surprises doubles during rate-cutting periods, and the variance contribution more than doubles.

Equally noteworthy is the larger contribution to the variance of day-to-day inter-meeting target rate expectations for the "upcoming" meeting is considerably larger during rate-cutting periods (38.0% versus 23.5%), while the contribution of the day-after expectations revisions is far smaller (42.6% versus 74.2%). Policy becomes less "foreordained" and more data dependent: market participants believe (justifiably) that bad news will tip the scales towards easing at the upcoming meeting. The pattern is less distinct for the "following" meeting, perhaps because the target rate setting was already perceived to be more highly data-dependent.

The main takeaway from this section's analysis is that monetary policy has become steadily more predictable since the late 1980s, consistent with a trend towards greater transparency. Funds rate surprises are smaller and less frequent. The FOMC no longer changes the target between

[7]The tumultuous GFC and Covid periods are again excluded, on the grounds that they are not representative of the typical policy easing cycle.

Table 1: Decomposition of meeting-to-meeting funds rate changes by policy direction

(a) Periods of steady or rising rates, June 1989 through March 2025

	Upcoming			Following		
	Days	SD (bp)	Var share (%)	Days	SD (bp)	Var share (%)
Expected change	148	20.0	74.21	148	18.1	50.1
Inter-meeting, no change	4398	2.1	23.5	4398	3.4	47.4
FOMC meetings	147	3.5	2.2	147	4.0	2.3
Unscheduled changes	1	9.7	0.1	1	14.0	0.2

(b) Periods of falling rates, June 1989 through March 2025

	Upcoming			Following		
	Days	SD (bp)	Var share (%)	Days	SD (bp)	Var share (%)
Expected change	61	18.5	42.6	61	18.9	34.4
Inter-meeting, no change	1708	3.3	38.0	1677	4.2	46.8
FOMC meetings	62	6.8	5.8	62	8.0	6.3
Unscheduled changes	21	17.8	13.5	21	19.4	12.5

Note: The statistics are based on the standard deviations and variances of *exprev1* and *exprev2*, defined in equations 2 and 4. The variance decompositions are based on equation 10.

meetings, except during crises. Market participants know with a great deal of certainty what target rate the FOMC will set at the upcoming meeting. They also have a very good idea what target will be set at the following meeting, although that is more dependent on incoming data. And relative to periods in which the funds rate is steady or rising, the target is less "foreordained" and more data dependent during periods in which the FOMC is cutting the rate.

4 Inter-meeting expectations revisions

This section focuses on the day-to-day changes in the expected target on non-policy days, i.e. the *D* green-bracketed terms on the right-hand side of equations 2 and 4. The purpose is to measure the effects of news about macroeconomic conditions and Fed communication on revisions to funds rate expectations. The relative contributions of these two types of news have implications for the nature of policy transparency, i.e. clarity with respect to the policy rule, versus explicit interest rate guidance.

4.1 The effects of news on policy expectations

Discerning the high-frequency effects of macroeconomic news on policy expectations is straightforward. Research on this topic, such as Gürkaynak *et al.* (2005b), has typically used measures of news constructed from the difference between data announcements and near-term private-sector forecasts.

Assessing the contribution of communication to expectation adjustment is more difficult. The problem is that the information is inherently qualitative, and hence not amenable to inclusion in a regression. One approach is to use textual analysis, classifying text as expressing either "hawkish" or "dovish" sentiment. With advances in machine learning and computing power, this method has become increasingly popular in recent years. One of the first was Lucca & Trebbi (2009), who applied textual analysis to FOMC statements. In a similar vein, Handlan (2022) used a neural network model to create "text shocks" interpretable as exogenous changes in forward guidance. And Aruoba & Drechsel (2024) employed machine learning to construct interest rate forecasts from FOMC documents, and constructed monetary policy shocks from the difference between the funds rate and the forecasts.

Our objectives are more modest, in the sense that we do not attempt to extract any kind of "shock" from the text of Fed communications, or even determine the directionality (i.e. "hawkish" versus "dovish"). Instead, our goal is to assess the degree to which the magnitude of inter-meeting expectation revisions can be attributed to macroeconomic news and various forms of communication. The limitation of this approach is that it does not say what *type* of information is conveyed by the communication, e.g. whether it reveals information about the Fed's economic outlook, a shift

in the FOMC's policy preferences, or something else entirely.

This type of analysis has been employed elsewhere, including Kohn & Sack (2004), Rosa (2016), Swanson (2023) and Swanson & Jayawickrema (2023). However, these papers look at the magnitudes of the changes in financial market variables, such as stock prices and bond yields, on days associated with policy-related communication, rather than directly at how the announcements affect policy expectations.

We employ two related metrics to assess the contribution of macro news, and Fed communication to revisions in policy expectations. One is the variance of expectations revisions on event days, relative to "no news" days. We also calculate the contribution of each type of news to the overall variance of the revisions in policy expectations from one meeting to the next.

The starting point for the analysis is equation 11, for the upcoming and following meetings ($h = 0$ and $h = 1$), with the days partitioned according to the event category c,

$$\text{Var}(\hat{T}^h_{i,D} - \hat{T}^h_{i,0}) = \sum_c \sum_{d \in c} \text{Var}(\hat{T}^h_{i,d \in c} - \hat{T}^h_{i,(d \in c)-1}) \ . \tag{12}$$

Or, to express it with less notational overhead: the variance of expectations revisions for events in category c is calculated as the sum of the squared daily values of *exprev1* and *exprev2* for the set of dates corresponding to each category.

We partition the (non-policy) days into the following categories:

- The dates of releases of macroeconomic data.
- The dates of speeches or testimony by the Fed Chair, Governors and reserve bank Presidents on topics related to the policy outlook. As a first pass, we use a simple keyword criterion to determine which are likely to provide hints about upcoming interest rate changes. Those whose titles include the words "monetary," "outlook," "inflation" or "employment" are deemed relevant. This eliminates speech titles that suggest they deal with topics such as payment system and bank regulation.[8] The Chair's semiannual testimony to Congress is always relevant, of course.
- The dates of the release of the FOMC meeting minutes. As mentioned previously, from 1993 through 2004, the minutes were made public *after* the subsequent meeting; in 2005, they began to be published approximately three weeks after the most recent meeting.

[8]This crude approach will generate both "type I" (rejecting relevance when true) and "type II" (accepting relevance when false) errors. Preliminary experimentation with large language models (e.g. ChatGPT) suggests that AI does a good job of distinguishing speeches relating to current monetary policy from those on other topics, and we intend to follow up with this approach.

- "No news" dates are those with no speeches, minutes, data releases or policy actions.

Note that the sets overlap (e.g. Fed officials sometimes deliver speeches on data release days), and so they are not disjoint.

To see which kinds of data releases have the largest impact on policy expectations, we identified three of the most salient releases consisting of employment (which includes payroll employment and the unemployment rate), the consumer price index and industrial production (which also includes capacity utilization). We also considered a more expansive set that includes ten additional releases: business inventories, construction spending, consumer credit, durable goods orders, housing starts, trade, new home sales, retail sales, and initial unemployment claims.[9] Similarly, we broke the speeches down into three categories. One consists of speeches and testimony by the Fed chair. The other two are speeches by members of the Board of Governors, and reserve bank Presidents. (We did not distinguish between voting and non-voting presidents, or between the Vice Chair and other members of the Board of Governors.)

Importantly, these are not disjoint sets of dates: a Fed president may make a speech on a day of a data release, for example; or a Fed President and Governor may give speeches on the same day. We try two different approaches for dealing with the overlaps.[10] One is simply to ignore them and include dummy variables for all the events, regardless of whether another event occurred on the same day. Implicitly, this assumes the effects on the variance are additive. The alternative is to define a "disjoint" set of dummies corresponding to days on which only one event occurred: e.g. a speech by a reserve bank President that did not coincide with a data release or a speech by any other Fed official. To create an exhaustive partition, we define an "overlap" set of dates on which two or more events occurred.

To quantify the variance associated with each set of events, we simply regress the squared deviations of *exprev1* and *exprev2* on an intercept and dummy variables corresponding to each set of dates. We run regressions both for days on which two or more events took place, and for the disjoint set of dates along with a separate "overlap" category for days with multiple events. Table 2 reports the results. On days with no identifiable events, the variances of upcoming and following meeting expectations revisions are approximately 3 and 7 basis points respectively (standard deviations of 1.7 and 2.6 bp), regardless of whether overlapping or disjoint event sets are used.

[9] Since we use release dates rather than the associated surprise components, we capture the information conveyed in both the headline figures and sub-components as well as the detailed content of the releases, as emphasized in Gürkaynak *et al.* (2020), which proposes a Kalman filter based procedure to capture the effects of non-headline news of different data announcements. See also Boehm & Kroner (2025) for a recent use of this procedure.

[10] Using intraday data would be another way to address the issue, if the times of the speeches could be determined precisely; and limiting the analysis to a narrow window would make it hard to perform a variance decomposition for the entire inter-meeting period.

Table 2: The effects of news on the magnitude of expectation revisions

	Upcoming meeting		Following meeting	
	Overlap	Disjoint	Overlap	Disjoint
Constant	3.36***	3.31***	7.38***	6.90***
"Top three" releases	6.19***	6.27***	20.52***	21.44***
Other data releases	1.13*	1.23*	3.41**	4.31**
Chair speeches	2.59	3.99	16.18***	33.33***
Governor speeches	−1.23	−1.46	−4.17	−2.59
President speeches	−1.54	0.19*	−4.77*	−2.50
Minutes	3.29*	−0.93	3.74	3.65
Overlap		−0.34		−3.20

Note: The numbers are the coefficients from an OLS regression of the squared de-meaned changes of the upcoming- and following-meeting expectations revisions on an intercept and dummy variables for the days indicated. The sample period is 2/4/1993 through 9/6/2024, excluding the GFC, ZLB and Covid periods (12/12/2007 through 6/16/2015 and 10/31/2019 through 12/14/2021). Asterisks indicate statistical significance: *** for 1%, ** for 5% and * for 10%.

The variances are higher on the days of the "top three" data releases: modestly so for the upcoming meeting (bringing the standard deviation to roughly 2.5 bp) and much more for the following meeting (implying a standard deviation of 5 bp). The other data releases are associated with only a small increase in the volatility of policy expectations. Clearly, market participants perceive that the Fed is paying a lot of attention the the CPI, employment, and industrial production numbers, compared to the other releases.

The parameter estimates for the speech and minutes dummies in the table's first two columns suggest that Fed communication has little impact on the target rate expectations for the "upcoming" meeting. But the Chair's speeches (and testimony) increase the variance by 16 or 33 (implying standard deviations of 5 or 6 bp) on those days. Corroborating the results of Swanson & Jayawickrema (2023), we find that speeches by officials *other than* the chair have no discernible effect on policy expectations, nor does the release of minutes.

To assess the contributions of each category of news to the inter-meeting variance of the expectations revisions, parallel to the analysis in section 3.2, we calculated variance shares by dividing equation 12 through by the overall variance on the left-hand side of the equation. Table 3 reports the results for disjoint sets of event days, plus the overlap set with two or more events.[11]

[11]The results with overlapping event sets are similar, but not reported in the interest of brevity.

Table 3: The variance decomposition of inter-meeting expectations revisions

	Days		Upcoming meeting		Following meeting	
	Number	Share (%)	SD (bp)	Var share (%)	SD (bp)	Var share (%)
Macro releases	2467	47.9	2.4	58.7	3.9	63.9
Chair speeches	38	0.7	2.7	1.2	6.4	2.6
Gov speeches	63	1.2	1.4	0.5	2.1	0.5
Prez speeches	157	3.1	1.9	2.3	2.1	1.2
Minutes	42	0.8	1.5	0.4	3.2	0.7
Two or more	522	10.1	2.3	11.3	3.4	10.1
No news	1857	36.1	1.8	25.6	2.6	21.0

Note: The numbers in the SD column are the standard deviations of the revisions in upcoming- and following-meeting target rate expectations (*exprev1* and *exprev2*) for the days indicated, expressed in basis points. The variance shares are based on the decomposition given by equation 12. The sample period is 2/4/1993 through 9/6/2024, excluding the GFC, ZLB and Covid periods (12/12/2007 through 6/16/2015 and 10/31/2019 through 12/14/2021).

As shown in the first column, almost *half* of the days have some identifiable macro news release, while there are only 38 with speeches or testimony by the Chair. Consequently, even though the pronouncements have a large impact on policy expectations, especially for the following meeting (a 6.4 bp standard deviation versus 2.6 bp for no-news days), the Chair's speeches and testimony account for a tiny share of the overall inter-meeting variance: 1.2% and 2.6% for the upcoming and following meetings respectively. The collective contribution of other forms of communication is even smaller. So, while not denying the important role of Fed communication in enhancing transparency, it turns out that macro news accounts for the lion's share of expectations revisions.

A intriguing feature of the decomposition is the large variance share attributed to the 36% of the days with no macro data releases or communication by Fed officials. The standard deviation of expectation revisions is somewhat smaller than on macro news days (1.8 bp versus 2.4 for the upcoming meeting, 2.6 bp versus 3.9 bp for the following), but they still account for significant variance shares: 26% for the upcoming and 21% for the following.

4.2 Bond market reactions

To better understand the nature of the information causing shifts in policy expectations, we next examine the relationship between the expectation revisions and policy surprises on the 10-year Treasury yield, broken down according to the type of news associated with the revisions. This

exercise has the same flavor as Gürkaynak *et al.* (2005a) (GSS). Our value added is to look systematically at *every* day in the FOMC cycle, not just those associated with announcements (speeches, etc.) or policy actions.

First, we constructed a measure of the change in the *following*-meeting expectations that is orthogonal to expectations about the upcoming meeting, $exprev2^{\perp}$ as the residual from a regression of *exprev2* on *exprev1*. The orthogonalized revisions, which are analogous to GSS's "path factor" Z_2, is intended to capture news pertaining to longer-horizon (but still relatively short) policy expectations.[12]

We then regressed changes in the 10-year Treasury yield on the revisions to the upcoming- and following-meeting target rate expectations,

$$\Delta yield_t = \beta_0 + \beta_1\, exprev1_t + \beta_2\, exprev2_t^{\perp} + \varepsilon_t \ , \tag{13}$$

where t indexes days, as opposed to policy events.

We considered seven sets of dates: (1) days of FOMC meetings, (2) days of macro news releases, (3) Chair speech days, (4) Governor speech days, (5) President speech days, (6) days on which FOMC minutes were released, and (7) days on which none of the above happened. We use the disjoint sets of news days on which only one of the enumerated events occurred. Table 4 reports the results (omitting those for the harder-to-interpret "overlap" days).

The estimates for the FOMC days show that surprises to longer term (following-meeting) have a much larger impact on the 10-year yield (70 basis points for a 100 basis point surprise), compared to the (statistically insignificant) effects of current-meeting surprises. By contrast, revisions in both upcoming- and following-meeting expectations associated with macro news days both have large, statistically significant effects on the 10-year yield.

Following-meeting expectations revisions associated with speeches by the Chair, Governors *and* Presidents *all* have large effects on the 10-year yield—considerably larger, in fact, than the surprises occurring on FOMC days (although imprecisely estimated). This is not what one would have expected, given that Governors' and Presidents' speeches have little or no impact on the volatility of policy expectations. For the same reason, the strong effects of upcoming-meeting expectations revisions associated with Governors' and Presidents' are puzzling.

From our standpoint, the most remarkable finding in Table 4 is the large (one-for-one for the following meeting) and statistically significant response of the 10-year yield to expectations revi-

[12]The key difference between $exprev2^{\perp}$ and GSS's Z_2 is that our measure pertains to the expected of the target rate set at a *specific* FOMC meeting, whereas GSS's embodies target rate expectations at a horizon of up to one year.

Table 4: The reaction of 10-year yield to expectations revisions

Set of events	$\hat{\beta}_1$ (SE)	$\hat{\beta}_2$ (SE)	R^2	N
FOMC dates	−0.08	0.70	0.17	175
	(0.10)	(0.11)		
Macro news	0.54	0.98	0.34	2414
	(0.05)	(0.04)		
Chair speeches	−0.11	1.85	0.44	36
	(0.62)	(0.60)		
Governor speeches	2.45	1.49	0.66	56
	(0.35)	(0.35)		
President speeches	0.42	2.17	0.31	145
	(0.21)	(0.28)		
Minutes releases	1.29	1.08	0.53	41
	(0.45)	(0.28)		
No news or speeches	0.85	1.06	0.29	1702
	(0.06)	(0.06)		

Note: The numbers are from an OLS regression with the the daily change in the 10-year yield as the dependent variable. $\hat{\beta}_1$ is the estimated coefficient on the revision in the upcoming meeting target rate expectation (*exprev1*) and $\hat{\beta}_2$ is the estimated coefficient on the following meeting target rate expectation revision, orthogonalized with respect to *exprev1* (*exprev2*$^{\perp}$) for the days indicated. (See equation 13 in the text.) The sample period is 2/4/1993 through 9/6/2024, excluding the GFC, ZLB and Covid periods (12/12/2007 through 6/16/2015 and 10/31/2019 through 12/14/2021). Standard errors are in parentheses.

sions on "no news" days. The coefficients on both revisions are larger than those for the macro news days and comparable to (given the standard errors) to those on minutes release days. We wouldn't expect to see such pronounced effects on the 10-year yield if the expectations revisions were merely noise.

4.3 What's happening on no-news days?

A significant share of the volatility of inter-meeting target rate expectations occur on days with no identifiable news events, and expectations revisions occurring on no-news days are highly correlated with changes in the 10-year yield, and hence must embody some macro-relevant information. What could be happening on those non-news days?

We can think of four possibilities. One is simply that some sources of macro news evaded our dragnet. In fact, there are very few days on which *no* macro-relevant news arrives. (The New York Fed's calendar of data releases for October 2025 shows only five days with no releases.) Obviously, if one were to assume that *every* day contained a macro date release, our decomposition would, by construction attribute 100% of the variance to macro news—even if the data contained in the releases were pure "noise." A second possibility is that day-to-day changes in policy expectations really *are* noise: either fluctuations in the term or risk premium, or random variations generated by trading activity. Neither is amenable to direct empirical verification, although the results of Piazzesi & Swanson (2008) indicate that fluctuations in the term premia in fed funds futures are primarily associated with the business cycle.

The third and fourth explanations are more interesting. One is that we are overlooking news events *other than* those contained in macro data releases. "Animal spirits," for lack of a better term, are another. Neither can be nailed down empirically, but we can at least offer anecdotal evidence that both may be operative.

To get a sense of what hard-to-quantify factors may have affected policy expectations, we combed through our estimates of expectations revisions in search of significant changes that were not associated with macro news or Fed statements. Table 5 enumerates five of the largest. All are multiples of the standard deviation of no-news expectations revisions.

Asset price fluctuations were factors in three of the five episodes. Two (4/4/1994 and 4/10/2001) were associated with stock movements. If the press reports are to be believed, the link between the markets' fluctuations and policy expectations are more nuanced than one might have expected. In 1994, the drop in stock prices led to expectations of *tighter policy* due to unspecified comments by Fed officials suggesting that policy would not react. The 2001 episode is more in line with one would have expected, with a rise in stock prices suggesting an upward revision in expecta-

Table 5: Large non-macro expectations revisions

Date	Upcoming	Following	Press reports (NY Times)
10/9/1992	+18.5	+9.0	"Bond traders and economists all but gave up hope yesterday for the prompt Fed easing that had seemed so certain a mere week ago... The falling value of the dollar and the nearness of the election most likely stayed the Fed's hand."
4/4/1994	+5.3	+21.5	"The tumble of the stock and bond markets has surprised Fed officials but has not persuaded them so far to change short-term interest rates. Fed officials say they are inclined for now to let investors determine" stock prices and long-term rates."
9/23/1998	−11.0	−21.4	"... speculation has increased that the Federal Open Market Committee may move to lower rates, which could help soothe anxiety in global markets..."
4/10/2001	+15.5	+12.4	"The Treasury market is getting direction from stocks, whose gain reflects evidence that an economic slowdown might not be as pronounced as expected..."
3/13/2023	−18.5	−41.2	Failure of Silicon Valley Bank

tions about the economy's strength. One of the five (10/9/1992) cited the fall in the dollar and the impending elections (although the latter can hardly be considered "news").

Financial stability considerations apparently were a factor in two of the episodes. While no specific event was cited, anticipations of a policy response to "anxiety in global markets" led to a decline in the expected target. And the proximate case of the 3/13/2023 downward revision in expectations was clearly the failure of Silicon Valley Bank.

Taken together, these anecdotes suggest that movements in policy expectations are not just noise or high-frequency fluctuations in a risk or term premium. The largest shifts were associated with changes in economic or financial developments—although in some cases, they seem to have been driven by a reassessment of existing information, as opposed to being due to some identifiable event.

4.4 Is communication actually helpful?

The results in section 4.1 suggest that speeches and minutes convey information regarding the next meeting's target rate. The question is whether this information is actually *helpful*, in the sense of

Figure 7: Changes in the upcoming-meeting gap on communication days

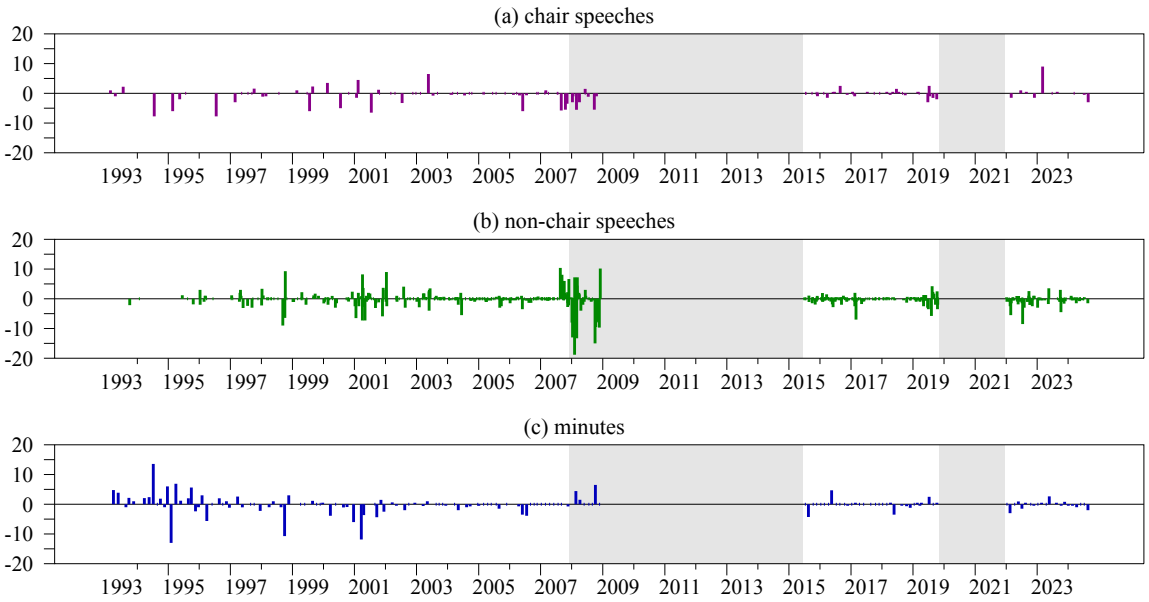


Figure 8: Changes in the following-meeting gap on communication days

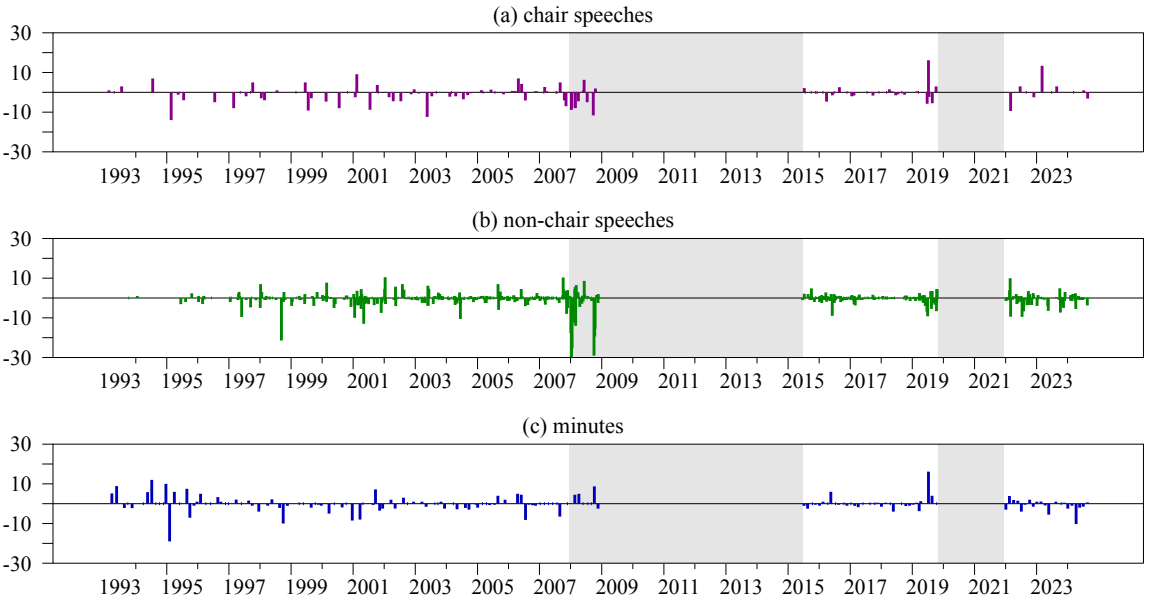


Table 6: The effects of communication on the expectations gap

(a) Disjoint event sets

	Upcoming meeting				Following meeting			
	Mean	Narrows	Same	Widens	Mean	Narrows	Same	Widens
Chair	–0.36	13	12	14	–1.03	15	11	13
Governors	–0.05	16	32	12	–0.46	24	21	15
Presidents	–0.20	45	81	32	–0.57	65	54	39
Minutes	0.37	10	21	12	0.35	16	11	16

(b) Overlapping event sets

	Upcoming meeting				Following meeting			
	Mean	Narrows	Same	Widens	Mean	Narrows	Same	Widens
Chair	–0.60	44	44	26	–0.92	52	28	34
Governors	–0.30	67	87	40	–0.82	87	56	51
Presidents	–0.22	130	226	96	–0.55	188	134	130
Minutes	–0.10	48	61	41	–0.08	62	44	44

Note: The numbers are from a tabulation of changes in the gap between the expected funds rate target and the target that was ultimately set at either the upcoming or the following meeting, as defined by equation 14. The sample period is 2/4/1993 through 9/6/2024, excluding the GFC, ZLB and Covid periods (12/12/2007 through 6/16/2015 and 10/31/2019 through 12/14/2021).

moving expectations closer to the rate set at future meetings. The standard deviations and variance decompositions are silent on this point: the higher variance on speech and minute days could result from the injection of noise; or markets could overreact to or misinterpret policy pronouncements, causing expectations to overshoot or diverge from the target.

To explore this issue, we define the expectations "gap" as the absolute value of the difference between the meeting-i target rate T_i and the futures-implied expectation on the day prior to the announcement (d),

$$\text{gap}_j = |T_i - \hat{T}^h_{i,d}| \ . \tag{14}$$

Recall that the gap on the day before the FOMC meeting (i.e. $d = D$) is the absolute value of the day-ahead policy surprise.

In terms of this gap, a "helpful" piece of information is one that moves the expected rate closer to its eventual target *ex post*. Pure noise, on the other hand, is as likely to widen the gap as to narrow it. Counterproductive communication could *widen* the gap. The degree of "helpfulness"

can therefore be assessed by the change in the gap on communication days. Figures 7 and 8 plot the change the expectation gap for the upcoming and following meetings, four sets of dates enumerated above. Negative spikes indicate a narrowing of the expectation gap, i.e. instances in which expected rate moves closer to the target (helpful); positive spikes represent movements away from the target (unhelpful). The vertical scales are the same in each panel, and the shaded areas are the financial crisis, Covid and ZLB periods. Table 6 complements the figure with descriptive statistics on the gap changes, excluding the shaded periods in the plots.

Panel (a) in both figures shows the gap changes for the dates of the Chair's speeches. For both the upcoming and following meetings, the Chair's track record is mixed, with roughly equal numbers of positive and negative spikes, although there appears to have been a string of helpful speeches in 2007 during the onset of the global financial crisis, a few of which occur after our December 11 cutoff. The statistics in Table 6 generally confirm this impression. Using the disjoint event sets in panel (a), (i.e. days on which the Chair's speech was the only identifiable information to arrive) the gap changes are roughly evenly split between positive, negative, and zero gap changes. On average, the following-meeting gap narrows by about 1 basis point, and less for the upcoming meeting. The scorecard is somewhat more favorable to the Chair if days with overlapping events are included in the tabulation: the gap narrows roughly 1.6 times more often than it widens.

When it comes to providing information that narrows the gap, the track record of the Governors and Presidents is comparable to that of the Chair. Negative spikes appear to slightly outnumber positive spikes in the middle panels of figures 7 and 8, even with the crisis period excluded. (Interestingly, non-Chair speeches drastically narrowed the gap on many occasions during this period.) This is somewhat surprising, given the results in sections 4, which showed that the variance of expectations revisions was the same or even slightly lower on the days of Governors' and Presidents' speeches, relative to the days of the Chair's. Table 6 confirms the impression conveyed from the figure: with the overlapping event sets, days with a narrowing gap outnumber those with a widening gap by roughly 1.5 to 1.

The changes in the gap associated with the release of minutes are depicted in the bottom panels of Figures 7 and 8 and tabulated in the last line of Table 6. As in the case of speeches, there is a slight tendency for minutes to narrow the gap looking at overlapping event sets, and it's a wash using the disjoint sets.

Interestingly, the figures reveal three instances in which the gap *widened* significantly on days with speeches or the release of minutes. The expectations revisions associated with these days were: -16 bp for the upcoming meeting on the day of the Chair's 7/10/2019 testimony on, $+9$ bp for the upcoming meeting on the day of the Chair's 3/7/2023 testimony, and $+5$ bp when the

Table 7: Three instances of "unhelpful" communication

Date	Upcoming	Following	Press reports (NY Times)
5/18/2016	+5	+6	"The Federal Reserve sent a sharp, simple message to financial markets on Wednesday: Pay attention. The Fed is thinking seriously about raising its benchmark interest rate at its next meeting, in June... That message was sharply at odds with the expectations of investors, who had largely written off a June increase before Wednesday, betting instead that the Fed would leave rates unchanged until later in the year."
7/10/2019	−6.5	−16	"The Federal Reserve chair, Jerome H. Powell, signaled on Wednesday that the Fed could soon cut interest rates... Mr. Powell, testifying before the House Financial Services Committee... [suggested] a cut may be likely when the Fed meets again later this month."
3/7/2023	+9	+13	"Before his [Powell's] remarks, markets were heavily prepared for a quarter-point move at the Fed's March 21–22 meeting. After his opening testimony, investors increasingly bet that the central bank would make a half-point move in March..."

minutes were released on 5/18/2016. On the face of it, these seem like small numbers (and they look small in the figures, because the scales were set to accommodate the very large movements in late 2007 and early 2008). But the revisions are quite large compared with those associated with policy-day surprises, whose post-2015 standard deviations were less than 3 bp for the upcoming meeting and less than or equal to 3.5 bp for the following meeting. The two speech-day revisions are even comparable to or larger than pre-2005 meeting-day surprises, whose standard deviations ranged from 6.1 to 7.7 bp. In this context, the expectations revisions look like very large policy shocks.

Judging from the press reports summarized in Table 7, the extraordinary expectations revisions resulted from the markets' misinterpretation of the testimony and minutes, which caused the funds rate expectation to diverge from its eventual target. These examples show that the higher variance associated with communication days may sometimes be due to the arrival of *mis*information. This raises the question of whether the high-frequency financial market reactions should be interpreted as policy shocks, since they were promptly followed by corrections and the expectations revision was not matched by the anticipated policy action.

5 Conclusions

The paper has proposed a decomposition of funds rate changes, expressing them in terms of inter-meeting expectations revisions, meeting-day policy surprises, and meeting-to-meeting adjustments in the target rate. It used this breakdown in a model-free variance decomposition to understand the proximate sources of meeting-to-meeting funds rate volatility. It also examined the sources of variation in day-to-day fluctuations in near-term policy expectations, the extent to which these are attributable to identifiable sources of news, and whether Fed communication narrowed the gap between market participants' expectations and the proximate meeting's target rate.

Four key findings from the decomposition of meeting-to-meeting changes in the funds rate are as follows. First, funds rate surprises, which have been the focus of most previous research, have become progressively less important, in terms of magnitude and the their contribution to the overall variance of the funds rate. Second, inter-meeting day-to-day expectations revisions have become more stable over the years. Third, these two observations suggest that the Fed has become more transparent with regard to its policy intentions. Market participants generally have a very good idea of the subsequent meeting's outcome. These three findings are symptomatic of an increase in the transparency of Fed policymaking. Fourth, the degree of policy predictability depends on the economic environment, with periods of rate cuts associated with significantly more uncertainty than periods of steady or rising interest rates.

Three important findings from the examination of inter-meeting day-to-day expectation revisions are the following. First, the three most salient economic indicators and speeches by the Chair are associated with larger-than-normal revisions. Second, a large share of the revisions' variance is attributable to macroeconomic news releases. And third, Fed communication has a mixed record in terms of guiding expectations towards the proximate meeting's target. These last two observations suggest that clarity regarding the policy rule, as opposed to telegraphing future policy actions, is the most important contributor to transparency.

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A Calculating the expected funds rate target

Table 8 enumerates the eight possible meeting sequences relevant to the upcoming-meeting target. There are never two consecutive no-meeting months, however, so three of the possibilities are inadmissible (cases 6 through 8). This reduces to five the number of distinct cases to be considered. For each sequence, the table also gives the combination of futures contracts used to construct a measure of the next meeting's target.

As an example, consider the case corresponding to the first row of the table, with no FOMC meeting in the current month followed by alternating meetings in the following two. Because there is no meeting two months hence, the two-month-ahead futures rate can be used to measure the expected rate set in month $t+1$. The scaled month-ahead rate could also be used in this case, but basing the calculation on the two-month ahead rate obviates the need to scale the futures rate, and thus finesses the possibility of a rate change occurring in the final few days of the month.

The calculation is slightly more complicated for months in which an FOMC meeting occurs, such as one in which there are two consecutive meetings followed by a no-meeting month (numbered 4 in the table). Because a meeting occurs in month $t+1$, the scaled current-month futures rate must be used to calculate the expected target rate on the days leading up to the meeting, as in Kuttner (2001). (Since there is also a meeting in month $t+1$, it is unlikely that an FOMC meeting would be scheduled for the waning days of the current month.) But since there is no meeting two months hence, in the days following the current month's meeting, the two-month-ahead futures rate can be used to calculate the expected change at the month $t+1$ meeting.

A similar method can be used to calculate the target rate for the following meeting, although it becomes even more complicated. The number of possible permutations increases from five to 12 and entails the use of futures contracts of up to four months. Table 9 enumerates the 12 permutations (excluding those that are inadmissible) and the contracts used for the calculation in each ease. However, as the table shows, the appropriate contracts depend on the sequence and timing of FOMC meetings across calendar months.[13]

[13] Boehm & Kroner (2024) and Brennan *et al.* (forthcoming) use the third and fourth federal funds futures contracts to infer expectations for the meeting after next, but do not take into account the timing of meetings within the two-month span covered by the contracts. Nakamura & Steinsson (2018) *do* properly account for the timing of the meetings relative to the futures contracts, but they only calculate surprises for the days of the FOMC meetings.

Table 8: Futures-based measures of the expected target at the upcoming meeting ($\hat{T}_i^0$)

	Months				
	t	$t+1$	$t+2$	Pre-meeting	Post-meeting
1.	no	yes	no	$T+(F^2-T)$	
2.	no	yes	yes	$T+\phi(F^1-T)$	
3.	yes	no	yes	$T+(F^1-T)$	$T+\phi(F^2-T)$
4.	yes	yes	no	$T+\phi(F^0-T)$	$T+(F^2-T)$
5.	yes	yes	yes	$T+\phi(F^0-T)$	$T+\phi(F^1-T)$
6.	no	no	no	n/a	
7.	no	no	yes	n/a	
8.	yes	no	no	n/a	

Table 9: Futures-based measures of the expected target at the following meeting ($\hat{T}_i^1$)

	Months						
	t	$t+1$	$t+2$	t+3	t+4	Pre-meeting	Post-meeting
1.	no	yes	no	yes	yes	$T+\phi(F^3-T)$	
2.	no	yes	no	yes	no	$T+(F^4-T)$	
3.	no	yes	yes	no	yes	$T+(F^3-T)$	
4.	no	yes	yes	yes	no	$T+\phi(F^2-T)$	
5.	no	yes	yes	yes	yes	$T+\phi(F^2-T)$	
6.	yes	no	yes	no	yes	$T+(F^3-T)$	$T+\phi(F^4-T)$
7.	yes	yes	yes	no	yes	$T+\phi(F^1-T)$	$T+(F^3-T)$
8.	yes	yes	yes	yes	no	$T+\phi(F^1-T)$	$T+\phi(F^2-T)$
9.	yes	no	yes	yes	no	$T+\phi(F^2-T)$	$T+(F^4-T)$
10.	yes	no	yes	yes	yes	$T+\phi(F^2-T)$	$T+\phi(F^3-T)$
11.	yes	yes	no	yes	no	$T+(F^2-T)$	$T+(F^4-T)$
12.	yes	yes	no	yes	yes	$T+(F^2-T)$	$T+\phi(F^3-T)$