

# Risk Management in Monetary Policy: Review with Asset Pricing Implications

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**Abstract:** We review recent research on how the Fed's risk-management approach manifests in the overall Fed's policy stance and how it affects financial market conditions. The evidence shows that policy stance contains a forward-looking conditional component that has long been an integral part of the Fed's policymaking toolkit. Asymmetric forward-looking policy tilts—motivated by risk-management considerations and revealed via the Fed's communication—complement and extend beyond the effects of direct policy actions. Going back at least to the early 1990s, the Fed has relied on tilts to not only steer market expectations, but equally importantly, to stabilize risk premia and maintain easy financial conditions. We discuss evidence on successes and challenges associated with communication via tilts.

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## I. Introduction

Bernanke (2015) famously estimated that monetary policy is “98% talk and only 2% action.” Emphasizing the power of words in policymaking, he also warned that “the cost of sending the wrong message can be high.” For much of the past three and a half decades, the US Federal Reserve has been credited with maintaining remarkably stable inflation while being able to decisively support the economy during downturns. Although that successful streak was disrupted by the post-Covid inflation surge, the Fed managed to navigate the complexities of the recent period without exploding inflation expectations and runaway long-term interest rates.

Given Bernanke’s 98% estimate, it is natural to ask what role the Fed’s “talk” plays in achieving such outcomes. An answer is far from straightforward: Communication is subject to a plethora of interpretations that blur the boundaries between the Fed’s objectives, instruments, signals, and financial market’s reactions. What, then, are the key aspects of the Fed’s policymaking that communication can mediate? Recent research on this question suggests that understanding the role of communication requires recognizing its inherent connection to the Fed’s risk-management approach to policymaking (Greenspan, 2004; Blinder and Reis, 2005).

In this review, we synthesize the results linking risk management, communication, and financial market outcomes.<sup>1</sup> We start from the baseline notion that the Fed’s policy stance encompasses a broader range of tools beyond the current policy action. Specifically, the policy stance, revealed through the FOMC’s language, contains a forward-looking conditional component over and above direct policy actions that the FOMC undertakes. We refer to this dimension as the policy “tilt.” We show that policy tilts expressed in FOMC’s language are not subsumed by the Fed’s forecasts of macroeconomic conditions. Not only does the FOMC language explain about a quarter of variation in Taylor rule residuals, it also independently predicts future policy path several meetings ahead. Importantly, however, the tilt is not isomorphic to forward guidance of the form that gained prominence post-2008.

The tilt captures the distribution of future policy paths that policymakers entertain, indicating an asymmetric bias toward tightening or easing, or otherwise a symmetric stance. The most direct interpretation of the tilt as a policy instrument comes from the period before 2000, when the tilt was part of the FOMC’s operational policy directive. We use the FOMC language to estimate the policy tilt after 2000 and argue that its

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<sup>1</sup>We draw in particular on the findings in Cieslak et al. (2024), Cieslak and McMahon (2024), and Cieslak et al. (2025).

importance extends considerably beyond operational technicality. Indeed, the tilt has been an integral part of the Fed’s policymaking toolkit, complementary to its policy actions.

We then ask two sets of questions. First, where do policy tilts come from? Specifically, what considerations enter the Fed’s objective function to give rise to an asymmetric forward-looking policy stance? Second, what do policy tilts achieve? Specifically, what is the financial market impact of the Fed’s communication via tilts that helps the Fed achieve its objectives?

In short, policy tilts emerge from the Fed’s balance-of-risk assessments. The forward-looking policy stance is tightly linked to perceptions of tail risks and uncertainty that policymakers express. Those risk perceptions determine policy stance independently of, rather than via, expected economic conditions. Conceptually, policy tilts are thus an indication of how the Fed breaks away from a certainty-equivalent policy rule that is standard in macro monetary models. The Fed responds to uncertainty and tails of economic distributions based on the view that they can affect those moments and, by doing so, avoid costly outcomes.

[Cieslak et al. \(2024\)](#) propose a suite of measures to capture the FOMC risk perceptions from language. The two main drivers of policy stance they uncover are the FOMC’s uncertainty about inflation and concerns about the downside risk in the real economy. A one standard deviation increase in FOMC-perceived inflation uncertainty raises the probability of a tightening tilt by 17 percentage points, a magnitude that is similar to the Fed’s response to macroeconomic forecasts. The effect of inflation uncertainty is non-linear, strengthening as the uncertainty increases.

Investigating the Fed’s motives behind tilts, we find evidence consistent with the use of asymmetric stance as a preemptive tool used to avoid costly policy mistakes: Policymakers aim to prevent build-up of risks that could ultimately erode into undesirable outcomes. Inflation disanchoring and the associated credibility loss is one example ([Goodfriend, 1993](#)), hitting the zero lower bound constraint is another ([Evans et al., 2015](#)). A further analysis of policymakers’ reasoning shows that the tightening tilt is commonly associated with their concerns about acting too late on inflation. While preemption is sometimes understood as taking an early policy action, we find that an important component of the Fed’s preemptive stance is revealed via communication of conditional promises. Such communication signals the Fed’s readiness to act if the need arises, but without acting now.

To uncover policymakers' reasoning behind tilts, we focus on a set of dissents voiced in FOMC meetings (that do not necessarily lead to dissent in vote). By construction, voiced dissents are deviations of individual policy preferences from the current policy action. We show that risk-management considerations—the need to counteract risks—are prevalent as justification for dissents and are much more common than argument solely based on forecasts of economic conditions.

Turning to second set of questions, we ask whether and how communication via tilts affects financial conditions. The Fed is clearly attuned to the importance of communication in achieving its economic objectives. The connection between economic objectives, effective communication, long-term interest rates and uncertainty is at the center of the Fed's stated strategy:

The Federal Open Market Committee (FOMC) is firmly committed to fulfilling its statutory mandate from Congress of promoting maximum employment, stable prices, and *moderate long-term interest rates*. The Committee seeks to explain its monetary policy decisions to the public as clearly as possible. Such clarity facilitates well-informed decisionmaking by households and businesses, *reduces economic and financial uncertainty*, increases the effectiveness of monetary policy [...]. — 2025 Statement on Longer-Run Goals and Monetary Policy Strategy.

To the extent that today's inflation and output gap depend on expected future real interest rate gaps, the Fed's ability to stabilize the economy depends on how its policy stance—through both actions and communication—affects longer-term interest rates. However, long-term rates reflect not only expectations about future policy and the economy but also market pricing of risks surrounding those paths. Communication thus can matter beyond anchoring expectations by stabilizing risk premia.

Understanding the Fed's effect on financial markets is inseparable from the question about the components of the policy stance that markets are reacting to. An extensive literature documents the market's response to the Fed's announcements.<sup>2</sup> Much less is known about the channels and what communication content leads to observed financial market outcomes. Building on [Cieslak and McMahon \(2024\)](#), we thus newly emphasize evidence on the primary role of communication via risk-management-motivated policy tilts. Policy tilts have quantitatively large effects on risk premia in stocks and bonds and operate independently from the market's policy path expectations. By issuing a forward-looking tightening tilt, the Fed has been able to significantly reduce the term premium in long-term yields thus raising both stock and bond valuations. The full impact of the tilt is seen over the intermeeting period and can be traced back to more granular communication by the FOMC officials via speeches and minutes.

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<sup>2</sup>See [Bauer et al. \(2023\)](#) and [Vissing-Jorgensen and Knox \(2025\)](#) for excellent recent reviews.

This evidence suggests that by using tilts to signal that a different-from-current policy may be implemented, if needed, the Fed has been able to reduce the amount of uncertainty about its own policy stance, enhance the efficacy of its policy tools, and by extension, reduce the amount of uncertainty in the economy. However, such risk management via “talk” is not without its own risks. We close the discussion with two opposing examples of the use of policy tilts: Greenspan’s productivity miracle period of the late 1990s, where tilts successfully steered financial conditions toward the Fed’s goals, and the post-Covid period where they seemed to have caused, at least temporarily, adverse movements in risk prices that undermined the Fed’s intentions of keeping conditions easy (Cieslak et al., 2025). “The costs of sending the wrong message,” in Bernanke’s language, can thus manifest in higher market volatility and premia when the market perceives an increased probability of a policy mistake.

The lessons from the post-2020 episode remain pertinent today. Despite the delay in 2021, the Fed was able to stabilize term premia by first shifting its communication and then taking actions. As part of a broader risk-management approach to policy making (Greenspan, 2004; Blinder and Reis, 2005), effective communication that recognizes risks and explains how the Fed would respond to those risks has historically proven effective in reducing the likelihood of undesirable market outcomes (Cieslak and McMahon, 2024). Risk management remains a sensible guiding strategy for institutional policy design and communication. In 2025 Jackson Hole speech, Chair Powell embraced the risk management idea saying: “Of course, preemptive action would likely be warranted if tightness in the labor market or other factors pose risks to price stability.”

## II. Conceptual framework and literature review

As early as Blinder and Reis (2005), the literature has observed that risk management is an important part of policymakers’ reasoning but also a concept without a uniformly agreed-upon definition. In order to distinguish between possible interpretations, Cieslak et al. (2024) introduce a conceptual framework, which we adapt here in abbreviated form.<sup>3</sup>

The policymaker has a standard quadratic loss function over deviations of inflation from the target and the output gap

$$L(\pi_t, y_t) = (\pi_t - \pi^*)^2 + \lambda(y_t - y^*)^2, \quad (1)$$

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<sup>3</sup>In Appendix B, we formulate a more specific model after discussing empirical evidence on the Fed’s risk management approach and its link to asset prices.

where  $\pi_t$  is period  $t$  inflation,  $\pi^*$  is the inflation target,  $y_t$  is period  $t$  output, and  $y^*$  is medium-term potential output.  $\lambda > 0$  is the weight placed on output relative to inflation. We view  $r_t$  as subsuming a range of instruments the policymaker uses to achieve their goals. Thus, a higher  $r_t$  could reflect higher nominal interest rates, quantitative tightening, or a change in the communicated interest rate outlook. As we show below, risk management considerations operate in large degree via a forward-looking stance not captured by the current policy rate.

In the absence of risk considerations, expected inflation is  $\bar{\Pi}_t(r_t) = \bar{\pi}_t - ar_t$  and expected output is  $\bar{Y}_t(r_t) = \bar{y}_t - br_t$ , where  $\bar{\pi}_t$  and  $\bar{y}_t$  are pre-determined variables (i.e., exogenous to  $r_t$ ) reflecting inflation and output forecasts, respectively, with  $a > 0, b > 0$ . It is then straightforward to derive the optimal policy  $\hat{r}_t$  as the Taylor-rule-like expression:

$$\hat{r}_t = \frac{a}{c} (\bar{\pi}_t - \pi^*) + \frac{\lambda b}{c} (\bar{y}_t - y^*) \text{ where } c = a^2 + \lambda b^2. \quad (2)$$

We take the view of [Evans \(2019\)](#) who explains “What does risk management actually mean? It entails thinking about what could go wrong with the forecast and then judging if policy should be adjusted from the baseline one way or the other in light of the alternative scenarios.”

To illustrate alternative interpretations, let us introduce a state variable  $\omega_t$  that captures the realization of an adverse outcome and assume its distribution is

$$\omega_t = \begin{cases} 1 & \text{with probability } p_t \\ 0 & \text{with probability } 1 - p_t, \end{cases}$$

where  $w_t = 1$  is the adverse event. We consider it to be rare in the sense that  $p_t < 0.5$ . In principle, the adverse event can apply to inflation or to output. Taking the former as an example, expected inflation is  $\bar{\Pi}_t(r_t) | \omega_t = \bar{\pi}_t - ar_t + \mathbb{1}(\omega_t = 1)\Delta_t$  where  $\Delta_t > 0$ . That is,  $\omega_t$  represents an “upside” inflation risk. Under this specification, optimal policy becomes

$$\hat{r}_t = \frac{a}{c} (\bar{\pi}_t + p_t\Delta_t - \pi^*) + \frac{\lambda b}{c} (\bar{y}_t - y^*) \text{ where } c = a^2 + \lambda b^2, \quad (3)$$

which implies a higher rate than in (2) because expected inflation is now higher by  $p_t\Delta_t$ . This effect is emphasized in [De Polis et al. \(2024\)](#), whereby deviations of expected inflation from its modal outcome is the fundamental force driving risk management. Similarly, a “downside” output risk would be captured by  $\bar{Y}_t(r_t) | \omega_t = \bar{y}_t - br_t - \mathbb{1}(\omega_t = 1)\Delta_t$  which would lower  $\hat{r}_t$  by reducing expected output. As we argue empirically below, FOMC meetings are typically characterized by one of these two risks.

Under the above view, risk management enters the policy rule (3) only via expected conditions. This contrasts with empirical evidence that policymakers react to the tails of the distributions of target variables in addition to their expected values (e.g., [Andrade et al., 2012](#)). A straightforward way to account for this behavior is to depart from quadratic preferences. [Kilian and Manganelli \(2008\)](#) show that higher-order moments matter for optimal policy when the loss function has non-quadratic curvature,<sup>4</sup> while the robust control literature ([Hansen and Sargent, 2001](#); [Giannoni, 2007](#); [Onatski and Stock, 2002](#); [Levin and Williams, 2003](#)) shows that, under certain conditions, policymakers react strongly to the possible realization of bad shocks.

Preference-based explanations for observed reactions to higher-order moments of outcome distributions treat these distributions as exogenous to the Fed's policy decisions. This contrasts with the Fed's own view that risk management involves taking out "insurance" against low-probability but costly potential future outcomes ([Greenspan, 2004](#); [Blinder and Reis, 2005](#); [Evans, 2019](#)). Our interpretation of insurance is that the Fed's decisions *change* the probability of high-cost outcomes not just *react* to them. On several occasions, FOMC members have been explicit on this point. [Mishkin \(2008\)](#) states (italics ours): "By cutting interest rates to offset the negative effects of financial turmoil on aggregate economic activity, monetary policy can *reduce the likelihood* that a financial disruption might set off an adverse feedback loop" and provides the broad argument that "monetary policy cannot—and should not—aim at minimizing valuation risk, but policy should aim at *reducing macroeconomic risk*." Furthermore, [Bernanke \(2009\)](#) states that "Liquidity provision by the central bank *reduces systemic risk* by assuring market participants that, should short-term investors begin to lose confidence, financial institutions will be able to meet the resulting demands for cash without resorting to potentially destabilizing fire sales of assets."

To capture the idea that policy can endogenously affect the probability of future adverse outcomes, we modify the distribution of  $\omega_t$  to explicitly depend on  $r_t$ .

$$\omega_t = \begin{cases} 1 & \text{with probability } p_t(r_t) \\ 0 & \text{with probability } 1 - p_t(r_t) \end{cases}$$

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<sup>4</sup>[Dolado et al. \(2004\)](#) and [Surico \(2007\)](#) also provide evidence that empirical monetary policy rules are asymmetric, which exists in tension with the Fed's mandate to treat upside and downside target misses symmetrically. In fact, the Fed formalized asymmetry in its 2020 strategic framework review emphasizing employment shortfalls. The implication of the asymmetric framework is a policy bias that increases with the Fed's uncertainty about the economy, as discussed by [Eggertson and Kohn \(2023\)](#) and further explored in [Cieslak et al. \(2025\)](#) through the lens of asset pricing implications.

where, as before,  $0 \leq p_t(r_t) < 0.5$  for all  $r_t$ . Considering first the case of upside inflation risk, the natural assumption is  $p'(r_t) < 0$  so that more aggressive policy reduces the probability of the high-inflation state. For example, [Goodfriend \(1993\)](#) presents a mechanism in which more aggressive action anchors inflation expectations and reduces the likelihood of high future inflation. Under this model, optimal policy becomes

$$2\bar{\Pi}'_t(\hat{r}_t)(\bar{\Pi}_t(\hat{r}_t) - \pi^*) + \underbrace{p'_t(\hat{r}_t)}_{<0} \underbrace{(1 - 2p_t(\hat{r}_t))}_{>0} \Delta_t^2 = -2\lambda \bar{Y}'_t(\hat{r}_t)(\bar{Y}_t(\hat{r}_t) - y^*) \quad (4)$$

where  $\bar{\Pi}_t(r_t) = \bar{\pi}_t - ar_t + p_t(r_t)\Delta_t$  and  $\bar{Y}_t(r_t) = \bar{y}_t - br_t$ . When  $p_t(\hat{r}_t) = p_t$  and there is no dependence of the tail event probability on policy, (4) can be solved to deliver rule (3). But, with endogenous tail risk, there is an additional motive to adopt more aggressive policy stances beyond a rise in expected inflation. Doing so reduces the variance of future inflation outcomes, which decreases expected loss. Moreover, [Cieslak et al. \(2024\)](#) show that under natural conditions  $\hat{r}_t$  rises when  $p_t$  and  $\Delta_t$  rise.

Under downside output risk, the natural assumption is instead that  $p'(r_t) > 0$  so that looser policy reduces the probability of an adverse tail event. One mechanism is highlighted in the quotations above, i.e., that policy accommodation lowers the chances of financial market instability and the associated impact on left-tail growth realizations.<sup>5</sup> Another is highlighted in [Evans et al. \(2015\)](#) who argues that preemptive loosening reduces the probability of hitting the zero lower bound where policy can no longer effectively counteract downside shocks. By arguments analogous to those in [Cieslak et al. \(2024\)](#), optimal policy is now looser than that dictated by certainty equivalence due to the additional motive to reduce the variance of future output realizations.

This framework provides a simple rationale for risk management as preemption in which policy stance is adjusted today to change the distribution of tail outcomes tomorrow. Such preemption takes the form of a more aggressive policy response to tail probabilities than certainty equivalence alone would dictate. Importantly, preemption does not necessarily operate solely through current policy actions and can involve a significant element of communication. To the extent that the distribution of future outcomes operates through changing market beliefs, part of the preemptive response may come from the Fed communicating forward-looking stance that shapes these beliefs. We now provide evidence this is indeed the case.

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<sup>5</sup>See also [Adrian et al. \(2019\)](#) for evidence linking financial conditions to downside growth risk.

### III. Monetary policy stance beyond the short rate

Over the last several decades, policymaking on the FOMC has evolved through distinct phases with numerous instruments adopted, modified, or phased out. This presents an empirical challenge since, as discussed in the previous section, we seek to measure a broad notion of policy stance beyond the policy rate. To overcome this, and in keeping with Bernanke's "98% words and only 2% action" logic, we use language as a natural starting point. In this section, we explore the transcripts of the FOMC meetings to gain insights into policy stance and its drivers.

The FOMC transcripts contain nearly verbatim record of policymakers' deliberations and are available in a consistent form over nearly four decades. We assume that the views expressed in the meetings are a union of the different signals about policy stance that policymakers send to the public. While some portion of deliberations remains private, the evidence suggests that the substantial policy views from the meeting find way into the public domain through formal communication in announcements, and during the intermeeting period via speeches, minutes, testimonies (Cieslak and McMahon, 2024; Swanson and Jayawickrema, 2023) as well as informal channels (Belongia and Kliesen, 1994; Cieslak et al., 2019; Vissing-Jorgensen, 2021).

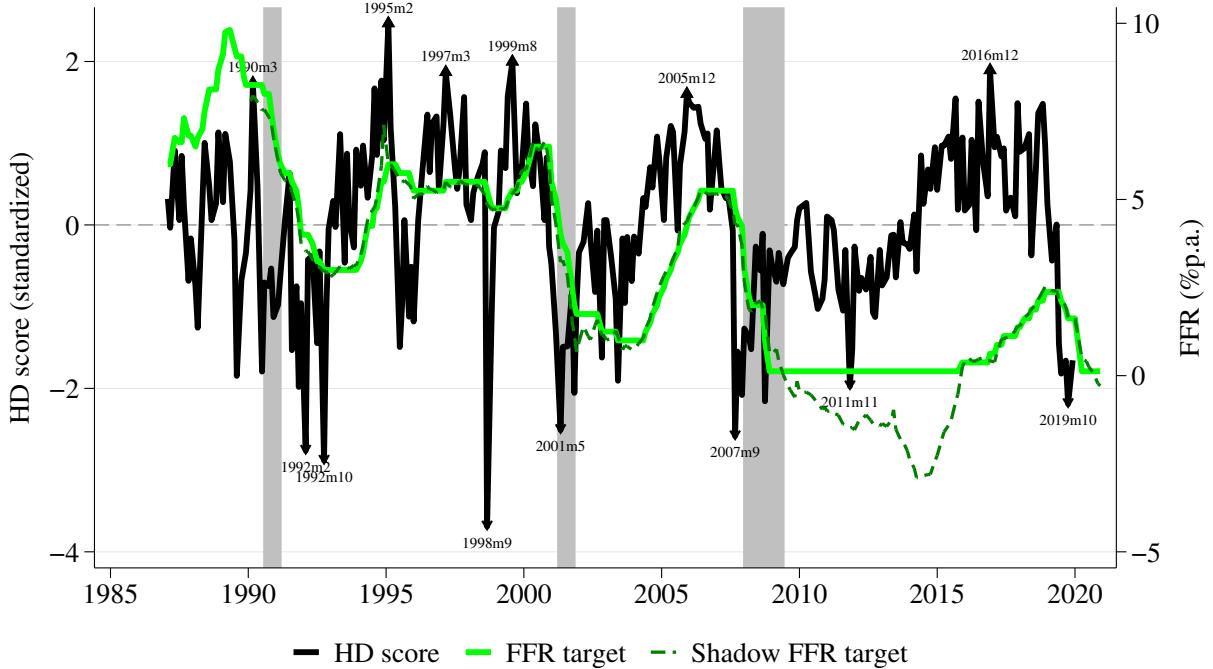
#### *III.A. Inferring conditional, forward-looking policy stance from policymakers' words*

We summarize results based on the FOMC meeting transcripts from August 1987 (the beginning of Greenspan's tenure) through December 2019 (as transcripts are released with a five year lag). We use the transcripts, first, to construct language-based measures of policy stance, and second, to understand the policymakers' motives for adopting a particular stance.

Our first stance proxy, which we refer to as the HD score (for Hawk-Dove), builds directly on the approach of Cieslak et al. (2024). Focusing on statements made by the FOMC members (chair, vice-chair, governors and regional Fed presidents) in the policy round of an FOMC meeting, they identify sentences pertaining to monetary policy,<sup>6</sup> and within this set, further classify directional policy stance based on counts of phrases associated with hawkish (tightening) and dovish (easing) views. The balance of those directional phrases is normalized by the length of overall policy round in a given meeting. The HD score,  $HD_t = Hawk_t - Dove_t$ , thus estimates the intensity in language with which policymakers express their leanings at each meeting,  $t$ . The benefit of the

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<sup>6</sup>Two conditions are imposed to obtain this set. First, a sentence must appear in the policy round of FOMC meetings. Second, a sentence must contain a word indicating policy discussion.



**Figure 1. Policy stance in FOMC meetings vs. policy rate.** The figure adapted from Cieslak et al. (2024) shows the policy stance measured from the FOMC language in the policy round of the meeting—the HD score—superimposed against the FFR target and the shadow rate from Wu and Xia (2016).

dictionary-based approach is its replicability and the ability to isolate concrete phrasing of policy views. We later augment the HD proxy with an alternative constructed using a large language model (LLM).

Figure 1 plots the meeting-level HD scores over time against the Fed funds rate (FFR) target and the Wu and Xia (2016) shadow rate to cover the zero-lower bound period. The HD measure has intuitive business cycle dynamics, becoming elevated in expansions and declining rapidly in recessions and during periods of financial turmoil.

A cursory look at the HD series points to significant shifts in FOMC’s language whereby its variation anticipates subsequent changes in the policy rate at future meetings. The fluctuations in policy views beyond short rate are, of course, most clearly displayed during the zero-lower bound, where stance adjusts continuously despite a fixed policy rate. However, the graph also indicates that the content of FOMC deliberations has been broader than what is reflected in the current policy rate decision long before the zero lower bound.

What considerations drive the expressed policy stance? Do they predict the actual future policy path, and, to the extent that policymakers communicate their views to the public, how do they affect financial markets more broadly? We summarize evidence

highlighting the key facts about the FOMC’s stance in language. Specifically, 1) HD explains the Fed’s current deviations from a standard policy rule beyond Greenbook macroeconomic forecasts; 2) HD predicts policy rate changes up to a year ahead; and 3) The FOMC’s perceptions of risk and uncertainty are substantial drivers of HD. This evidence thus points to a broad interpretation of policy stance as describing the entire distribution of policy paths that policymakers entertain, beyond the current action and beyond first moments.

### *III.B. FOMC’s policy stance in language explains current deviations from a policy rule*

To measure deviations from a policy rule, we use a series of monetary policy shocks originally constructed by [Romer and Romer \(2004\)](#) and available through December 2007 from [Ramey \(2016\)](#). These shocks are residuals from regressing the Fed’s intended changes in the FFR in meeting  $t$  on the internal Greenbook macroeconomic forecasts prepared by the Fed’s staff before the meeting.

Figure 2 displays Romer-Romer shocks against the HD stance, showing their strong positive comovement during the 1987–2007 period. A one-standard-deviation increase in the HD language, indicating a tighter stance, is associated with a 9 bps change policy rate that cannot be explained by Fed staff’s macro forecasts in Greenbooks. The  $HD_t$  coefficient is highly significant with a t-statistic of nearly 7 and regression R-squared of 0.28.<sup>7</sup> The estimated 9 bps effect is economically large relative to the 18 bps standard deviation of Romer-Romer shocks in this sample. While a structural interpretation of monetary policy shocks remains debated, this result shows that policy views in the meeting can cast new light on the reasons for why the FOMC deviates from policy rules.<sup>8</sup>

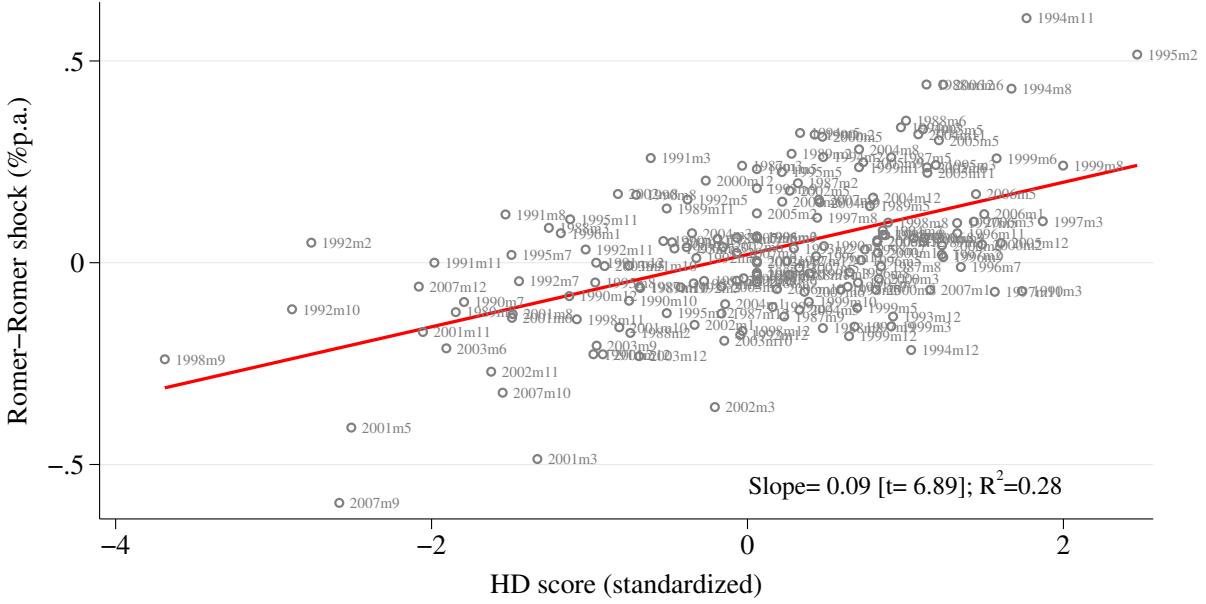
### *III.C. FOMC’s policy stance in language predicts policy path beyond Fed’s macroeconomic forecasts*

An important source of variation in HD beyond the current policy rate is information about future policies that policymakers either expect to implement or consider as a set of possible outcomes. The forward-looking content of HD stance can already be seen from Figure 1. To test it formally, we estimate predictive regressions of future changes

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<sup>7</sup>These results are robust to adding other Greenbook controls and lags of the FFR, beyond controls used to construct Romer-Romer shocks.

<sup>8</sup>[Aruoba and Drechsel \(2025\)](#) shows that language reflecting economic conditions can predict the policy rate. The HD measure is instead based on language explicitly linked to policy preferences, given conditions.

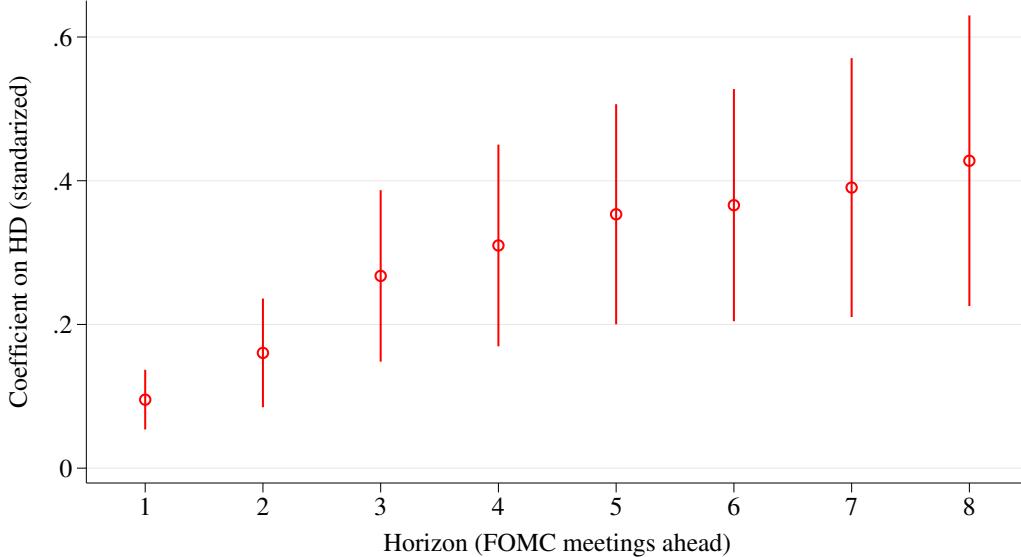


**Figure 2. Policy stance in FOMC meetings language vs. Romer-Romer shocks, 1987:08–2007:12.** The figure shows Romer and Romer (2004) monetary policy shocks against the HD score from Cieslak et al. (2024).

in the policy rate on current HD variable and a rich set of controls including Greenbook forecasts and forecast updates, a proxy for trend inflation, the current and lagged policy rate.<sup>9</sup> To cover the zero lower bound period, we replace the FFR target with the Wu-Xia shadow rate between January 2009 and October 2015. We refer to this spliced variable as the FFR target through the rest of the paper.

Figure 3 plots the estimated regression coefficients on  $HD_t$  predicting the FFR change from meeting  $t$  to  $t + h$ . The predictability accumulates with horizon up to eight meetings ahead (one year), most steeply over the next four meetings. A one-standard-deviation increase in HD score predicts a roughly 40 bps higher policy rate at eight meeting ahead, controlling for macroeconomic expectations and lagged FFR to account for the well-known inertia in the policy rate. The magnitude of the forward-looking effect is economically large, corresponding to more than 20% of volatility of annual FFR changes over this sample period.

<sup>9</sup>The controls are informed by the literature estimating forward-looking policy rules, e.g., Romer and Romer (2004), Coibion and Gorodnichenko (2012). We verify that the predictive power of HD language for future policy is robust to the specific variables we include. The trend inflation variable is estimated using constant gain learning, a backward-looking discounted moving average of past core CPI inflation, which is frequently used in the literature to proxy for the long-run perceived inflation target (Cieslak and Povala, 2015; Malmendier and Nagel, 2015; Bianchi et al., 2022).



**Figure 3. Predictability of future policy rate with policy stance in FOMC meetings language, 1987:08–2019:12.** The figure reports  $\beta_h$  coefficients from predictive regression,  $FFR_{t+h} - FFR_t = \alpha_h + \rho_0 FFR_t + \rho_1 FFR_{t-1} + \beta_h HD_t + \gamma'_h Controls_t + \varepsilon_{t,t+h}$ .  $HD_t$  is standardized,  $FFR_t$  is in percent p.a. The spikes indicate 95% HAC confidence intervals using bandwidth with 9 lags. The regressions are estimated at the FOMC meeting frequency over the sample period 1987:8–2019:12 for the dependent variable, so the last forecast at  $h = 8$  meetings ahead extends through 2020:12.

To further dissect the contribution of forward-looking views to the HD score, we classify policy sentences by their temporal orientation—future-oriented, focused on current actions, or both—using an LLM. Future-oriented statements account for over half (51%) of all policy sentences, while 31% of sentences focus on current actions and 6% include both time frames. A further decomposition shows that 41% of future-oriented statements involve conditionalities, 44% are unconditional forecasts, and the remaining 16% are undetermined. Appendix Figure A-1 provides additional details on this decomposition.

These estimates quantify the importance of forward-looking considerations in policy-making, corroborating anecdotal reports by current and former Fed officials that such considerations are an integral to the FOMC’s policy process.<sup>10</sup> These dimensions of the Fed’s decision making are ignored in the traditional estimates of policy rules used in the literature to describe the policy behavior.

<sup>10</sup>For example, Meyer (2004) states: “So was the FOMC meeting merely a ritual dance? No. I came to see policy decisions as often evolving over at least a couple of meetings. The seeds were sown at one meeting and harvested at the next. [The discussion] could change my mind, even if it could not change my vote at that meeting. (...) I was often positioning myself, and my peers, for the next meeting.”

### *III.D. Interpreting policy stance expressed in language as a policy instrument*

The properties of the HD score indicate that policymakers' views regularly tilt away from the current policy action, and those tilts are unexplained by the Fed's forecasts of macroeconomic conditions. To interpret the HD score as an additional policy tool, one would want to connect it to an explicit policy outcome. The Fed's use of policy tools, including communication, has undergone substantial changes over the past four decades. The link between HD policy stance and a concrete policy outcome can be most directly established for the early part of our sample. Between 1983 and 1999, the FOMC's instructions—so called “directive”—to the open market trading desk at the New York Fed included a statement about the Committee's expectations for future changes in the policy stance, in addition to instructions for current policy. The statement regarding the possible future policy was known as the “symmetry,” “tilt,” or “bias,” of the policy directive ([Thornton and Wheelock, 2000](#)).

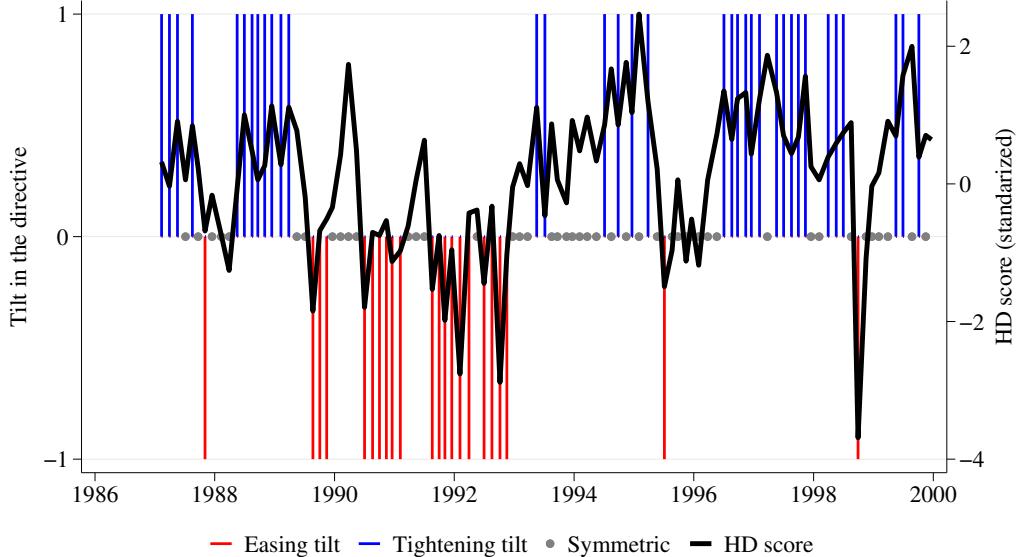
A symmetric directive (no tilt) indicated that a tightening or an easing were equally likely in the future. Otherwise, the directive was denoted as asymmetric toward either tightening or easing. While the Fed did not provide an official interpretation of the tilt, it was seen as a valuable policy information by financial markets. [Belongia and Kliesen \(1994\)](#) document that on 11 occasions between 1989 and 1993 the essence of the directives, including the tilt, was leaked to the Wall Street Journal within one week of an FOMC meeting.<sup>11</sup> As the tilt was oftentimes the focus of leaks, this suggests that market participants valued this information.

We now show a close correspondence between the FOMC language and the policy tilt during the 1987–1999 sample. The historical tilt outcomes are available from [Thornton and Wheelock \(2000\)](#). We code the tilt as a discrete  $-1, 0, +1$  variable, respectively, for an easing bias, symmetry, or a tightening bias. Figure 4 shows that the policymakers' language in a given meeting is a strong predictor of the tilt adopted by the FOMC. While the tilt is positively correlated with the contemporaneous policy action (the change in the FFR rate), this relationship is fully accounted for by the Greenbook forecasts. In contrast, the HD language explains a substantially larger share of the variation in the tilt over time, in a way orthogonal to both the Greenbook forecasts and the current policy action (see Appendix Table A-1).

To translate stance in language into a tilt outcome, we estimate an ordered logit model predicting tilt with  $HD_t$  while controlling for the FFR target change from meeting  $t - 1$  to

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<sup>11</sup>The most famous articles were two stories by David Wessel in May 1992 and May 1993 on the FOMC's decision to switch to a “symmetric tilt” in 1992 and an “asymmetric tilt” toward tightening in 1993. Greenspan was suggested as the likely source of the 1989 to 1993 leaks (see [Cieslak et al. \(2019\)](#)).



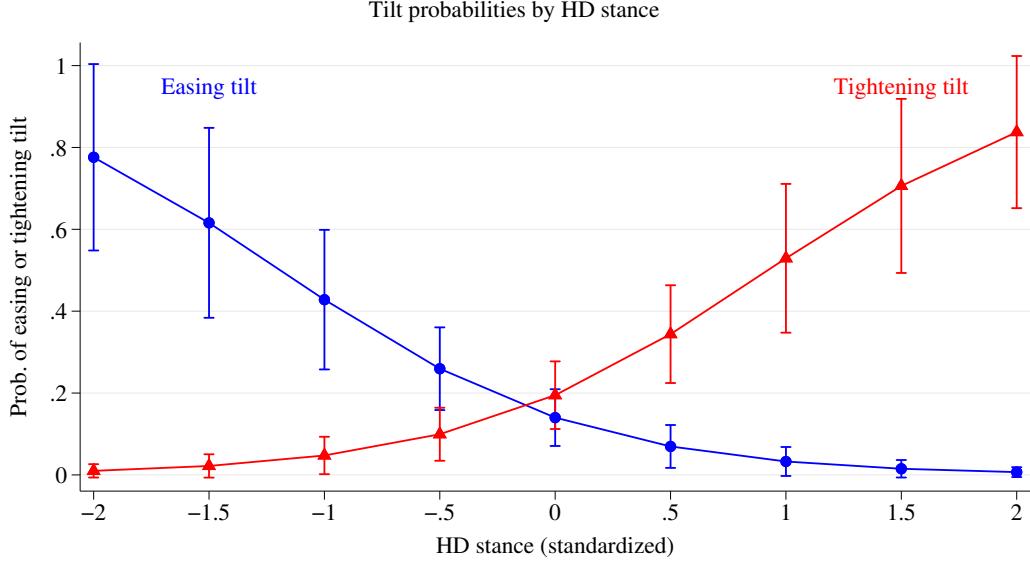
**Figure 4. Policy stance in FOMC meeting language vs. policy tilts in the FOMC’s directive, 1987:08–1999:11.** The figure plots the standardized HD score from FOMC language in the meeting (Cieslak et al., 2024) against the tilt in the FOMC directive sent to the open market desk at the New York Fed. The tilt data come from Thornton and Wheelock (2000)

$t$ , and Greenbook forecasts at meeting  $t$ . Figure 5 reports the estimated probabilities of a tightening tilt or an easing tilt at different levels of the HD score (in standardized units, from  $-2$  to  $2$  standard deviations), keeping control variables at their sample means. The probability of the FOMC issuing a tightening tilt increases by about 33 percentage points from 19.5% to 53% when HD score increases by one standard deviation from 0 to 1, and the effect is nearly symmetrically distributed for the easing and tightening tilt (the symmetric no-tilt case is the omitted category in the graph).

Overall, these results establish that a large forward-looking component of policymakers’ deliberations is not revealed by an immediate policy rate action, and cannot be explained by the Fed’s Greenbook forecasts, but it drives policy outcomes through policy tilts.

#### IV. Risk management as driver of monetary policy stance

We next summarize and extend evidence establishing the FOMC’s risk and uncertainty perceptions as key determinants of policy stance beyond the Fed’s economic expectations.



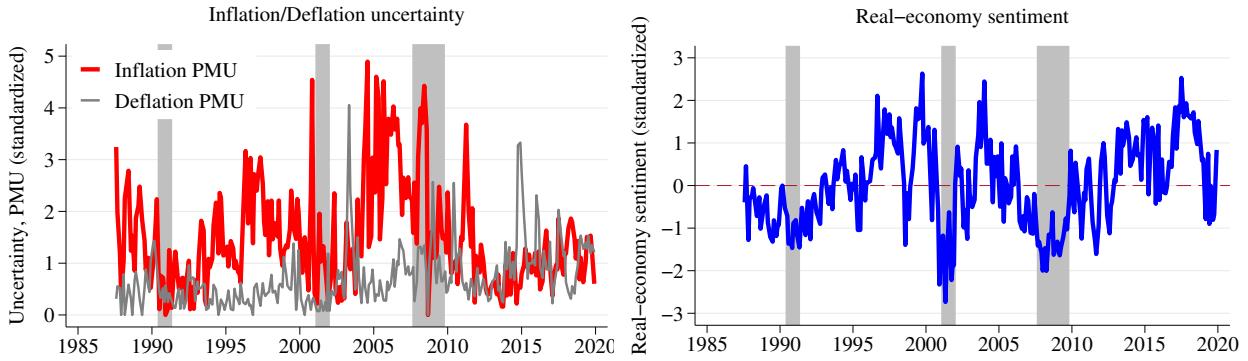
**Figure 5. Policy stance in FOMC meeting language vs. policy tilts in the FOMC’s directive, 1987:08–1999:11.** The figure plots probability estimates from an ordered logit model predicting policy tilt with the HD score. The tilt is coded as  $-1, 0, +1$  for easing, symmetry and tightening, respectively. The symmetric case is the omitted category in the plot. The HD score is standardized to have a zero mean and a unit standard deviation.

#### IV.A. Policymakers’ perceptions of uncertainty and risk drive forward-looking policy tilts

Cieslak et al. (2024) establish that policymakers’ inflation uncertainty and worries about downside risks to the real economy (“sentiment”) drive the forward-looking policy stance. These higher-moment beliefs are the primary factor creating a wedge between the voiced policy stance and the current action.

Specifically, Cieslak et al. (2024) develop a collection of language-based measures to assess policymakers’ beliefs about economic distributions: policymakers’ perceptions of uncertainty (PMU) and asymmetrically distributed tail risks (sentiment). PMU measures are based on the FOMC’s expression of risk and uncertainty about inflation, real economy, or financial markets. Sentiment measures instead capture expressed directional beliefs on the evolution of these variables, constructed as a balance of positive and negative views. PMU or sentiment are not explained by the first-moment forecasts from Greenbooks, or measures of public uncertainty (e.g., VIX, Baker et al. (2016), professional survey disagreements).

Importantly, these higher-moment perceptions are estimated solely from the economy round of the meeting, i.e., the part of deliberations that precedes the policy round when policy decisions are taken and from which the HD score is obtained. To the extent that the economy round is designed to summarize policymakers’ views of the economy



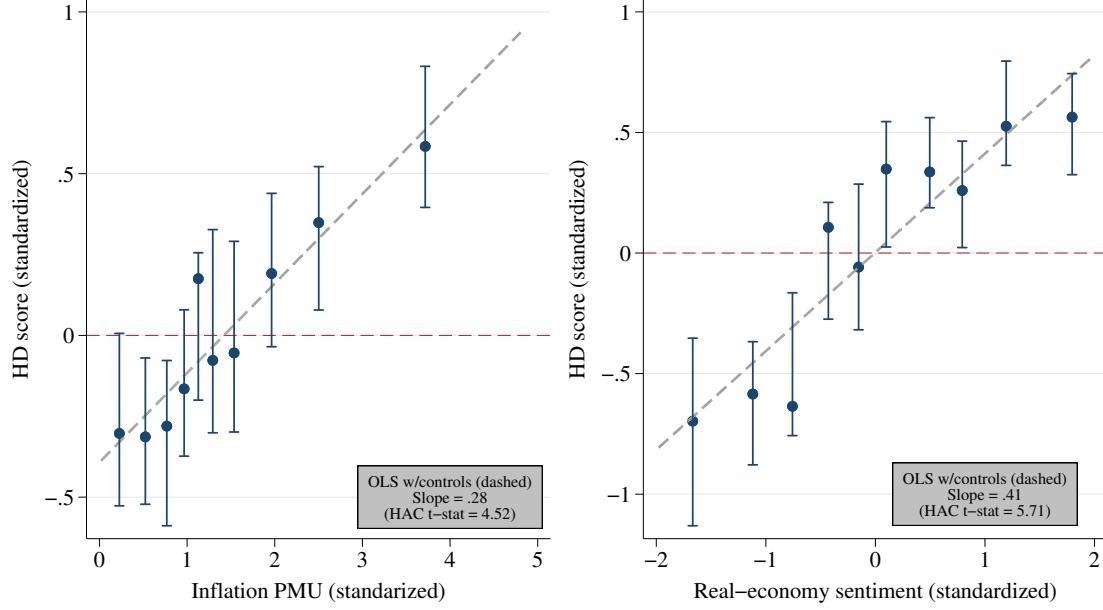
**Figure 6. Time series of FOMC’s distributional perceptions of the economy.** The figure plots the updated series from Cieslak et al. (2024). The left panel plots the inflation/deflation uncertainty indices (PMU); the right panel plots the real-economy sentiment. The series are based on the language of the FOMC members in the policy round of the meeting. Sentiment is a balance of directional language (positive less negative) about the real economy. The series are expressed in units of standard deviations, where we shift the PMU series by a constant so that they remain positive throughout the sample. For comparability, deflation PMU is expressed in units of standard deviation of inflation PMU.

before the policy decision is made, the structure of the meeting allows us to assess how policy stance responds to uncertainty and risk perceptions.<sup>12</sup>

Figure 6 plots the time-series of the two leading predictors of policy stance: the FOMC-perceived inflation uncertainty (inflation PMU, left panel) and the sentiment about the direction of the real economy (positive sentiment indicating better economic conditions, right panel). The left panel additionally displays the deflation PMU component and shows that inflation uncertainty prevails over deflation uncertainty for most of the sample, although the deflation component features notable spikes and, perhaps not surprisingly, becomes prominent in more recent years. Inflation PMU rises gradually throughout expansions of the late 1990s and mid-2000s. While the real sentiment in the right panel shows pronounced cyclical shifts as well, its correlation with inflation PMU is close to zero over our sample period. This suggests that uncertainty perceptions and the directional beliefs capture distinct aspects of the FOMC’s economic assessment.

Figure 7 examines the relationship between policy stance and the FOMC’s perceptions. To account for possible nonlinearities, we use binned scatter plots of HD against inflation PMU and real-economy sentiment. In each plot, we partial out the Greenbook controls and the other perception proxy. The left panel demonstrates that policymakers adopt increasingly hawkish policy stance in language as they become more uncertain about

<sup>12</sup>The assumption that uncertainty and risk perceptions are pre-determined relative to policy stance decided in the meeting is analogous to the assumptions on pre-determined Greenbook forecasts when estimating forward-looking policy rules.



**Figure 7. Policy stance and FOMC distributional perceptions, 1987:08–2019:12.** The figure shows the relationship between the HD score and FOMC perceptions of inflation uncertainty and sentiment about the direction of real economy. The binscatter for inflation PMU residualizes the HD score and inflation PMU against Greenbook controls and the real-sentiment. The residuals of inflation PMU are split into decile bins containing approximately 10% of observations each. The distribution of the HD score residual is then calculated for each bin (mean and 95% confidence interval). The binscatter for the real-economy sentiment is constructed analogously. The dashed line presents the fitted linear binned regression model. The bottom left corner reports slope estimates from OLS regressions of HD score on inflation PMU (real sentiment), controlling Greenbook and real sentiment (inflation PMU).

inflation. The relationship exhibits notable nonlinearity: relatively modest increases in hawkishness at low uncertainty, and sharper increases when uncertainty becomes elevated. This pattern suggests the Fed may use forward-looking stance as a preemptive tool to anchor inflation expectations when uncertainty is high. The right panel shows a more linear positive relationship between real-economy sentiment and policy stance. Importantly, as these relationships hold independently of each other, they reflect distinct considerations in the policymakers' decision process.

Further, using the policy tilt in the FOMC directive as the outcome variable, we estimate that a one standard deviation increase in inflation PMU raises the probability of a tightening tilt by 17 percentage points in an ordered logit model. An analogous effect of a one standard deviation increase in the real-economy sentiment is 14 percentage points probability increase. These estimates are significant at the 0.1% level, controlling for the current FFR target rate change and the Greenbooks (see Appendix Figure A-2). Appendix Table A-2 confirms these results using regressions of  $HD_t$  and  $Tilt_t$  on a full suite of textual PMU and sentiment proxies.

#### IV.B. An LLM approach to inferring policy tilt and its drivers from FOMC language

The evidence so far shows that policymakers' assessments of risk and uncertainty are reflected in their expressed policy stance. We have also seen that policy language strongly predicts an actual policy outcome—the tilt in the policy directive. While the tilt is only available through 1999, its discontinuation does not render it an obsolete concept in policymaking. Rather, the way the Fed conveys its policy inclinations has evolved as it adopted a more systematic and deliberate approach to public communication.<sup>13</sup>

We now show that asymmetric policy tilts have been an integral part of policymaking complementing the Fed's actions over the past four decades. We extend the previous analysis with an LLM-based approach. This allows us to construct an inferred policy tilt over the entire 1987–2019 sample, extrapolating beyond 1999. Specifically, we supply each of the 259 FOMC meeting transcripts<sup>14</sup> between 1987:8 and 2019:12 to Claude LLM along with a query to evaluate on a discrete scale the current decision (easing, tightening, unchanged) as well as any forward-looking or conditional policy stance that the FOMC could implement in the future (tightening, easing, neutral, none). We denote the current policy as  $ActionLLM_t$  and the forward-looking stance as  $TiltLLM_t$ .

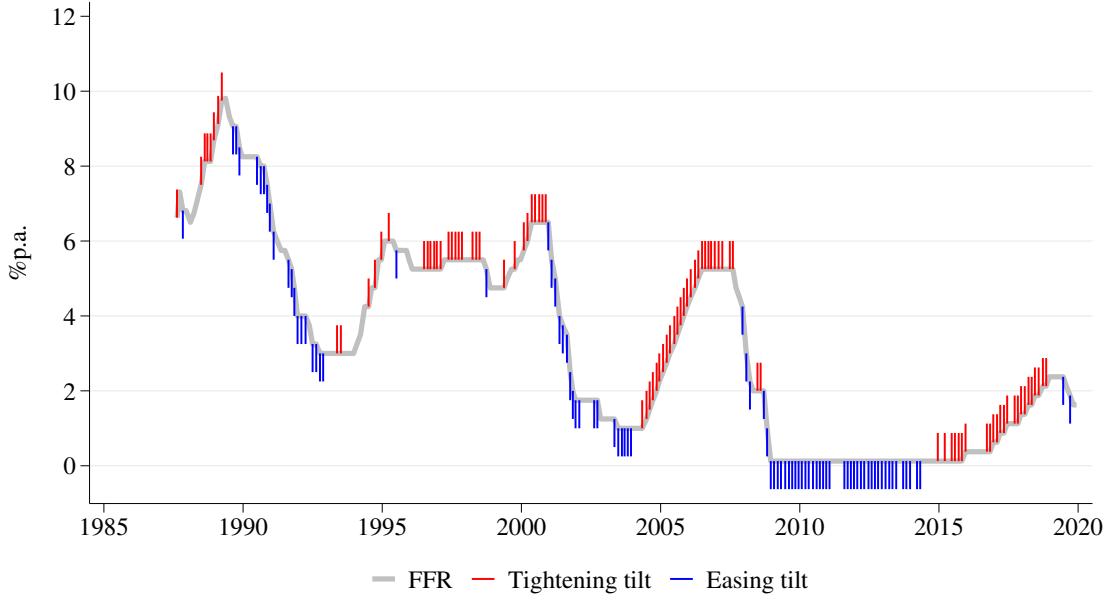
To validate the classification, we compare the tilt constructed by the LLM with the tilt in the FOMC directive in the pre-2000 sample. The LLM is correct in all instances except for one, in which it classifies the tilt as neutral rather than as tightening. Complementary to the dictionary approach, the LLM converts the FOMC language into a discrete outcome consistent with how the tilt was historically reported.

Several features support the interpretation of the tilt as an independent policy tool beyond current action. Figure 8 illustrates how the tilt has evolved over time relative to the FFR target. The red bars indicate a tightening tilt and blue bars an easing tilt. Most clearly, the voiced tilt supports policy accommodation post 2008 during the zero lower bound. However, the graph also shows that such asymmetries have been a regular feature of policy stance throughout our sample. The FOMC has used the asymmetric tilt most frequently in meetings when no policy action is taken, and somewhat less frequently, to reinforce the direction of the current action. Figure 9 stratifies the tilt by the current action, indicating that 65% of instances of either tightening or easing tilt occur at meetings where the FOMC did not change its current policy.

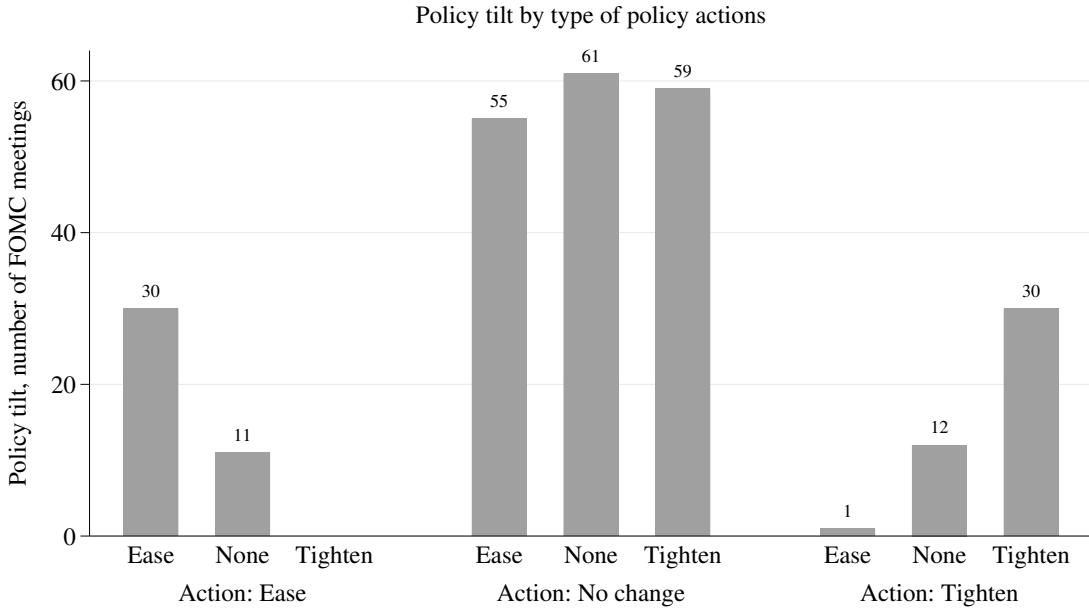
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<sup>13</sup>The tilt in the directive was issued internally from 1983 until March 1999. In May 1999 the FOMC for the first time included information about the asymmetric policy directive in the FOMC statement. However, already in January 2000, the tilt for the FFR target was replaced in the statement by the balance of risk towards growth or inflation (e.g., [Middeldorp, 2011](#)).

<sup>14</sup>We drop one transcript from May 1988 because it is incomplete, and does not contain the policy round.



**Figure 8. LLM-inferred policy tilt and the FFR target.** The figure superimposes the LLM-inferred policy tilt against the FFR target rate. The red (blue) bars indicate an easing (tightening) tilt.



**Figure 9. LLM-inferred policy tilt by type of policy action.** The figure counts the meetings with a given policy tilt, conditional on the type of current policy action taken at the meeting. The sample period is 1987:8–2019:12. The policy tilt is inferred from the text of the FOMC meetings using Claude LLM.

#### IV.C. Balance of risk and policy tilt

A further LLM-based analysis of what drives the asymmetric tilts reveals the importance of the Fed's risk perceptions, supporting the connection between policy stance and

policymakers' uncertainty first established by [Cieslak et al. \(2024\)](#). The fact that the FOMC decided to replace the tilt with the balance of risk statement—a change implemented in 2000—is in itself informative about the relationship between these concepts in policy conduct. To further explore this relationship, we use the LLM to infer how at a given meeting the FOMC assesses the balance of risks to its dual mandate: toward high inflation, toward low growth/employment, balanced, or none? We code the outcomes as a discrete  $+1, 0, -1$  variable, which we denote as  $BoRLLM_t$ .

As one would expect, the asymmetric policy tilt moves together with the balance of risk assessment. The FOMC displays a tightening tilt when its risk assessment slants toward high inflation and an easing tilt when it slants toward weak growth. Rarely does the Fed adopt an asymmetric policy tilt when the risks are viewed as balanced (Appendix Figure A-3).

Table I summarizes the results by tying the policy stance (current action and the tilt) to the balance-of-risk assessments and the textual uncertainty and risk perceptions proxies from [Cieslak et al. \(2024\)](#). While both components reflect FOMC risk assessments, the relationship is much stronger for the tilt, and is independent of the influence of the risk assessment on action. We estimate OLS regressions for easy comparison across specifications.

The dependent variable in panel A is the current change in the FFR target from  $t - 1$  to  $t$  in columns (1)–(2) or the LLM-inferred discrete policy action,  $ActionLLM_t$ , in columns (3)–(4), where the latter allows us to take a broader view of action, e.g., via unconventional balance sheet policies. The estimates show that FOMC tends to tighten current policy when  $BoRLLM_t$  points toward rising risks to inflation, and when  $InfPMU_t$  and  $EcoSent_t$  increase, controlling for Greenbooks and lagged policy rate. Thus, risk perceptions lead the FOMC to modify its current action.

In panel B, we treat the policy tilt  $TiltLLM_t$  as the outcome variable and estimate how it changes with the FOMC's risk perceptions. Since we are interested in the component of the tilt beyond action, we control for the current and lagged FFR target as well as  $ActionLLM_t$ , in addition to the Greenbook controls.

Columns (1)–(3) validate that the  $TiltLLM_t$  is strongly positively associated with the balance-of-risk  $BoRLLM_t$ : risks of higher inflation (lower growth) predict a tightening (an easing) tilt. The  $BoRLLM_t$  coefficient is little affected by controlling for current action or macro forecasts. Among the controls, one variable worth highlighting is the deviation of the Greenbook four-quarter inflation forecast from a slow-moving inflation trend (proxy for the Fed's inflation target),  $F_t(\pi_4) - \tau_t$ ; other controls are suppressed in the table. This

expected deviation in inflation emerges as a significant predictor of the tilt, separately from the balance of risk. One interpretation is that the tilt is also used to reinforce the current policy action and reaffirm the Fed’s stance on inflation when the FOMC is concerned that its action may be insufficient to anchor inflation expectations.

Columns (4)–(6) extend earlier evidence in Figure 5 based on the tilt from the directive to cover the full 1987–2019 sample. The LLM tilt shows a clear positive correlation with the directional FOMC language summarized by the HD score (column (4)). By extension, the FOMC perceptions of inflation uncertainty, measured by *InfPMU* (columns (5)–(6)), are highly informative about the tilt’s asymmetry.

#### *IV.D. Mistake avoidance as a motive behind risk management and policy tilt*

The central motive behind the risk management approach cited by policymakers is their desire to avoid costly policy mistakes. These mistakes can most simply be viewed as concerns about doing too little or too much. However, a more specific consideration relates to the policy timing as the FOMC neither wants to appear to “fall behind the curve” nor to withdraw policy accommodation too soon.

Figure 9 already shows that the FOMC is more likely to adopt the tilt when it is not currently acting. To capture the FOMC’s motives, in Figure 10, we additionally separate the tilt by the balance-of-risk assessment and the concern about policy timing (too early/late). The tilt tends to become more asymmetric when the Committee worries about being too late—especially in the face of emergent risks of high inflation or weak growth. The FOMC is hardly ever worried about acting too early when perceiving upside risks to inflation, but worries about withdrawing accommodation too early when faced with low growth prospects.

In summary, this evidence helps validate the largely anecdotal accounts of preemption being a key tenet of the Fed’s risk management approach. Specifically, it shows that the FOMC uses policy tilts, rather than actions, as a preemptive tool to reflect its perceptions of asymmetric risks to inflation and the real-economy.

#### *IV.E. Additional evidence on the Fed’s risk management motives from dissent data*

The transcript data allows us to further investigate *individual* FOMC member arguments for different policy positions. The dissenting statements in the meeting provide a useful case studies to understand the reasons underlying the policy tilts as by construction dissents are not revealed in current action. While the FOMC has relatively little formal

A. Dependent variable: FOMC policy action,  $\Delta FFR_t$  or  $ActionLLM_t$ 

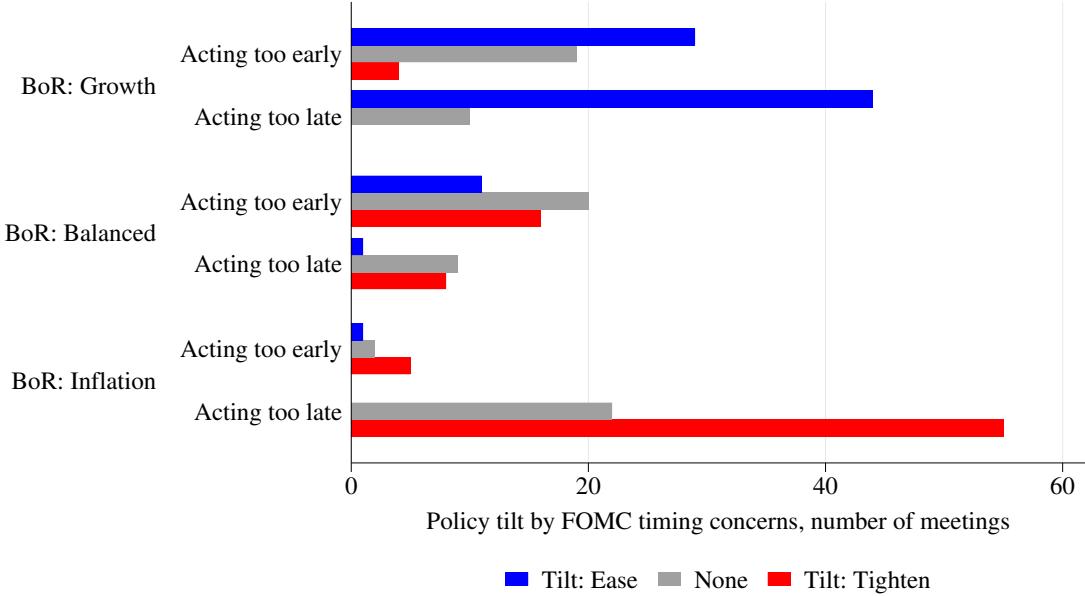
	$\Delta FFR_{t-1,t}$		$ActionLLM_t$	
	(1)	(2)	(3)	(4)
$BoRLLM_t$	0.12*** (5.45)		0.29*** (7.59)	
$InfPMU_t$		0.045** (2.48)		0.096** (2.32)
$EcoSent_t$		0.052** (2.31)		0.11** (2.47)
Controls	Yes	Yes	Yes	Yes
$\bar{R}^2$	0.43	0.39	0.39	0.36
$\Delta \bar{R}^2$	0.073	0.053	0.12	0.11
N	259	259	259	259

B. Dependent variable: FOMC policy tilt,  $TiltLLM_t$ 

	$TiltLLM_t$					
	(1)	(2)	(3)	(4)	(5)	(6)
$BoRLLM_t$	0.68*** (11.15)	0.60*** (7.58)	0.58*** (7.96)			
$ActionLLM_t$		0.22* (1.67)	0.017 (0.13)			
$HD_t$				0.42*** (7.09)		
$InfPMU_t$					0.32*** (4.26)	0.27*** (4.38)
$EcoSent_t$					0.30*** (4.25)	0.16** (2.46)
$F_t(\pi_4) - \tau_t$			0.49*** (5.66)	0.31*** (3.08)		0.48*** (3.89)
Controls	No	No	Yes	Yes	No	Yes
$\bar{R}^2$	0.49	0.51	0.62	0.50	0.40	0.51
N	259	259	259	259	259	259

**Table I. Policy action, tilt, and risk perceptions.** Panel A reports regressions of current policy action on the LLM-inferred balance-of-risk assessment  $BoRLLM_t$  and measures of policymakers' perceptions of risk and uncertainty from Cieslak et al. (2024). The dependent variable in columns (1) and (2) is the FFR target change from  $t - 1$  to  $t$ ; in columns (3) and (4), it is the LLM-inferred policy action,  $ActionLLM_t$ . Controls include lagged policy rate, Greenbook forecasts, and trend inflation  $\tau_{tt}$ , used before (individual estimates not displayed).  $\Delta \bar{R}^2$  is the incremental  $\bar{R}^2$  after adding  $BoRLLM_t$  or  $InfPMU_t$  and  $EcoSent_t$  to the regression relative to controls only. Panel B reports regressions of the LLM-inferred tilt in policy stance on FOMC balance of risk assessments. The dependent variable is the FOMC tilt from LLM. Columns (1)–(3) use LLM-inferred balance-of-risk assessment and current action. Columns (4)–(6) use  $InfPMU_t$  and  $EcoSent_t$  measures. The  $F_t(\pi_4) - \tau_t$  variable is the deviation of the four-quarter-ahead CPI forecast from Greenbooks from a slow-moving inflation trend  $\tau_t$  constructed following Cieslak and Povala (2015). Additional controls include the current and lagged policy rate, and the remaining Greenbook forecasts used previously (individual estimates not displayed).  $BoRLLM_t$ ,  $ActionLLM_t$ , and  $TiltLLM_t$  are discrete  $-1, 0, +1$  variables;  $\Delta FFR_{t-1,t}$  is in percentage points;  $InfPMU_t$  and  $EcoSent_t$  are standardized to have unit standard deviation. The sample period is 1987:8–2019:12. HAC t-statistics are in parentheses.

dissent in the voting record, individual members voice substantial disagreements in meetings.

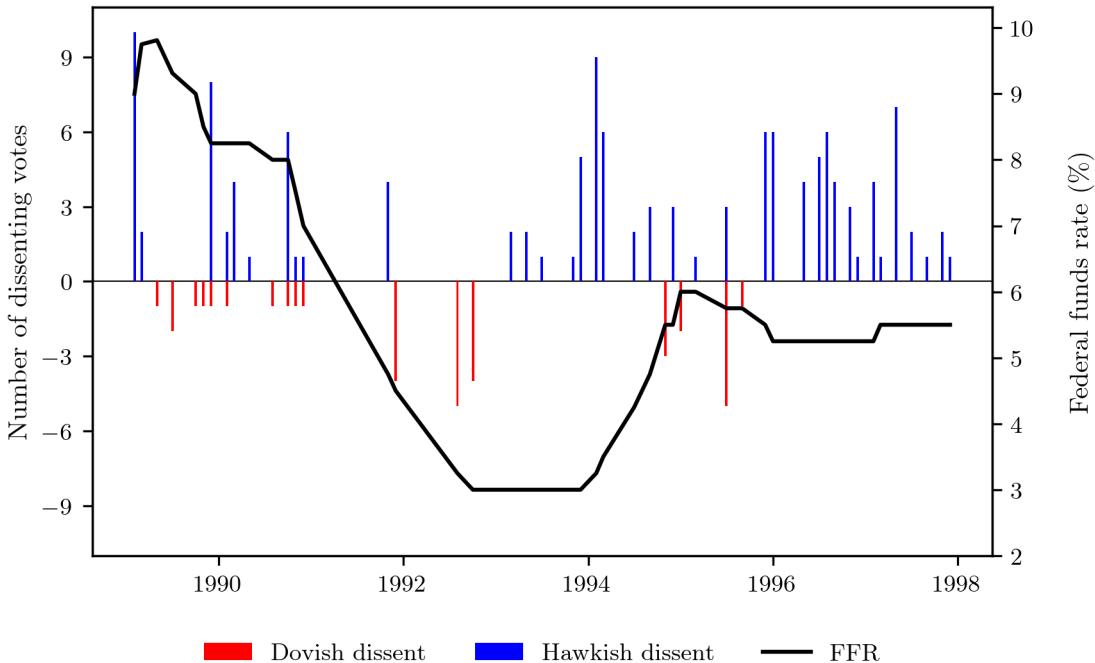


**Figure 10. FOMC policy timing concerns.** The figure counts FOMC meetings in which policymakers adopt asymmetric tilt conditional on their balance-of-risk assessment and whether they voice concerns about acting too late or too early.

[Meade \(2005\)](#) develops a dataset of “dissent in voice” from the policy round of FOMC transcripts from 1989–1997. During this era, Alan Greenspan typically began the policy round with a proposal for adjusting the policy rate and his reasoning. Other FOMC members would then follow in sequence and either verbally agree or disagree with the proposal, often along with supporting arguments or counter-arguments. In every FOMC meeting, Greenspan’s original proposal was ultimately implemented with unanimous, or near-unanimous, formal votes.

Nevertheless, [Meade \(2005\)](#) finds voiced disagreement with the FFR proposal for 30% of FOMC members. Figure 11 tabulates the number of dissents per FOMC meeting, separated into hawkish and dovish dissents. Hawkish dissents are more common than dovish dissents, and most meetings feature dissents in only one direction.

What drives these dissents? The certainty-equivalence view is that different members have different expectations of economic conditions which in turn drives different rate preferences. The risk-management view is that members have different assessments of the need to adjust policy to counteract future risks. To distinguish between these views, we focus on the subset of hawkish dissents in meetings in which Greenspan either recommended no change or an increase in the target rate (95 dissents in total). These are cases where FOMC members express a preference for acting more aggressively than Greenspan. We extract individual arguments from the policy round and pass them into



**Figure 11. Dissents voiced by individual FOMC members, 1989–1997.** The figure presents the number of hawkish and dovish voiced dissents from Greenspan's policy rate preference. Data on voiced dissent is from Meade (2005). The FFR target on an FOMC meeting date is the rate decided at that meeting.

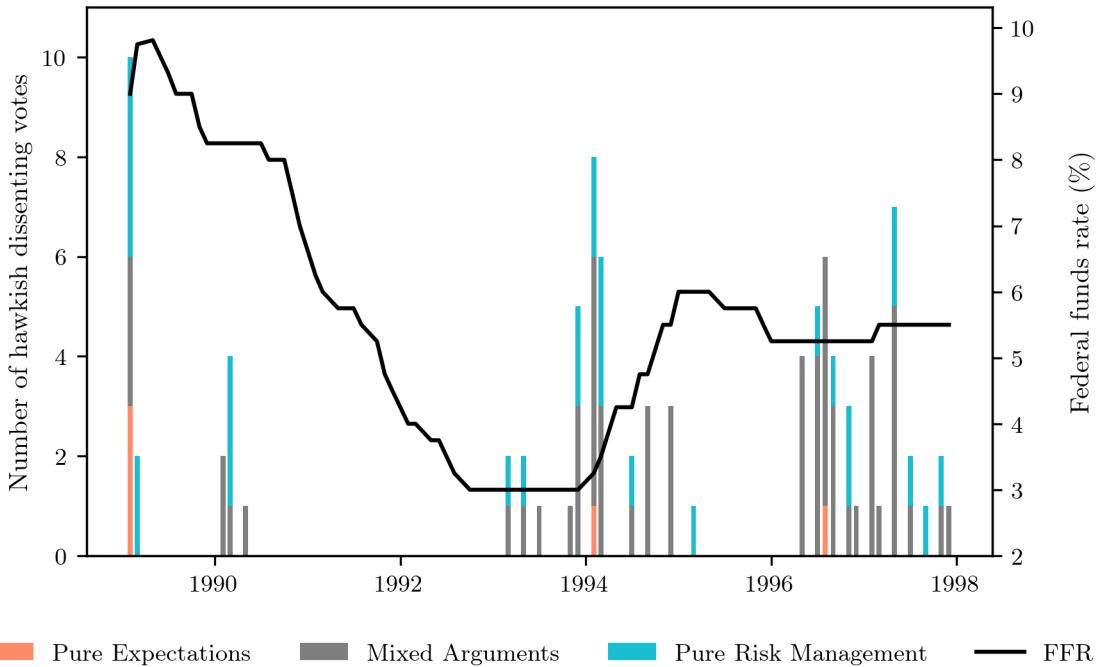
an LLM query that detects the presence of expectations- or risk-management-related arguments. The query specifies several underlying risk-management motives: (i) taking out insurance; (ii) credibility; (iii) non-linear dynamics; (iv) preemption.<sup>15</sup>

In total, 89 of the 95 dissents contain some form of risk-management argument, with 29 of those having *only* such arguments; 65 of the dissents contain some form of expectations-based arguments, with 5 containing only such arguments. Figure 12 tabulates the frequency of dissents by argument type over the sample period. Overall, risk management appears a dominant factor in voiced hawkish policy disagreement on the FOMC.

To provide concrete examples of the arguments we identify, consider the February 1994 meeting in which the FOMC embarked on a tightening cycle by raising the FFR 25 bps. The meeting features 8 total dissents in voice with classified argument types.<sup>16</sup> In

<sup>15</sup>These are described as follows in the LLM query: (i) *Insurance/Asymmetric Risk*—acting to hedge against uncertain future risks even if not the most likely scenario; (ii) *Credibility/Expectations Management*—acting to influence private sector expectations or maintain anti-inflation credibility; (iii) *Nonlinear Dynamics*—acting because delays could trigger threshold effects, financial instability, or harder-to-reverse outcomes; (iv) *Preemptive Action/Hysteresis*—acting before problems fully materialize because reversal is costly or inflation has persistence.

<sup>16</sup>There is a ninth dissent in the meeting by Dallas Fed President Bob McTeer which has no classified argument, the only such dissent in the sample.



**Figure 12. Arguments for voiced hawkish dissents, 1989–1997.** The figure presents justifications for hawkish dissents by individual FOMC members in the meetings where Chair Greenspan supported no change or an increase in the FFR target rate. Argument types are classified by an LLM into pure risk-management motives, pure expectations motives, and mixed containing both types of arguments.

justifying his argument for a 50 bps rate rise, Richmond Fed President Alfred Broaddus emphasizes price pressures by highlighting “the signs of strength in the economy and the evidence of some nascent upward price pressures” which is classified as an expectations argument. But the risk-management arguments for needing to move 50 bps include: “If we don’t move, we would put our credibility seriously at risk because there’s no question really that we need to move” and “If we don’t, I think we will fall way behind the curve... A 1/2 point move, in contrast, would be a decisive move. It would help us get out in front of this thing as it develops.” Governor John LaWare justifies his preference for a 50 basis point rise with

I believe a 50 basis point move will send an unmistakable message that will damp this enthusiasm in the stock market without causing it to crash. If it successfully scotches the inflationary expectations that may be part of the structure of long-term rates, that may have a very salubrious effect.

In the March 1994 meeting, when the FOMC again raised rates by another 25 basis points, there were six hawkish dissenters. Among them, Cleveland Fed President Jerry Jordan argues

If we assume that the economy is on a satisfactory path now, a gliding path toward some notion of its capacity and inflation is not accelerating and later we find out we were wrong, that is a very costly thing to correct. Whereas if we assume that we have stayed too easy too long and we need to move very quickly to get to this ideal neutral policy stance, and we find out we were wrong, that's a relatively easier thing for us to correct.

Table II summarizes policy stance during 1994. While hawkish dissents largely disappear after May, the FOMC adopts a tightening tilt in July and September 1994, keeping rates steady. In November, it moves by a full 75 bps without a tilt, and reverses to the tightening tilt in December while not changing the rate. The risks are weighted toward inflation throughout this period.

The 1994 case study shows that the Fed practiced a risk management approach long before [Greenspan \(2004\)](#) discussed its principles in “Risk and uncertainty in monetary policy.” In fact, 1994 could be considered as the first time when the Fed took the approach to test under Greenspan to preempt a rise in inflation and a second time in post-war FOMC history, according to [Goodfriend \(2010\)](#).

Date	$\Delta FFR_t$ (bps)	Policy Action (LLM)	Tilt (Directive)	Tilt (LLM)	Balance of Risk (LLM)	# Hawkish Dissenters	# Dovish Dissenters
04 Feb	25	Tightening	Neutral	Neutral	Inflation	9	0
22 Mar	25	Tightening	Neutral	Neutral	Inflation	6	0
17 May	50	Tightening	Neutral	Neutral	Inflation	0	0
06 Jul	0	Unchanged	Tightening	Tightening	Inflation	2	0
16 Aug	50	Tightening	Neutral	Neutral	Inflation	0	0
27 Sep	0	Unchanged	Tightening	Tightening	Inflation	3	0
15 Nov	75	Tightening	Neutral	Neutral	Inflation	0	3
20 Dec	0	Unchanged	Tightening	Tightening	Inflation	3	0

**Table II. Fed policy stance in 1994.** The table summarizes policy action, policy tilt, and balance-of-risk assessment during 1994. The last two columns report the number of dissents in voice from [Meade \(2005\)](#).

## V. Asset pricing implications

Evidence up to this point indicates that policy stance extends beyond current policy rate to include a forward-looking conditional component. That component captures not only expectations of what policy rate will be but also the distribution surrounding the expected path. We have seen that asymmetric policy tilts, voiced to complement actions, reflect the FOMC’s balance-of-risk assessments and concerns about errors in policy timing.

Communication is a primary mode how these additional policy dimensions, which we refer to as tilts, can transmit onto financial conditions and the economy. In this section, we review evidence suggesting that tilts significantly affect financial markets, in particular, by impacting risk premia.

A large literature studies asset price reactions to the FOMC announcement. Although specifics differ, the usual approach is to measure monetary policy surprises from movements at the short end of the yield curve (typically up to two-year maturity) in narrow windows around the announcements. Such surprises reveal unexpected policy rate changes and/or investors' updates of their expected policy rate path. [Bernanke and Kuttner \(2005\)](#) and [Hanson and Stein \(2015\)](#),<sup>17</sup> document that short-rate surprises can cause movements in risk premia on stocks and bonds on impact, at the FOMC announcements. Specifically, their estimates indicate that short-rate cut surprises raise stock returns and lower real forward rates on impact by reducing risk premium.

Our discussion of the Fed's asset pricing implications departs from that mainstream view in two ways. First, we recognize that Fed-driven news is not fully captured by realized or expected short-rate surprises and can cause investors to update risk perceptions and risk pricing independently of traditional monetary (short-rate) news (e.g., [Cieslak and Pang, 2021](#)).<sup>18</sup> While unconventional policy, e.g., quantitative easing, is one example, our point applies more generally to the effects of the Fed's communication on financial markets, even with otherwise conventional tools. Second, we acknowledge that important news from the Fed can and does come out outside of the scheduled Fed events.<sup>19</sup> Overall, the Fed's effects through short-rate expectations on FOMC scheduled announcements constitute just a subset of Fed-driven news.

#### *V.A. How could the Fed's policy stance affect risk premiums?*

To better understand how policy impacts asset prices, we illustrate the ideas with a stylized three-equation model with the output gap  $x_t$ , inflation gap  $\pi_t$ , and the monetary policy instrument  $r_t$ . Here, we interpret  $r_t$  as an overall policy stance that includes the short-term policy action as well as forward-looking stance. In Appendix B, we present a richer model in which tail risks and policy stances are considered in more detail.

The economy evolves as:

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<sup>17</sup>See also [Bekaert et al. \(2013\)](#), [Bianchi et al. \(2022\)](#), [Pflueger and Rinaldi \(2022\)](#), [Kekre and Lenel \(2022\)](#), [Nagel and Xu \(2024\)](#) for analysis of how monetary policy short-rate surprises affect risk premia and [Bauer et al. \(2023\)](#) for a review of this literature.

<sup>18</sup>See also [Cieslak and Schrimpf \(2019\)](#), [Hansen et al. \(2019\)](#), [Kroencke et al. \(2021\)](#), [Bundick et al. \(2024\)](#), [Cieslak and Khorrami \(2025\)](#), [Knox et al. \(2024\)](#), and [Boehm and Kroner \(2025\)](#) as well as [Vissing-Jorgensen and Knox \(2025\)](#) for a recent review of the related literature.

<sup>19</sup>[Cieslak et al. \(2019\)](#); [Cieslak and Pang \(2021\)](#); [Swanson and Jayawickrema \(2023\)](#); [Cieslak and McMahon \(2024\)](#); [Bianchi et al. \(2025\)](#).

$$x_t = \rho_x x_{t-1} - \chi r_t + d_t \quad (\text{IS curve}) \quad (5)$$

$$\pi_t = \kappa x_t \quad (\text{Phillips curve}) \quad (6)$$

$$r_t = \phi_\pi \pi_t + \varepsilon_t \quad (\text{Policy rule}) \quad (7)$$

where  $\chi, \kappa, \phi_\pi$  are positive parameters. The economy is subject to an exogenous demand shock  $d_t$  and a monetary policy shock  $\varepsilon_t$  with variances  $\sigma_d^2$  and  $\sigma_\varepsilon^2$ . Solving for the equilibrium output gap and its conditional variance, we have:

$$x_t = \frac{1}{\Omega(\phi_\pi)} (\rho_x x_{t-1} + d_t - \chi \varepsilon_t) \quad (8)$$

$$Var_t(x_{t+1}) = \frac{1}{\Omega^2(\phi_\pi)} \sigma_d^2 + \frac{\chi^2}{\Omega^2(\phi_\pi)} \sigma_\varepsilon^2. \quad (9)$$

where  $\Omega(\phi_\pi) = 1 + \chi \phi_\pi \kappa$ . The two terms in equation (9) highlight two sources of economic uncertainty, both of which can be affected by the Fed.

The first effect is associated with exogenous uncertainty ( $\sigma_d^2$ ) that emanates from demand shocks. As in Section II, and in the model in Appendix B, this variance may depend on the probability and magnitude of tail risks. The Fed can mitigate such uncertainty by changing the degree of policy activism through its reaction function coefficient  $\phi_\pi$ .<sup>20</sup> A more aggressive Fed (larger  $\phi_\pi$ ) stabilizes the output gap and reduces its volatility. While we do not solve for optimal policy in this environment, the framework in Section II shows that policymakers may deviate from standard linear decision rules to reduce the likelihood of adverse outcomes (and thereby the variance of target variables). In this environment, such an effect would manifest by the Fed adopting a more hawkish stance (larger  $\phi_\pi$ ) in response to heightened demand uncertainty (higher  $\sigma_d^2$ ).

The second effect, which we refer to as *Fed-induced uncertainty* ( $\sigma_\varepsilon^2$ ), arises from policy uncertainty regarding  $r_t$ . Here,  $\varepsilon_t$  represents possible deviations of the Fed's actions from market expectations. This deviation may stem from Fed-market disagreements about the assessment of the economy (Caballero and Simsek, 2022; Sastry, 2024; Cieslak et al., 2025) or from the market believing the Fed makes errors in responding to the economy (Cieslak and McMahon, 2024; Cieslak et al., 2025). This channel is close in spirit to what Cecchetti and Schoenholtz (2021) describe as "in conducting policy, there is one

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<sup>20</sup>See, e.g., Bianchi et al. (2025) for an example of a New Keynesian model with time-varying policy parameters. Ang et al. (2010) develop a dynamic quadratic term structure model embedding a time-varying coefficient Taylor rule and analyze its implications for bond risk premia. Bauer et al. (2024a) estimate public perceptions of the Fed's time-varying policy rule using surveys and study how these perceptions affect the sensitivity of interest rates to macroeconomic news, term premia, and the response of the stock market to monetary policy surprises.

uncertainty that policymakers can and should reduce: the uncertainty they themselves create." In Appendix B, the source of disagreement arises from the perceived probability  $p_t$  of the realization of an adverse tail event.

To tie these uncertainty effects to implications for asset prices, let us assume that investors dislike negative output gap shocks and price assets with a real stochastic discount factor (SDF) whose innovation is  $\tilde{m}_{t+1} = -\gamma \tilde{x}_{t+1}$ ,  $\gamma > 0$  where  $\tilde{x}_{t+1} = x_{t+1} - E_t(x_{t+1})$ . We consider two assets: a one-period stock with payoff equal to the output gap  $x_{t+1}$ , and a two-period bond whose one-period ahead real payoff is  $-r_{t+1} - \pi_{t+1}$ . Their log risk premia are determined by the covariances between the SDF innovation and the innovations to the payoffs,  $rp_t^{stock} = -Cov_t(\tilde{m}_{t+1}, \tilde{x}_{t+1})$  and  $rp_t^{bond} = -Cov_t(\tilde{m}_{t+1}, -r_{t+1} - \tilde{\pi}_{t+1})$ , respectively:

$$\begin{aligned} rp_t^{stock} &= \underbrace{\gamma \left( \frac{1}{\Omega^2(\phi_\pi)} \sigma_d^2 \right)}_{(+)\text{RP from } d_t} + \underbrace{\frac{\chi^2}{\Omega^2(\phi_\pi)} \sigma_\varepsilon^2}_{(+)\text{RP from } \varepsilon_t} \\ rp_t^{bond} &= \underbrace{\gamma \left( -\frac{(1 + \phi_\pi)\kappa}{\Omega^2(\phi_\pi)} \sigma_d^2 \right)}_{(-)\text{RP from } d_t} + \underbrace{\frac{\chi(1 - \kappa\chi)}{\Omega^2(\phi_\pi)} \sigma_\varepsilon^2}_{(+)\text{RP from } \varepsilon_t}. \end{aligned} \quad (10)$$

Equation (10) decomposes the overall conditional risk premia into two parts that illustrate distinct implications for stocks and bonds, and specifically, the direction of stock-bond co-movement they induce. An increase in demand uncertainty ( $\sigma_d^2$ ), exogenous to the Fed, increases the risk premium on the stock but reduces it on the bond. This is similar to a flight-to-safety effect where bonds serve as hedges for stocks. In contrast,  $\sigma_\varepsilon^2$  moves stock and bond risk premia in the same direction, akin to a common discount-rate uncertainty effect.

The Fed can shift risk premia by shifting market expectations of the parameters that enter the expressions above. Consider news from the Fed (via action or communication) that increases the market's belief about  $\phi_\pi$ , the strength of the response to inflation. A basic comparative statics exercise implies that the risk premium will decrease for both

bonds and stocks under reasonable conditions.<sup>21</sup> Fed-driven news that decreases policy uncertainty  $\sigma_\varepsilon^2$  will also decrease risk premia for stocks and bonds.<sup>22</sup>

As we explain below, our empirical strategy relies on identifying “common risk premium” (CRP) shocks at daily frequency which drive positive co-movement between stocks and bonds. Regressions of the CRP on  $HD_t$  and policy tilts then reveal whether the Fed’s forward-looking stance delivers information on its reaction function coefficient or affects policy uncertainty. In principle, the forward-looking stance could do either. For example, it can reveal an intention to react more aggressively to known tail risks, inducing a shift in expected  $\phi_\pi$ . Alternatively, by signaling its views on the evolution of economic conditions, and how it intends to react to them, the Fed can align market expectations of its future behavior with its own plans. We interpret this as reducing  $\sigma_\varepsilon^2$ .

In Appendix B, we show that the impact of hawkish or dovish tilts on risk premia depends on market expectations of Fed behavior and economic conditions, and risk premia can in principle either increase or decrease. Ultimately, then, the effect of Fed behavior on risk premia is an empirical question which we next seek to establish.

Of course, this interpretation relies on a stylized comparative statics exercise that abstracts from real-world complexities, including supply-side shocks and expectations formation. Risk premium dynamics become considerably more complex when cost-push shocks are present. However, when the Fed is not the source of such shocks and attempts to “look through” them—and when we can identify Fed-driven news through event timing or textual analysis—this stylized framework remains valuable for interpreting empirical analysis.

#### V.B. Measuring short-rate expectations and term premia in the yield curve

We rely on two decompositions to empirically separate term premium variation in the yield curve. The first approach is based on the [Kim and Wright \(2005\)](#), KW no-arbitrage term structure model. The data is available at a daily frequency starting from 1991 via the [Fed Board website](#). Using the term premium estimates, we compute the short-rate expectations as the yield (fitted by KW model) minus the corresponding term premium.

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<sup>21</sup>More specifically, from equation (10), increasing  $\phi_\pi$  unambiguously lowers premium for stocks via the first and second components, and on bonds via the second component. The effect on the first component for bonds depends on the parameters  $\beta(\phi_\pi) = -\frac{(1+\phi_\pi)\kappa}{\Omega^2(\phi_\pi)}$  and  $\text{sgn}(\beta'(\phi_\pi)) = \text{sgn}(\chi\kappa(2 + \phi_\pi) - 1)$ . So, the first component decreases with more activism if  $\chi\kappa(2 + \phi_\pi) < 1$ , which will generally be the case if the Phillips curve is not too steep, as suggested by the estimates (e.g., [Hazell et al., 2022](#)). In this case, a more activist Fed will be able to reduce the risk premium in stocks and bonds.

<sup>22</sup>Relatedly, [Hansen et al. \(2019\)](#) show that central banks can shift term premia by changing beliefs on the uncertainty in economic conditions.

Our second approach follows Cieslak and Pang (2021, CP) by exploiting sign restrictions on daily innovations in stock market returns and yield changes in a structural VAR framework. The decomposition provides four labeled orthogonal factors by splitting short-rate expectations news into “monetary news” (*MP*) and “growth news” (*G*), and risk premium news into common premium (*CRP*) news and hedging premium (*HRP*) news. *MP* news moves short-rate expectations, affecting primarily the short-end of the yield curve and pushing stocks and bonds in the same direction. It is separated from expected growth news *G*, which also dominates at shorter maturities but pushes stocks and bonds in opposite directions. *G* absorbs Fed information effects.<sup>23</sup> *CRP* is of particular interest as a proxy for the effect of Fed-induced uncertainty. We identify this component as news that dominantly impacts the long end of the yield curve and moves stock and long-term bond returns in the same direction, as motivated by equation (10). The *HRP* component is instead identified from news moving stocks and long-term bonds in opposite directions, as in flight-to-safety episodes, aiming to reflect economic uncertainty exogenous to the Fed.

#### *V.C. How do policy tilts affect term premia?*

We estimate predictive regressions of yield curve changes over the intermeeting period from  $t$  to  $t + 1$  on measures of policy tilt:

$$\Delta y_{t,t+1}^{(n)}(z) = \alpha + \beta Tilt_t + \gamma' Controls_t + \varepsilon_{t,t+1}. \quad (11)$$

The dependent variable  $\Delta y_{t,t+1}^{(n)}(z)$  is the change in the  $n$ -year nominal rate attributed to component  $z$ , where  $z$  can represent short-rate expectations or term premium. We consider yield changes over the intermeeting period based on evidence that information about policy tilt does not come out (or not fully) at the time of scheduled announcement. It is then disseminated as part of “communication refinements” that the Fed officials undertake to explain their stance between the meetings.<sup>24</sup>

Throughout, we choose the two- and ten-year yields,  $n = 2$  and  $n = 10$ , as our benchmark maturities as they are known to be highly informative about short-rate expectations and term premia, respectively, with term premium news dominating the longer end of the yield curve and short-rate expectations news dominating the shorter end.

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<sup>23</sup>See, e.g., Campbell et al. (2012), Nakamura and Steinsson (2018), Jarocinski and Karadi (2020).

<sup>24</sup>The leaks associated with the tilt in the early Greenspan years are examples that support this interpretation.

Table III reports the results using KW and CP decompositions. The main insight from the table is that an FOMC shift toward a tightening tilt predicts a significant reduction in the term premium over the intermeeting period, consistent with the findings in [Cieslak and McMahon \(2024\)](#). This finding holds across all tilt proxies.

Specifically, in columns (1)–(4), the dependent variable is the intermeeting term premium change at the ten-year maturity. In columns (5)–(8) the dependent variable is intermeeting short-rate expectations change at the two-year maturity. We predict these components with three measures of the tilt—the HD stance  $HD_t$ , the LLM-based tilt  $TiltLLM_t$ , and the tilt from the directive  $Tilt_t$ —always controlling for the Greenbook forecasts and the current and lagged FFR. The last proxy  $Tilt_t$  restricts the sample in columns (4) and (8) to the pre-2000 period. In column (2), as robustness we also report the pre-2008 results using  $HD_t$  to acknowledge that stance inferred with a simple dictionary approach can be more noisy with unconventional policy. Using the LLM-based tilt or the actual tilt from the directive is not subject to this concern.

Panel A of Table III reports regressions based on the KW decomposition. We focus first on the overall term premium in Panel A. In columns (1) and (2), a one-standard-deviation increase in the FOMC hawkish stance,  $HD_t$ , predicts term premium decline of 3 bps over the intermeeting period over the full sample 1991–2019 and 5 bps during sample ending in 2008. In column (3), a shift from a neutral to a tightening tilt in  $TiltLLM_t$  predicts a reduction in the term premium of 5 bps over the intermeeting period. Column (4) reports an analogous finding using the tilt in the FOMC directive before 2000, showing a 10 bps reduction in that shorter sample. These magnitudes are economically large relative to the overall 10-year yield volatility. To show this, the row “Std coef” expresses the coefficient on the tilt divided by the unconditional standard deviation of intermeeting 10-year yield changes. For example, the effect in column (3) using  $TiltLLM_t$  shows that the term premium reduction is equivalent to about 15% of intermeeting volatility when the FOMC shifts from a neutral to a tightening tilt.

The overall term premium is an amalgam of variation that is independent from the Fed and one that the Fed can affect (as seen in equation (10)). To isolate these components, in Panel B of Table III, we report analogous regressions using the identified common risk premium news  $CRP$  and monetary policy news  $MP$  from the CP decomposition. The other two components,  $G$  and  $HRP$ , are not reported as they do not feature a significant response to the tilt. Panel B of Table III sharpens the results by focusing on the common premium component  $CRP$ , after pruning the hedging premium variation  $HRP$ . The results corroborate the interpretation that a more hawkish tilt predicts a reduction in term premium. Across four columns (1)–(4) the loading on the tilt is always negative

and significant, with the estimated reduction of  $CRP$  corresponding to between 13% and 28% of intermeeting 10-year yield volatility.

Importantly, the effect of the tilt on term premium is unaffected by controlling for current or lagged policy rate or the Fed’s Greenbook forecasts. This is in contrast with its effect on short-rate expectations. Indeed, the conclusion from Table III, columns (5)–(8), is that the tilt does not have an equally strong independent explanatory power for intermeeting updates in short-rate expectations. Coefficients on the tilt are positive across specifications (all but one), consistent with a tightening tilt being associated with investors’ expectations updating toward higher short rate. However, the statistical and economic significance is mixed across proxies, with the strongest evidence coming from  $TiltLLM_t$ .

To complement the regression results, Figure 13 presents a simple nonparametric assessment of the relationship between the tilt, term premium, and short rate expectations. In top panels, we plot the average intermeeting term premium change at the ten-year maturity conditional on easing, neutral or tightening  $TiltLLM_t$  together with 95% confidence intervals. On average, the term premium declines following a tightening tilt and increases following an easing tilt and the relationship is especially significant under tightening. In periods when the Fed adopts a neutral stance, the term premium does not materially change.

In bottom panels of Figure 13, we present analogous results for updates in short-rate expectations at the two-year maturity. Short-rate expectations move in the direction of the tilt, and relatively more so when the tilt points toward easing, where expected short rate drops by nearly 10 bps. The contribution of short-rate expectations updates diminishes with yield maturity. At the ten-year maturity, the term premium clearly dominates and short rate expectations effect is economically negligible and statistically insignificant (not reported).

The asymmetric effects of easing versus tightening tilts in Figure 13 may also reflect the different underlying Fed’s motives. Tightening tilts are associated with a more significant and larger risk premium effects, whereas easing tilts generate a weaker risk-premium response but a stronger adjustment in short-rate expectations. As shown in Figure 9, tightening tilts are always issued when the Fed’s balance-of-risks assessment is biased toward inflation and policymakers are concerned about acting too late, reflecting worries about policy credibility and the potential de-anchoring of inflation expectations. Consequently, a tightening tilt serves to reinforce policy credibility, reduce policy uncertainty, and thereby lower risk premium. By contrast, easing tilts are less associated with

Panel A. Kim-Wright decomposition

	Term premium, 10y				Expected short rate, 2y			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$HD_t$	-0.028** (-2.29)	-0.045*** (-2.94)			0.015 (0.62)	0.0098 (0.29)		
$TiltLLM_t$			-0.050*** (-3.07)				0.056** (2.25)	
$ActionLLM_t$				-0.0029 (-0.12)			0.070* (1.78)	
$Tilt_t$					-0.099*** (-3.92)			-0.025 (-0.49)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Std coef	-0.082	-0.13	-0.15	-0.30	0.043	0.028	0.16	-0.071
$R^2$	0.037	0.040	0.049	0.19	0.084	0.091	0.11	0.13
N	240	152	240	79	240	152	240	79
Sample	91-19	91-08	91-19	91-99	91-19	91-08	91-19	91-99

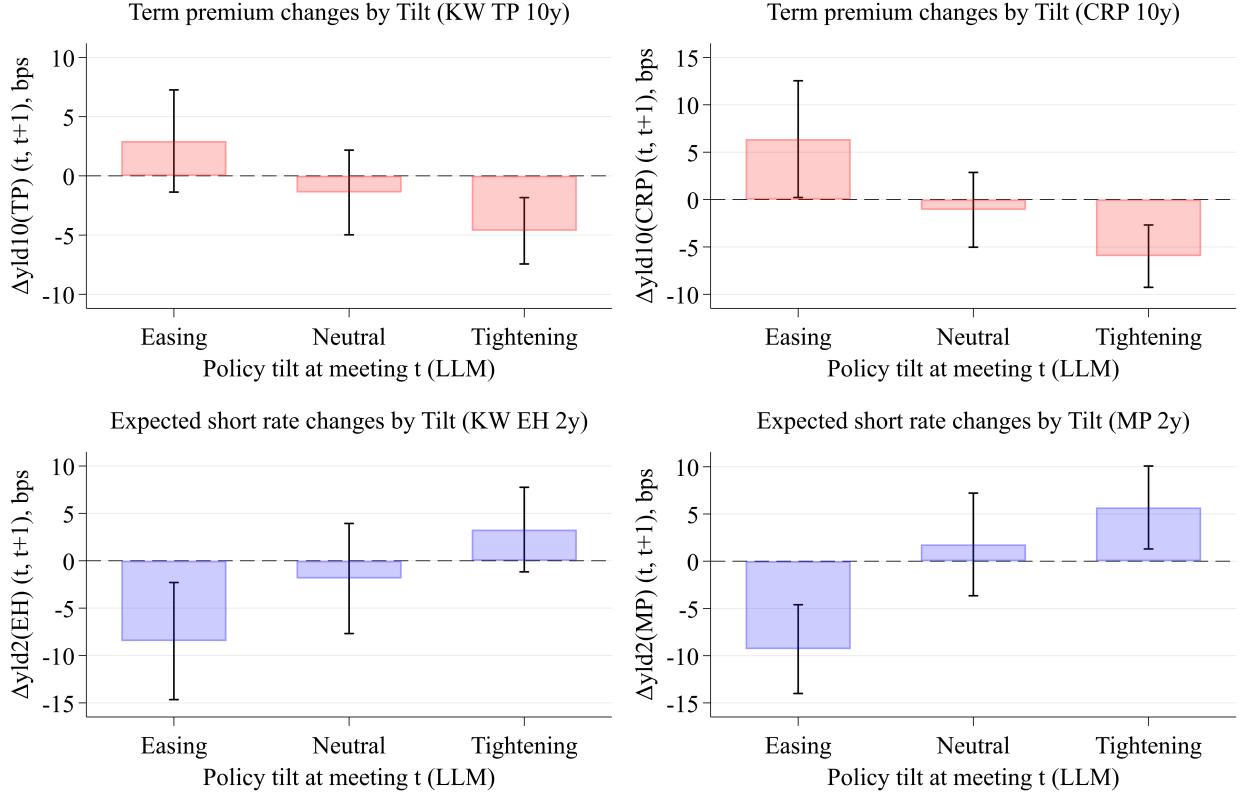
Panel B. Cieslak-Pang decomposition

	Term premium news (CRP), 10y				Expected short rate news (MP), 2y			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$HD_t$	-0.045*** (-2.75)	-0.074*** (-3.64)			0.020 (1.21)	0.023 (1.05)		
$TiltLLM_t$			-0.083*** (-3.13)				0.074*** (3.14)	
$ActionLLM_t$				-0.052 (-1.56)			0.070** (1.98)	
$Tilt_t$					-0.093*** (-2.93)			0.053 (1.21)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Std coef	-0.13	-0.22	-0.25	-0.28	0.058	0.067	0.21	0.15
$R^2$	0.076	0.12	0.11	0.10	0.082	0.11	0.14	0.064
N	259	171	259	98	259	171	259	98
Sample	87-19	87-08	87-19	87-99	87-19	87-08	87-19	87-99

**Table III. Effect on policy tilt on the term premium.** The table reports the estimates of regression (11). The top panel is based on the KW decomposition using the ten-year term premium and two-year short rate expectations over the 1991:01-2019:12 sample. The bottom panel is based on the CP decomposition using the CRP and MP components of the ten-year-year and two-year yield for the 1987:07–2019:12 sample. Controls include the Greenbook forecasts and the current and lagged FFR, as in earlier tables. The row “Std coef” reports the coefficient on the tilt divided by the unconditional standard deviation of intermeeting 10-year yield changes, e.g., -0.15 is interpreted as a term premium reduction equivalent to 15% of intermeeting volatility when the FOMC shifts from a neutral to a tightening tilt. Robust standard errors are in parentheses.

these credibility concerns and primarily convey information about the expected future short rates.

Overall, these results point to a sizable effect of FOMC tilts on the intermeeting behavior of long-term interest rates where tightening tilts are associated with term-premium re-

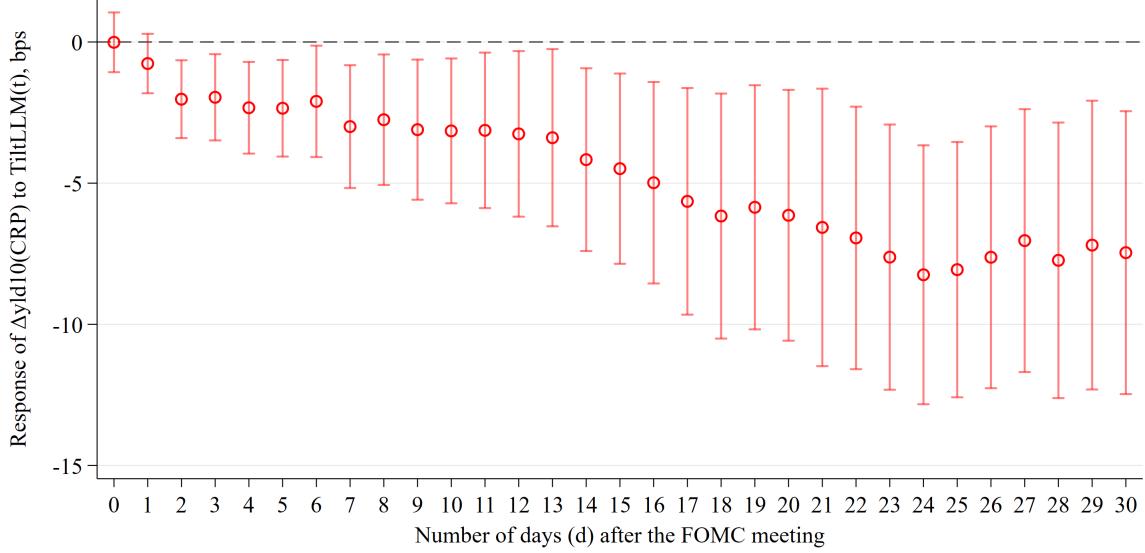


**Figure 13. Term premium and short-rate expectations conditional on the policy tilt.** The figure reports the average intermeeting change in the ten-year yield due to term premium (top panels) and short rate expectations (bottom panels), conditional on the FOMC policy tilt,  $TiltLLM_t$ . The left panels are based on the KW decomposition for the 1991:01–2019:12 sample and the right panels on the CP decomposition for the 1987:07–2019:12 sample. The spikes display 95% robust confidence intervals for the mean.

ductions. This effect is not subsumed but the policy action, in line with the interpretation of the tilt as a separate policy instrument operating primarily through communication.

Importantly, the term premium effect of the tilt accrues over the intermeeting period, and not at the time of the FOMC meeting. Cieslak and McMahon (2024) argue for an important role of intermeeting communication. In Figure 14, we extend their results showing how the term premium effect cumulates in days  $d$  following a meeting in response to a  $TiltLLM_t$  increase. Specifically, we plot coefficients on  $TiltLLM_t$  from regression (11), where the dependent variable is the cumulative change the CRP component of the ten-year yield up to  $d$  days after the meeting. The first observation for  $d = 0$  is the coefficient on impact, i.e.  $\Delta y^{(10)}(CRP)_{t_d-1,t_d}$ , where we use notation  $t_d$  to indicate daily frequency (as opposed to the meeting frequency) and  $t_d - 1$  is the day before meeting  $t$ . Observations for  $d > 0$  measure cumulative change  $\Delta y^{(10)}(CRP)_{t_d,t_d+d}$  from the day of meeting  $t$  till  $d$  days after the meeting. The full effect takes about three weeks to

develop. Cieslak and McMahon (2024) show how the information is disseminated by speeches and minutes.



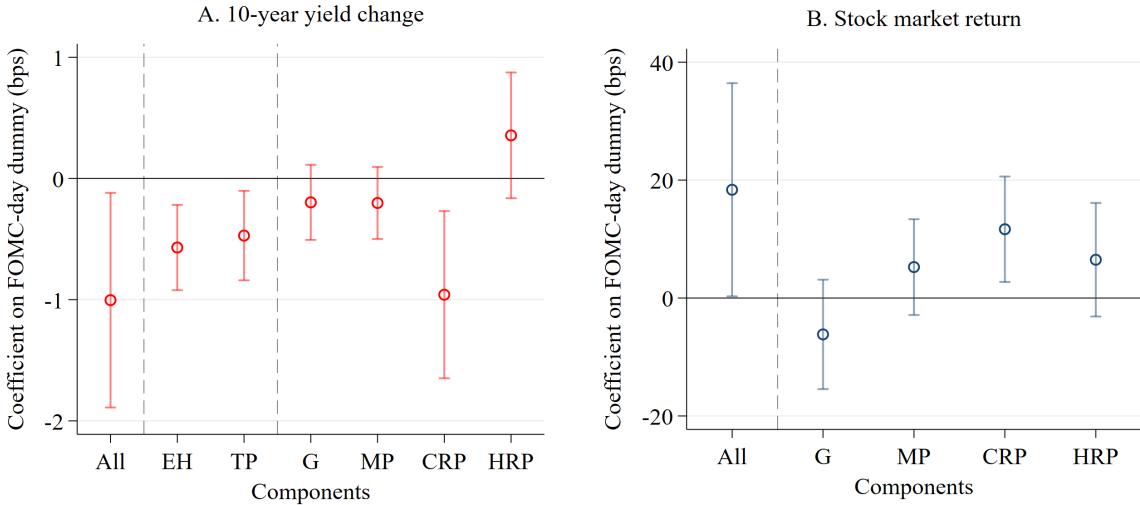
**Figure 14. Term premium response to tilt day-by-day following the FOMC meeting.** The effect of tilt  $TiltLLM_t$  on the ten-year term premium change (the CRP component) up to 30 days after the meeting. The term premium is based on the CP decomposition. The sample period is 1987:07–2019:12. The spikes display 95% robust confidence intervals. The first observation for  $d = 0$  is the coefficient on impact, i.e.  $\Delta y^{(10)}(CRP)_{t_d-1,t_d}$ , where  $t_d - 1$  is the day before meeting  $t$ . Observations for  $d > 0$  measure cumulative change  $\Delta y^{(10)}(CRP)_{t_d,t_d+d}$  from the day of meeting  $t$  till  $d$  days after the meeting. The spikes mark 95% robust confidence intervals. All regressions include current and lagged policy rate and the Greenbooks as controls.

#### V.D. Risk premium effects of the FOMC announcements

The results so far indicate that tilts lead to risk premium adjustments over the inter-meeting period, pointing to a role of the Fed's granular communication. Of course, the FOMC announcements are also highly influential. Growing evidence suggests that news coming out on scheduled FOMC announcements affects market risk perceptions inducing asset-price movements that cannot be explained solely by investors updating short-rate expectations, or any Fed informational effects.

Here, we review the average impacts of the FOMC announcements on the ten-year yield and the aggregate stock market. The estimates are obtained by running the following regression of different components of daily yield changes  $\Delta y_t^{(10)}$  or log stock market returns  $\Delta s_t$  on a constant and the scheduled FOMC-day dummy:

$$\Delta y_t^{(10)}(z) \text{ or } \Delta s_t(z) = \alpha + \beta_{FOMC} 1_{t,FOMC} + \varepsilon_t, \quad (12)$$



**Figure 15. Average ten-year yield changes and stock returns on scheduled FOMC days.** The figure plots the estimates coefficient  $\beta_{\text{FOMC}}$  from regression (12) along with 95% robust confidence intervals. The sample period is 1994:01–2024:12, covering 248 scheduled announcements and 8087 days in total. The estimates are in basis points. Panel A shows the effect on the ten-year yield changes and Panel B shows the effect on stock market returns. Panel A reports the change in the overall ten-year yield (All), attributed to short-rate expectations (EH) and term premium (TP) changes using KW decomposition, and further attributed to growth news (G), monetary news (MP), common premium (CPR) and hedging premium (HRP) news using CP decomposition. Panel B reports the overall stock return and its CP decomposition.

where  $z$  represents the type of news. The coefficient of interest  $\beta_{\text{FOMC}}$  measures the average change in asset prices on FOMC days relative to all other days.

Figure 15 plots  $\beta_{\text{FOMC}}$  coefficients updating the results in [Cieslak and Pang \(2021\)](#). The leftmost estimate shows the overall ten-year yield change (panel A) and overall stock return (panel B) on FOMC day relative to other days. Subsequent estimates show the contribution of different types of news. All results are in basis points. The sample period runs from 1994:01 to 2024:12, adding seven years (2018–2024) to the original analysis in [Cieslak and Pang \(2021\)](#). Year 1994 is when the Fed started making announcements and is the usual starting point in the literature.

The leftmost estimates in Figure 15 show that on average long-term yields decline and stock market rises on FOMC days.<sup>25</sup> Since yields and bond prices move in opposite directions, both bonds and stocks returns are higher on FOMC days. A one basis point reduction in the ten-year yield implies a ten basis point positive return on the ten-year bond.

<sup>25</sup>See also [Hillenbrand \(2025\)](#) for yield behavior around announcements, and [Lucca and Moench \(2015\)](#) for pre-FOMC stock market drift.

Further decomposition attributes these average changes to different sources. First, the Fed eased somewhat more than the public expected (EH and MP components) lowering yields and raising stock returns. The biggest effect, however, is due to lower risk premium via the common risk premium (CRP) channel. CRP drives down risk premia on both stocks and bonds (see equation (10)). Ten-year bond rises by about ten basis points (as yield drops by one bps) and stock market rises by about 12 basis points on average. The FOMC announcements are also associated with lower hedging premium component (HRP) of about half the CRP magnitude. Since HRP moves stocks and bonds in opposite directions, higher long-term yields coincide with higher stock returns. On average, the FOMC announcements are not associated with systematic positive or negative growth news (G), i.e., average information effect is close to zero. Appendix Figure A-4 shows estimates of regression (12) over an expanding window showing the relative stability of the risk premium components.

Importantly, these average announcement effects are separate from the propagation of policy tilts over the intermeeting period documented in Section V.C. One interpretation, as suggested by equation (10), is that Fed's transmission onto risk premium involves several channels that operate at different frequencies. A resolution of uncertainty about the immediate policy stance at the FOMC announcement could reduce the Fed-driven uncertainty via  $\sigma_\epsilon^2$ . Instead, the communication of the forward-looking policy tilts is likely more nuanced and complex, involving market's learning about the Fed's reaction function which can take time and multiple rounds of communication. Our model in Appendix B provides further interpretation of these channels.

The effect via the hedging premium HRP is separately interesting as it suggests that the Fed can also affect public perception of the amount of economic uncertainty or the market's pricing of that uncertainty. A deeper interpretation of the hedging premium effect, formulated in [Cieslak and Khorrami \(2025\)](#), is that it represents a violation of long-run monetary neutrality in asset prices, distinct from the classic notion of long-run monetary neutrality in real outcomes. Intuitively, long-run monetary neutrality in asset prices requires that the Fed does not affect permanent components of marginal utility. [Cieslak and Khorrami \(2025\)](#) develop and test the condition showing that long-run neutrality is frequently violated, and especially strongly during the period of unconventional monetary policy. This evidence implies that investors' marginal utilities are sensitive to the Fed's impact on uncertainty. It also supports the view that the Fed can affect risk premia through channels that are independent of the current policy rate or its expectations.

## VI. Risk-management via communication: Successes and failures

In light of the Fed's goal to keep long-term interest moderate and stable, the results so far can be interpreted as evidence of the Fed's success. By using tilts to communicate its willingness to tighten if needed, the Fed stabilized long-term interest rates and was able to ease policy without runaway term premiums. However, communication of forward-looking conditional policy stance is not without its challenges, and as [Bernanke \(2015\)](#) put it, "the cost of sending the wrong message can be high."

We now discuss specific episodes when the Fed used communication to manage public risk perceptions, and highlight successes and failures of such communication.

### VI.A. Greenspan's productivity miracle

The second half of the 1990s, a period known as the "productivity miracle," is an illustration how the Fed can successfully use communication with tilts. Faced with a booming economy, Greenspan's Fed resisted tightening rates based on belief in an expanded productive capacity of the economy while reassuring the public that the Fed would correct any potential errors (see [Gorodnichenko and Shapiro \(2007\)](#) for an analysis of this period). While the Fed kept its policy rate nearly steady,<sup>26</sup> Figure 8 shows a frequent use of the tightening tilt during 1996–1999.

Figure 16 zooms in on the term premium dynamics over this period, superimposing cumulative KW term premium change against indicators of the tilt.<sup>27</sup> The sequence of hawkish tilts coincided with a progressive term premium decline of about 90 bps between July 1996 and September 1998. The process was interrupted when the Fed issued the sole easing tilt to manage risks associated with the turbulence in global markets and the near LTCM collapse. Term premia started to rise again shortly after until the Fed reversed back to the tightening tilt in 1999. This episode suggests that keeping rates steady during 1997–1998, and absent the Fed's communication via tilts, would have resulted in higher term premia, and tighter financial conditions.

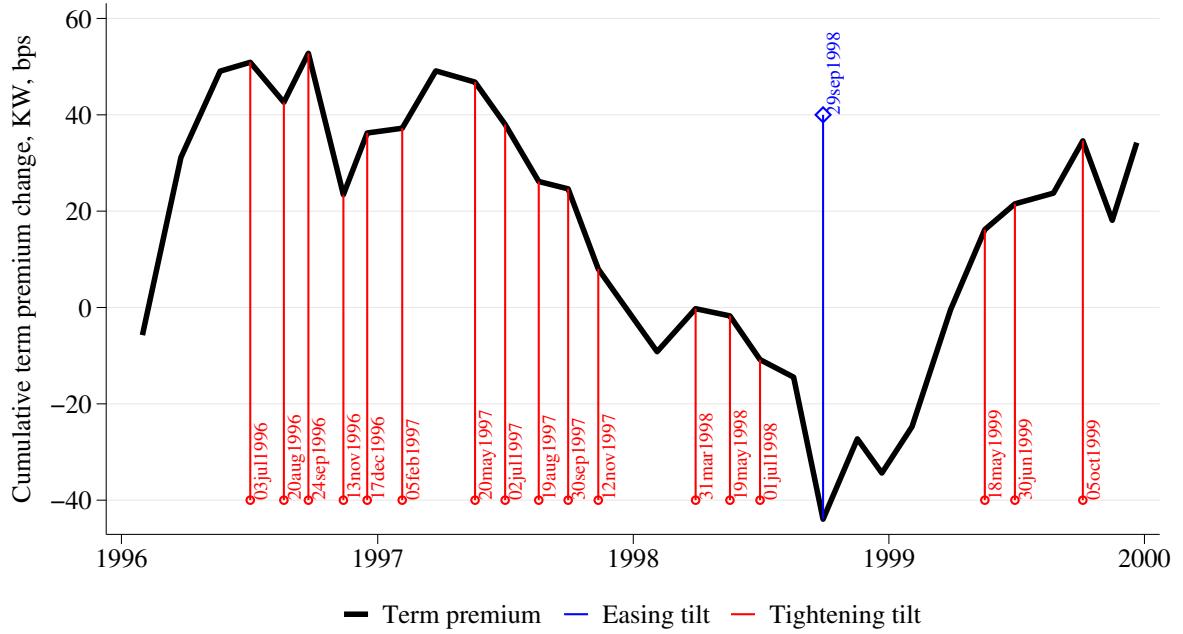
### VI.B. Post-Covid period and the 2020 monetary policy framework

While the late 1990s are a positive example, the post-2020 period provides a cautionary tale of how managing risks can also turn asset prices against the Fed's intentions.<sup>28</sup>

<sup>26</sup>Between 1997 until September 1998, the policy rate increased only by 25 bps from 5.25% to 5.5% in March 1997.

<sup>27</sup>The CRP component shows a similar pattern.

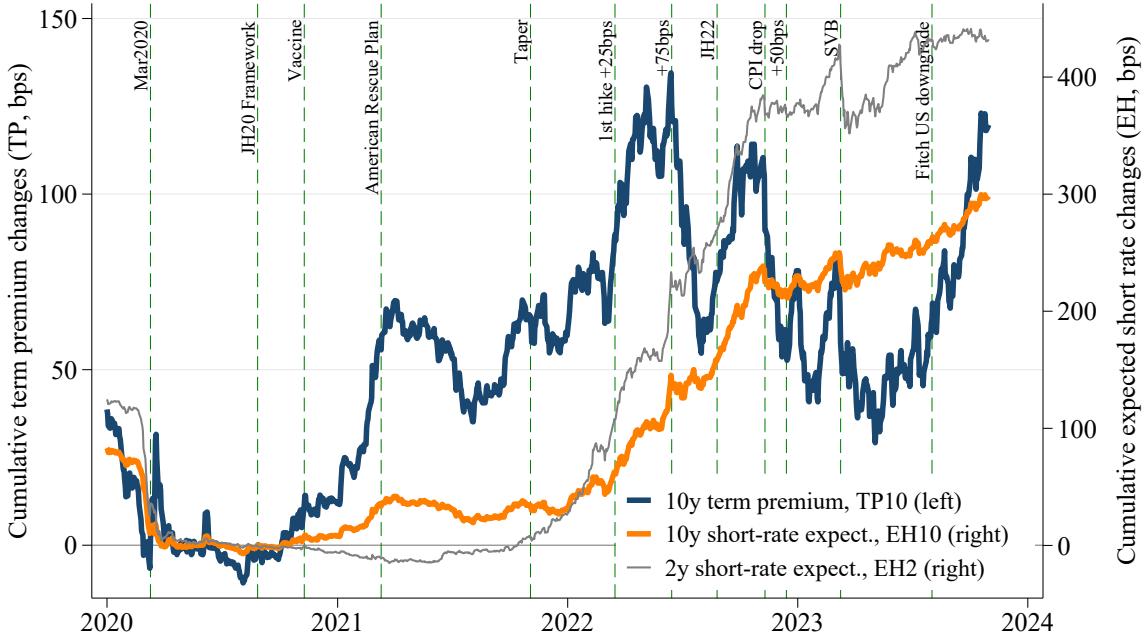
<sup>28</sup>See e.g., [Cieslak et al. \(2025\)](#), [Bocola et al. \(2024\)](#), [Bauer et al. \(2024b\)](#) for the analysis of this period.



**Figure 16. Term premium and tilt in Greenspan miracle period, 1996–1999.** The figure plots cumulative ten-year term premium from 1996:01 to 1999:12 based on the KW decomposition. The term premium is normalized to zero at the end of 1995. The vertical lines mark meetings with a tightening or easing tilt in the FOMC's directive.

In August 2020, during the Covid-19 pandemic, the Fed announced a significant revision to its monetary policy framework, introducing two key elements: flexible average inflation targeting (FAIT) and asymmetric focus on employment shortfalls. In contrast to the earlier policy conduct, the framework was focused primarily on managing downside risks in the face of negative demand shocks. The intention was to create a policy buffer for times when the Fed is constrained by the zero-lower bound. As part of the new strategy, the Fed would abandon the preemptive tightening approach it relied on in the past and would instead allow inflation to run above target aiming for an average rate of 2% over time. Thus, it would seek to “make up” for periods of low inflation with periods of somewhat higher inflation. Forceful forward guidance added in late 2020 successfully communicated the intention of lower-for-longer at a time when such a policy was warranted by the economic recovery. However, it reinforced the Fed’s one-sided focus and made it harder to invoke the framework’s escape clauses when it became necessary (e.g., Eggertson and Kohn, 2023; Meade, 2023). Ultimately, the framework was tested on a scenario different from the one it was designed for.

From late 2020 through the first half of 2021 the Fed maintained an easing tilt amid growing market concerns about the economy overheating. Figure 17, adapted from Cieslak et al. (2025), superimposes paths of two- and ten-year short-rate expectations



**Figure 17. Short-rate expectations and term premia, 2020-2023.** The figure adapted from Cieslak et al. (2025) reports the ten-year term premium, and two- and ten-year short-rate expectations components of the nominal yield curve. The estimates are based on the KW model. Vertical lines mark selected events (JH denotes Jackson Hole Economic Symposium). Cumulative changes are normalized to be zero on Aug 27, 2020, at the time of the framework announcement.

against the ten-year term premium. Although short-rate expectations remained well-anchored at the zero lower bound through most of 2021, in line with the Fed's intentions, financial conditions started to tighten already in late 2020 as term premia saw pronounced increases, rising by 71 basis points (bps) from August 26, 2020 through the end of March 2021. In March 2021, participants in the Survey of Primary Dealers identified a mix of fiscal policy, improved Covid outlook, and the Fed's reaction function as the main factors behind rising premium. As policymakers shifted their language to recognize upside risks, by July 2021, changes in perceptions of the FOMC's framework or reaction function emerged as the most important factor behind then moderating premia.<sup>29</sup> Overall, between August 2020 announcement and the 75 bps hike in June 2022, term premia increased in total by 137 bps, the biggest such move since 1994.

Analyzing this period, Cieslak et al. (2025) argue that market's uncertainty stemming from perceived policy errors can raise risk premia. The Fed's communication under the 2020 framework introduced uncertainty about the Fed's reaction function. Market concerns about policy mistakes amid incoming adverse macroeconomic data drove up

<sup>29</sup>The New York Fed Survey of Primary Dealers in March 2021 and November 2021 asked participants to rate the importance of various factors in explaining intermeeting changes in long-term rates (question 7).

term premia, undermining easy financial conditions the Fed initially sought. While short-rate expectations were stable and anchored by forward guidance, term premium sensitivity to inflation news increased. The subsequent shift in Fed's communication toward consistently more hawkish starting from second half of 2021 and eventual policy rate tightening in 2022 helped stabilize premia and mitigate the impact of adverse macroeconomic news.

More broadly, prolonged periods of low interest rates can contribute to investors' concerns about the Fed overstimulating the economy, raising risk perceptions regarding the future policy path and, consequently, risk premia. The evidence we have reviewed here suggests that the Fed can influence uncertainty during these periods by expressing its readiness to stabilize inflation and the output gap, should the need arise. This is captured as additional tilt in the language used during FOMC meetings to signal forward-looking conditional policy intentions. The communication with tilts serves to reassure the market that any potential policy mistakes are unlikely to persist, signaling that the Fed is closely monitoring signs of errors and is prepared to reverse course.

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# Internet Appendix

## Risk management in monetary policy: Review with asset pricing implications

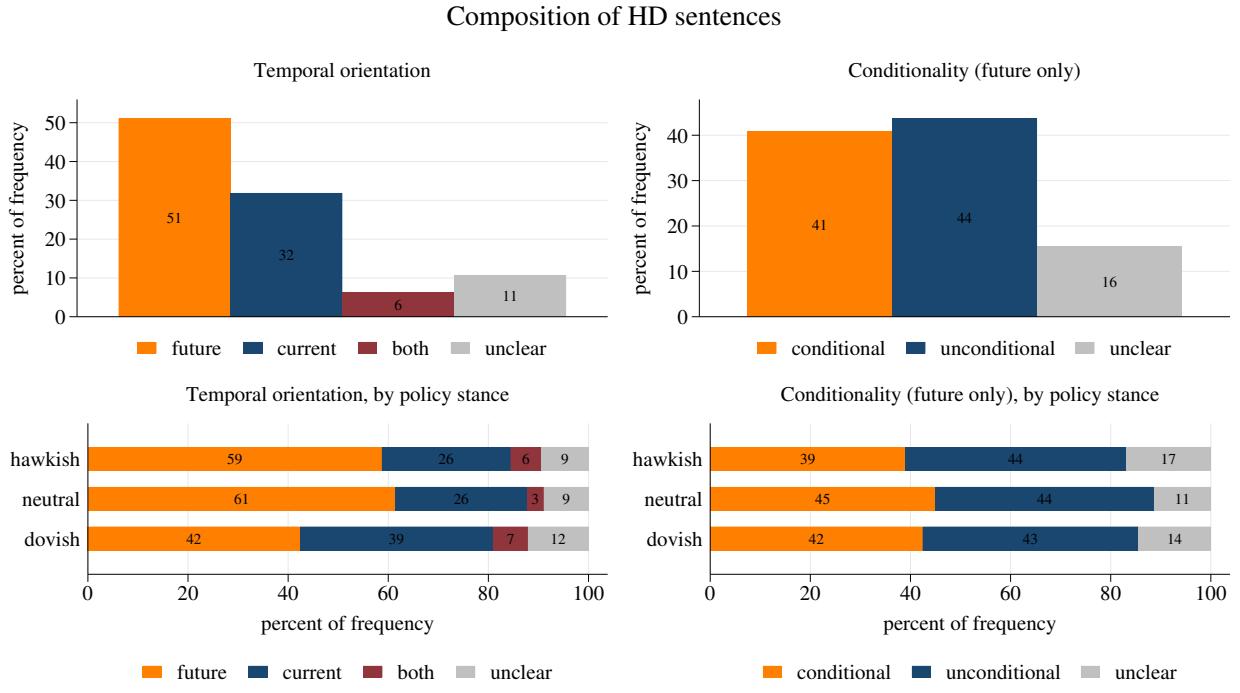
ANNA CIESLAK STEPHEN HANSEN HAO PANG<sup>1</sup>

This version: November 14, 2025

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## A. Additional tables and figures



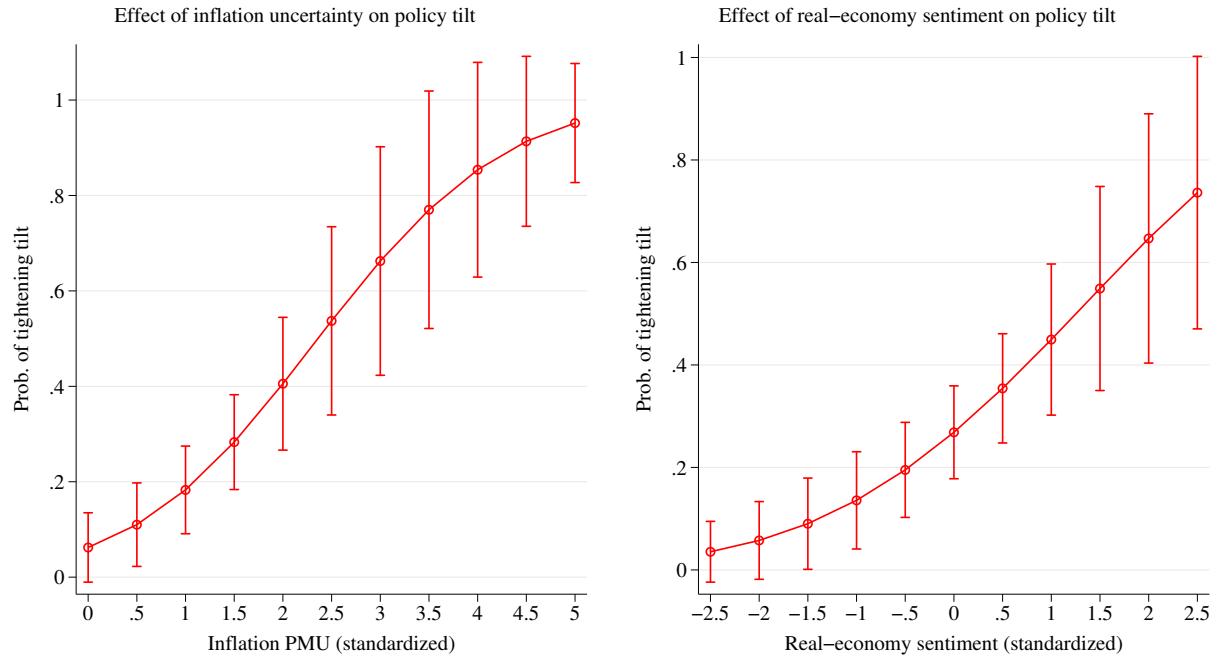
**Figure A-1. Policy stance in FOMC meetings: Temporal orientation and conditionality.**

Dependent variable: Tilt in the NY Fed directive				
	(1)	(2)	(3)	(4)
$\Delta FFR_t$	1.17*** (3.82)	0.72* (1.74)		0.11 (0.28)
$HD_t$			0.45*** (7.14)	0.38*** (7.91)
GB controls	No	Yes	No	Yes
$\bar{R}^2$	0.21	0.26	0.44	0.44
N	102	102	102	102

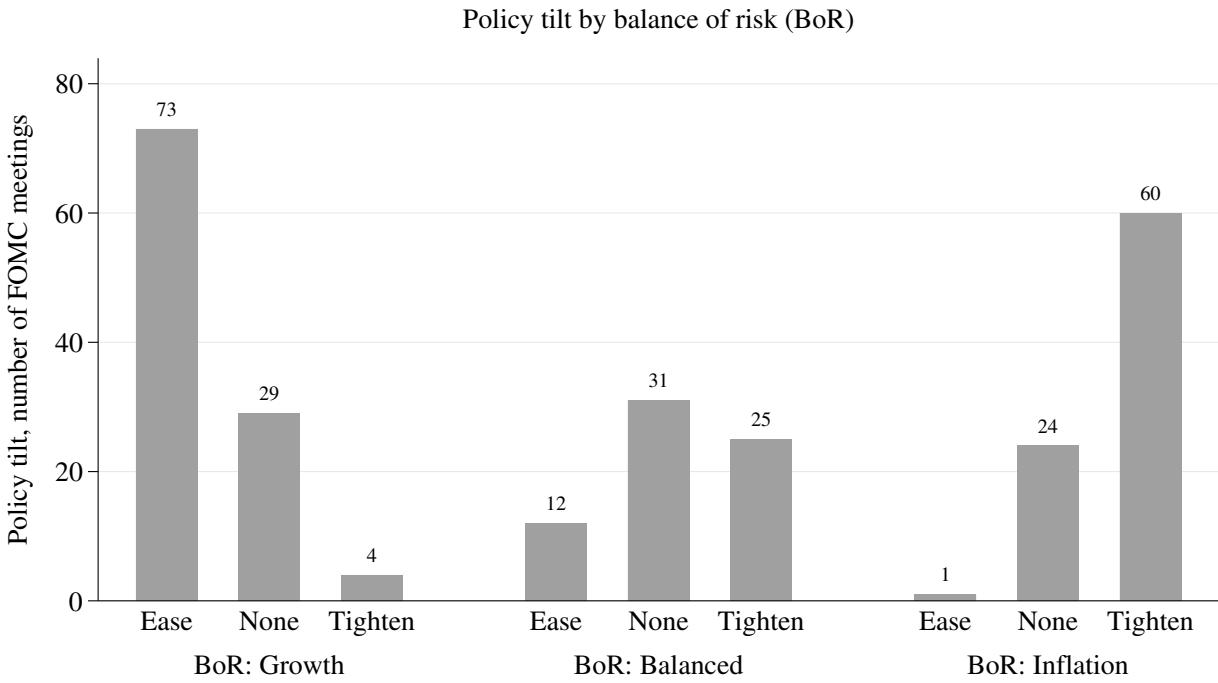
**Table A-1. Policy stance in FOMC language and policy tilt in the NY Fed directive.** The table reports regressions of the tilt in the FOMC's policy directive to the open market desk at the New York Fed over the 1987:08–1999:11. The tilt variable is coded as  $-1, 0, +1$  for an easing tilt, symmetry, or a tightening tilt.  $\Delta FFR_t$  is the change in the FFR target from meeting  $t - 1$  to  $t$  and is expressed in percentage points. The coefficients are standardized. HAC standard errors are in parentheses.

Dependent variable: Tilt in the NY Fed directive							
	(1) $HD_t$	(2) $HD_t$	(3) $HD_t$	(4) $HD_t$	(5) $HD_t$	(6) $HD_t$	(7) $HD_t$
$InfPMU_t$		0.33*** (4.07)		0.27*** (3.10)	0.22*** (3.30)	0.16** (2.50)	0.14** (2.23)
$DefPMU_t$		0.091 (0.93)		0.052 (0.61)	0.013 (0.19)	0.0010 (0.01)	-0.019 (-0.23)
$EcoPMU_t$		-0.16 (-1.63)		-0.17** (-2.22)	-0.17* (-1.94)	-0.14* (-1.80)	-0.036 (-0.51)
$MktPMU_t$		-0.23* (-1.74)		-0.074 (-0.79)	-0.089 (-0.95)	-0.079 (-0.98)	-0.23*** (-3.88)
$InfSent_t$			0.27*** (3.44)	0.12 (1.45)	0.082 (1.23)	0.067 (1.13)	0.12* (1.68)
$EcoSent_t$			0.43*** (5.30)	0.42*** (5.65)	0.32*** (4.49)	0.26*** (3.82)	0.24** (2.59)
$MktSent_t$			0.055 (0.68)	0.037 (0.58)	0.020 (0.33)	0.028 (0.52)	0.040 (0.51)
GB controls	Yes	No	No	No	Yes	Yes	Yes
$FFR_t, FFR_{t-1}$	No	No	No	No	No	Yes	Yes
$\bar{R}^2$	0.27	0.18	0.30	0.37	0.44	0.50	0.54
N	259	259	259	259	259	258	170
							97

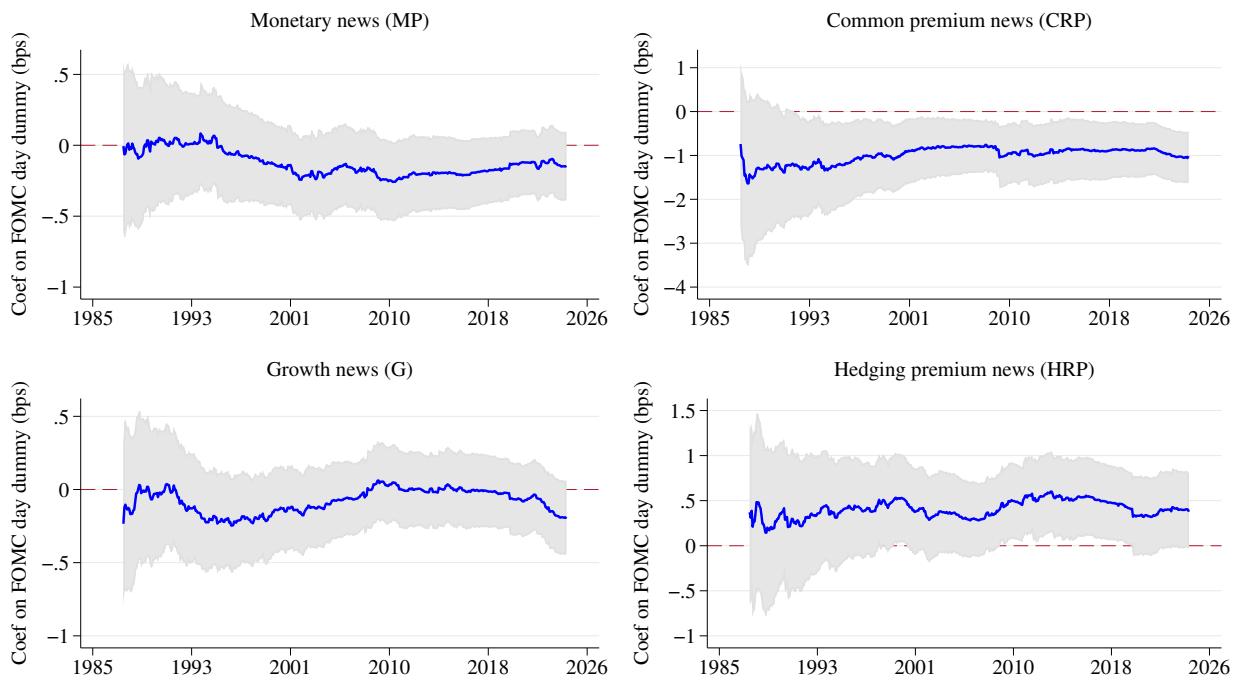
**Table A-2. Uncertainty and risk perceptions as drivers of policy stance.** The table updates and extends regressions from Cieslak et al. (2024) of policy stance on measures of policymakers' perceptions of uncertainty and tail risks. The dependent variable in columns (1)–(8) is the  $HD_t$  and in column (8) is the tilt from the FOMC directive to the NY Fed. The sample period in columns (1)–(6) is 1987:8–2019:12, in column (7) it is 1987:8–2008:12, and in column (8) it is 1987:8–1999:12, where the tilt variable is available. The coefficients are standardized. HAC standard errors are in parentheses.



**Figure A-2. Predicting policy tilt with FOMC uncertainty and risk perceptions.** The figure presents estimates from ordered logit model predicting tilt in the policy directive with policymakers' inflation PMU and real-economy sentiment. The sample period is 1987:7–1999:11 when the tilt in the directive is available.



**Figure A-3. LLM-inferred policy tilt by the balance of risk (BoR) assessment.**



**Figure A-4. Expanding window estimates of regressions (12).**

## B. Model illustration

### B.1. Model setup

In this appendix, we build on the simple framework introduced in Section V.A to examine two specific forms of the Fed’s risk management and discuss their implications for asset pricing. We begin by extending the three-equation system as follows:

$$x_t = \rho_x x_{t-1} - \chi i_t + \underbrace{d_t + \Delta_t}_{\tilde{d}_t} \quad (\text{A.13})$$

$$\pi_t = \kappa x_t \quad (\text{A.14})$$

$$r_t = \phi_{\pi,t} \pi_t + \tilde{\phi}_\pi E_t[\Delta_{t+1}] + \varepsilon_t \quad (\text{A.15})$$

$$d_t \sim i.i.d N(0, \sigma_{d,t-1}^2), \varepsilon_t \sim i.i.d N(0, \sigma_\varepsilon^2), \text{ and } \Delta_{t+1} \sim i.i.d \begin{cases} 1 & p_t \cdot \mathbb{1}_{t,\text{up}} \\ 0 & 1 - p_t \cdot (\mathbb{1}_{t,\text{up}} + \mathbb{1}_{t,\text{down}}) \\ -1 & p_t \cdot \mathbb{1}_{t,\text{down}} \end{cases} \quad (\text{A.16})$$

There are a few key modifications. We introduce an adverse tail event,  $\Delta_t$ , into the IS curve. This term is effectively an additional exogenous demand shock. Denoting  $\tilde{d}_t \equiv d_t + \Delta_t$  as the total demand shock,  $d_t$  captures symmetric demand shocks, while  $\Delta_t$  represents the asymmetric component. We also allow for time-varying volatility in  $d_t$ , denoted by  $\sigma_{d,t}$ .

The term  $\Delta_t$  follows a discrete distribution. Specifically,  $\mathbb{1}_{t,\text{up}}$  indicates the presence of an upside risk, whereas  $\mathbb{1}_{t,\text{down}}$  represents a downside risk. For simplicity, we assume that the unconditional probabilities of upside and downside risks are identical, i.e.,  $E[\mathbb{1}_{t,\text{up}}] = E[\mathbb{1}_{t,\text{down}}] = p_1 < 0.5$ , and that the realizations of the two indicator functions are independent of all other variables. Moreover, we impose  $\mathbb{1}_{t,\text{up}} \cdot \mathbb{1}_{t,\text{down}} = 0$ , implying that in any period  $t$ , there can be either an upside or a downside risk, but not both. Both indicators may be zero, in which case  $\Delta_{t+1} = 0$  with certainty.

Conditional on the presence of either an upside or downside risk,  $p_t$  denotes the time-varying probability of the adverse event, with  $p_t \sim U[0, a]$  and  $a < 0.5$  unconditionally. These assumptions jointly imply that  $\Delta_t$  has an unconditional mean of zero. The  $t$  subscripts in the probabilities and indicators for the  $\Delta_{t+1}$  distribution indicate that the distribution is already determined at time  $t$ , thereby generating a conditionally nonzero expected demand shock. This feature warrants a preemptive policy response,  $\tilde{\phi}_\pi E_t[\Delta_{t+1}]$ , which captures forward-looking policy instruments—such as a policy tilt or bias—designed to mitigate the effects of the adverse event. We next discuss the monetary policy in this model in greater detail.

#### B.1.1. Traditional policy response $\phi_{\pi,t} \pi_t$

The traditional policy rule  $\phi_{\pi,t} \pi_t$  is assumed such that the Fed only responds to the inflation gap (or equivalently, the output gap) but not directly to the demand shock  $d_t$  or  $\Delta_t$ . Under this assumption, the Fed cannot perfectly offset  $\tilde{d}_t$ —there is no “divine coincidence.” In practice, this reflects either the unobservability of demand shocks or, even if the Fed can infer it using granular micro-level information, the communication challenges that lead policymakers to react primarily to realized inflation instead. This simplification allows the model to focus exclusively on demand

shocks while still delivering the realistic result that policy cannot fully neutralize them, capturing the trade-off the Fed faces in the presence of supply shocks.

We further model the Fed's response to the inflation gap,  $\phi_{\pi,t}$ , as time-varying, which constitutes one source of variation in the policy stance. We assume that the Fed adopts a period-by-period external discretion: the Fed does not anticipate future changes in  $\phi_{\pi,t}$  but treats the current period's exogenous value as permanent for all future periods. Although  $\phi_{\pi,t}$  is modeled as externally determined, it follows  $\phi_{\pi,t} = \phi_\pi + b\sigma_{d,t-1}^2$ , where  $b > 0$ . This specification reflects the empirical finding that the policy stance is shaped by the Fed's perception of uncertainty and that risk management manifests through the time-varying strength of the policy response.

### B.1.2. Forward-looking policy response $\tilde{\phi}_\pi E_t[\Delta_{t+1}]$

The policy rule additionally incorporates a response to expected demand shocks,  $E_t[\Delta_{t+1}]$ , which captures the Fed's preemptive behavior. The constant reaction parameter  $\tilde{\phi}_\pi > 0$  reflects both the Fed's degree of aggressiveness and the strength of transmission of this "unconventional" policy channel to the economy. This preemptive component represents an additional dimension of the policy stance: the Fed can be viewed as more hawkish (dovish) than under a conventional policy rule when it anticipates a positive (negative)  $E_t[\Delta_{t+1}]$ . Importantly, this response need not be implemented through immediate policy actions; it can instead be conveyed through communication. Such behavior is consistent with empirical evidence showing that the Fed's *Balance of Risks* assessment informs its policy-tilt communications.

Although this model does not explicitly specify the Fed's optimization problem that gives rise to the preemptive response, the framework discussed in Section II provides such a foundation. From the perspective of that conceptual framework, while the Fed in this model cannot influence the probability of the adverse event ( $p_t$ ), the preemptive response can mitigate its impact because the backward-looking component of the output gap,  $\rho_x x_{t-1}$ , implies that today's policy affects future outcomes. The magnitude of  $\tilde{\phi}_\pi$ , which is unconstrained in this model, can therefore be interpreted as the optimal policy choice derived from the problem outlined in Section II.

## B.2. The Equilibrium

Suppose that the Fed has full knowledge about all parameters and distributional information. Conditionally, the Fed's (econometrician's) belief of the mean and the variance of the next-period demand shocks are:

$$E_t[\tilde{d}_{t+1}] = E_t[\Delta_{t+1}] = p_t(\mathbb{1}_{t,\text{up}} - \mathbb{1}_{t,\text{down}}), \quad \text{Var}_t[\tilde{d}_{t+1}] = \underbrace{\sigma_{d,t}^2}_{\text{Sym. risk}} + \underbrace{p_t(1-p_t)(\mathbb{1}_{t,\text{up}} + \mathbb{1}_{t,\text{down}})}_{\text{Asy. risk}}$$

The conditional expectation of the  $t+1$  demand shock arises solely from the asymmetric component  $\Delta_{t+1}$ , while the conditional variance reflects both symmetric and asymmetric risks. When asymmetric risk is absent ( $p_t = 0$  or  $\mathbb{1}_{t,\text{up}} = \mathbb{1}_{t,\text{down}} = 0$ ), it follows that  $E_t[\tilde{d}_{t+1}] = 0$ , and  $\text{Var}_t[\tilde{d}_{t+1}] = \sigma_{d,t}^2$ .

The Fed sets the policy instrument  $i_t$  at time  $t$  according to their expectation of  $\Delta_{t+1}$ , which are their perception of  $p_t$  and whether there will be an upside risk ( $\mathbb{1}_{t,\text{up}} = 1$ ) or downside risk ( $\mathbb{1}_{t,\text{down}} = 1$ ) or no asymmetric risk. In equilibrium, the output gap  $x_t$ , inflation gap  $\pi_t$ , the Fed's

conditional expectation of output gap  $x_{t+1}$ , inflation gap  $\pi_{t+1}$ , and the policy they set are:

$$x_t = \frac{1}{\Omega(\phi_{\pi,t})} \left[ \rho_x x_{t-1} + \tilde{d}_t - \underbrace{\chi \varepsilon_t}_{-\chi \tilde{\phi}_\pi E_t[\Delta_{t+1}]} \right] \quad (\text{Add'l gap from } \tilde{\phi}_\pi E_t[\Delta_{t+1}]) \quad (\text{A.17})$$

$$\pi_t = \kappa x_t$$

$$r_t = \underbrace{\frac{1}{\Omega(\phi_{\pi,t})} [\kappa \phi_{\pi,t} (\rho_x x_{t-1} + \tilde{d}_t) + \varepsilon_t]}_{\text{Contemporaneous response}} + \underbrace{\frac{1}{\Omega(\phi_{\pi,t})} \tilde{\phi}_\pi E_t[\Delta_{t+1}]}_{\text{Forward-looking policy tilt}} \quad (\text{A.18})$$

$$E_t[x_{t+1}] = \frac{1}{\Omega(\phi_{\pi,t})} [\rho_x x_t + E_t[\Delta_{t+1}]]$$

$$= \frac{\rho_x}{\Omega(\phi_{\pi,t})^2} (\rho_x x_{t-1} + \tilde{d}_t - \chi \varepsilon_t) + \frac{1}{\Omega(\phi_{\pi,t})} \underbrace{\left(1 - \frac{\rho_x \chi \tilde{\phi}_\pi}{\Omega(\phi_{\pi,t})}\right)}_{\text{Offset by Fed's } (\tilde{\phi}_\pi E_t[\Delta_{t+1}])} E_t[\Delta_{t+1}] \quad (\text{A.19})$$

$$E_t[\pi_{t+1}] = \kappa E_t[x_{t+1}],$$

where  $\Omega(\phi_{\pi,t}) = 1 + \chi \phi_{\pi,t} \kappa$ . The  $\frac{1}{\Omega(\phi_{\pi,t})} \tilde{d}_t$  term in equation (A.17) represents the portion of the demand shock that the Fed cannot fully offset. As  $\phi_{\pi,t} \rightarrow \infty$ , this term converges to zero, consistent with the optimal rule in a world driven solely by demand shocks. When  $\phi_{\pi,t}$  is finite, however, the policy rate is effectively constrained, creating an incentive for the Fed to respond preemptively. In equation (A.19), the expected remaining demand shock for the next period,  $\frac{1}{\Omega(\phi_{\pi,t})} E_t[\Delta_{t+1}]$ , is partly mitigated by the Fed's forward-looking response. This preemption, however, is not costless: it generates an additional output gap today, given by the  $-\frac{1}{\Omega(\phi_{\pi,t})} \chi \tilde{\phi}_\pi E_t[\Delta_{t+1}]$  term in equation (A.17).

The conditional variances of the output gap and the inflation gap are:

$$Var_t[x_{t+1}] = \frac{1}{\Omega(\phi_{\pi,t})^2} \left[ Var_t[\tilde{d}_{t+1}] + \sigma_\varepsilon^2 + \frac{2\chi^2 \tilde{\phi}_\pi^2 a^2 p_1}{3} \right] \quad (\text{A.20})$$

$$Var_t[\pi_{t+1}] = \kappa^2 Var_t[x_{t+1}]$$

The conditional output gap volatility still comprises an exogenous uncertainty component,  $Var_t[\tilde{d}_{t+1}]$ , which can be damped by the Fed's policy stance  $\phi_{\pi,t}$ , and a Fed-induced policy uncertainty component,  $\sigma_\varepsilon^2$ . In addition, there now appears an extra term,  $\frac{2\chi^2 \tilde{\phi}_\pi^2 a^2 p_1}{3}$ , also induced by the Fed. This term arises from uncertainty about the Fed's future forward-looking policy response, since the Fed commits to responding to expected future shocks. Note that this conditional variance is derived under the Fed's own belief: even the Fed does not yet know its perceived asymmetry of risk in period  $t+1$ . That perception, in turn, determines its  $t+1$  response to the expected  $t+2$  demand shock, thereby generating an additional source of conditional variance. The term is mathematically derived from the assumptions of the uniformly distributed  $p_{t+1} \sim U[0, a]$ ,  $E[\mathbb{1}_{t+1,\text{up}}] = E[\mathbb{1}_{t+1,\text{down}}] = p_1$ , and  $p_{t+1}$  is independent from  $\mathbb{1}_{t+1,\text{up}}$  and  $\mathbb{1}_{t+1,\text{down}}$ .

### B.2.1. The Fed's risk management

The model incorporates two forms of the Fed's risk management. The first, as in Section V.A but now made more explicit, concerns the Fed's response to heightened demand uncertainty. When the Fed perceives greater uncertainty (a higher  $\sigma_{d,t-1}^2$ ), it adopts a more aggressive stance (a larger  $\phi_{\pi,t}$ ). Although this assumption is empirically motivated, the underlying incentive remains the same and can be seen from equation (A.20): increasing  $\phi_{\pi,t}$  mitigates the impact of heightened uncertainty—reflected in the  $\sigma_{d,t-1}^2$ -induced rise in  $Var_t[\tilde{d}_{t+1}]$ —thereby stabilizing the economy.

The second form operates through the forward-looking, preemptive response. The Fed communicates a hawkish (dovish) tilt when it perceives upside (downside) risks, as captured by equation (A.18). This behavior, represented by  $\tilde{\phi}_\pi > 0$ , generates an additional current-period output gap (equation (A.17)) but helps reduce the expected output gap in the subsequent period (equation (A.19)). However, this commitment entails a fixed cost: an increase in conditional volatility (the last term in equation (A.20)). This increase can be interpreted as the premium the Fed pays to commit to this form of risk management.

## B.3. Asset prices

### B.3.1. The market's beliefs

Suppose the market holds beliefs about some parameters and variables that differ from those of the Fed (or the econometrician).

1. The market knows that  $\phi_{\pi,t}$  is time-varying and that the Fed responds to uncertainty  $\sigma_{d,t-1}^2$ , i.e.,  $\phi_{\pi,t} = \phi_\pi + b\sigma_{d,t-1}^2$ , but does not observe the true value of  $\phi_{\pi,t}$ . The market knows  $\phi_\pi$ ,  $b$ , and  $\tilde{\phi}_\pi$ .
2. The market observes the current-period  $d_t$ ,  $\Delta_t$ ,  $x_t$ , and  $\pi_t$ .
3. The market shares the Fed's knowledge about the distributional form of  $d_{t+1}$  and agrees with the Fed on the indicator functions ( $\mathbb{1}_{t,\text{up}}$  and  $\mathbb{1}_{t,\text{down}}$ ). Since the Fed is assumed to have full information on whether there is an upside risk ( $\mathbb{1}_{t,\text{up}}$ ) or a downside risk ( $\mathbb{1}_{t,\text{down}}$ ), the market is assumed to have this information as well.
4. The market holds beliefs about  $\sigma_{d,t-1}^2$  and  $p_t$  that may differ from those of the Fed, denoted by  $E_t^m[\sigma_{d,t-1}^2]$  and  $E_t^m[p_t]$ . In other words, the market's perception of risk differs from that of the Fed. The expectations  $E_t^m[\sigma_{d,t-1}^2]$  and  $E_t^m[p_t]$  are determined through an exogenous learning process, implying that the market does not internalize future revisions to its beliefs.<sup>2</sup>
5. After the Fed implements policy instruments, the market observes the  $i_t$ .

Under these information assumptions, the market's perceived variance of the output gap is:

$$Var_t^m[x_{t+1}] = \frac{1}{E_t^m[\Omega(\phi_{\pi,t})]^2} \left[ Var_t^m[\tilde{d}_{t+1}] + \chi^2 \sigma_\varepsilon^2 + \frac{2\chi^2 \tilde{\phi}_\pi^2 a^2 p_{\mathbb{1}}}{3} \right]. \quad (\text{A.21})$$

<sup>2</sup>This external learning assumption also implies that market beliefs are treated as permanent; for example, the market expects  $E_t^m[\phi_{\pi,t+n}] = E_t^m[\phi_{\pi,t}]$  for all  $n$ .

### B.3.2. Asset pricing

The innovation to the real log stochastic discount factor (SDF) remains defined as  $\tilde{m}_{t+1} = -\gamma \tilde{x}_{t+1}$ , where  $\tilde{x}_{t+1}$  denotes the innovation to the output gap. We continue to consider two assets: a claim to next period's consumption (the "stock," which pays a real cash flow equal to  $x_{t+1}$ ) and a two-period nominal bond (which pays  $-r_{t+1} - \pi_{t+1}$  in real terms at time  $t + 1$ ).

$$rp_t^x = -Cov_t^m(\tilde{m}_{t+1}, \tilde{x}_{t+1}) = \gamma Var_t^m[x_{t+1}] = \frac{\gamma}{E_t^m[\Omega(\phi_{\pi,t})]^2} \left[ \underbrace{Var_t^m[\tilde{d}_{t+1}]}_{HRP} + \underbrace{\frac{2\chi^2\tilde{\phi}_\pi^2 a^2 p_{\perp}}{3} + \chi^2 \sigma_\varepsilon^2}_{CRP} \right] \quad (\text{A.22})$$

$$\begin{aligned} rp_t^b &= -Cov_t^m(\tilde{m}_{t+1}, -\tilde{r}_{t+1} - \tilde{\pi}_{t+1}) \\ &= \frac{\gamma}{E_t^m[\Omega(\phi_{\pi,t})]^2} \left[ \underbrace{-\kappa(1 + E_t^m[\phi_{\pi,t}]) Var_t^m[\tilde{d}_{t+1}]}_{HRP} + \underbrace{\chi(1 - \kappa\chi) \left( \sigma_\varepsilon^2 + \frac{2\tilde{\phi}_\pi^2 a^2 p_{\perp}}{3} \right)}_{CRP} \right] \end{aligned} \quad (\text{A.23})$$

Same as in Section V.A, we define the *hedging risk premium* (HRP) as the component of the risk premium that drives opposite signs of the stock and bond risk premia, and the *common risk premium* (CRP) as the component that drives the same signs of both. The market's belief about the Fed's reaction parameter (the symmetric risk),  $E_t^m[\phi_{\pi,t}]$  (or equivalently,  $E_t^m[\sigma_{d,t-1}^2]$ ), and the perceived uncertainty about the future demand shock,  $Var_t^m[\tilde{d}_{t+1}]$ , jointly determine these two types of risk premia. Comparative statics imply that an increase in  $E_t^m[\phi_{\pi,t}]$  reduces both the HRP and the CRP, whereas an increase in  $Var_t^m[\tilde{d}_{t+1}]$  raises the HRP. We next discuss how the market updates these beliefs following the Fed's policy tilt and bias communications.

### B.3.3. Fed-market belief difference

Note that the market knows  $\sigma_{d,t-1}^2$  and  $p_t$  are independent. From the market's perspective, the expected monetary policy is:

$$E_t^m[r_t] = \frac{1}{E_t^m[\Omega(\phi_{\pi,t})]} [\kappa E_t^m[\phi_{\pi,t}] (\rho_x x_{t-1} + \tilde{d}_t) + \tilde{\phi}_\pi E_t^m[p_t] (\mathbb{1}_{t,\text{up}} - \mathbb{1}_{t,\text{down}})], \quad (\text{A.24})$$

which is determined by the market's belief of the symmetric risk  $E_t^m[\sigma_{d,t-1}^2]$  and the asymmetric risk  $E_t^m[p_t]$ . The perceived policy surprise is:

$$\begin{aligned} r_t - E_t^m[r_t] &= \underbrace{\left( \frac{\kappa \phi_{\pi,t}}{\Omega(\phi_{\pi,t})} - \frac{\kappa E_t^m[\phi_{\pi,t}]}{E_t^m[\Omega(\phi_{\pi,t})]} \right) (\rho_x x_{t-1} + \tilde{d}_t)}_{\text{(i)}} + \underbrace{\frac{1}{\Omega(\phi_{\pi,t})} \varepsilon_t}_{\text{(ii)}} \\ &\quad + \underbrace{\left( \frac{\tilde{\phi}_\pi}{\Omega(\phi_{\pi,t})} p_t - \frac{\tilde{\phi}_\pi}{E_t^m[\Omega(\phi_{\pi,t})]} E_t^m[p_t] \right) (\mathbb{1}_{t,\text{up}} - \mathbb{1}_{t,\text{down}})}_{\text{(iii)}} \end{aligned} \quad (\text{A.25})$$

The perceived surprises consist of three components: (i) the reaction parameter, arising from incorrect beliefs about the symmetric risk,  $\sigma_{d,t-1}^2 - E_t^m[\sigma_{d,t-1}^2]$ ; (ii) the monetary policy shock,

$\varepsilon_t$ , which captures other unmodeled perceived policy “mistake;” and (iii) the belief difference regarding the asymmetric risk,  $p_t - E_t^m[p_t]$ . Confusion between components (i) and (iii) can therefore lead the market to update its belief about  $E_t^m[\phi_{\pi,t}]$  following the Fed’s policy tilt or bias communication.

Such confusion is plausible for two reasons. First, the multidimensional nature of monetary policy communications and the complexity of economic conditions make it difficult for market participants to perfectly disentangle the two components. Second, policy biases are typically issued in the absence of an explicit policy action, as shown in Figure 9, which further complicates the market’s inference regarding component (i), if we believe (i) as being more closely related to target rate setting. We next discuss in detail how different directions of the policy tilt affect the risk premium through the lens of the model and this confusion mechanism.

#### B.3.4. Market belief updates and risk premium

The non-linear form of equation (A.25) makes it difficult to derive clear implications, so we first simplify it. Note that the contemporaneous response component in equation (A.18) is an increasing function of  $\phi_{\pi,t}$  (and thus of  $\sigma_{d,t-1}^2$ ). Consider the case where  $E_t^m[\sigma_{d,t-1}^2] = \sigma_{d,t-1}^2$  and  $\varepsilon_t = 0$ , i.e., the market holds the correct belief about symmetric risk (though they do not know this) and the Fed does not make any other monetary policy “mistake”. This can also be viewed as a one-period comparative statistics in which there is initially no belief difference regarding  $\sigma_{d,t-1}^2$ . Under this assumption, the realized policy surprise in equation (A.25) reduces to equation (A.26), which is driven solely by belief differences in  $p_t$  (the probability of the adverse event):

$$r_t - E_t^m[r_t] = \frac{\tilde{\phi}_\pi}{\Omega(\phi_{\pi,t})} (p_t - E_t^m[p_t]) (\mathbb{1}_{t,\text{up}} - \mathbb{1}_{t,\text{down}}). \quad (\text{A.26})$$

The market still interprets the realized surprise in equation (A.26) through the lens of equation (A.25) and attributes at least part of it to belief difference in  $\phi_{\pi,t}$  (i.e.,  $\frac{\kappa\phi_{\pi,t}}{\Omega(\phi_{\pi,t})} - \frac{\kappa E_t^m[\phi_{\pi,t}]}{E_t^m[\Omega(\phi_{\pi,t})]}$ ). Intuitively, the direction in which a policy bias shifts the market’s belief about  $\phi_{\pi,t}$  (toward a more hawkish or dovish stance) depends on three factors: (i) whether the bias is upside ( $\mathbb{1}_{t,\text{up}}$ ) or downside ( $\mathbb{1}_{t,\text{down}}$ ); (ii) whether the market underestimates ( $p_t - E_t^m[p_t] > 0$ ) or overestimates ( $p_t - E_t^m[p_t] < 0$ ) the adverse event; and (iii) whether the economy is currently in a tightening ( $\rho_x x_{t-1} + \tilde{d}_t > 0$ ) or easing ( $\rho_x x_{t-1} + \tilde{d}_t < 0$ ) cycle.

To narrow the discussion, we rely on empirical evidence related to policy tilts. Figure 8 shows that upside tilts ( $\mathbb{1}_{t,\text{up}} = 1$ ) occur predominantly during tightening ( $\rho_x x_{t-1} + d_t > 0$ ) cycles. This observation helps fix the signs of factors (i) and (iii). Figure 10 further indicates that a typical scenario for an upside (tightening) tilt arises when the balance-of-risks assessment is toward inflation and policymakers are concerned about acting too late. Such concern may reflect fears of undermining policy credibility or leading to unanchored inflation expectations. Because these concerns are likely not under the market’s perspective, this corresponds to a case where  $p_t > E_t^m[p_t]$ , that is, the market underestimates the upside risk. In summary, the above discussion gives rise to the negative impact of the tightening tilts on the risk premium in Figure 13:

**Case 1:**  $\mathbb{1}_{t,\text{up}} = 1$ ,  $\rho_x x_{t-1} + d_t > 0$ , and  $p_t > E_t^m[p_t]$ . The Fed issues a tightening tilt during a tightening cycle and is more concerned about the upside risk than the market. The market interprets this stronger-than-expected hawkish signal as a higher perceived  $\phi_{\pi,t}$ , leading to an upward revision in  $E_t^m[\phi_{\pi,t}]$  and eventually a decline in the CRP.

Figure 13 also shows that an easing tilt is associated with a higher risk premium, although the effect is only marginally statistically significant. Using the same reasoning as in Case 1, Figure 8 indicates that a downside tilt typically occurs during easing cycles. However, in this case, it is more ambiguous whether the Fed overestimates or underestimates the underlying risks, which likely contributes to the weak statistical significance. If anything, the following case helps explain the observed positive risk-premium effect of the easing tilt:

**Case 2:**  $\mathbb{1}_{t,\text{down}} = 1$ ,  $\rho_x x_{t-1} + d_t < 0$ , and  $p_t < E_t^m[p_t]$ . The Fed issues an easing tilt, but the market had already expected an even more accommodative stance. The communication is therefore interpreted as a lower perceived  $\phi_{\pi,t}$ , prompting a downward revision in  $E_t^m[\phi_{\pi,t}]$  and an increase in the CRP.