Policymakers' Uncertainty

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We examine how uncertainty impacts decision-making by the Federal Open Market Committee (FOMC). Drawing from private deliberations, we quantify the uncertainty types the FOMC perceives and their policy impact. Inflation uncertainty prompts a tighter stance, unexplained by macroeconomic forecasts or public uncertainty indicators, particularly when expected inflation nears or exceeds the target. The FOMC's focus on upper-tail inflation risks explains this response, diverging from common models of policymaking under uncertainty. Narrative evidence connects tail-risk perceptions to credibility concerns. We thus highlight how the Fed's risk management contributed to price stability in pre-pandemic decades, with implications for future monetary policy frameworks.

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I. Introduction

The US Federal Reserve has been credited with remarkable price stability over the last several decades. That successful streak has recently been punctured by the post-Covid pandemic inflation surge, with growing research pointing to the Fed's delayed response to address inflation. What aspects of the Fed's decision-making in prior years contributed to the desirable outcomes? In this paper, we characterize the monetary policymaking process based on the Fed's internal deliberations to establish the crucial role played by policymakers' perceived inflation uncertainty in determining their forward-looking policy stance. This risk management approach to inflation uncertainty, focused on upper inflation tail risks, led to a tighter policy stance than otherwise predicted by standard policy rules based on the Fed's response to expected macroeconomic conditions.

Alan Greenspan famously said, "(...) uncertainty is not just a pervasive feature of the monetary policy landscape; it is the defining characteristic of that landscape" (Greenspan, 2004). Despite the ubiquitous emphasis on uncertainty in central bankers' speeches and statements, there is little empirical evidence about how policymakers' uncertainty perceptions and, more broadly, their beliefs about higher-order moments of economic outcomes affect policy decisions that we observe. While many existing models capture uncertainty in optimal policymaking, the ambiguous predictions from the literature leave mixed guidance for what to expect empirically. In an oft-quoted result, Brainard (1967) postulated that policymakers should adopt a more conservative stance when faced with uncertainty about policy transmission. However, the effect of uncertainty on monetary policy has since been shown to be model-specific. Depending on the assumptions about the structure of the economy and policymakers' preferences, uncertainty can induce a more or less aggressive optimal policy response or no response at all.[1]

We use a simple theoretical framework to lay out the channels through which uncertainty can impact decisions. We distinguish four possibilities: certainty equivalence commonly assumed in the monetary literature; economic uncertainty shocks that suppress expected output (e.g., Bloom, 2009; Basu and Bundick, 2017); uncertainty about model parameters (e.g., Brainard, 1967); and uncertainty arising from upper-tail inflation risks. With the two last channels, we introduce the notion of Fed-managed uncertainty, i.e., uncertainty that the Fed can influence and, therefore, directly takes into account in its policy decisions.

[1] The models characterizing optimal rules under uncertainty can be broadly divided into two strands, see, e.g., Blinder (1999), Rudebusch (2001), Walsh (2003), and Bernanke (2007) for discussion of this literature. Following Brainard (1967), one strand considers Bayesian policymakers facing parameter uncertainty, e.g., Söderström (2002), Kimura and Kurozumi (2007), highlighting the non-robustness of the conservatism result. The other strand derives from the literature on model uncertainty considering a robust-control policymaker (e.g., Hansen and Sargent, 2001; Giannoni, 2007; Onatski and Stock, 2002; Levin and Williams, 2003).

Our contribution is to characterize empirically how different uncertainty types affect the Fed's behavior. We document that policymakers' perceptions of increased *inflation uncertainty* in particular predict a significantly more hawkish policy stance. This result is robust to controlling for a rich set of measures for expected economic conditions and other forms of uncertainty. Moreover, the effect is asymmetric and is strongest when expected inflation is at or above the target. Among the four possible uncertainty channels, the evidence aligns most closely with the tail-risk explanation. The FOMC's concern about unlikely but costly inflationary outcomes led to policy stances in our pre-pandemic sample that were more aggressive than a typical Taylor rule would suggest. Narrative evidence suggests that tail-risk concerns were a hallmark of the Fed's decision-making post-mid-1980s, with policymakers especially worried about losing credibility if they did not take a strong enough stance on inflation.

The primary challenge for understanding the relationship between uncertainty and decision-making lies in measuring policymakers' perceptions of uncertainty and disentangling their effect from first-moment beliefs about the economy. We capture those hard-to-quantify beliefs via private deliberations of FOMC members and the Fed staff in the FOMC meeting transcripts between 1987 and 2015.[2] We develop three types of text-based measures. First, we construct textual indices of policymakers' uncertainty—PMU, for short—distinguishing perceived uncertainty about inflation and the real economy as our main indices. We also measure uncertainty about financial markets and models, as well as residual unclassified uncertainty. Second, we construct proxies of policymakers' sentiments reflecting their directional views on inflation and the real economy. Finally, to analyze the impact of these perceptions on policy, we develop a new textual gauge of policy stance based on the balance of FOMC members' hawkish and dovish language: the hawk-dove (HD) score. The textual approach applied to internal deliberations allows us to elicit a broad notion of policy stance, which encompasses forward-looking views beyond the current policy rate and is consistently available through our sample, including the zero-lower-bound episode. We document that the hawk-dove score based on internal FOMC deliberations significantly predicts the federal funds rate (FFR) target beyond the Greenbook forecasts. As such, the policy stance in the FOMC language reflects in large part deviations from the standard policy rule.

[2]The focus on private FOMC deliberations, rather than external communication, is the key aspect of our analysis, providing a window into the Fed's decision-making process. Meade (2005) pioneers using transcripts to analyze the FOMC voting behavior. Hansen et al. (2018) study how transparency affects private FOMC deliberations. Shapiro and Wilson (2022) estimate the Fed's loss function via the negative sentiment in the transcripts's language. A separate literature focuses on the Fed's public communication to measure the implied policy stance (e.g., Lucca and Trebbi, 2009; Apel and Blix Grimaldi, 2012; Handlan, 2020). Istrefi (2019) and Bordo and Istrefi (2023) study individual FOMC member policy preferences based on narrative records in the public media. Malmendier et al. (2021) analyze individual FOMC member policy preferences from speeches.

To identify the effect of FOMC's uncertainty beliefs on decision-making, those beliefs need to be pre-determined with respect to the policy stance adopted in a given meeting. Our identification exploits the structure of the FOMC meetings. The deliberations during our sample are comprised of two main rounds, each serving different objectives. In the first round—the economy round—policymakers discuss economic and financial market developments and the baseline outlook. This step lays the foundation for the second round—the policy round—which discusses the appropriate policy choice and where the policy decision takes place. We argue that beliefs expressed in the economy round are pre-determined with respect to the policy stance. We thus study how uncertainty and sentiment manifest in the economy round affect the FOMC's stance communicated in the policy round. As an additional layer of analysis, the transcribed statements are individually attributed, allowing us to study the decision-making across individual FOMC members and to delineate the differences between the subjective perceptions of the FOMC versus the staff.

Our core empirical finding is that policymakers' perception of higher inflation uncertainty in the economy round—higher inflation PMU—predicts a more hawkish (tighter) policy stance in the meeting. This result remains robust to controlling for various factors, including the Greenbook forecasts and proxies for public uncertainty (e.g., macro survey dispersion, VIX, and economic policy uncertainty index of Baker et al. (2016)). The magnitude is economically large: A one standard deviation increase in FOMC members' inflation PMU predicts a 0.18 standard deviation more hawkish policy stance in the FOMC's language, in the most restrictive specification with a host of controls. Inflation PMU is also quantitatively important for the Fed's actual policy choices. Its effect on the federal funds rate (FFR) accumulates with horizon reaching 31 basis points at eight meetings ahead, or roughly 1.5 times the size of a typical interest rate increase, per one-standard-deviation increase in the FOMC's inflation PMU. A similar result holds when extending the analysis through the zero-lower-bound with a shadow rate. The magnitude of the cumulative impact of inflation PMU exceeds that of the Greenbook economic forecasts, viewed as typical determinants of policy reaction function.

The effect of policymakers' inflation uncertainty is distinct from that of their perceived uncertainty and sentiment about the real economy. Contrary to inflation PMU, we find that an increased real-economy PMU in the economy round predicts an easier policy stance, and it is largely driven out by controlling for Greenbook macroeconomic forecasts and measures of public uncertainty. This suggests that real-economy PMU describes uncertainty that policymakers take as given by the economic environment, and respond to it via its effect on the expected economic conditions. This is consistent with models studying economic uncertainty outside the Fed (Bloom, 2009; Basu and Bundick, 2017), where increased uncertainty operates as a negative demand shock through reduced growth forecasts. The different ways in which inflation PMU and real-economy PMU are linked to policy stance highlight the need to distinguish the implications of economic uncertainty versus Fed-managed uncertainty.[3]

Given the directional effect of inflation PMU on policy stance, we revisit several candidate interpretations of Fed-managed uncertainty in setting policy. We argue that the Brainard (1967)-style parameter uncertainty is unlikely to explain our results. While parameter uncertainty models predict that uncertainty can induce a more conservative (or more activist) behavior relative to a certainty-equivalence benchmark, they do not imply a clear directional effect of uncertainty on policy that we find. We propose an alternative channel building on the idea of inflation scares (e.g., Goodfriend, 1993), whereby policymakers are concerned about low-probability high inflation outcomes endogenous to their policy choices. We develop a stylized model in which the effect of Fed-managed uncertainty on policy stems from the policymakers' perceptions of policy-dependent upper inflation tail risk. We show that inflation tail concerns can affect policy even when expected inflation is at the FOMC's target. The tail risk idea rationalizes why higher inflation PMU induces a more hawkish policy stance. Consistent with the model, inflation PMU tends to comove positively with current beliefs of rising inflation, and its effect on policy emerges most strongly when expected inflation exceeds the target.

The tail risk model offers a simple way to capture how the Fed's credibility concerns introduce a wedge between the objective and FOMC-perceived uncertainty. We collect narrative evidence from the transcripts consistent with the credibility channel. In line with credibility concerns, inflation PMU's impact on policy is entirely driven by the FOMC's views, which vary distinctly from the staff's. To the extent that neither PMU nor directional inflation sentiment predict future inflation outcomes, policymakers' inflation beliefs in the meeting are an expression of concern that does not materialize in the sample we study, in line with the Fed taking preemptive actions against inflation.

Our analysis delivers several novel implications for understanding the Fed's policy setting. Even though deviations from a Taylor-type rule are frequently detected empirically and associated with the Fed's direction, their sources remain debated. By drawing on the Fed's internal deliberations, we establish the Fed's inflation uncertainty perceptions as one prominent reason for why such deviations occur. As policymakers' perceptions of inflation uncertainty fluctuate with inflation conditions, our findings also provide an argument for the time-variation of the Fed's reaction function and suggest endogeneity in monetary policy

[3] In addition to the inflation PMU, we separately find that the FOMC policy stance is highly sensitive to the real-economy sentiment beyond macro forecasts. This fact validates, based on the Fed's internal deliberations, the view that the Fed responded to the real economy more strongly than was warranted by growth forecasts as argued by Bauer and Swanson (2023).

shocks arising from the Fed's reaction to such perceptions. More broadly, the FOMC's concerns about the ability to control inflation, which have come to the fore of policy discussions again recently, are not captured by standard monetary reaction functions.

The Fed's management of uncertainty encapsulates the risk-management approach to policymaking that Fed officials, beginning with Greenspan (2004), have frequently referenced. Our findings suggest that, as part of this approach, the FOMC's focus on inflation tail risks—aimed at maintaining credibility—was a key factor influencing decisions from the late 1980s onward. This may explain why the Fed appeared to prefer inflation rates lower than the widely assumed 2%, as documented by Shapiro and Wilson (2022). Our sample period concludes in 2015, when the Fed's concerns began to shift toward inflation undershooting the 2% target. This shift resulted in the 2020 adoption of a new monetary policy framework, which placed an asymmetric emphasis on employment shortfalls and introduced flexible average inflation targeting. The framework effectively paused the Fed's focus on managing upside inflation risks (e.g., Cieslak et al., 2024). However, experience from earlier decades demonstrates the potential advantages of preemptive actions against inflation. Our findings thus remain pertinent to the ongoing debate about the role of uncertainty in the Fed's policy framework, particularly in light of the post-Covid inflation surge.

We draw on multiple strands of the literature and discuss the connections to related work throughout the paper. The rest of the paper is structured as follows. Section II introduces a conceptual framework through which we summarize the channels linking uncertainty and monetary policy. Section III discusses the data and the measurement. Section IV empirically analyzes the relationship between uncertainty and policy stance. Section V interprets the results against model predictions and provides additional tests in support of the tail risk interpretation. Section VI concludes.

II. Uncertainty and Optimal Monetary Policy

In this section, we lay out the channels through which uncertainty can impact monetary policy. We introduce a simple static framework describing the policymaker's decision problem which is to choose a policy stance r_t. We use this framework to summarize the leading uncertainty channels in the literature and to guide our empirical analysis. All proofs are in Appendix A.

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

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

where π_t is period t inflation, π^* 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. While the typical policy choice focuses on setting the nominal interest rate, we view r_t more broadly as subsuming a range of instruments the policymaker uses to achieve their goals. Thus, a tighter policy stance could reflect higher nominal interest rates, quantitative tightening, or a change in the communicated interest rate outlook.

The expected loss function takes the mean-variance form

$$E\left[L(\pi_t, y_t)\right] = \left(\overline{\Pi}_t(r_t) - \pi^*\right)^2 + V_{\pi,t}(r_t) + \lambda\left(\overline{Y}_t(r_t) - y^*\right)^2 + \lambda V_{y,t}(r_t), \tag{2}$$

where $\overline{\Pi}_t(r_t)$ and $\overline{Y}_t(r_t)$ are the expected values of inflation and output. A standard assumption in the literature, which we also impose, is that both expectations continuously decrease in r_t. The variances of inflation and output are $V_{\pi,t}(r_t)$ and $V_{y,t}(r_t)$, and may also depend on r_t as specified below. The optimal policy choice $\hat{r}_t$ is characterized by the first-order condition

$$2\overline{\Pi}'_t(\hat{r}_t)\left(\overline{\Pi}_t(\hat{r}_t) - \pi^*\right) + V'_{\pi,t}(\hat{r}_t) = -2\lambda\overline{Y}'_t(\hat{r}_t)\left(\overline{Y}_t(\hat{r}_t) - y^*\right) - \lambda V'_{y,t}(\hat{r}_t) \tag{3}$$

where LHS (RHS) is the marginal inflation loss (output gain) from tightening policy. This general rule can be used to explore the different ways uncertainty may, or may not, influence optimal policy.

II.A. Theoretical impacts of uncertainty

Case 1. Certainty Equivalence. We refer to certainty equivalence as a situation in which uncertainty is irrelevant to decision-making. The central bank reacts to its assessment of the economy in the same way, regardless of whether uncertainty about economic outcomes is high or low. Suppose that inflation and output are not subject to uncertainty so that $\overline{\Pi}_t(r_t)$ and $\overline{Y}_t(r_t)$ describe deterministic relationships between policy and outcomes. The policy rule (3) then simplifies to

$$\overline{\Pi}'_t(\hat{r}_t)\left(\overline{\Pi}_t(\hat{r}_t) - \pi^*\right) = -\lambda\overline{Y}'_t(\hat{r}_t)\left(\overline{Y}_t(\hat{r}_t) - y^*\right) \tag{4}$$

The same decision rule emerges when inflation and output are subject to some baseline uncertainty, but this uncertainty is not related to the policy choice, i.e., $V'_{\pi,t}(r_t) = V'_{y,t}(r_t) = 0$ for all r_t.

As such, certainty equivalence obtains when uncertainty in the economic environment is exogenous to the policy itself. This situation arises in classic monetary models in which the policymaker's losses are quadratic as in equation (1), and shocks affecting π_t and y_t are additive, symmetrically distributed, and independent of the policy choice (see, e.g., Blinder, 1999 for discussion of this literature). Notably, the Taylor (1993) rule prescribes no role for uncertainty in policy decisions and can be derived under such conditions. To illustrate it, we posit a linear dependence of macro outcomes on policy stance: $\overline{\Pi}_t(r_t) = \overline{\pi}_t - ar_t$ and $\overline{Y}_t(r_t) = \overline{y}_t - br_t$, where $\overline{\pi}_t$ and $\overline{y}_t$ are pre-determined variables (i.e., exogenous to $\hat{r}_t$) reflecting inflation and output forecasts, respectively, with $a > 0, b > 0$. Equation (4) then simplifies to

$$\hat{r}_t = \frac{a}{c}\left(\overline{\pi}_t - \pi^*\right) + \frac{\lambda b}{c}\left(\overline{y}_t - y^*\right) \text{ where } c = a^2 + \lambda b^2. \tag{5}$$

In a typical Taylor-rule estimation, a proxy for $\hat{r}_t$ is regressed on pre-determined inflation and output gap forecasts, whose time-series variation is used to estimate the reaction function coefficients.

Case 2. Uncertainty as a Negative Demand Shock. Recent literature focuses on how uncertainty impacts economic agents outside the central bank. While specific theoretical mechanisms differ, greater uncertainty about the real economy acts similarly to a negative demand shock, which causes a drop in employment and output (e.g., Bloom, 2009; Basu and Bundick, 2017; Leduc and Liu, 2016).[4] An increase in this type of uncertainty tends to lead the policymaker to loosen monetary policy, even though uncertainty shocks in these models are exogenous to policy.

To capture this effect, suppose the economy faces a given level of economic uncertainty ζ_t that is exogenous to Fed policy so that $V'_{\pi,t}(r_t) = V'_{y,t}(r_t) = 0$ for all r_t. Expected output becomes $\overline{Y}_t(r_t, \zeta_t)$ where $\overline{Y}_t$ is decreasing in ζ_t, but $\frac{\partial^2 \overline{Y}_t(r_t,\zeta_t)}{\partial r_t \partial \zeta_t} = 0$ so that changes in uncertainty do not impact the transmission of monetary policy. In the linear case, the optimal policy remains as in (5) but with $\overline{y}_t$ replaced by $\overline{y}_t(\zeta_t)$, where $\overline{y}'_t(\zeta_t) < 0$. Thus, uncertainty affects $\hat{r}_t$ solely via changes in expected output, and this case collapses back to certainty equivalence. The only difference is that the process determining expected output is now linked to the process governing macroeconomic uncertainty. However, once one controls for $\overline{y}_t$, shifts in ζ_t do not induce additional shifts in $\hat{r}_t$.

Case 3. Policy-managed Uncertainty. The remaining case occurs when the variance of inflation or output *does* depend on the policy choice. We refer to it as *policy-managed* to highlight that what matters for decisions is the uncertainty the policymakers can affect. More generally, policy-managed uncertainty captures the intuition of risk management in policymaking, which Greenspan (2004) described as "a judgment about the probabilities, costs, and benefits of the various possible outcomes under alternative choices for policy."

[4] See also empirical evidence of Jurado et al. (2015) and Kumar et al. (2023) documenting the effects of uncertainty on the macroeconomy.

For simplicity, and given our empirical findings outlined below, we focus on the situation where r_t affects inflation volatility, but equivalent arguments apply when it also affects output volatility. The decision rule (3) becomes

$$2\overline{\Pi}'_t(\hat{r}_t)\left(\overline{\Pi}_t(\hat{r}_t)-\pi^*\right)+V'_{\pi,t}(\hat{r}_t)=-2\lambda\overline{Y}'_t(\hat{r}_t)\left(\overline{Y}_t(\hat{r}_t)-y^*\right). \tag{6}$$

Expected economic conditions are no longer sufficient to pin down optimal policy: Compared to (4), decision rule (6) now has an additional term $V'_{\pi,t}(\hat{r}_t)$ which reflects the effect of policy on inflation volatility. In principle, policy-managed uncertainty can either increase or decrease the marginal inflation loss. When inflation volatility declines in r_t ($V'_{\pi,t}(r_t)<0$), policy-managed uncertainty incentivizes the policymaker to choose a higher r_t. The opposite is true when $V'_{\pi,t}(r_t)>0$.[5]

We now illustrate the effects of policy-managed uncertainty that arise in two specific settings: model parameter uncertainty and inflation tail risks.

Model parameter uncertainty. Parameter uncertainty is a classic setting in which optimal policy under uncertainty has been studied, starting with Brainard (1967).[6] Suppose that $\pi_t=\overline{\pi}_t-a_t r_t$, where $\overline{\pi}_t$ is the pre-determined inflation forecast and a_t describes how policy transmits to inflation. Coefficient a_t is a random variable with mean $\overline{a}$ and variance $\sigma^2_{a,t}$, where the latter captures parameter uncertainty. The mean and variance of inflation become $\overline{\Pi}_t(r_t)=\overline{\pi}_t-\overline{a}r_t$ and $V_{\pi,t}(r_t)=r_t^2\sigma^2_{a,t}$. We normalize $r_t=0$ to be the neutral policy stance in the sense that $\hat{r}_t=0$ when the pre-determined forecasts are at target, i.e., $\overline{\pi}_t=\pi^*$ and $\overline{y}_t=y^*$. Moreover, inflation uncertainty is minimized by choosing the neutral policy as in the original Brainard (1967) model.

Plugging into the decision rule (6) yields

$$\overline{\Pi}'_t(\hat{r}_t)\left(\overline{\Pi}_t(\hat{r}_t)-\pi^*\right)+\underbrace{\sigma^2_{a,t}\hat{r}_t}_{\gtrless 0\iff \hat{r}_t\gtrless 0}=-\lambda\overline{Y}'_t(\hat{r}_t)\left(\overline{Y}_t(\hat{r}_t)-y^*\right), \tag{7}$$

where we have substituted in for $V'_{\pi,t}(\hat{r}_t)$. Policy-managed inflation uncertainty shifts the marginal inflation loss associated with tighter policy, but the direction of the shift depends on whether policy is above or below its neutral level. When $\hat{r}_t>0$, the marginal loss increases, providing an incentive to choose lower rates, whereas if $\hat{r}_t<0$, there is an incentive to choose higher rates.

Assuming $\overline{Y}_t(\hat{r}_t)=\overline{y}_t-br_t$, one can directly solve for optimal policy

[5] We assume throughout that (6) has at least one solution, which holds under minor technical assumptions.

[6] See Blinder (1999), Walsh (2003), Bernanke (2007) for references to this literature.

$$\hat{r}_t = \frac{\overline{a}}{\overline{a}^2 + \lambda b^2 + \sigma^2_{a,t}} \left(\overline{\pi}_t - \pi^*\right) + \frac{\lambda b}{\overline{a}^2 + \lambda b^2 + \sigma^2_{a,t}} \left(\overline{y}_t - y^*\right), \tag{8}$$

from which it follows that

$$\hat{r}_t \gtrless 0 \Longleftrightarrow \overline{a}\left(\overline{\pi}_t - \pi^*\right) + b\lambda\left(\overline{y}_t - y^*\right) \gtrless 0.$$

In the absence of parameter uncertainty ($\sigma_{a,t} = 0$), the policymaker wishes to raise policy above its neutral value in response to inflation and output forecasts being above target. The same is true with parameter uncertainty, but now this policy response also induces a cost in the form of increased inflation variance, which dampens the response compared to certainty equivalence (seen from $\sigma^2_{a,t}$ in the denominator of (8)). A similar logic applies when inflation and output forecasts are below target. The policymaker now wishes to shift r_t below its neutral level, which again generates increased inflation variance, so the overall response is less than under the certainty equivalence. Such a dampening effect of uncertainty on the policy response is at the core of the oft-referenced Brainard conservatism principle. Importantly, in the context of our empirical investigation, an increase in exogenous uncertainty $\sigma^2_{a,t}$ has no clear directional impact on the marginal inflation loss.

The uncertainty-induced conservatism can be overturned by alternative assumptions on the source of parameter uncertainty. Söderström (2002) notes that policymakers' uncertainty about inflation persistence can lead to a more aggressive policy behavior (see also Tetlow (2018)). It still remains the case that the policymaker becomes more activist both in the dovish and hawkish directions, without a clear directional prediction.[7]

Inflation tail risks. An alternative mechanism for policy-managed uncertainty we propose arises from policymakers' perceptions of inflation tail risks motivated by the idea of "inflation scares" from Goodfriend (1993).[8] A policy that is not sufficiently hawkish raises the chance that the central bank loses its credibility, which in turn leads to a large inflation realization. A tighter monetary policy reduces the chance of losing the nominal anchor. In this scenario, the risk is in the upper tail of the inflation distribution. In other situations, the tail risk may lie in the lower tail, although our empirical analysis shows this case to be unlikely in our sample.

[7]The activism prediction in this class of models is mainly qualitative. Even with very large uncertainty about inflation persistence, the size of the effect on policy choice remains very small, as shown by the calibrations in Söderström (2002). A similar observation holds for standard calibrations of robust control models of policy uncertainty (McMahon and Munday, 2024). An earlier version of this paper illustrated the properties of these standard models; the results are available upon request.

[8]See also Goodfriend and King (2005), Orphanides and Williams (2005), King and Lu (2022). Orphanides and Williams (2022) discuss how Goodfriend's insight has influenced policymakers' thinking in the decades following his 1993 paper, covering a major part of our sample.

Throughout, we maintain the standard assumption of a quadratic loss function as in equation (2).[9] Even if policymakers' preferences are symmetric, they may nevertheless have motives to act on inflation tail risks. Maintaining credibility to avoid costly scenarios in which inflation expectations become unanchored is one such motive.

To formalize the idea, let there be two states of the world: a baseline low-inflation state and a high-inflation state in which the tail risk is realized. In the low state, expected inflation is $\overline{\pi}_t - ar_t$ and, in the high state, expected inflation is $\overline{\pi}_t - ar_t + \Delta_t$. Here, coefficient a is fixed and known, so there is no parameter uncertainty. $\Delta_t > 0$ captures the additional inflation in the tail risk scenario. $p_t(r_t)$ is the probability of the high state in period t. We make the following assumptions:

Assumption 1. ***Upper-tail inflation risk***

1. $0 \leq p_t(r_t) < 0.5$ *for all* r_t.
2. $p'(r_t) < 0$ *for all* r_t.

The first assumption implies that the high-inflation state is the rarer event, consistent with an upper-tail risk. Under this assumption, $\overline{\pi}_t - ar_t$ is the modal expected inflation outcome. By the second assumption, inflation tail risk declines when the policy becomes more hawkish. Importantly, the baseline inflation variance (absent tail risk) is the same in both states and given by $s^2_{\pi,t}$. Hence, the policy effects of tail risks do not arise simply because of inherently more uncertainty in the high state. Finally, expected output remains $\overline{Y}_t(r_t)$.

As before, the mean and variance of macroeconomic outcomes are the key moments for determining policy choice.

Lemma 1. *In the presence of tail risks, expected inflation and inflation variance are*

1. $\overline{\Pi}_t(r_t) = \overline{\pi}_t - ar_t + p_t(r_t)\Delta_t$
2. $V_{\pi,t}(r_t) = s^2_{\pi,t} + p_t(r_t)[1 - p_t(r_t)]\Delta^2_t$.

The variance of inflation is given by the common baseline inflation uncertainty $s^2_{\pi,t}$ in both states plus a component due to uncertainty in the realization of the tail risk event. Using this result, one can plug into the policy rule (6) to obtain the decision rule

[9] A straightforward argument behind this assumption is that, over the 1987–2015 period we study, asymmetry of preferences would be inconsistent with the Fed's mandate. The empirical evidence on the asymmetry in the Fed's inflation preferences is mixed. Surico (2007) finds evidence for asymmetric preferences only during the pre-Volcker regime, with the interest rate response to the output gap being the dominant type of nonlinearity. He fails to establish asymmetry in inflation preferences. Shapiro and Wilson (2022) consider both symmetric and asymmetric objective functions and, again, find mixed results.

$$2\overline{\Pi}_t'(\hat{r}_t)\left(\overline{\Pi}_t(\hat{r}_t)-\pi^*\right)+\underbrace{p_t'(\hat{r}_t)}_{<0}\underbrace{(1-2p_t(\hat{r}_t))}_{>0}\Delta_t^2=-2\lambda\overline{Y}_t'(\hat{r}_t)\left(\overline{Y}_t(\hat{r}_t)-y^*\right) \tag{9}$$

where the stated signs arise from Assumption 1. Unlike in the parameter uncertainty case, the effect of policy-managed uncertainty in the tail-risks model is unambiguous: it reduces the marginal inflation loss and, thus, incentivizes higher rates. The reason is that increasing rates lowers the tail risk probability, which, when small, reduces the inflation variance.

Notice that when $1 \geq p_t(r_t) > 0.5$, the low-inflation outcome becomes the tail event, and policymakers instead have an incentive to lower rates compared to certainty equivalence. This might arise if the concern is a disanchoring of inflation expectations to the downside. We maintain Assumption 1 to stay close to the literature building on Goodfriend (1993) and to rationalize our empirical findings about the role of perceived inflation uncertainty in the 1987–2015 sample.

II.B. Mapping to empirics

The above arguments establish that uncertainty matters for policy choices when policy impacts the variance of inflation. We now map these results onto an empirical strategy for detecting the presence of policy-managed uncertainty and for discriminating among models.

In a typical Taylor-rule estimation, a measure of policy stance is regressed on pre-determined inflation and output forecasts whose time-series variation identifies reaction function coefficients. Analogously, our empirical strategy relies on measures for *pre-determined uncertainty* to examine whether their time-series variation induces variation in the policy stance after conditioning on a rich set of first-moment controls. We thus extend the Taylor-rule approach from only considering pre-determined forecasts of economic conditions to also considering pre-determined variances of economic conditions, as perceived by policymakers.

To the extent that different models produce distinct predictions on how variation in pre-determined uncertainty maps onto variation in policy, we can distinguish between mechanisms. We provide comparative statics to guide our empirical analysis. Starting from the basic case, under certainty equivalence (whether with or without uncertainty shocks operating through expected output), there should be no impact of uncertainty on policy. Likewise, under the negative demand shock mechanism, uncertainty should not impact policy after controlling for expected economic conditions.

Model parameter uncertainty. From the parameter uncertainty model, equation (8), one obtains the following comparative static:

Proposition 1. $\frac{\partial \hat{r}_t}{\partial \sigma_{a,t}^2} \gtrless 0 \Longleftrightarrow \overline{a}\left(\overline{\pi}_t - \pi^*\right) + b\lambda\left(\overline{y}_t - y^*\right) \lesseqgtr 0.$

While ex-ante the directional impact of changing uncertainty on policy stance is unclear, there is a conditional prediction: When expected inflation and output are above (below) their target values, an increase in uncertainty generates a looser (tighter) policy. This is because higher uncertainty pushes policy towards its neutral level, $r_t = 0$.

Inflation tail risks. Our starting point is to consider situations where (9) has a solution $\hat{r}_t$ that satisfies $\overline{\pi}_t - a\hat{r}_t \geq \pi^* - K$ for some positive constant K (we characterize K more formally below). In other words, the policymaker begins in a situation where modal inflation is not too far below target. Otherwise, it is unlikely that policymakers would be concerned about meaningful upper-tail inflation risks.

When upper-tail inflation risks do operate, the variance expression for inflation uncertainty in Lemma 1 reveals two potential drivers. The first is the tail-risk probability $p_t(r_t)$, which we capture by decomposing $p_t(r_t) = p_{t,0} + p_{t,1}(r_t)$. Here $p_{t,0}$ is the pre-determined part of the tail risk which can be higher or lower depending on economic conditions. The second is the size of the inflation jump Δ_t in the tail event. Although $p_{t,0}$ and Δ_t are exogenous to the Fed's policy, they only matter for policy because inflation variance is endogenous to r_t. Both $p_{t,0}$ and Δ_t act as shifters of the marginal impact of r_t on the variance. Since our empirical measures do not differentiate between these two drivers, we derive comparative statics for both.

Before establishing how optimal policy reacts to shifts in pre-determined uncertainty, we need to ensure the solution to (9) is well behaved. We thus place additional structure on the tail risk probability:

Assumption 2. ***Reaction of tail risk to policy***

1. *$p'(r_t)$ is continuous and bounded for all r_t.*
2. *$p''(r_t) \geq 0$ for all r_t.*

The first condition states that the tail risk reacts smoothly to marginal changes in policy. The second states that increasingly aggressive policy stances are associated with increasingly high marginal reductions in tail risk. In other words, the more hawkish a policymaker is, the more effective they are at reducing the tail risk with further policy tightening.

Proposition 2. *There exists a $K > 0$ such that:*

1. *If $\hat{r}_t$ solves (9) and satisifes $\overline{\pi}_t - a\hat{r}_t \geq \pi^* - K$, $\hat{r}_t$ is the unique solution to (9).*
2. *$\frac{\partial \hat{r}_t}{\partial p_{t,0}}, \frac{\partial \hat{r}_t}{\partial \Delta_t} > 0$ whenever $\overline{\pi}_t - a\hat{r}_t \geq \pi^* - K$.*

The first result states that the first-order condition for optimal policy has only one solution consistent with inflation being in the range where upper-tail inflation risks are relevant. The second is the main empirical prediction and states that an increase in either source of pre-determined tail risk induces a more hawkish policy stance.

Importantly, these comparative statics apply even when modal expected inflation $\overline{\pi}_t - a\hat{r}_t$ is at or even moderately *below* target. This provides a possible interpretation of the findings of Shapiro and Wilson (2022), who argue that the FOMC had an implicit inflation target of approximately 1.5% on average over the 2000–2011 sample, below the commonly assumed 2%.[10] The existence of upper-tail inflation risk, even when modal expected inflation is at target π^*, induces a more hawkish stance than the typical Taylor rule would suggest. In reduced form, such behavior would appear as the policymaker having a lower inflation target. Our tail risks model delivers additional predictions whose consistency with the data we test below.

The empirical strategy to discriminate among models relies on obtaining convincing measures of pre-determined uncertainty, a challenge we confront in the next section.

III. Measuring Policymakers' Uncertainty and Policy Stance with Text

Bringing the above comparative statics predictions to data requires empirical proxies for several objects. Most basically, we require measures of uncertainty about economic conditions. One potential source is asset prices or surveys of financial market participants, but in our framework, it is *policymakers'* perceptions of uncertainty that matter rather than those of external agents. These do not necessarily align, for example, due to different subjective expectations or because market participants condition on the Fed's expected policy path, which already internalizes the effects of policy-managed uncertainty. To the best of our knowledge, no structured survey exists regarding FOMC members' views on uncertainty over a long sample period.[11] For these reasons, we instead develop textual measures of policymakers' perceptions of uncertainty (**PMU**) about different economic variables using their deliberations in the FOMC meeting transcripts. Importantly for testing predictions, we rely on the structure of the FOMC meetings, which allows us to isolate views on uncertainty that are pre-determined with respect to each meeting's policy choice.

[10] The Fed adopted an explicit inflation target of 2% in 2012.

[11] Beginning in 2007, the FOMC's views on uncertainty about forecasts for inflation, output, and employment, respectively, are recorded in the Summary of Economic Projections (SEP) conducted every other meeting. In some reports, these are attributed to specific individuals but not in others. Also, since one function of the SEP is to communicate the FOMC's views to the public, members' stated beliefs play a signaling role that may prevent fully truthful communication.

Next, we require a measure of policy stance. The announced policy rate is problematic for several reasons. Fed observers have noted that many meetings' formal decision is largely agreed on in advance and that a primary purpose of FOMC deliberations is to shape views on appropriate future actions (e.g., Meyer, 2004). Furthermore, public communication is an increasingly important policy tool and, thus, a subject of extensive FOMC discussion, which is not necessarily reflected by the current policy rate. Lastly, the final years of our sample coincide with the zero lower bound (ZLB) on the policy rate, necessitating an alternative approach that consistently reflects the FOMC's views before and during the ZLB. To address these challenges, we again use the FOMC's language in the transcripts to construct a novel text-based policy stance proxy, which we label as the hawk-dove score (**HD**).

We first review the FOMC transcript corpus as a basis for our constructions, followed by a description and validation of our core measures. Appendix B and C contain further details.

III.A. Exploiting the FOMC meeting structure in the transcripts

The FOMC transcripts contain a fully attributed, statement-by-statement account of meetings with minimal editing. Our sample covers 227 meetings from August 1987 (the first meeting of Alan Greenspan's chairmanship) through December 2015.[12] Scheduled FOMC meetings occur eight times per year. The FOMC typically consists of 19 members: twelve regional Fed Presidents and seven Governors. During our sample, 75 unique FOMC members appear in at least one meeting. Fed staff economists also participate.

The FOMC meetings have a regular structure, which we exploit in our measurement. The first core part is the *economy round*, which makes up 43% of all sentences in the transcripts. Fed staff economists first present their economic forecasts (contained in Greenbooks/Tealbooks) along with supporting information. Each FOMC member in turn presents their views on economic developments, which can differ from the staff. FOMC members do not advocate for particular policy choices at this stage. Importantly, staff and member statements are largely prepared in advance, and participants have limited interaction (Hansen et al., 2018).

The second core part of the meeting is the *policy round*, which accounts for 24% of all sentences.[13] This round begins with the staff laying out policy alternatives, which FOMC

[12] See https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm. Only a small part of the May 1988 meeting was transcribed, so we treat it as a missing observation. The FOMC also conducts occasional special meetings convened via conference call during times of macroeconomic turbulence. Since the format of these calls is irregular, we only consider regular meetings in our analysis.

[13] The remainder of the transcripts, which we do not use, is largely made up of staff discussion of financial market conditions and discussion of special topics in monetary policy. We manually section the meetings.

members debate before proceeding to a final vote. This section also includes a discussion of the public statement to be announced.

To test the comparative statics results from Section II.B, the PMU measures at meeting t need to reflect pre-determined uncertainty perceived *before* the policy stance at meeting t is adopted, i.e., before the policy stance feeds back onto the uncertainty perceptions. The economy round, preceding the policy round, allows us to build such measures. We use only economy round text to construct PMU and only policy round text to build HD. In this way, we interpret PMU as uncertainty that policymakers perceive when they enter the meeting, and not the uncertainty they expect to prevail after their policy choice.[14]

We primarily focus on meeting-level measures. In part of the analysis, we also distinguish between statements made by the staff versus the FOMC members and by individual FOMC members.

III.B. Core empirical measures

III.B.1. Policymakers' uncertainty (PMU)

Our measurement of topic-specific uncertainty is based on the local co-occurrence of terms denoting uncertainty with terms denoting a topic.[15] To obtain the uncertainty terms, we begin with the four seed terms 'uncertain,' 'uncertainty,' 'risk,' and 'risks.'[16] We then use a word embedding model—the Continuous Bag-of-Words (Mikolov et al., 2013)—applied to FOMC transcripts to generate an expanded set of terms.[17] We provide fifty nearest neighbors for each of the seed words in Appendix Tables B.1 and B.2, and discuss the construction of embeddings and uncertainty topics in Appendix C.1.

One outlier is the September 2009 meeting, for which the economy and policy rounds were merged into one round. In this case, we manually classify sentences as either belonging to the economy round or the policy round. For further details on the FOMC meetings, see Hansen et al. (2018).

[14] The timing of deliberations within the FOMC meeting makes reverse causation unlikely, whereby policy decision drives PMU within meeting t, and not vice versa. This is plausible even if the policy choice at meeting t was largely agreed upon before the meeting. In this case, the economy round would focus on the prevailing conditions that justify the policy choice to follow rather than an assessment of how the economy would look in future periods after the policy action has been implemented.

[15] The use of local co-occurrence patterns to build text-based proxies for economic phenomena has been pioneered by Mikael and Blix (2014) in the monetary policy context and by Hassan et al. (2019) to measure specific types of uncertainty in a corporate context. Our innovation is to apply these ideas to analyze the impact of perceived risk and uncertainty on policy stances.

[16] The motivation for the seeds is that 'risk' and 'risks' capture objective uncertainty, while 'uncertain' and 'uncertainty' capture Knightian uncertainty. Combining both in the discussion of economic uncertainty is common. For example, Bloom (2014) writes: "I'll refer to a single concept of uncertainty, but it will typically be a stand-in for a mixture of risk and uncertainty."

[17] This approach follows recent studies such as Hanley and Hoberg (2019), Atalay et al. (2020), Davis et al. (2020), and Bloom et al. (2021). See Ash and Hansen (2023) for additional details.

Our topic-specific PMU indices cover four dimensions of uncertainty relevant for policymaking, as motivated by the framework in Section II: (i) inflation and (ii) real economy, as both are standard inputs into monetary policymakers' loss functions; (iii) financial markets, as market uncertainty might spill over into the real economy; and (iv) model uncertainty, in line with the theoretical literature on the role of parameter and model uncertainty in optimal policy. The term lists we use to measure topics come from our judgment[18] and are reported in Appendix Tables B.3 through B.11.

An uncertainty word in the economy round is assigned to topic k if it occurs in a sentence containing a topic-k keyword, or if a topic-k keyword appears in an immediately surrounding sentence. Meeting-level PMU for topic k is the number of topic-k uncertainty words expressed as a fraction of total words spoken in the economy round overall. We denote the four meeting-level indices by $InfPMU_t$ for inflation PMU, $EcoPMU_t$ for the real-economy PMU, $MktPMU_t$ for financial markets PMU, and $ModPMU_t$ for model PMU, which can be interpreted as the intensity with which policymakers discuss topic-specific uncertainty. With uncertainty mentions that cannot be classified into a specific topic, we form a residual category, $OthPMU_t$, for other PMU. Appendix Figure B.1 presents the distribution of terms in topic-k uncertainty sentences, showing that topic keywords capture the overall topical focus well.

Table I presents summary statistics for each PMU index. The economic uncertainty topic is most common, followed by inflation and financial market uncertainty, respectively. Model uncertainty makes up a small fraction of discussions. For this reason, we focus the empirical analysis on the other three PMU indices. These have substantial independent variation that cannot be described by a single common factor. The pairwise correlations between the three main indices are 0.07 for $InfPMU_t$ and $EcoPMU_t$, 0.12 for $InfPMU_t$ and $MktPMU_t$, and 0.38 for $EcoPMU_t$ and $MktPMU_t$.

In Figure 1, we graph the unsmoothed PMU time series and their moving averages over the past eight meetings; in the empirical analysis, we rely on the unsmoothed series. In contrast to the countercyclical behavior usually expected from uncertainty indicators (Bloom, 2014), $InfPMU_t$ is strongly procyclical: it rises following each of three recessions in the sample and most quickly during the 2000s-era expansion. While $EcoPMU_t$ rises at the onsets of the bursting of the dot-com bubble and the Global Financial Crisis (GFC), its variation is also not purely countercyclical.[19] Finally, $MktPMU_t$ is most elevated at the height of the GFC,

[18]The reason we use a purely manual rather than partially automated approach as for the uncertainty list is that the topical terms are largely made up of phrases, and sequence embeddings are substantially more complex to build than single word embeddings.

[19]Its highest reading occurs during the March 18, 2003 meeting, driven by the uncertainty about the timing and extent of the Iraq war and about the underlying economic conditions. In another major episode, $EcoPMU_t$ becomes elevated in the first half of 2007 before the start of the official NBER-dated recession.

A. Summary statistics for PMU indices

	N	Mean	SD	P10	P50	P90	AR1
$InfPMU_t$	227	0.302	0.153	0.131	0.276	0.529	0.550
$EcoPMU_t$	227	0.388	0.138	0.226	0.386	0.566	0.463
$MktPMU_t$	227	0.222	0.149	0.071	0.180	0.426	0.571
$ModPMU_t$	227	0.066	0.044	0.018	0.061	0.119	0.107
$OthPMU_t$	227	0.282	0.135	0.128	0.260	0.456	0.481

B. Correlations of topic-specific PMU indices

	InfPMU	*EcoPMU*	*MktPMU*	*ModPMU*
EcoPMU	0.074			
MktPMU	0.122	0.375		
ModPMU	0.222	0.113	0.096	
OthPMU	-0.335	0.132	0.161	-0.209

Table I. Descriptive statistics for PMU. The table reports summary statistics for the topic-specific PMU indices. All indices are obtained from the economy round of the FOMC meeting and represent the share of uncertainty-related mentions (by topic) relative to the total number of words in the economy round of the meeting. The sample period is 1987:08–2015:12, covering 227 meetings. Summary statistics in Panel A are expressed in percentages (e.g., mean inflation PMU of 0.302 means that, on average, inflation uncertainty mentions are 0.302% of all economy round words). Column "AR(1)" reports the first-order autoregressive coefficient (at the meeting frequency). Panel B reports the pairwise correlations between topic-specific PMU indices.

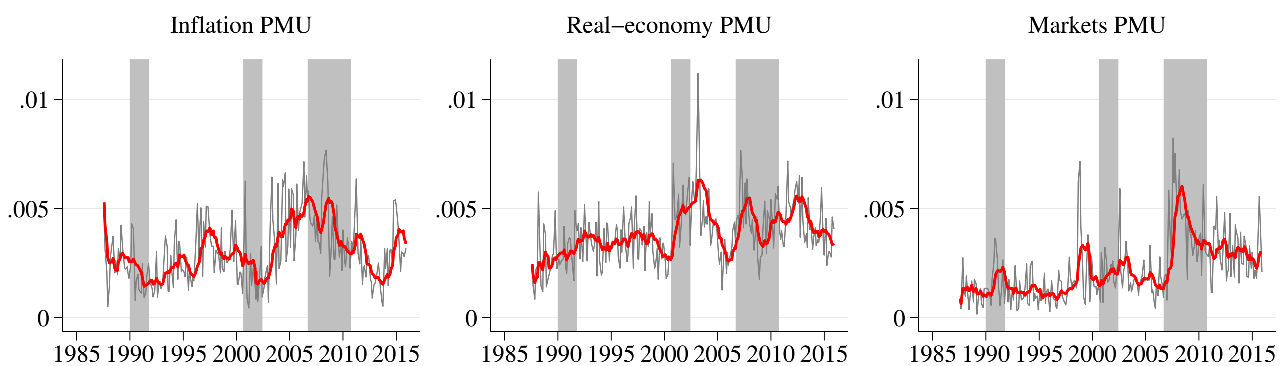

Figure 1. Topic-specific PMU time series. This figure displays the time series of the topic-specific PMU measures during the sample period 1987:08–2015:12. The grey curves represent the raw time series. The red curves are moving averages over the last eight meetings. The y-axis is expressed as the fraction of total economy round words contained in topic-k uncertainty sentences. NBER recessions are shaded.

a major market turmoil. The substantial independent variation in the topic-specific PMU suggests that the FOMC shifts its discussions depending on which sources of uncertainty are most salient, given the underlying evolution of the economy.

The transcripts of the March 21, 2007 meeting highlight rising concerns about the growth outlook and heightened forecast uncertainty that are not yet associated with a direct downgrade of the economic forecasts. The uncertainty actually declines during the height of the financial crisis, even as policymakers continue to express negative sentiment about the real economy.

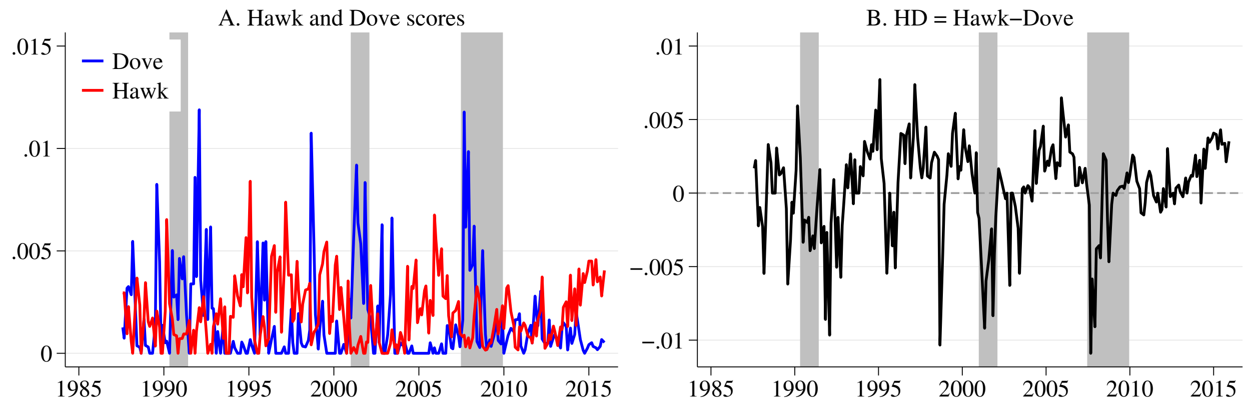

Figure 2. Time series of textual measures of policy stance. The figure presents textual measures of policy preferences derived from the statements of FOMC members during the policy round of the FOMC meetings. The construction of the measures is described in Appendix C.3.

III.B.2. FOMC's policy stance: The Hawk-dove score (HD)

To construct a text-based policy stance measure, we identify sentences that express FOMC members' views on policy in the policy round of the meeting (see Appendix C.3 for details), excluding statements by the Fed staff. Within this set, we then count the number of words that suggest a policy tightening ($Hawk'_t$) and a policy easing ($Dove'_t$). For meetings beginning in 2009, we additionally consider policy sentences that contain keywords related to asset purchases and count words that suggest a reduction ($Hawk''_t$) and an increase ($Dove''_t$) in those purchases.

To each meeting, we assign $Hawk_t$ and $Dove_t$ scores measuring the intensity of hawkish and dovish views. The $Hawk_t$ score equals the sum $Hawk'_t + Hawk''_t$, scaled by the total number of words in the policy round, and analogously for the $Dove_t$ score. The overall policy stance for meeting t is the difference between the directional scores:

$$HD_t = Hawk_t - Dove_t. \tag{10}$$

Figure 2 presents the time series of the $Hawk_t$, $Dove_t$ and HD_t scores. The dynamics of these variables display intuitive properties, with $Dove_t$ becoming elevated around recessions and in periods of financial turmoil, and $Hawk_t$ increasing in expansions. Importantly, the text-derived policy stance shows substantial variation post-2008 when short-term nominal interest rates are constrained by the ZLB.

III.B.3. Other control variables

Numerous factors driving policymaking are important to account for when assessing the relationship between PMU and HD. Here, we enumerate the main variables we use as controls.

Greenbook forecasts. As standard in the literature, we measure economic expectations with Greenbook (now Tealbook) forecasts prepared by the Fed staff before the scheduled FOMC meetings. We denote a forecast at meeting t about variable Z as $F_t(Z_q)$, where q indicates forecast horizon (in quarters) relative to the calendar quarter in which meeting t takes place, e.g., $q = 0$ meaning the current quarter of meeting t, and $q = 4$ four quarters ahead from meeting t. In our main specifications, we use a four-quarter-ahead CPI inflation forecast ($F_t(\pi_4)$), to reflect the Fed's focus on less transitory inflation components, and the current quarter real GDP growth forecast (nowcast, $F_t(g_0)$) as in Coibion and Gorodnichenko (2012). We also add forecast revisions between meetings ($FR_t(\pi_3), FR_t(g_1)$), following Romer and Romer (2004) to account for changes in forecasts in addition to levels. We calculate a forecast revision as $FR_t(Z_q) = F_t(Z_q) - F_{t-1}(Z_q)$ ensuring that the target forecast horizon at t and $t - 1$ refers to the same calendar quarter.

Trend inflation. Both interest rates and inflation expectations feature a pronounced common trend (e.g., Kozicki and Tinsley, 2001; Rudebusch and Wu, 2008). To control for these slow-moving dynamics, we construct a measure of the perceived long-run inflation target, trend inflation denoted τ_t, as the discounted moving average of past core inflation, following Cieslak and Povala (2015) and motivated by Sargent (1999) (see also Bianchi et al. (2022), Pflueger (2023) for a related approach). Including trend inflation in our policy regressions allows us to capture the effect that deviations of expected inflation from the target have on policy.

Sentiment. As staff forecasts, Greenbooks may not fully capture FOMC's views. It is also likely that they report modes,[20] which can differ from policymakers' mean beliefs if outcome distributions are skewed, or if FOMC and staff disagree on the modal outcome. We therefore augment our controls with text-based sentiment indices as additional proxies for economic forecasts.[21]

[20] While there is uncertainty whether Greenbook forecasts in our sample reflect means or modes, Bernanke (2016) describes the more recent FOMC's Summary Economic Projections (SEP) as "SEP projections are explicitly of the 'most likely' or modal outcomes rather than the range of possible scenarios." Likewise, the New York Fed forecast "is referred to as the 'modal' forecast in that it is intended to be the most likely of a wide range of potential outcomes" (Alessi et al., 2014).

[21] Several authors show that text-based sentiments obtained from the Fed documents correlate with the Fed's policy action (Ochs, 2021; Aruoba and Drechsel, 2023) and improve forecasting (Sharpe et al., 2022).

To measure topic-specific sentiment, we estimate the frequency of topic terms preceded or followed by direction words that indicate positive or negative sentiment. As for the PMU, we use the economy round only and scale the topic-specific sentiment count by the total words in that round. For some applications, we further distinguish the sentiment of the staff versus FOMC and that of individual FOMC members. To avoid a mechanical relationship, the sentiment excludes sentences used for the PMU indices. We label the mentions of falling inflation in meeting t as negative inflation sentiment ($InfNeg_t$), mentions of weakening economic activity as negative sentiment about the real economy ($EcoNeg_t$), and mentions of deteriorating financial conditions as negative market sentiment ($MktNeg_t$). We reverse those relations for the positive sentiment ($InfPos_t$, $EcoPos_t$, and $MktPos_t$). We then define the overall sentiment as the difference between the positive and negative sentiments, e.g., for inflation $InfSent_t = InfPos_t - InfNeg_t$. Appendix C.2 provides details of the sentiment construction.

Public uncertainty indices. We also consider proxies for uncertainty perceived by the public about general economic policy and the Fed's policy specifically. We include (i) the economic policy uncertainty index (EPU) from Baker et al. (2016), (ii) the monetary policy uncertainty (MPU) newspaper-based index from Husted et al. (2020), (iii) the option-implied volatility index (VXO) following Bloom (2009), and (iv) dispersion of forecasts about CPI inflation and real GDP growth from the Blue Chip Financial Forecast survey.[22] The PMU indices are weakly related to public uncertainty (see Appendix Table D.12). In particular, given its procyclical dynamics, inflation PMU (see Figure 1) is negatively correlated with public uncertainty indicators, which are strongly countercyclical (e.g., Bloom, 2014). This fact reinforces that inflation PMU captures a dimension of policymakers' beliefs that is not subsumed by existing proxies.

III.C. Validation

III.C.1. Uncertainty, sentiment, and economic outcomes

The aim of PMU indices is to gauge policymakers' perceptions of the second moments of economic outcomes. The Greenbook forecast and text-based sentiment should instead capture directional beliefs on the evolution of economic conditions. To validate that we can

[22] Bauer et al. (2022) and De Pooter et al. (2021) study market-perceived monetary policy uncertainty over the FOMC cycle using implied volatility of short-term interest rate derivatives. Using the Bauer et al. (2022) measure, we find that inflation and real-economy PMU are weakly correlated with market-based interest rate volatility (with correlations not exceeding 0.1 in absolute value). Since interest-rate implied volatility series are available starting from 1990, we do not include them in our main specification. We verify that including this measure does not materially change our conclusions about the link between PMU and policy stance.

A. Dependent variable: Greenbook CPI inflation nowcast h meetings ahead, $F_{t+h}(\pi_0)$

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$	$h=7$	$h=8$
$InfPMU_t$	0.039	-0.038	-0.042	0.011	-0.107	-0.070	0.038	0.044
	(0.62)	(-0.48)	(-0.38)	(0.08)	(-0.69)	(-0.42)	(0.27)	(0.45)
$InfNeg_t$	-0.260***	-0.164*	0.012	0.093	0.086	0.010	-0.058	-0.025
	(-3.49)	(-1.87)	(0.18)	(1.30)	(1.04)	(0.17)	(-0.98)	(-0.39)
$InfPos_t$	0.173***	0.144***	0.025	-0.131	-0.100	-0.120	-0.169*	-0.138
	(3.81)	(2.67)	(0.38)	(-1.32)	(-0.97)	(-1.42)	(-1.80)	(-1.47)
$\overline{F}_t(\pi)$	0.560***	0.457***	0.378***	0.351***	0.319***	0.321***	0.337***	0.335***
	(8.46)	(6.91)	(4.30)	(3.39)	(2.82)	(2.90)	(3.73)	(4.01)
$\bar{R}^2$	0.50	0.30	0.13	0.11	0.11	0.11	0.12	0.10
N	226	225	224	223	222	221	220	219

B. Dependent variable: Greenbook real GDP growth nowcast h meetings ahead, $F_{t+h}(g_0)$

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$	$h=7$	$h=8$
$EcoPMU_t$	-0.081	-0.058	0.032	0.069	0.029	-0.001	0.087	0.113
	(-1.60)	(-1.15)	(0.69)	(1.03)	(0.36)	(-0.02)	(1.01)	(1.23)
$EcoNeg_t$	-0.150***	-0.163**	-0.220***	-0.275***	-0.313***	-0.226**	-0.238**	-0.237**
	(-2.92)	(-2.40)	(-2.65)	(-3.00)	(-4.29)	(-2.28)	(-2.05)	(-2.32)
$EcoPos_t$	0.116**	0.127**	0.147**	0.149*	0.151*	0.193**	0.203**	0.190**
	(2.39)	(2.17)	(2.07)	(1.68)	(1.72)	(2.25)	(2.30)	(2.14)
$\overline{F}_t(g)$	0.623***	0.553***	0.401***	0.287***	0.227**	0.174	0.112	0.075
	(7.20)	(5.78)	(5.03)	(3.20)	(2.12)	(1.31)	(0.80)	(0.51)
$\bar{R}^2$	0.56	0.48	0.35	0.28	0.26	0.19	0.16	0.13
N	226	225	224	223	222	221	220	219

Table II. Predicting macro variables with textual measures of uncertainty and sentiment. The table predicts inflation and real GDP growth by PMU and sentiment indices from the next meeting ($h = 1$) horizon up to eight meetings ahead ($h = 8$). The regressions are estimated at the FOMC meeting frequency. For consistency with the meetings' timing, we use Greenbook nowcasts at future meetings as the dependent variable. The regression in Panel A is $F_{t+h}(\pi_0) = \beta_0 + \beta_1 InfPMU_t + \beta_2 InfPos_t + \beta_3 InfNeg_t + \beta_4 \overline{F}_t(\pi) + \varepsilon_{t+h}$, where $F_{t+h}(\pi_0)$ is the CPI inflation nowcast at meeting $t+h$, and $\overline{F}_t(\pi)$ is the average forecast (across horizons) at meeting t. We estimate analogous regressions for the real GDP growth in Panel B. The coefficients are standardized. HAC standard errors that account for the overlap are reported in parentheses. The sample period is 1987:08–2015:12.

distinguish between those concepts, we regress inflation and real GDP growth observed at meeting $t+h$ on meeting t Greenbook forecasts, PMU, and sentiments indices. For consistent timing of the meetings and macroeconomic outcomes, we use future Greenbook nowcasts as the dependent variables and estimate regressions for $h = 1, \ldots, 8$, i.e., up to eight meetings ahead.

Table II presents the forecasting results. While the PMU does not predict future outcomes, contemporaneous Greenbook forecasts and sentiment do, with longer-lasting effects for the Greenbook forecast (sentiment measures) on inflation (growth). As such, our text-based proxies organize the Fed's language distinctly from forecasts. The finding that PMU lacks predictive power is not sensitive to controls we include and is confirmed in univariate predictive regressions (see Appendix Table D.13). These results do not imply that policymakers' economic perceptions can be fully described by the first and second moments. They do, however, suggest that PMU is not a simple reflection of directional beliefs. Instead, such beliefs (via means or skews) appear to be encoded in the text-based sentiment.

III.C.2. Hawk-dove score and policy actions

To validate the hawk-dove score as a measure of policy stance, we analyze its relationship with the policy rate adopted in meeting t. In Panel A of Table III, we first project HD_t on typical variables included in policy rules. Column (1) serves as a benchmark to describe the systematic policy component reflected in language. The explanatory variables include the Greenbook forecasts and revisions for inflation and real GDP growth, as well as the trend inflation τ_t to account for a slow target adjustment in our sample. Most loadings in column (1) are highly significant and have expected signs: higher expected growth and higher expected deviation of inflation from the target predict a more hawkish tilt in the policy language. However, with $\bar{R}^2$ of 29%, the regression leaves more than two-thirds of the variation in policy language unexplained by the macro forecasts.

Columns (2)–(4) focus on explaining the FFR target changes from $t-1$ to t with the policy stance language in meeting t. We estimate these regressions through 2008:12 due to the ZLB thereafter. We include two FFR lags to account for policy inertia (Coibion and Gorodnichenko, 2012). The estimates indicate a high explanatory content of policy language for the FFR target. In column (3), a one-standard-deviation increase in HD_t is associated with a 14 bps increase in the FFR, with a t-statistic of 6.8. The significance of HD_t could reflect the policy rule rather than a deviation from a rule, given column (1). However, column (4) shows this is not the case: HD_t remains a significant predictor of the FFR with a full set of controls.

The FOMC policy language should reflect broader forward-looking views on policy, as opposed to just the contemporaneous action. To evaluate this idea, Panel B of Table III presents predictive regressions using the FFR change from t to $t+h$ as the dependent variable (with controls as in column (4) in Panel A). Notably, HD_t contains more information about future policy path than about contemporaneous action: a one-standard-deviation increase in HD_t is associated with more than 25 bps cumulative FFR increase over the following five meetings. HD_t remains significant at the 5% level up to six meetings ahead, suggesting that it encapsulates how the FOMC positions itself in meeting t for future actions.

A. HD and changes to the Fed Funds Rate target: contemporaneous effect

	(1) HD_t	(2) ΔFFR_t	(3) ΔFFR_t	(4) ΔFFR_t
HD_t			0.14***	0.096***
			(6.83)	(5.30)
$F_t(\pi_4)$	0.62***	0.23***		0.18***
	(3.64)	(3.79)		(2.97)
$F_t(g_0)$	0.38***	0.18***		0.15***
	(2.99)	(6.60)		(5.75)
τ_t	-0.70***	-0.13***		-0.078**
	(-3.81)	(-3.30)		(-2.06)
$FR_t(\pi_3)$	0.073	0.015		0.0067
	(1.43)	(0.86)		(0.39)
$FR_t(g_1)$	0.15***	0.039**		0.026
	(2.79)	(2.30)		(1.32)
L.FFR_t		0.087	0.26***	-0.013
		(1.14)	(3.18)	(-0.15)
L2.FFR_t		-0.13*	-0.27***	-0.024
		(-1.84)	(-3.40)	(-0.29)
Constant	0.00	0.14**	0.0088	0.11**
	(0.00)	(2.54)	(0.20)	(2.23)
$\bar{R}^2$	0.29	0.52	0.45	0.59
N	227	169	169	169

B. HD and changes to the Fed Funds Rate target: future effect

	(1) $h=1$	(2) $h=2$	(3) $h=3$	(4) $h=4$	(5) $h=5$	(6) $h=6$	(7) $h=7$	(8) $h=8$
HD_t	0.087***	0.14***	0.20***	0.27***	0.28***	0.24**	0.22*	0.25*
	(4.10)	(3.18)	(2.62)	(2.84)	(2.88)	(2.46)	(1.88)	(1.83)
GB controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\bar{R}^2$	0.43	0.41	0.43	0.46	0.51	0.52	0.53	0.53
N	169	168	167	166	165	164	163	162

Table III. Validity of HD as a measure of policy stance. This table reports the relationship between *HD* and the target FFR. Panel A, column (1), contains regression of *HD* on Greenbook controls (forecasts $F_t(\cdot)$ and updates $FR_t(\cdot)$) and the trend inflation τ_t over the 1987:08–2015:12 sample. The dependent variable in columns (2)–(4) is $FFR_t - FFR_{t-1}$ and the period is 1987:08–2008:12 excluding the ZLB. The dependent variable in Panel B is $FFR_{t+h} - FFR_t$ for $h = 1$ through $h = 8$, and each regression includes the controls as in column (4) of Panel A. HAC t-statistics with eight lags are reported in parentheses in both panels. All regressions are estimated at the FOMC meeting frequency. The HD_t variable is standardized, and FFR_t is expressed in percentages.

IV. Uncertainty and Policy Stance

We now establish that the policymakers' perceptions of increased inflation uncertainty, $InfPMU_t$, are associated with a significantly more hawkish policy stance, HD_t. This result survives a host of controls, including directional beliefs on inflation and public uncertainty proxies. We also quantify the impact of $InfPMU_t$ on the policy rate and find that it induces a large cumulative response.

IV.A. Baseline empirical specification

Our baseline regression model takes the form

$$HD_t = \alpha + \beta_1' \mathbf{PMU}_t + \beta_2' \mathbf{Controls}_t + \varepsilon_t, \tag{11}$$

where $\mathbf{PMU}_t$ is the vector of PMU indices and the hawk-dove score HD_t is a proxy for $\hat{r}_t$ in Section II. We use the FOMC members' language for baseline results since it is their perceptions that are most relevant for decisions.[23]

In effect, regression (11) is an extended forward-looking Taylor rule. In the literature (e.g., Romer and Romer, 2004; Coibion and Gorodnichenko, 2012), such rules are estimated by regressing the FOMC's policy stance (typically, the policy rate) on the Greenbook forecasts under the assumption that these forecasts are pre-determined with respect to the current policy decision.[24] The linear dependence of policy on economic forecasts emerges from the policymaker minimizing a quadratic loss function as in equation (5). In this classic setting, beliefs on the first moments of economic conditions are all that matters for policy because policy only acts to shift the mean of economic conditions.

Instead, we extend the model to allow beliefs on *second* moments of economic conditions to influence the policy decision. To the extent that $\mathbf{PMU}_t$ measures are plausibly pre-determined with respect to the policy stance at meeting t, HD_t, as we have argued in Section III.A, the coefficient β_1 in regression (11) captures how an increase in uncertainty impacts the policy stance. The sign of β_1 allows us to link the results to the comparative statics predictions in Section II.B and differentiate between models of policy-managed uncertainty. As a caveat, since β_1 is estimated from the time-series variation in perceived uncertainty and policy stance across meetings, our empirical strategy does not reveal how uncertainty impacts policymaking in a fixed way over time.

IV.B. Baseline results

In Table IV, we begin with the least restrictive specification of regression (11) and gradually add covariates as controls. Columns (1) and (2) project *HD* on macro PMU and sentiment without any controls. The PMUs in column (1) are highly significant and jointly explain 15% of the *HD*'s variance. Notably, inflation and real-economy PMU predict policy stance with opposite signs. A one-standard-deviation increase in *InfPMU* is associated with a 0.34-standard-deviation increase in *HD* (t-statistic = 3.39), indicating a more hawkish stance. In contrast, a one-standard-deviation increase in *EcoPMU* is associated with a 0.24-standard-

[23] In Section V, we discuss further the distinction between FOMC members' and staff PMU language.

[24] See, e.g., Reifschneider et al. (1997) for the discussion of assumptions in the Greenbook forecasts.

Dependent variable: Meeting-level HD_t policy stance score

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$InfPMU_t$ (FOMC)	0.336***		0.284***	0.310***	0.180***	0.186***	0.182**
	(3.40)		(4.07)	(4.57)	(2.84)	(3.06)	(2.57)
$EcoPMU_t$ (FOMC)	-0.215***		-0.110**	-0.073	-0.093	-0.083	-0.075
	(-3.60)		(-2.53)	(-1.46)	(-1.48)	(-1.28)	(-1.21)
$MktPMU_t$ (FOMC)				-0.126			-0.171*
				(-1.33)			(-1.76)
$InfSent_t$ (FOMC)		0.206***	0.105	0.099	0.088	0.109*	0.079
		(2.67)	(1.52)	(1.37)	(1.56)	(1.85)	(1.32)
$EcoSent_t$ (FOMC)		0.501***	0.485***	0.432***	0.399***	0.386***	0.329***
		(5.74)	(5.78)	(5.25)	(4.51)	(3.51)	(3.85)
$MktSent_t$ (FOMC)				0.046			0.044
				(0.65)			(0.66)
GB controls	No	No	No	No	Yes	Yes	Yes
Public uncertainty	No	No	No	No	No	Yes	No
Other PMUs	No	No	No	No	No	No	Yes
$\bar{R}^2$	0.14	0.31	0.38	0.40	0.43	0.44	0.46
N	227	227	227	227	227	227	227

Table IV. Predicting FOMC policy stance *HD* with PMU at the meeting-level. The table reports regressions of the policy stance score *HD* on topic-specific PMU indices computed using just FOMC members' language. The controls include textual sentiment measures, GB forecasts, and proxies for public perceived uncertainty described in Section III.B.3. The *HD* variable is derived from the statements of FOMC members in the policy round of the FOMC meeting, while the PMU and sentiment indices are based on the statements by the FOMC members in the economy round of the meeting. All regressions are estimated at the FOMC meeting frequency. The coefficients are standardized. HAC t-statistics with eight lags are reported in parentheses. The sample period is 1987:08–2015:12.

deviation decrease in *HD* (t-statistic $= -3.97$). Column (2) shows that the text-based sentiment also strongly predicts policy stance. The coefficients have the expected signs: sentiments indicating rising inflation or a stronger real economy anticipate a more hawkish policy round of the meeting.

Column (3) shows that the predictive content of uncertainty for policy stance is not subsumed by sentiment variation. In fact, inflation PMU drives out the significance of inflation sentiment. In contrast, uncertainty and sentiment about the real economy contain largely independent information. Views of a stronger economy captured by a heightened *EcoSent* predict hawkishness, while increased uncertainty about the economy captured by *EcoPMU* predicts a more dovish stance.

Controlling for financial market PMU and sentiment (*MktPMU* and *MktSent*) in column (4) weakens somewhat the economic and statistical significance of the real-economy PMU, but not that of inflation. The financial market-based measures are insignificant, echoing Cieslak and Vissing-Jorgensen (2021) result that the Fed reacts to financial markets only to the extent that they affect the Fed's beliefs about the real economy. Therefore, we do not focus on the financial market *PMU* in the subsequent analysis.

Columns (5) through (7) control for additional covariates, as detailed in Section III.B.3. Column (5) includes Greenbook forecasts and trend inflation (as used in Table III). Also with these variables, inflation PMU maintains a material effect on the policy stance: Compared to column (3), the coefficient on inflation PMU is reduced by about a third (from 0.28 to 0.18 standard deviation units) but remains significant at the 1% level. Instead, the real-economy PMU becomes marginally significant, being largely absorbed by Greenbook forecasts and sentiment.[25]

Column (6) introduces measures of public perceptions of policy and macroeconomic uncertainty to account for the broad demand-shock channel of uncertainty described in Section II. Considering various proxies from the literature, we find that none drives out inflation PMU, while the importance of the real-economy PMU is further diminished.

Finally, for robustness, column (7) uses the full suite of PMU indices, including the model PMU and the unclassified category. The inflation PMU coefficient remains significant at the 5% level. Thus, our macro PMU indices are unlikely to omit a key aspect of policymakers' uncertainty relevant to policy outcomes.

IV.C. Member-level regressions

One consideration in interpreting the meeting-level results is that they could arise from a disagreement among FOMC members rather than the common perceptions of the committee. We thus exploit our granular data to estimate the language-based reaction functions at the individual FOMC-member level. The results show that it is the common FOMC's perception of uncertainty that affects the policy stance.

In Table V, we project the policy stance of member i in meeting t, HD_{it} (using the policy-round statements) on the PMU and sentiment scores of that member (using their economy-round statements). The goal is to study how a policymaker's own expression of uncertainty predicts their individual policy stance. All regressions include member fixed effects, and so the estimates represent the within-individual reaction functions. Column (1) shows that, similar to the meeting-level results, also within-member inflation PMU is associated with more hawkishness, while the real-economy PMU with more dovishness (although this latter effect is weak). The impact of inflation uncertainty on policy stance is not driven by the member-specific sentiment (column (2)).

[25] While not the main focus of our analysis, the results show that FOMC's economic sentiment contains significant information relevant for policymaking but not reflected in numeric staff forecasts. This finding is consistent with the contemporaneous literature that extracts beliefs from text, e.g., Aruoba and Drechsel (2023) using Greenbook/Tealbook texts prepared by the staff.

Dependent variable: Individual meeting-level HD_{it} policy stance score

	(1)	(2)	(3)	(4)	(5)	(6)
$InfPMU_{it}$ (ind)	0.12***	0.12***	0.00014	-0.011	0.11**	-0.0097
	(2.86)	(2.82)	(0.00)	(-0.30)	(2.62)	(-0.25)
$EcoPMU_{it}$ (ind)	-0.074	-0.058	0.018	0.012	-0.041	0.011
	(-1.65)	(-1.43)	(0.45)	(0.30)	(-1.03)	(0.29)
$InfPMU_t$ (agg)			0.93***			
			(4.97)			
$EcoPMU_t$ (agg)			-0.74***			
			(-3.63)			
$MktPMU_{it}$ (ind)					-0.16***	0.011
					(-2.70)	(0.25)
$ModPMU_{it}$ (ind)					-0.071	-0.15
					(-0.64)	(-1.38)
$OthPMU_{it}$ (ind)					-0.19***	-0.11**
					(-4.20)	(-2.40)
Sentiment	No	Yes	Yes	Yes	Yes	Yes
Meeting FE	No	No	No	Yes	No	Yes
Member FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.028	0.048	0.070	0.26	0.059	0.26
N	3925	3925	3925	3925	3925	3925

Table V. Uncertainty of FOMC members: individual member-level regressions. The table reports regressions of individual FOMC member's i policy stance at meeting t, HD_{it}, on individual PMU indices at that meeting (denoted with "(ind)"). Column (4) controls for aggregate PMU indices (denoted with "(agg)") calculated at the meeting level. Standard errors are double-clustered at the meeting and member level.

To distinguish between the common FOMC's perceptions vis-á-vis member heterogeneity, column (3) includes aggregate meeting-level PMU indices, and column (4) includes time-fixed effects. Both specifications render the member-level PMU insignificant, indicating that the explanatory power of uncertainty for policy stance stems from the time-series variation common to members rather than from the cross-sectional dispersion of views across members.

Finally, the last two columns include the full set of individual-level PMU indices, including financial markets, model, and the unclassified other PMU, without and with meeting fixed effects in columns (5) and (6), respectively. Individual member policy views are sensitive to the financial market uncertainty, with increased $MktPMU_{it}$ associated with an easier stance, supporting the demand-shock interpretation of market uncertainty. However, this effect reflects common rather than member-specific variation and is subsumed by the meeting fixed effects in column (6). Model PMU ($ModPMU_{it}$) is not significant at the individual level, suggesting that model specification is not a primary concern in policymakers' discussion driving our results. The residual uncertainty component ($OthPMU_{it}$) predicts an easier policy stance even with time-fixed effects, indicating that idiosyncratic uncertainty perceptions do influence individual policy views, but their impact on the overall policy stance of the committee is weak, as seen from Table IV column (7).

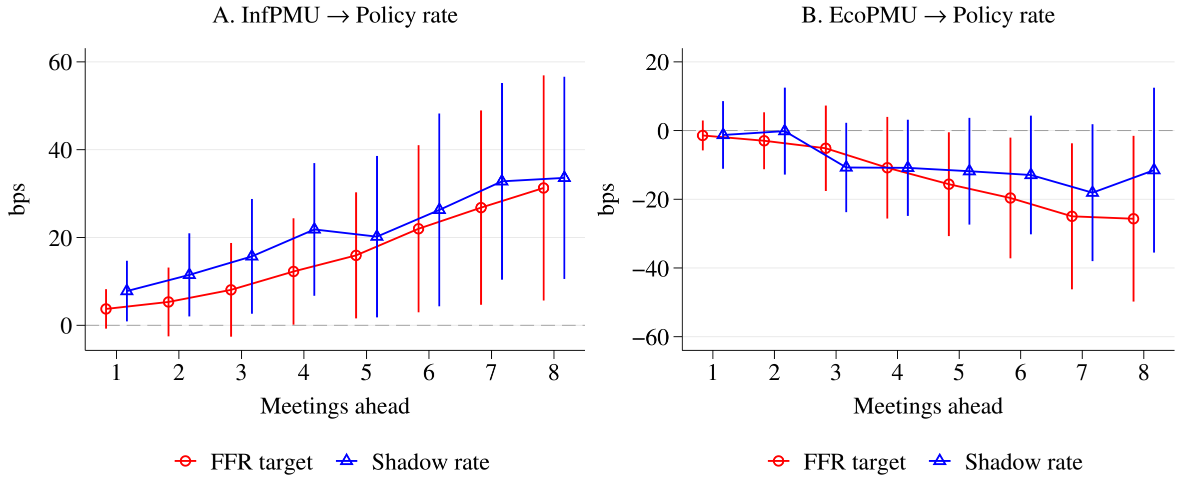

Figure 3. Cumulative effects of PMU on the policy rate. The figure presents the response of the policy rate (in basis points) to a one-standard-deviation change in the PMU. Two measures of the policy rate are considered: the FFR target (circles) and the shadow rate of Wu and Xia (2016) (triangles). The coefficients are obtained from regressing cumulative changes in policy rate ($\Delta FFR_{t+h} = FFR_{t+h} - FFR_t$ and analogously for the shadow rate), on the PMU indices, and controls including GB forecasts, trend inflation τ_t, two lags of policy rate (t and $t-1$), the BBD EPU index and inflation and real-economy sentiment ($InfSent_t$, $EcoSent_t$). The textual measures are obtained from statements of FOMC members in the economy round of the meeting. The spikes mark the 95% confidence intervals obtained with HAC standard errors. The maximum sample for the eight-meeting-ahead forecast is 1987:08–2008:12 using the FFR target and 1987:08–2015:12 using the shadow rate.

IV.D. Uncertainty and the target policy rate

The results so far relate inflation PMU to the policy stance in language, which we show encapsulates forward-looking FOMC's views beyond the current policy action. We now quantify how much PMU affects the FOMC's actual policy choices.

We regress changes in the policy rate between meetings t and $t+h$ for $h = 1, \ldots, 8$ on time-t FOMC members' PMU indices and controls from column (5) of Table IV. Additionally, we include the EPU index Baker et al. (2016) to account for the demand channel of uncertainty and two lags of the policy rate to account for its inertia. We present the estimates for the FFR target over the 1987:08–2008:12 sample and for the Wu and Xia (2016) shadow rate over the 1987:08–2015:12 sample, covering the ZLB period.

Figure 3 presents the effect of a one-standard-deviation change in *InfPMU* and *EcoPMU* on the cumulative change in the policy rate up to eight meetings ahead. We superimpose the estimates for the FFR target in the pre-zero lower bound period (marked as circles) and the shadow rate in the full sample (marked as triangles). The effect of uncertainty accumulates with the horizon. At eight meetings ahead, a one-standard-deviation increase in *InfPMU*

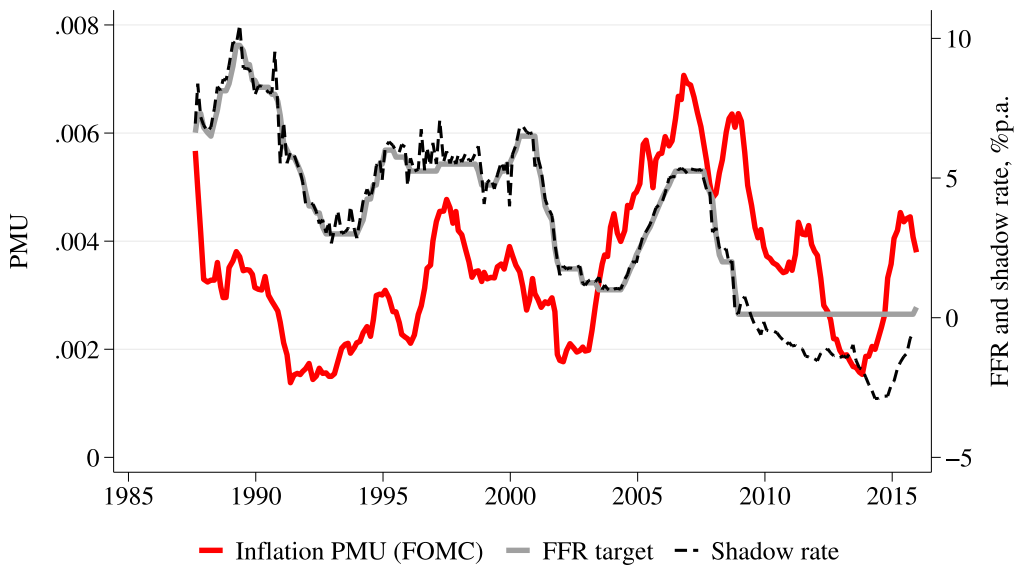

Figure 4. Inflation PMU and policy rate. The figure superimposes the inflation PMU of FOMC members measured in the economy round of the meeting against the policy rate: FFR target and the shadow rate from Wu and Xia (2016). The PMU is smoothed over the last eight meetings for the graph's clarity.

induces a 31 bps FFR target increase. In economic terms, this magnitude is the largest among the covariates we consider, including that of a one-standard-deviation increase in the real GDP growth nowcast (which equals 28 bps at eight meetings ahead). Similarly, the estimates for the shadow rate yield a 34 bps cumulative impact of inflation PMU at the eight-meeting horizon. The longer-run effect of the real-economy PMU is less robust, with statistical and economic magnitudes weakening further in the full sample.

To visualize the predictive content of inflation PMU for future policy in raw data, Figure 4 superimposes the FFR target and the shadow rate against the FOMC members' inflation PMU (smoothed over the last eight meetings). The figure illustrates a systematic relationship whereby policy tightenings (easings) tend to be preceded by rising (declining) policymakers' perceptions of inflation uncertainty. As such, the effects of inflation PMU are not isolated to a particular episode in our sample.

V. Interpreting Uncertainty Effects as Tail Risk Concerns

The framework from Section II organizes channels that can drive the empirical relationship between policymakers' uncertainty and their policy stance. We now interpret our results in the context of those mechanisms.

First, the results support the demand channel of uncertainty. Column (1) of Table IV indicates that the FOMC adopts a softer policy stance in the face of higher uncertainty about the real economy, which aligns with its accommodating a negative demand shock. The theory in Section II also predicts that once one controls for the growth outlook and public uncertainty, there should be no remaining effect of real-economy PMU on policy stance, just as we find in column (6) of Table IV. Thus, these results per se do not violate certainty equivalence.

A second broad insight is that the certainty equivalence does not hold with respect to inflation uncertainty. Inflation PMU consistently predicts a more hawkish stance.[26] To the best of our knowledge, we are the first to document that perceived inflation uncertainty explains FOMC's policymaking beyond expected inflation (and other controls).[27] While this result suggests policy-managed uncertainty is a material channel in FOMC's decisions, Proposition 1 (on the model parameter uncertainty) and Proposition 2 (on the tail risks) outlined in Section II provide a more direct link to our regression results. In the remainder of this section, we argue that the empirical findings align with the tail risk model and discuss further evidence supporting this interpretation.

V.A. Comparative statics predictions: Parameter uncertainty vs. tail risks

Under the model parameter uncertainty interpretation, the time-series variation in $InfPMU_t$ arises from time-series variation in $\sigma^2_{a,t}$, i.e., uncertainty in the sensitivity of inflation to monetary policy. Proposition 1 does not stipulate a directional prediction on how policy should respond to this form of increased uncertainty. To rationalize the positive relationship between policy stance and *InfPMU*, the FOMC meetings in our sample would need to have featured below-target inflation and output forecasts on average. In this regime, $\frac{\partial \hat{r}_t}{\partial \sigma^2_{a,t}} > 0$, which in our regression model would translate into a positive loading on *InfPMU*.

Under the inflation tail risk interpretation, the time-series variation in *InfPMU* arises from time-series variation in exogenous components of tail risk ($p_{t,0}$ or Δ_t). According to Proposition 2, an increase in the tail risk leads to more hawkish policy whenever the modal inflation

[26] To the extent that controlling for sentiment may also capture policymakers' perceptions of higher-order moments, the estimated effect of PMU on HD represents a lower bound on the actual impact of perceived uncertainty on stance.

[27] Evans et al. (2015) study how uncertainty affects policymaking. They identify uncertainty mentions in the FOMC minutes but do not separately consider uncertainty types. Based on reading the minutes, they human-code the directional effect of uncertainty on policy and assign an indicator variable (plus or minus one) to meetings where the effect is present and zero otherwise. They find that this measure predicts the current FFR action beyond macro forecasts. Instead, the frequency of uncertainty mentions (ignoring the directional effect) shows a much weaker link to the policy rate. Our results, especially the opposite effects of *InfPMU* and *EcoPMU* on policy stance, highlight the need to isolate the different types of uncertainty.

Dependent variable: Meeting-level policy stance score, HD_t

		Split by CPI inflation			Split by RGDP growth		
	(1) All	(2) Low	(3) High	(4) Interact	(5) Low	(6) High	(7) Interact
$InfPMU_t$ (FOMC)	0.180***	0.103	0.235***	0.101	0.197**	0.151**	0.219**
	(2.84)	(1.52)	(3.13)	(1.35)	(2.04)	(2.10)	(2.55)
$EcoPMU_t$ (FOMC)	-0.093	-0.129	-0.036	-0.101	-0.168*	-0.112	-0.085
	(-1.48)	(-1.54)	(-0.35)	(-1.56)	(-1.71)	(-1.01)	(-1.40)
$InfPMU_t$(FOMC) $\times$ $1_{\pi \text{ high}}$				0.208**			
				(2.48)			
$InfPMU_t$(FOMC) $\times$ $1_{g \text{ high}}$							-0.119
							(-1.04)
GB controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sentiment (FOMC)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\bar{R}^2$	0.43	0.32	0.53	0.44	0.44	0.25	0.44
N	227	122	105	227	106	121	227

Table VI. Policymakers' uncertainty impact on policy stance, split by expected economic conditions. The table reports regressions of meeting-level policy stance, HD_t, on macro PMU, conditioning on expected inflation and real GDP growth. Column (1) presents the baseline estimate from Table IV, column (5). Columns (2)–(4) condition on inflation forecasts. Column (2) runs the baseline regression on observations when $F_t(\pi_4)$ is below trend ("Low"), and column (3) runs it when $F_t(\pi_4)$ is above trend ("High"). Column (4) estimates an interaction coefficient of $InfPMU_t$ with a dummy variable equal to one when $F_t(\pi_4)$ is above the trend. We define a low (high) inflation environment when the residual from regressing $F_t(\pi_4)$ on trend inflation τ_t is negative (positive). Column (5) presents analogous results but splits the sample by whether the nowcast of real GDP growth, $F_t(g_0)$, is above or below the sample mean (2.1%). The text-based measures of PMU are constructed from statements of FOMC members in the economy round of the meeting. Coefficients are standardized. HAC t-statistics are reported in parentheses.

forecast is above a critical value that itself lies below the inflation target, as was plausibly the case for most of our 1987–2015 sample. Hence, one obtains the prediction that an increase in *InfPMU* should induce more hawkishness. For low inflation forecasts, it is natural to assume that inflation tail risks do not operate materially, if at all.

To distinguish between these two interpretations, in Table VI, we repeat the baseline regression from Table IV column (5), but split the sample based on expected economic conditions. We first condition on whether expected inflation is relatively high or low. Specifically, to capture the cyclical variation in expected inflation, we orthogonalize the inflation forecast $F_t(\pi_4)$ with respect to the trend inflation, τ_t, and extract the residual, denoted $F_t(\pi_4)^{\perp}$. We run the regressions separately on a sample where $F_t(\pi_4)^{\perp}$ is negative in column (2) or positive in column (3). In column (4), we directly test for a differential response of policy stance to *InfPMU* in low and high inflation conditions by interacting *InfPMU* with a dummy variable for $F_t(\pi_4)^{\perp} > 0$. Columns (5)–(7) conduct a similar exercise but for a sample split based on whether the real GDP growth is below or above the sample average.

Consider first the split on inflation forecasts in columns (2)–(4) of Table VI. The impact of $InfPMU_t$ on policy stance is only significant for the high-inflation subsample. The point estimate is nearly 30% higher than in the full sample and more than twice as high as in the low-inflation subsample. The significant interaction term in column (4) further shows a significantly more hawkish response in the high-inflation subsample.

According to the parameter uncertainty model, Proposition 1, an increased uncertainty should make policy stance more conservative, i.e., less hawkish when economic conditions are above their target values and more hawkish when they are below target values. The positive and significant coefficient on $InfPMU_t$ in column (3) is inconsistent with this prediction, as is the insignificant coefficient in column (2). In this sense, we do not observe that higher uncertainty shifts policy toward an uncertainty-minimizing neutral rate, which is the key insight of parameter uncertainty models featuring conservatism. Similarly, the evidence does not support higher uncertainty inducing policy activism (e.g., Söderström, 2002) since activism would also manifest as oppositely signed $InfPMU_t$ coefficients across columns (2) and (3) (albeit with signs flipped compared Proposition 1). Instead, the tail risk model shows that the effect of increased inflation uncertainty on policy is positive when inflation forecasts are relatively high. When inflation forecasts are low, one expects little to no impact, which aligns with the estimates.

Turning to the split on the real GDP growth, Proposition 1 shows that the degree to which an increase in inflation uncertainty shifts policy depends not just on the inflation forecast but also on the output forecast: It is a linear combination of deviations from respective targets that determines the directional effect of uncertainty. Whereas we observe a different impact of $InfPMU_t$ on policy stance in high and low samples, the effect across the real GDP split is roughly symmetric with no significant interaction in column (7). As such, the policy impact of $InfPMU_t$ is specific to policymakers' inflation concerns and not related to business cycle variation per se, supporting the tail risk interpretation and Proposition 2.

Overall, the relationship between $InfPMU_t$ and HD_t exhibits several properties indicating that policymakers' time-varying concern with inflation tail risks affects policy stance in the 1987–2015 sample. These findings do not rule out the possibility that model parameter uncertainty operates through a fixed level of uncertainty faced by the FOMC. However, they suggest that the *time-series* variation in $InfPMU_t$ is unlikely to be driven by concerns over time-varying parameter uncertainty. This is further supported by the fact that the FOMC infrequently discusses model PMU explicitly.

V.B. Policy-managed uncertainty: FOMC members vs. staff

The analysis so far exploits PMU indices derived from FOMC members' language in the economy round since it is their uncertainty perceptions that should drive policy stance.

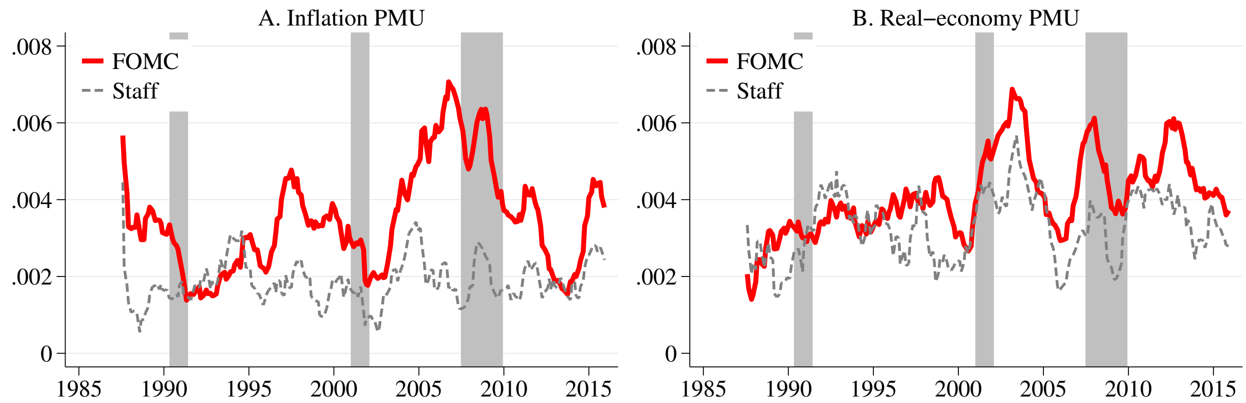

Figure 5. PMU of FOMC members vs. staff. This figure presents inflation and economy PMU indices constructed separately for FOMC members and the staff. Each uncertainty index is scaled relative to the overall length of the statements made by FOMC members or staff, respectively, in the economy round of the meeting. The series are smoothed averages over the last eight FOMC meetings.

To the extent that the Fed's staff explains forecasting scenarios behind the quantitative Greenbook forecasts, the staff's uncertainty language should be mainly relevant to forming economic expectations and thus subsumed by our controls. In contrast, the FOMC members' language should reflect a broader view of the economy, incorporating any higher-order moments relevant to their decision-making, and specifically policy-managed uncertainty considerations. To explore this distinction, we construct PMU and sentiment indices for the staff and the FOMC separately, again using just the economy round of the transcripts.

Figure 5 disaggregates the meeting-level PMU indices from Figure 1 by FOMC members and the staff. Both groups' real-economy PMUs show a similar cyclical variation. However, the FOMC's inflation PMU rises much faster during expansions than the staff's and remains persistently elevated.

If the staff's inflation PMU depicts general uncertainty around inflation forecasts but not policy-managed uncertainty, it should not influence the FOMC's policy stance once Greenbook forecasts and sentiment are accounted for. The uncertainty relevant to the policy decisions should instead be encapsulated in FOMC's PMU. Table VII tests this idea by regressing *HD* on staff- and FOMC-specific PMU indices and controls from Table IV, column (5). The results confirm that the effect of inflation uncertainty on policy stems primarily from the FOMC members' views. On a stand-alone basis in column (2), the staff's inflation PMU is marginally significant, but it is entirely driven out by the FOMC's PMU in a joint specification in column (3).

Dependent variable: Meeting-level HD_t policy stance score			
	(1)	(2)	(3)
$InfPMU_t$ (FOMC)	0.180***		0.183***
	(2.84)		(3.18)
$EcoPMU_t$ (FOMC)	-0.093		-0.087
	(-1.48)		(-1.36)
$InfPMU_t$ (Staff)		0.109*	0.011
		(1.81)	(0.23)
$EcoPMU_t$ (Staff)		-0.137*	-0.038
		(-1.93)	(-0.65)
GB controls	Yes	Yes	Yes
Sentiment	Yes	Yes	Yes
$\bar{R}^2$	0.43	0.33	0.43
N	227	227	227

Table VII. Uncertainty of FOMC members vs. staff. The table reports regressions of meeting-level HD_t variable on uncertainty indices of staff and FOMC members. We control for sentiment (*InfSent* and *EcoSent*) specific to FOMC members (column (1)), staff (column (2)), and members and staff (column (3)). HAC t-statistics are reported in parentheses.

V.C. Additional predictions

V.C.1. Directional inflation beliefs and uncertainty

The tail risk view implies a close link between expected inflation and inflation uncertainty. By Lemma 1, both the mean and variance of inflation are increasing in the size and baseline probability of an inflation tail, i.e., Δ_t and $p_t(r_t)$. This yields a prediction that inflation PMU should be positively related to measures of expected inflation if PMU indeed captures tail risk concerns.

To illustrate this prediction in the data, Figure 6 plots FOMC members' inflation PMU against two proxies for variation in expected inflation. In Panel A, we use the orthogonalized inflation forecast $F_t(\pi_4)^\perp$ described in Table VI. In Panel B, we consider inflation sentiment $InfSent_t$ as an alternative proxy for policymakers' inflation beliefs expressed via language.

A positive relationship with inflation PMU is evident for both expected inflation measures. The correlation is 0.31 for $F_t(\pi_4)^\perp$ and 0.30 for sentiment (based on unmoothed series). Further decomposing inflation sentiment into separate positive and negative components, we find that the co-movement with PMU is driven primarily by the positive sentiment, i.e., the language associated with increasing inflation (as shown in Appendix Figure D.2).[28] This evidence aligns with the tail risk view that inflation PMU increases with beliefs about rising inflation. Notably, Figure 6 shows that the FOMC remained highly sensitive to upper

[28] Appendix Table D.14 reports regressions of expected inflation and sentiment on inflation PMU, showing that the relationship is economically and statistically significant. The loading of $InfPMU_t$ on positive sentiment ($InfPos_t$) is about twice as strong as that on negative sentiment ($InfNeg_t$).

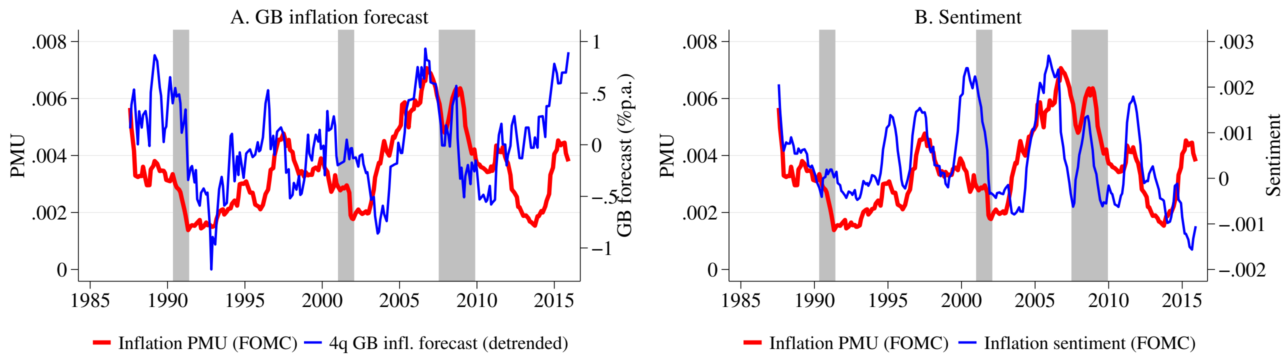

Figure 6. Inflation PMU and inflation beliefs. Panel A superimposes inflation PMU against $F_t(\pi_4)^{\perp}$, which proxies for the deviation of expected inflation from the target. $F_t(\pi_4)^{\perp}$ is constructed by orthogonalizing the four-quarter Greenbook CPI inflation forecast residualized with respect to the trend inflation, τ_t. Panel B superimposes inflation PMU against inflation sentiment, constructed from FOMC members' statements. Increasing inflation sentiment indicates the balance of views toward rising inflation. The text-based series are smoothed averages over the last eight FOMC meetings.

inflation tails at times of relatively stable inflation. Policy-managed uncertainty can thus rationalize why FOMC members internally display a preference for a lower inflation target, as argued by Shapiro and Wilson (2022).

V.D. Effect of uncertainty conditional on policy cycle

So far, the balance of evidence suggests that the policy-managed uncertainty channel acts to tighten the policy stance when the FOMC is concerned about the upside inflation tail. We have not detected conservatism induced by parameter uncertainty whereby an increase in *InfPMU* shifts policy towards a neutral rate, which may be above or below the current policy, depending on expected economic conditions. An alternative dynamic interpretation of conservatism is that an increase in *InfPMU* leads to gradualism, whereby the FOMC slows down the pace of interest rate adjustments. An opposite prediction holds for uncertainty-driven activism (Söderström, 2002) where an increase in *InfPMU* would accelerate adjustments, making policy response more aggressive.

To test whether uncertainty accelerates or slows down the policy reaction, we split the sample into meetings where the FOMC exhibited a tilt, respectively, towards lowering, raising rates, or neither. We then repeat our baseline estimates separately for these subsets of meetings. Depending on the policy tilt, the expected signs of HD_t loadings on $InfPMU_t$ under uncertainty-induced conservatism or activism are as follows:

	Cutting tilt	Hiking tilt
Conservatism	(+)	(−)
Activism	(−)	(+)

We consider two measures of policy tilt:

1. *Interest rate cycle measure.* We define a cutting (hiking) cycle if (i) the meeting involves a cut (hike) in interest rates, or (ii) the last move, within the previous eight meetings, was a cut (hike). Once eight meetings have passed, we assume that the cutting cycle is over even if rates have not yet started to rise; the periods between cutting and hiking cycles form the "neither" subsample.

2. *Blue/Tealbook measure.* Using alternative policy options in Tealbooks,[29] we define a meeting as having a cutting (hiking) tilt when either (i) the staff's proposed Alternative B (central scenario) involves a cut (hike) or (ii) where Alternative B assumes no change but the staff propose more cut (hike) alternatives than hike (cut) alternatives. The remaining meetings form the "neither" subsample.

Table VIII presents the results. Column (1) repeats the baseline estimates from Table IV; columns (2)–(4) split the sample based on approach 1, and columns (5)–(7) based on approach 2. The results show that the predictive power of inflation PMU for policy stance stems from periods when there is no tendency to cut or hike interest rates (columns (4) and (7)). To the extent that inflation PMU only drives hawkishness when there is no apparent bias towards raising or lowering rates, these findings do not indicate either a conservative or an activist policymakers' behavior. Indeed, when policy exhibits a cutting tilt (columns (2) and (5)), conservatism would imply a positive loading of *HD* on *InfPMU* (as higher uncertainty attenuates the desire to cut), whereas activism would imply a negative loading on *InfPMU* (as higher uncertainty strengthens the desire to cut). When the policy exhibits a hawkish tilt (columns (3) and (6)), the loadings should be reversed. These predictions are not born out in the data. Repeating the regressions without baseline controls or adding public uncertainty measures does not alter these findings.

V.E. Discussion: Inflation tail risk perceptions and policy credibility

The effect of policy-managed uncertainty in the decision rule (9) follows from a reduced-form assumption linking policy choices to inflation tail events. While developing a theory

[29] Tealbooks (formerly Bluebooks) contain alternative policy options prepared by the Fed staff before an FOMC meeting. Alternative B is the central policy scenario as viewed by the staff.

Dependent variable: Meeting-level HD_t policy stance score

	Baseline	Approach 1: Int. rate cycle			Approach 2: Blue/Tealbook		
	(1) All	(2) Cut	(3) Hike	(4) Neither	(5) Cut	(6) Hike	(7) Neither
$InfPMU_t$ (FOMC)	0.180***	0.122	0.017	0.368***	0.085	0.010	0.322***
	(2.84)	(1.45)	(0.09)	(3.41)	(0.59)	(0.07)	(4.29)
$EcoPMU_t$ (FOMC)	-0.093	-0.104	0.073	-0.066	0.152	0.046	-0.215**
	(-1.48)	(-0.89)	(0.49)	(-0.49)	(1.19)	(0.50)	(-2.16)
GB controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sentiment (FOMC)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\bar{R}^2$	0.43	0.32	0.13	0.33	0.052	0.23	0.31
N	227	98	67	62	44	70	119

Table VIII. Relationship between PMU and policy stance HD conditional on policy tilt. The table reports the estimates of the relationship between PMU and policy stance conditional on policy tilt, defined by recent interest rate moves (columns (2)–(4)) or by Blue/Tealbook alternative strategies (columns (5)–(7)). Column (1) reports the baseline specification corresponding to column (5) in Table IV. The sample period is 1987:08–2015:12. All variables are scaled by their standard deviations. HAC t-statistics with eight lags are reported in parentheses. The regressions are estimated at the frequency of the FOMC meetings.

of why such dependence arises is outside the scope of this paper, the Fed's credibility considerations are one candidate explanation. Goodfriend (1993) emphasized the importance of "the acquisition and maintenance of credibility for [Fed's] commitment to low inflation" during the Volcker and the early Greenspan Fed. Building on Goodfriend (1993) inflation scares idea, fluctuations in the PMU could thus be interpreted as reflecting the time-varying FOMC's concern about maintaining credibility.[30]

Figure 4 suggests that policymakers' perceptions of inflation uncertainty fluctuate significantly and can remain persistently elevated for an extended time. Two episodes that feature rapidly rising inflation PMU are the mid-to-late 1990s and 2004 until the global financial crisis. In the second half of the 1990s, when inflation remained relatively low and stable, transcripts show the FOMC members nonetheless worried about their credibility. The rapid increase in inflation PMU in mid-2004 was accompanied by concerns about rising inflation (e.g., the May 2004 meeting). Arguing for the Fed's preference for a below-2% inflation target, Shapiro and Wilson (2022) also provide a narrative of the Fed's credibility concerns over the 2000–2011 sample. Even more recently, after a brief focus on deflation during the global financial crisis, by 2012, the FOMC quite quickly returned to worrying about the

[30] One source of potential credibility loss is that the market worries the FOMC will deviate to loose policy to boost output as in Barro and Gordon (1983). A credibility loss could also result from the FOMC's misjudgement of the neutral rate, r^*. With the true r^* being higher than policymakers assumed, their policy would become too easy and overstimulate the economy, opening a positive output gap. The probability of such a policy mistake, as well as the PMU and the associated credibility concern, are plausibly time-varying. The signaling aspect of monetary policy to maintain credibility is central to long-standing literature such as Cukierman and Meltzer (1986), Backus and Driffill (1985a,b), and Hansen and McMahon (2016).

inflationary impact of the unconventional policies they pursued. Appendix E contains a chronological review of the narrative evidence from the transcripts to support the tail-risk credibility channel.

The impact of inflation uncertainty perceptions of FOMC decision-making due to credibility concerns has implications for the modeling of monetary policy decisions. Benchmark New Keynesian models usually assume full information and rational expectations and are solved assuming the central bank commits to its reaction function. In such models, credibility is established by the once-and-for-all announcement of the reaction function. More recently, Bianchi and Melosi (2018) study constrained discretion, where the central bank can temporarily deviate from active inflation stabilization, but at the cost of unanchoring inflation expectations.[31] In support of this idea, our results suggest the need for considering the central bank's fighting continually to establish and maintain credibility and then using that credibility to counter recessions when faced with adverse shocks. Carvalho et al. (2022) and Gáti (2022) find that optimal policy responds aggressively to movements in the long-run inflation expectations. We find that over the 1987–2015 sample, the FOMC has been preemptively hawkish to prevent the *feared* changes in inflation expectations that, indeed, do not materialize in our sample, consistent with the Fed's preemptive actions.

Our findings offer further insights into the empirical study of monetary policy rules. A stable Taylor-type reaction function has been shown to poorly capture the historical FOMC behavior. Studies like Clarida et al. (2000) and Coibion and Gorodnichenko (2011) show the Fed became more sensitive to expected inflation after Volcker's tenure. Complementing this work, our results suggest that credibility concerns can lead the FOMC to adjust policy tightness over time, driven by their inflation tail-risk perceptions.

More broadly, the results demonstrate the importance of risk management in the Fed's policymaking. Kilian and Manganelli (2008) argue that the policy decisions under Greenspan were better described in terms of the Fed weighing upside and downside risks to its objectives rather than simply responding via a Taylor rule to the conditional means of inflation and the output gap (see also Blinder and Reis (2005)). Our approach based on the FOMC's deliberations provides a granular view of how the Fed's uncertainty perceptions evolve over time and how they affect forward-looking policy stances. Risk management has remained prominent in the FOMC's decision-making under chairs Bernanke and Yellen (e.g., Bernanke (2007); Yellen (2017) and Appendix E).

[31] Schaumburg and Tambalotti (2007) analyze a continuum of monetary policy rules with differing degrees of credibility, with full commitment and discretion being the special cases of such quasi or loose commitment. Palomino (2012) explores bond pricing implications of monetary policy under full commitment vis-a-vis discretion, while Lakdawala and Wu (2017) study the implications of loose committment.

While we focus on the distinct impact of inflation uncertainty via upper inflation tail risk on the Fed's thinking over the 1987–2015 period, our results additionally reveal a role for the Fed's directional beliefs about the real economy (Table II and IV). Like inflation PMU, the effect of the FOMC's real-economy sentiment on policy stance is not subsumed by any of the standard first-moment controls. This suggests a parallel channel also driving the Fed's reaction, separate from inflation tail risk perceptions. The real-sentiment effect can be viewed as supporting, from the Fed's own deliberations, the argument that the Fed responded to economic conditions more strongly than warranted by the first-moment macroeconomic beliefs (Cieslak, 2018; Bauer and Swanson, 2023).[32]

The end of our sample in 2015 marks the start of a major shift in the Fed's thinking, as the FOMC increasingly focussed on downside inflation risks. That culminated in the 2020 announcement of a revised strategic monetary policy framework with flexible average inflation targeting (FAIT) and a focus on employment shortfalls as its centerpieces. The hiking cycle, beginning in December 2015, was motivated by the management of upper inflation risks (Yellen, 2017), in line with our analysis. However, the decision came to be viewed as a policy mistake both inside and outside of the Fed (see, e.g., Eggertson and Kohn (2023); Meade (2023)). In part due to this experience, the FAIT framework removed preemptive strikes against inflation. Cieslak et al. (2024) argue the FOMC effectively suspended the risk-management practice in the form we document here for the 1987–2015 period, followed by worse inflation outcomes in the post-Covid pandemic period. Nonetheless, with the Fed's hawkish policy shift in 2022, risk-management considerations motivated by the desire to reestablish inflation-fighting credibility are newly evident in recent communications from the Fed's officials. Our findings on the influence of the Fed's inflation uncertainty perceptions on its policy stance therefore remain relevant in today's environment.

VI. Conclusions

We contribute to the literature by quantifying otherwise hard-to-measure factors driving monetary policymaking and revealed through the Fed's private deliberations from 1987 to 2015. We develop textual measures for the policymakers' perceptions of different types of uncertainty, directional beliefs on the path of the economy, and forward-looking policy stances. We show that uncertainty perceptions drive a quantitatively significant wedge between actual FOMC decision-making and standard policy rules estimated with Greenbook forecasts.

[32] In a robustness check, we use elastic net with a large set of covariates (77 total), including textual measures of FOMC and staff PMU and sentiment indices as well as numeric Greenbooks forecasts. We find that the two most important covariates explaining the FOMC's policy stance in language ranked by significance are, first, FOMC's inflation PMU and, second, real-economy sentiment.

Our main new results pertain to the effects of FOMC-perceived inflation uncertainty. Heightened inflation uncertainty leads to more hawkish policy views, predicting tighter policy up to eight meetings ahead. The economic magnitude of the uncertainty effect is comparable to that of the real GDP growth. The FOMC's inflation uncertainty relevant to decision-making is distinct from public uncertainty indicators, objective measures of macroeconomic volatility, and uncertainty discussed by the Fed staff. We rationalize these findings with a model of upper inflation tail risks, which are endogenous to policy decisions. Narrative evidence links FOMC's uncertainty perceptions to their concerns about maintaining credibility for fighting inflation.

The issue of central bank efforts to maintain credibility is timely. Chair Powell (2022) at the 2022 Jackson Hole Symposium spoke forcefully about the Fed's determination to control inflation. The concern with credibility is also warranted. Credibility allows for better management of economic expectations, as "achieving through word and deed" well-anchored inflation expectations can lead to better policy outcomes (Bernanke, 2022). Our results reveal the Fed's continued management of inflation risks supported inflation vigilance in the pre-pandemic years, shaping policy choices in a way not explained by standard policy reaction functions. The successes of those prior years for inflation stability provide lessons for future policy design and the role of risk management in achieving the Fed's objectives. Beyond macroeconomic stabilization, the Fed's risk management has additional implications for financial market outcomes. By communicating risk-management motives in their forward-looking policy stances, the Fed can signal its willingness to act decisively should a need arise. Such communication can assuage investor concerns about potential policy mistakes, leading to lower-than-otherwise term premia and financial volatility (Cieslak and McMahon, 2024), and thus further facilitate the Fed achieving its goals.

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Internet Appendix for:

Policymakers' Uncertainty

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A. Proofs for Tail Risks Model

A.1. Proof of Lemma 1

Proof. The expression for expected inflation is immediate from the structure of the distribution described in the main text.

To compute the variance, let $\overline{\pi}_L$ ($\overline{\pi}_H$) be expected inflation in the low-inflation (high-inflation) state; for now we suppress the dependence on r_t. We have (where again we suppress the dependence of p_t on r_t)

$$\mathbb{E}\left[\,\pi_t^2\,\right] = p_t\left[s_{\pi,t}^2 + \overline{\pi}_H^2\right] + (1-p_t)\left[s_{\pi,t}^2 + \overline{\pi}_L^2\right]$$

and

$$\left(\mathbb{E}\left[\,\pi_t\,\right]\right)^2 = \left(p_t\overline{\pi}_H + (1-p_t)\overline{\pi}_L\right)^2$$

and so

$$\begin{aligned}\mathrm{Var}(\pi_t) = p_t\left[s_{\pi,t}^2 + \overline{\pi}_H^2\right] + (1-p_t)\left[s_{\pi,t}^2 + \overline{\pi}_L^2\right] - \left(p_t\overline{\pi}_H + (1-p_t)\overline{\pi}_L\right)^2 = \\ s_{\pi,t}^2 + p_t\overline{\pi}_H^2 + (1-p_t)\overline{\pi}_L^2 - \left(p_t\overline{\pi}_H + (1-p_t)\overline{\pi}_L\right)^2 = \\ s_{\pi,t}^2 + p_t(1-p_t)\overline{\pi}_H^2 + p_t(1-p_t)\overline{\pi}_L^2 - 2p_t(1-p_t)\overline{\pi}_H\overline{\pi}_L = \\ s_{\pi,t}^2 + p_t(1-p_t)(\overline{\pi}_H - \overline{\pi}_L)^2 = s_{\pi,t}^2 + p_t(1-p_t)\Delta^2\end{aligned}$$

■

A.2. Proof of Proposition 2

Proof.

We begin with the first condition on the uniqueness of $\hat{r}_t$ over stated range. The most important step is to establish conditions under which the marginal inflation loss (the LHS of (9)) is increasing in r_t. We can rewrite the LHS as

$$2[-a + p_t'(r_t)\Delta_t][\overline{\pi}_t - ar_t + p_t(r_t)\Delta_t - \pi^*] + p_t'(r_t)[1 - 2p_t(r_t)]\Delta_t^2$$

Differentiating with respect to r_t yields

$$\begin{aligned}2p_t''(r_t)\Delta_t[\overline{\pi}_t - ar_t + p_t(r_t)\Delta_t - \pi^*] + \\ 2[-a + p_t'(r_t)\Delta_t][-a + p_t'(r_t)\Delta_t] + \\ p_t''(r_t)[1 - 2p_t(r_t)]\Delta_t^2 - \\ 2p_t'(r_t)p_t'(r_t)\Delta_t^2\end{aligned}$$

Gathering terms and canceling yields

$$p_t''(r_t)[1 + 2\Delta_t(\overline{\pi}_t - ar_t - \pi^*)] +$$
$$2[a^2 - 2ap_t'(r_t)\Delta_t]$$

The second line is positive by assumption. The first line is positive whenever $\overline{\pi}_t - ar_t - \pi^* > 0$, given $p_t''(r_t) \geq 0$. By continuity, therefore, the overall sign is positive whenever $\overline{\pi}_t - ar_t - \pi^* > -k_1$ for some constant $k_1 > 0$. Hence, whenever $r_t < \overline{r}$ where $\overline{\pi}_t - a\overline{r} - \pi^* = -k_1$, the expression is positive.

Suppose now that there exists a solution to (9) in $(-\infty, \overline{r})$. There can be no other r_t in this range for which (9) is satisfied because on this range the LHS is strictly increasing by the arguments above the RHS is strictly decreasing by assumption. By continuity, the solution is unique.

For the comparative static results, begin by assuming that $\hat{r}_t < \overline{r}$. In this case, it is sufficient to show the marginal inflation loss, i.e. the LHS of (9) is decreasing in $p_{0,t}$ and Δ_t, respectively.

Begin with $p_{0,t}$. Using the expansion of the LHS of (9), and replacing $p_t(r_t) = p_{0,t} + p_{t,1}(r_t)$ yields

$$2[-a + p_{1,t}'(r_t)\Delta_t][\overline{\pi}_t - ar_t + (p_{t,0} + p_{t,1}(r_t))\Delta_t - \pi^*] +$$
$$p_{1,t}'(r_t)[1 - 2(p_{t,0} + p_{t,1}(r_t))]\Delta_t^2$$

differentiating with respect to $p_{0,t}$, we obtain

$$2\Delta_t[-a + p_{1,t}'(r_t)\Delta_t] - 2\Delta_t^2 p_{1,t}'(r_t) = -2a\Delta_t < 0$$

so the marginal inflation loss is strictly decreasing.

Now consider Δ_t. The derivative with respect to Δ_t of the LHS of (9) is

$$2p_t'(r_t)[\overline{\pi}_t - ar_t + p_t(r_t)\Delta_t - \pi^*] +$$
$$2[-a + p_t'(r_t)\Delta_t]p_t(r_t) + 2\Delta_t p_t'(r_t)[1 - 2p_t(r_t)] =$$
$$2p_t'(r_t)[\overline{\pi}_t - ar_t - \pi^*] + 2[-ap_t(r_t) + \Delta_t p_t'(r_t)]$$

The last term is negative by assumption. The first term is negative if $\overline{\pi}_t - ar_t - \pi^* > 0$. So, by continuity, the derivative is negative whenever $\overline{\pi}_t - ar_t - \pi^* > -k_2$ for some positive constant k_t. Taking $K = \min\{k_1, k_2\}$ completes the proof. ■

B. Dictionaries for Risk, Uncertainty, Topics, and Sentiment

risk			risks		
Term	Similarity	Count in Econ Discussion	Term	Similarity	Count in Econ Discussion
risks	0.691266	3183	downside risk*	0.737511	1118
downside risk*	0.59828	1118	upside risk*	0.704978	585
threat	0.594511	135	risk	0.691266	3236
upside risk*	0.522107	585	threat	0.52743	135
danger	0.502593	121	skewed	0.501801	101
probability	0.484233	524	uncertainties	0.48339	505
possibility	0.475492	1010	~~downside~~	0.449301	707
likelihood	0.469565	224	~~tilted~~	0.448698	119
vulnerability	0.439843	72	danger	0.445836	121
dangers	0.406005	28	dangers	0.439822	28
~~headwind~~	0.402709	38	fatter	0.434411	14
chances	0.386979	65	~~outcomes~~	0.420205	291
fragility	0.374305	106	probability	0.412639	524
~~risktaking~~	0.373512	50	skew	0.40086	29
~~challenges~~	0.348706	174	~~challenges~~	0.395508	174
~~prospect~~	0.347213	242	~~juncture~~	0.393311	114
~~unwelcome~~	0.345361	42	modal	0.391584	131
sensitivity	0.343196	82	~~headwinds~~	0.385167	288
probabilities	0.342825	87	vulnerabilities	0.378889	59
~~breakout~~	0.34249	39	probabilities	0.375555	87
uncertainty	0.341431	2317	concerns	0.374206	628
~~consequences~~	0.339106	367	~~breakout~~	0.372844	39
concern* that	0.33652	678	possibilities	0.369255	98
odds	0.332704	190	uncertainty	0.362784	2317
fatter	0.331849	14	vulnerability	0.355743	72
concern	0.326579	1047	~~directive~~	0.355738	29
potentially	0.322536	275	tensions	0.35208	51
concerns	0.318465	628	~~crosscurrents~~	0.350524	49
tension	0.313301	101	odds	0.343869	190
~~spiral~~	0.312127	69	threats	0.33815	36
possibly	0.309975	290	fragility	0.337531	106
~~costly~~	0.309472	63	~~symmetric~~	0.336238	57
~~challenge~~	0.307298	179	~~asymmetry~~	0.333936	25
~~urgency~~	0.303853	28	~~skews~~	0.33296	14
~~instability~~	0.303578	91	~~urgency~~	0.3309	28
unease	0.303215	25	skewness	0.330203	7
vulnerabilities	0.302247	59	tension	0.325514	101
fear	0.299544	194	~~headwind~~	0.323167	38
skewness	0.298903	7	~~vigilant~~	0.319233	55
~~trap~~	0.297911	58	~~drags~~	0.31894	75
~~overshoot~~	0.296446	53	~~costpush~~	0.318601	4
~~problem~~	0.295296	1221	possibility	0.318443	1010
skew	0.29475	29	~~balanced~~	0.317706	646
worries	0.294228	132	tails	0.31724	28
threats	0.294017	36	~~challenge~~	0.316888	179
~~repercussions~~	0.289451	23	likelihood	0.315145	224
skewed	0.287008	101	imponderables	0.31498	10
volatility	0.284335	360	~~considerations~~	0.311688	184
doubts	0.283668	65	~~consequences~~	0.306922	367
~~juncture~~	0.283524	114	~~leaning~~	0.305052	38

Table B.1. Nearest Neighbors of Risk and Risks in FOMC Word Embeddings. This table shows the fifty nearest neighbors to the terms 'risk' and 'risks' for a word embedding model estimated from the economy round of the FOMC transcripts. For each neighbor term, we report the cosine similarity in the word embedding space and the count of the term in the economy round. We remove certain terms from our final dictionary if they are too generic (struck through).

uncertain			**uncertainty**		
Term	Similarity	Count in Econ Discussion	Term	Similarity	Count in Econ Discussion
!confident	0.460385	367	uncertainties	0.65845	505
fragile	0.455998	157	anxiety	0.515023	70
!sanguine	0.442406	101	angst	0.433309	24
murky	0.43732	24	skepticism	0.430759	68
unclear	0.436552	57	tension	0.427094	101
wary	0.428437	41	uncertain	0.426752	399
uncertainty	0.426752	2317	~~caution~~	0.423748	445
unsure	0.423955	14	downside risk*	0.418226	1118
~~poor~~	0.411094	194	~~challenges~~	0.414084	174
~~dependent~~	0.406995	119	pessimism	0.411988	179
apprehensive	0.404002	11	fragility	0.401378	106
vulnerable	0.401095	203	gloom	0.380074	65
stressed	0.397458	53	~~conflict~~	0.370107	47
~~challenging~~	0.391555	71	risks	0.362784	3183
~~bullish~~	0.38583	65	volatility	0.359692	360
bleak	0.385454	52	concerns	0.359599	628
skeptical	0.384238	169	!clarity	0.352539	89
~~attuned~~	0.383523	15	sensitivity	0.348326	82
uncertainties	0.383365	505	unease	0.347682	25
~~vigilant~~	0.382641	55	~~publicity~~	0.346734	31
~~cautious~~	0.378045	537	fog	0.343423	20
grim	0.376893	34	~~headwinds~~	0.341591	288
~~jury~~	0.376789	20	risk	0.341431	3236
agnostic	0.375537	31	~~surrounding~~	0.340727	163
!optimistic	0.372549	1249	worries	0.337692	132
~~muted~~	0.365712	87	!certainty	0.332492	91
unsettled	0.362423	22	doubts	0.328778	65
concern* about	0.361507	1634	concern	0.327687	1047
~~buoyant~~	0.360631	70	optimism	0.32465	498
~~disruptive~~	0.359961	50	~~pain~~	0.323275	31
~~depend~~	0.359918	198	ambiguity	0.322258	18
skittish	0.35904	18	error	0.320998	234
jittery	0.358658	11	skittishness	0.319675	9
precarious	0.357391	22	nervousness	0.319648	31
fog	0.357145	20	unknown	0.316516	32
fluid	0.357016	12	tensions	0.314929	51
!convinced	0.354622	173	imponderables	0.314825	10
pessimistic	0.354016	430	upside risk*	0.313048	585
!upbeat	0.352921	217	~~debate~~	0.312722	168
~~destabilizing~~	0.35242	22	~~awareness~~	0.312388	26
precise	0.352262	81	~~uncertaintyin~~	0.310427	3
uncomfortable	0.348358	102	~~disagreement~~	0.304366	57
~~assessing~~	0.345848	110	~~admits~~	0.302832	3
~~damaging~~	0.342869	39	~~science~~	0.29633	31
~~satisfactory~~	0.339921	66	~~apprehension~~	0.292553	16
anxious	0.33839	40	~~headwind~~	0.290777	38
~~worried~~	0.337316	410	~~instability~~	0.290598	91
ambiguous	0.335987	32	~~troubles~~	0.288294	35
problematic	0.33498	78	~~questions~~	0.288182	698
daunting	0.332674	19	~~worry~~	0.286513	402

Table B.2. Nearest Neighbors of Uncertain and Uncertainty in FOMC Word Embeddings. This table shows the fifty nearest neighbors to the terms 'uncertain' and 'uncertainty' for a word embedding model estimated from the economy round of the FOMC transcripts. For each neighbor term, we report the cosine similarity in the word embedding space and the count of the term in the economy round. We remove certain terms from our final dictionary if they are too generic (struck through). An exclamation mark preceding a term indicates it is only associated with the dictionary when it is negated, i.e., when it is immediately preceded by a negation phrase, which is one of {'less', 'no','not', 'little', 'don't', 'doesn't', 'hasn't', 'haven't', 'won't', 'shouldn't', 'didn't'}.

Nouns	Match w/ direction words		Direction words	
	Negative	Positive	Group 1	Group 2
commodity price*	1	2	*abated*	*acceler**
consumer energy price*	1	2	*adjust* downward*	*adjust* upward*
consumer food price*	1	2	*contract**	*advanc**
consumer price index*	1	2	*cool**	*bolster**
consumer price index* cpi	1	2	*deceler**	*boost**
consumer price inflation	1	2	*declin**	*elevat**
consumer price*	1	2	*decreas**	*expand**
core consumer price inflation	1	2	*down*	*fast**
core consumer price*	1	2	*downturn*	*gain**
core cpi	1	2	*downward*	*go* up*
core cpi inflation	1	2	*downward adjust**	*heighten**
core inflation	1	2	*downward revision*	*high**
core pce inflation	1	2	*drop**	*increas**
core pce price inflation	1	2	*eas**	*mov* higher*
core pce price*	1	2	*fall**	*mov* up*
core price inflation	1	2	*fell*	*mov* upward*
core producer price*	1	2	*go* down*	*pick* up*
cost basic material*	1	2	*limit**	*rais**
cost* goods and services	1	2	*low**	*rallied*
cost* health care	1	2	*moderate**	*rally**
cost* labor	1	2	*moderati**	*rebound**
cost* living	1	2	*mov* down*	*recoup**
cost* us goods and services	1	2	*mov* downward*	*revis* up**
crude oil price*	1	2	*mov* lower*	*rise**
disinflation*	2	1	*pullback*	*rising*
disinflation* pressure*	2	1	*reduc**	*rose*
employment cost index*	1	2	*revis* down**	*run up*
energy prices	1	2	*slow**	*runup*
headline inflation	1	2	*slow* down*	*stop decline*
health care cost*	1	2	*soft**	*strength**
inflation*	1	2	*stagnate**	*strong**
inflation compensation	2	1	*stall**	*tick* up*
inflation expectation*	1	2	*subdu**	*up*
inflation level	1	2	*tick* down*	*upward*
inflation outlook	1	2	*tight**	*upward adjust**
inflation rate	1	2	*weak**	*upward revision*
inflation wage*	1	2	*weigh* on*	*went up*
labor compensation	1	2	*went down*	
labor cost pressure*	1	2		
labor cost*	1	2		
long* run inflation expectation*	1	2		
long* term inflation expectation*	1	2		
manufacturing price*	1	2		
material price*	1	2		
near* term inflation expectation*	1	2		
oil price*	1	2		
pce price index*	1	2		
pressure* inflation	1	2		
pressure* wages	1	2		
price index*	1	2		
price inflation	1	2		
price level stability	2	1		
price stability	2	1		
prices of durable goods	1	2		
prices of durables	1	2		
prices of manufacturing	1	2		
prices of material*	1	2		
producer price ind*	1	2		
producer price*	1	2		
real oil price*	1	2		
unit labor cost*	1	2		
wage gains	1	2		
wage inflation	1	2		
wage pressure*	1	2		
wage price pressure*	1	2		
wages	1	2		
inflation* pressure*	1	2		
price pressure*	1	2		
deflation* force*	2	1		
deflation* pressure	2	1		
deflation*	2	1		
prices of durable goods	1	2		
prices of durables	1	2		
prices of manufacturing	1	2		
prices of material*	1	2		

Table B.3. Noun Phrases and Direction Words Related to Inflation and Wages. The first column displays the phrases we associate with inflation and wage discussion in the FOMC transcripts. The second to fifth columns relate to the construction of inflation sentiment. An instance of positive sentiment occurs when a mention of one of the nouns with a 1 (2) recorded in the 'Positive' column is preceded or followed by a phrase from Group 1 (Group 2) within sub-sentences. Negative sentiment is constructed analogously.

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
aggregate demand	2	1	adjust* downward	acceler*
aggregate inventory sales ratio	1	2	adverse	adjust* upward
aggregate spending	2	1	contract*	advanc*
building activity	2	1	cool*	better
business activity	2	1	cut*	bolster*
business capital spending	2	1	deceler*	boost*
business confidence	2	1	declin*	elevat*
business demand capital equipment	2	1	decreas*	encourag*
business equipment investment	2	1	deteriorat*	expand*
business equipment spending	2	1	disappoint*	fast*
business equipment spending	2	1	down	favor*
business equipment spending and industrial production	2	1	downturn	gain*
business expansion	2	1	downward	go* up
business expenditure*	2	1	downward adjust*	heighten*
business fixed investment	2	1	downward revision	high*
business fixed investment and household spending	2	1	drag*	improv*
business inventory investment	2	1	drop*	increas*
business investment	2	1	eas*	mov* higher
business investment spending	2	1	fall*	mov* up
business outlay*	2	1	fell	mov* upward
business outlays capital equipment	2	1	go* down	pick* up
business output	2	1	held down	rais*
business purchas*	2	1	hold down	rallied
business purchases of transporation equipment	2	1	increas* at slow* rate	rally*
business sector	2	1	limit*	rebound*
business sentiment	2	1	low*	recoup*
business spending	2	1	moderate*	revis* up*
business spending capital equipment	2	1	moderati*	rise*
business spending of transporation equipment	2	1	mov* down	rising
capacity utilization	2	1	mov* downward	rose
capital investment	2	1	mov* lower	run up
capital spending	2	1	pressur*	runup
capital spending plan*	2	1	pullback	stop decline
civilian unemployment rate	1	2	reduc*	strength*
claim* unemployment insurance	1	2	revis* down*	strong*
construction activity	2	1	slow*	tick* up
consumer confidence	2	1	slow* down	tight*
consumer sector	2	1	soft*	up
consumer sentiment	2	1	stagnat*	upward
consumer spending	2	1	stall*	upward adjust*
consumption	2	1	strain*	upward revision
consumption spending	2	1	stress*	went up
current account deficit			subdu*	
current account surplus			take* toll on	
disposable income	2	1	tension*	
domestic components of spending	2	1	tick* down	
domestic demand	2	1	took toll on	
domestic economy	2	1	weak*	
domestic final demand	2	1	weigh* down	
domestic spending	2	1	weigh* on	
domestic spending components	2	1	went down	
durable equipment	2	1	worse*	
economic activity	2	1		
economic development*	2	1		
economic expansion	2	1		
economic growth	2	1		
economic outlook	2	1		
economic performance	2	1		
economic recovery	2	1		
economic situation	2	1		
employment	2	1		
employment growth	2	1		
employment rate	2	1		
excess capacity	1	2		
factory output	2	1		

Table B.4. Noun Phrases and Direction Words Related to Economic Growth (1). The first column displays a subset the phrases we associate with economic growth discussion in the FOMC transcripts (see other tables in sequence for other nouns). The second to fifth columns relate to the construction of growth sentiment. An instance of positive sentiment occurs when a mention of one of the nouns with a 1 (2) recorded in the 'Positive' column is preceded or followed by a phrase from Group 1 (Group 2) within sub-sentences. Negative sentiment is constructed analogously. Nouns with no number recorded in the second and third columns are used to contextualize uncertainty language but not for the construction of sentiment.

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
final demand	2	1	adjust* downward	acceler*
gdp growth	2	1	adverse	adjust* upward
global economic growth	2	1	contract*	advanc*
gross domestic product	2	1	cool*	better
high tech equipment investment	2	1	cut*	bolster*
high tech equipment spending	2	1	deceler*	boost*
household spending and business fixed investment	2	1	declin*	elevat*
household* spending	2	1	decreas*	encourag*
housing activity	2	1	deteriorat*	expand*
housing construction	2	1	disappoint*	fast*
housing demand	2	1	down	favor*
income growth	2	1	downturn	gain*
industrial production	2	1	downward	go* up
inventories	2	1	downward adjust*	heighten*
inventory accumulation	1	2	downward revision	high*
inventory investment	2	1	drag*	improv*
inventory liquidation	2	1	drop*	increas*
inventory sales ratio	1	2	eas*	mov* higher
investment condition*	2	1	fall*	mov* up
investment demand	2	1	fell	mov* upward
investment high tech equipment	2	1	go* down	pick* up
investment manufacturing	2	1	held down	rais*
investment situation	2	1	hold down	rallied
investment spending	2	1	increas* at slow* rate	rally*
job growth	2	1	limit*	rebound*
labor demand	2	1	low*	recoup*
labor force participation	2	1	moderate*	revis* up*
labor market*	2	1	moderati*	rise*
labor market condition*	2	1	mov* down	rising
labor market indicator*	2	1	mov* downward	rose
labor market slack	1	2	mov* lower	run up
labor productivity	2	1	pressur*	runup
manufacturing activity	2	1	pullback	stop decline
manufacturing capacity utilization	2	1	reduc*	strength*
manufacturing output	2	1	revis* down*	strong*
manufacturing production	2	1	slow*	tick* up
manufacturing sector	2	1	slow* down	tight*
motor vehicle assembl*	2	1	soft*	up
motor vehicle production	2	1	stagnat*	upward
motor vehicle purchas*	2	1	stall*	upward adjust*
motor vehicle sales	2	1	strain*	upward revision
motor vehicle sector	2	1	stress*	went up
new construction	2	1	subdu*	
new home sales	2	1	take* toll on	
new orders	2	1	tension*	
nominal gdp	2	1	tick* down	
nonfarm business sector	2	1	took toll on	
nonfarm payroll employment	2	1	weak*	
nonresidential construction	2	1	weigh* down	
nonresidential construction activity	2	1	weigh* on	
orders and shipments of nondefense capital goods	2	1	went down	
orders of nondefense capital goods	2	1	worse*	
outlays business equipment	2	1		
outlays high tech equipment	2	1		
outlays transporation equipment	2	1		
outlook economic activity	2	1		
output gap				
output growth	2	1		
payroll employment	2	1		
pce	2	1		
personal consumption expenditure*	2	1		
personal income	2	1		
potential output	2	1		
potential output	2	1		
private expenditures business equipment	2	1		

Table B.5. Noun Phrases and Direction Words Related to Economic Growth (2). The first column displays a subset the phrases we associate with economic growth discussion in the FOMC transcripts (see other tables in sequence for other nouns). The second to fifth columns relate to the construction of growth sentiment. An instance of positive sentiment occurs when a mention of one of the nouns with a 1 (2) recorded in the 'Positive' column is preceded or followed by a phrase from Group 1 (Group 2) within sub-sentences. Negative sentiment is constructed analogously. Nouns with no number recorded in the second and third columns are used to contextualize uncertainty language but not for the construction of sentiment.

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
private nonfarm employment	2	1	*adjust* downward*	*acceler**
private nonfarm payroll employment	2	1	*adverse*	*adjust* upward*
private sector investment	2	1	*contract**	*advanc**
private spending	2	1	*cool**	*better*
productivity	2	1	*cut**	*bolster**
productivity growth	2	1	*deceler**	*boost**
purchas* of motor vehicle*	2	1	*declin**	*elevat**
real activity	2	1	*decreas**	*encourag**
real business spending	2	1	*deteriorat**	*expand**
real consumer spending	2	1	*disappoint**	*fast**
real disposable income	2	1	*down*	*favor**
real disposable personal income	2	1	*downturn*	*gain**
real gdp	2	1	*downward*	*go* up*
real gdp growth	2	1	*downward adjust**	*heighten**
real gnp	2	1	*downward revision*	*high**
real personal consumption expenditure*	2	1	*drag**	*improv**
real spending	2	1	*drop**	*increas**
residential construction	2	1	*eas**	*mov* higher*
residential construction activity	2	1	*fall**	*mov* up*
residential investment	2	1	*fell*	*mov* upward*
resource use	2	1	*go* down*	*pick* up*
resource utilization	2	1	*held down*	*rais**
retail trade	2	1	*hold down*	*rallied*
shipments of nondefense capital goods	2	1	*increas* at slow* rate*	*rally**
spending and production	2	1	*limit**	*rebound**
spending business equipment	2	1	*low**	*recoup**
spending high tech equipment	2	1	*moderate**	*revis* up**
spending nonresidential structures	2	1	*moderati**	*rise**
spending transporation equipment	2	1	*mov* down*	*rising*
structural productivity	2	1	*mov* downward*	*rose*
total industrial production	2	1	*mov* lower*	*run up*
total nonfarm payroll employment	2	1	*pressur**	*runup*
unemployment	1	2	*pullback*	*stop decline*
unemployment insurance claim*	1	2	*reduc**	*strength**
unemployment level	1	2	*revis* down**	*strong**
unemployment rate	1	2	*slow**	*tick* up*
us economic activity	2	1	*slow* down*	*tight**
us economy	2	1	*soft**	*up*
outlook economy	2	1	*stagnat**	*upward*
inventory level*	1	2	*stall**	*upward adjust**
fiscal			*strain**	*upward revision*
deficit			*stress**	*went up*
surplus			*subdu**	
			take toll on*	
			*tension**	
			tick down*	
			took toll on	
			*weak**	
			weigh down*	
			weigh on*	
			went down	
			*worse**	

Table B.6. Noun Phrases and Direction Words Related to Economic Growth (3). The first column displays a subset the phrases we associate with economic growth discussion in the FOMC transcripts (see other tables in sequence for other nouns). The second to fifth columns relate to the construction of growth sentiment. An instance of positive sentiment occurs when a mention of one of the nouns with a 1 (2) recorded in the 'Positive' column is preceded or followed by a phrase from Group 1 (Group 2) within sub-sentences. Negative sentiment is constructed analogously. Nouns with no number recorded in the second and third columns are used to contextualize uncertainty language but not for the construction of sentiment.

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
aaa spread*	1	2	adjust* downward	acceler*
baa spread*	1	2	contract*	adjust* upward
corporate bond spread*	1	2	cool*	advanc*
corporate spread*	1	2	deceler*	adverse
cost of bank credit	1	2	declin*	bolster*
cost of bond financ*	1	2	decreas*	boost*
cost of capital	1	2	down	deteriorat*
cost of credit	1	2	downturn	edge* up*
cost of equity	1	2	downward	elevat*
cost of external capital	1	2	downward adjust*	expand*
cost of funding	1	2	drop*	fast*
cost of raising capital	1	2	eas*	gain*
cost of raising capital through equity	1	2	edge* down	go* up
credit cost*	1	2	encourag*	heighten*
credit default swap*	1	2	fall*	high*
credit risk spread*	1	2	favor*	increas*
credit spread*	1	2	fell	mov* higher
debt securities spread*	1	2	go* down	mov* up
equity risk prem*	1	2	improv*	mov* upward
expected real return equit*	1	2	limit*	pick* up
expected return equit*	1	2	low*	pressure*
financing cost	1	2	moderate*	rais*
funding cost	1	2	moderati*	rebound*
risk prem*	1	2	mov* down	recoup*
risk spread*	1	2	mov* downward	revis* up*
risk spread* corporate bonds*	1	2	mov* lower	rise*
spread* corporate bond*	1	2	narrow*	rising
spread* investment grade bond*	1	2	pullback	rose
spread* speculative grade bond*	1	2	reduc*	run up
			revis* down*	runup
			slow*	stop decline
			soft*	strain*
			subdu*	strength*
			take* toll on	stress*
			tick* down	strong*
			took toll on	tension*
			weak*	tick* up
			weigh* on	up
			went down	upward
				upward adjust*
				went up
				widen*
				worse*

Table B.7. Noun Phrases Related to Financial Markets (1). The first column displays a subset the phrases we associate with financial market discussion in the FOMC transcripts (see other tables in sequence for other nouns). The second to fifth columns relate to the construction of market sentiment. An instance of positive sentiment occurs when a mention of one of the nouns with a 1 (2) recorded in the 'Positive' column is preceded or followed by a phrase from Group 1 (Group 2) within sub-sentences. Negative sentiment is constructed analogously.

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
appetite* risk taking	2	1	*adjust* downward*	*acceler**
appetite* risk*	2	1	*adverse*	*adjust* upward*
appetite* risk* asset*	2	1	*contract**	*advanc**
appetite* risk* investment*	2	1	*cool**	*bolster**
appetite* taking risk*	2	1	*deceler**	*boost**
condition* credit market*	2	1	*declin**	*eas**
condition* financial market*	2	1	*decreas**	*elevat**
credit condition*	2	1	*deteriorat**	*encourag**
credit growth	2	1	*down*	*expand**
credit market*	2	1	*downturn*	*fast**
credit market condition*	2	1	*downward*	*favor**
credit market demand	2	1	*downward adjust**	*gain**
development financial market*	2	1	*downward revision*	*go* up*
financial condition*	2	1	*drop**	*high**
financial development*	2	1	*fall**	*improv**
financial instabilit*	1	2	*fell*	*increas**
financial market condition*	2	1	*go* down*	*loos**
financial market confidence	2	1	*limit**	*mov* higher*
financial market development*	2	1	*low**	*mov* up*
financial market index*	2	1	*moderate**	*mov* upward*
financial market indic*	2	1	*moderati**	*normaliz**
financial market pressure*	1	2	*mov* down*	*pick* up*
financial market price*	2	1	*mov* downward*	*rais**
financial market sentiment	2	1	*mov* lower*	*rallied*
financial market*	2	1	*pressure**	*rally**
financial situation	2	1	*pullback*	*rebound**
financial stability	2	1	*reduc**	*recoup**
investor* appetite*	2	1	*restrictive*	*revis* up**
investor* appetite* risk*	2	1	*revis* down**	*rise**
investor* confidence	2	1	*slow**	*rising*
investor* risk appetite*	2	1	*soft**	*rose*
investor* sentiment	2	1	*stagnate**	*run up*
investor* sentiment toward risk*	2	1	*stall**	*runup*
investor* sentiment toward risk* asset*	2	1	*strain**	*stop decline*
liquidity	2	1	*stress**	*strength**
pressure* financial market	1	2	*subdu**	*strong**
risk appetite*	2	1	*take a toll on*	*tick* up*
bank credit	2	1	*tension**	*up*
bank lending	2	1	*tick* down*	*upward*
banking supervision			*tight**	*upward adjust**
banking system	2	1	*took toll on*	*upward revision*
consumer credit	2	1	*turbulent*	*went up*
credit availability	2	1	*weak**	
credit quality	2	1	*weigh* on*	
domestic credit	2	1	*went down*	
domestic nonfinancial debt	2	1	*worsen**	
financial outlook	2	1		
financial system	2	1		
foreign exchange				
foreign exchange market*				
foreign exchange valu*				
household balance sheet*	2	1		
market exchange rate*				
market liquidity	2	1		
mortgage refinancing activity	2	1		
non market exchange rate*				
nonfinancial debt	2	1		
private credit	2	1		
private credit market*	2	1		
seasonal borrowing	2	1		
total domestic non financial debt	2	1		
total domestic nonfinancial debt	2	1		
us dollar				

Table B.8. Noun Phrases Related to Financial Markets (2). The first column displays a subset the phrases we associate with financial market discussion in the FOMC transcripts (see other tables in sequence for other nouns). The second to fifth columns relate to the construction of market sentiment. An instance of positive sentiment occurs when a mention of one of the nouns with a 1 (2) recorded in the 'Positive' column is preceded or followed by a phrase from Group 1 (Group 2) within sub-sentences. Negative sentiment is constructed analogously. Nouns with no number recorded in the second and third columns are used to contextualize uncertainty language but not for the construction of sentiment.

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
aaa yield*	1	2	*adjust* downward*	*acceler**
baa yield*	1	2	*contract**	*adjust* upward*
bond yield*	1	2	*cool**	*advanc**
corporate bond yield*	1	2	*deceler**	*bolster**
corporate debt yield*	1	2	*declin**	*boost**
corporate yield*	1	2	*decreas**	*elevat**
debt yield*	1	2	*down*	*encourag**
high grade corporate bond* yield*	1	2	*downturn*	*expand**
interest rate*	1	2	*downward*	*fast**
investment grade and speculative grade corporate bond* yield*	1	2	*downward adjust**	*gain**
investment grade corporate bond yield*	1	2	*downward movement*	*go* up*
long* term interest rate*	1	2	*downward revision*	*heighten**
long* term rate*	1	2	*drop**	*high**
mortgage interest rate*	1	2	*fall**	*increas**
real long* term interest rate*	1	2	*fell*	*mov* higher*
real long* term rate*	1	2	*go* down*	*mov* up*
speculative grade corporate bond* yield*	1	2	*limit**	*mov* upward*
yield* agency mortgage backed securities mbs	1	2	*low**	*pick* up*
yield* corporate bond*	1	2	*moderate**	*rais**
yield* corporate bonds and agency mbs	1	2	*moderati**	*rallied*
yield* mortgage backed securities	1	2	*mov* down*	*rally**
yield* private sector debt securities	1	2	*mov* downward*	*rebound**
comparable maturity treasury securities			*mov* lower*	*recoup**
discount rate*	1	2	*pullback*	*revis* up*
long* term treasury securities			*reduc**	*revision upward*
nominal treasury securities			*revis* down*	*rise**
real interest rate*	1	2	*slow**	*rising*
short* term interest rate*	1	2	*soft**	*rose*
us government securities			*stagnate**	*run up*
			*stall**	*runup*
			*subdu**	*stop decline*
			take toll on*	*strength**
			tick down*	*strong**
			*tight**	*tick* up*
			took toll on	*up*
			*weak**	*upward*
			weigh on*	*upward adjust**
			went down	*upward movement*
				upward revision
				went up

Table B.9. Noun Phrases Related to Financial Markets (3). The first column displays a subset the phrases we associate with financial market discussion in the FOMC transcripts (see other tables in sequence for other nouns). The second to fifth columns relate to the construction of market sentiment. An instance of positive sentiment occurs when a mention of one of the nouns with a 1 (2) recorded in the 'Positive' column is preceded or followed by a phrase from Group 1 (Group 2) within sub-sentences. Negative sentiment is constructed analogously. Nouns with no number recorded in the second and third columns are used to contextualize uncertainty language but not for the construction of sentiment.

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
asset index*	2	1	_adjust* downward_	_acceler*_
asset indic*	2	1	_adverse_	_adjust* upward_
asset market*	2	1	_burst*_	_advanc*_
asset price index*	2	1	_contract*_	_bolster*_
asset price indic*	2	1	_cool*_	_boost*_
asset price*	2	1	_deceler*_	_edge* up_
asset valu*	2	1	_declin*_	_elevat*_
equities	2	1	_decreas*_	_encourag*_
equity and home price*	2	1	_deteriorat*_	_expand*_
equity and home valu*	2	1	_down_	_fast*_
equity and house price*	2	1	_downturn_	_favor*_
equity and housing price*	2	1	_downward_	_gain*_
equity index*	2	1	_downward adjust*_	_go* up_
equity indic*	2	1	_downward movement_	_high*_
equity market index*	2	1	_downward revision_	_improv*_
equity market indic*	2	1	_drop*_	_increas*_
equity market price*	2	1	_eas*_	_mov* high*_
equity market valu*	2	1	_edge* down_	_mov* up_
equity market*	2	1	_fall*_	_mov* upward_
equity price index*	2	1	_fell_	_pick* up_
equity price indic*	2	1	_go* down_	_rais*_
equity price measure*	2	1	_limit*_	_rallied_
equity price*	2	1	_low*_	_rally*_
equity valu*	2	1	_moderate*_	_rebound*_
equaity wealth	2	1	_moderati*_	_recoup*_
financial wealth	2	1	_mov* down_	_revis* up*_
home and equity price*	2	1	_mov* downward_	_rise*_
house and equity price*	2	1	_mov* lower_	_rising_
household wealth	2	1	_plummet*_	_rose_
household* net worth	2	1	_pressure*_	_run up_
housing and equity price*	2	1	_pull* back_	_runup_
price* of risk* asset*	2	1	_pullback_	_stop decline_
ratio of wealth to income	2	1	_reduc*_	_strength*_
risk* asset price*	2	1	_revis* down*_	_strong*_
s p 500 index	2	1	_slow*_	_tick* up_
stock index*	2	1	_slow* down_	_up_
stock indic*	2	1	_soft*_	_upward_
stock market index*	2	1	_stagnate*_	_upward adjust*_
stock market price*	2	1	_stall*_	_upward movement_
stock market wealth	2	1	_strain*_	_upward revision_
stock market*	2	1	_stress*_	_went up_
stock price indic*	2	1	_subdu*_	
stock price*	2	1	_take* toll on_	
stock prices index*	2	1	_tension*_	
stock val*	2	1	_tick* down_	
us stock market price*	2	1	_tight*_	
wealth effect*	2	1	_took toll on_	
wealth to income ratio	2	1	_tumbl*_	
			weak*	
			weigh* on	
			went down	
			worse*	

Table B.10. Noun Phrases Related to Financial Markets (4). The first column displays a subset the phrases we associate with financial market discussion in the FOMC transcripts (see other tables in sequence for other nouns). The second to fifth columns relate to the construction of market sentiment. An instance of positive sentiment occurs when a mention of one of the nouns with a 1 (2) recorded in the 'Positive' column is preceded or followed by a phrase from Group 1 (Group 2) within sub-sentences. Negative sentiment is constructed analogously. Nouns with no number recorded in the second and third columns are used to contextualize uncertainty language but not for the construction of sentiment.

parameter*
model*
measurement*
forecast error*
relationship*
error band*
nairu
trend
confidence interval*
uncertainty band*
confidence band*

Table B.11. Noun Phrases Related to Model. The table contains phrases we associate with model discussion in the FOMC transcripts.

Figure B.1. Distribution of phrases in topic-specific PMU indices. The figure presents the distribution of terms within topic-specific uncertainty sentences. The size of the term is approximately proportional to its frequency. All topic-specific PMU indices are obtained from the economy round of the FOMC meetings. The sample period is 1987:08–2015:12.

C. Algorithms for Uncertainty, Sentiment, and Policy Stance Construction

In this section, we describe in detail how we construct text-based measures of uncertainty, sentiment, and policy stance. The first step is to preprocess the transcripts by breaking each statement by each speaker into separate sentences using a standard sentence tokenizer. This yields 559,709 total sentences, which form the basic units of linguistic analysis for the algorithms we propose below.

C.1. Uncertainty construction

The construction of the uncertainty indices begins with the estimation of a word embedding model. Specifically, we use the Continuous Bag-of-Words (CBOW) model (Mikolov et al., 2013) estimated on the set of FOMC sentences contained in the economy round to obtain a vector representation of each unique term. A word embedding model represents each unique term in a corpus as a relatively low-dimensional vector in a vector space. Words whose vectors lie close together in the vector space share similar meanings. To obtain the uncertainty terms, we begin with the four seed terms 'uncertain,' 'uncertainty,' 'risk,' and 'risks.'

In general, the neighbors are synonyms of the seeds, such as 'unclear' and 'unsure,' or terms reflecting worries and concerns, such as 'threat,' 'fear,' and 'wary.' The nearest neighbors can also contain generic terms not clearly related to uncertainty. We therefore further organize the lists using our domain expertise, and after removing irrelevant terms, we obtain 78 terms in total. The separate lists contain substantial overlap, which is another reason for the reduction to 78 terms. We provide fifty nearest neighbors for each of the seed words in Appendix Tables B.1 and B.2.

We preprocess each sentence following standard steps of tokenization and stop word removal. We also replace a limited number of bigrams with a single term, e.g., 'downside risk' and 'upside risk.' We remove all sentences that do not contain at least five terms from the estimation corpus. The embedding model is estimated with 200-dimensional embedding vectors and a window size of five, which are typical defaults in the natural language processing literature. See Ash and Hansen (2023) for more background on word embedding models.

Tables B.1 and B.2 contain the fifty nearest neighbors for the terms 'risk', 'risks', 'uncertain', and 'uncertainty'. The similarity measure for computing nearest neighbors is cosine similarity, which is the cosine of the angle formed by two vectors in a vector space.[34] We then manually prune the neighbors to arrive at our final set of uncertainty words.

Let $u_{t,s}$ be the count of uncertainty terms in sentence s. That is, the number of instances of any of the non-struck-through terms in tables B.1 and B.2 that appear in sentence s. For each topic (inflation and wages, economic growth, financial markets, model), we construct topic-specific uncertainty counts using the following procedure. For each sentence in each FOMC meeting:

[34] So, if two vectors point in the same direction, and have a zero angle between them, the cosine similarity is 1. If they point in opposite directions, and have an angle of 180 degrees, the cosine similarity is -1. Mathematically, the formula is the dot product of two vectors normalized to have unit length.

1. Increase the topic k uncertainty count by $u_{t,s}$ if sentence s contains any term in the list associated with topic k. Thus, if a term from more than one topic set appears in sentence s, $u_{t,s}$ can be assigned to more than one topic.

2. If no term from any set of topic words appears in sentence s, assign $u_{t,s}$ to topic k if a topic-k term appears in sentence $s-1$ or sentence $s+1$ (whenever these sentences are uttered by the same speaker of sentence s).

3. If no topic k term appears in sentences $s-1$, s, or $s+1$ then leave $u_{t,s}$ unassigned.

We then normalize the topic-specific counts by the total number of terms in the economy round of the meeting. We denote policymakers' perceived inflation uncertainty in meeting t as $InfPMU_t$; real economic uncertainty as $EcoPMU_t$; financial market uncertainty as $MktPMU_t$; and uncertainty about models as $ModPMU_t$.

C.2. Sentiment construction

Here we describe the construction of sentiment for topic k (which corresponds to economic growth, inflation and wages, and financial markets). The algorithm follows closely that in **?** which use a similar approach to build a stock market sentiment index. Here we expand this to additional topics.

Sentiment is built exclusively using economy round language. We first remove any sentence in the economy round that either contains an uncertainty flag word, i.e. a term in the 'Term' columns of tables B.1 or B.2 that is not struck through, as well as sentences that immediately precede or follow such sentences. This ensures that sentiment is constructed using a different set of input words than the uncertainty measures, which avoids a mechanical relationship between the two.

The next step is to break all remaining sentences in the economy round into sub-sentences based on the presence of words in {'and', 'because', 'but',' if', 'or', 'so','that', 'when', 'where', 'while', 'although', 'however', 'though', 'whereas', 'despite'}. Let $\mathbf{p}_{t,s}$ be the sth phrase in meeting t generated by this rule.

As described in the tables above, each topic is associated with a set of nouns. Let $g_{k,m}$ be the mth noun associated with topic k. This noun will be associated with a set of positive words $\text{Pos}_{k,m}$ and a set of negative words $\text{Neg}_{k,m}$ according to the group definitions in the tables. The positive and negative sentiment measures in meeting t begin with the tabulations

$$\tilde{S}^{+}_{t,k} = \sum_{s}\sum_{m}\sum_{n} \mathbb{1}(w_{t,s,n} = g_{k,m}) \left[\mathbb{1}(w_{t,s,n-1} \in \text{Pos}_{k,m}) + \mathbb{1}(w_{t,s,n+1} \in \text{Pos}_{k,m})\right]$$

$$\tilde{S}^{-}_{t,k} = \sum_{s}\sum_{m}\sum_{n} \mathbb{1}(w_{t,s,n} = g_{k,m}) \left[\mathbb{1}\left(w_{t,s,n-1} \in \text{Neg}_{k,m}\right) + \mathbb{1}\left(w_{t,s,n+1} \in \text{Neg}_{k,m}\right)\right]$$

That is, we count the number of times topic-k words are immediately preceded or followed by (word-specific) positive and negative terms.[35] To obtain our final sentiment measure, we scale these counts by the number of total tokens in the economy round.

C.3. Preference construction

We now describe the algorithm for constructing the measures of hawkishness and dovishness used in the main text to capture policy preferences. For all meetings, we measure generic monetary policy preferences using the procedure detailed below. For meetings conducted in 2009 and onwards, we additionally measure preferences over the size of asset purchases as part of the Fed's quantitative easing program. The sentences we consider consist of those in the policy round since that is the section of the meeting pertaining to the articulation of preferences.

C.3.1. Generic monetary policy preferences

First, we exclude from the policy round any sentence in which the term 'increase' appears along with any of {cpi, inflation, yield*, treasury} to ensure we do not include language describing the direction of non-policy-related market prices and interest rates. We classify each remaining sentence as pertaining to monetary policy:

1. If it contains any phrase in the set {federal funds rate, funds rate, target rate, policy rate, interest rate, taylor rule, alternative a, alternative b, alternative c, directive, language, statement, symmetry, asymmetry, hawkish, dovish},
2. OR if 'policy' is in the sentence and NOT any phrase in the set {fiscal policy, supervisory policy, public policy, budget policy, tax policy, housing policy, regulatory policy, ecb policy, economic policy, government policy, inventory policy, health care policy, macro policy, macroeconomic policy, spending policy, legislation, law, regulation}.
3. OR if 'basis point' is found in the sentence AND any phrase in the set {[cut*, hik*, eas*, tight*, action*, moving, move, firming, recommendation, reduction, increase]}.

We define $Hawk_t^i$ to be the count of terms in {tight*, hike*, increas*, hawkish, taper, liftoff} in policy sentences; and $Dove_t^i$ to be the count of terms in {ease*, easing*, cut*, dovish, reduc*, decrea*} in policy sentences. Here we account for negation, and if any of the hawk (dove) terms is immediately preceded by one of {'less', 'no','not', 'little', 'don't', 'doesn't', 'hasn't', 'haven't', 'won't', 'shouldn't', 'didn't'}, it is counted as belonging to dove (hawk) set.

[35] Since in preprocessing we remove stop words, adjacency in this definition can include separation by stop words.

C.3.2. *Quantitative easing preferences*

We define policy round sentences beginning in 2009 as relating to quantitative easing whenever they contain the term 'purchase*' immediately preceded by a phrase in {mortgage backed securities, mbs, asset, treasur*, agency debt}.

We then define $Hawk''_t$ to be the count of terms in {reduc*, taper, stop, purchas*} within the set of QE sentences; and $Dove''_t$ to be the count of terms in {more, additional, further} within the set of QE sentences. We again account for negation.

C.3.3. *Overall preference measure*

Let NP_t be the overall number of terms in the policy round in meeting t. Our hawk measure is

$$Hawk_t = \begin{cases} \frac{Hawk'_t}{\text{NP}_t} & \text{if meeting } t \text{ occurs prior to 2009} \\ \frac{Hawk'_t + Hawk''_t}{\text{NP}_t} & \text{if meeting } t \text{ occurs during or after 2009} \end{cases}$$

and $Dove_t$ is defined analogously.

D. Additional Tables and Figures

D.1. Material for Section III

	(1) BBD EPU	(2) HRS MPU	(3) VXO	(4) Infl disp	(5) Growth disp
$InfPMU_t$	-0.397***	-0.062	-0.169*	0.057	-0.172
	(-5.83)	(-0.86)	(-1.91)	(0.68)	(-1.55)
$EcoPMU_t$	0.211*	0.276*	-0.037	-0.325***	-0.200
	(1.75)	(1.93)	(-0.22)	(-2.61)	(-1.65)
$MktPMU_t$	0.183*	0.097	0.323**	0.326**	0.007
	(1.66)	(1.02)	(2.53)	(2.36)	(0.06)
$\bar{R}^2$	0.22	0.093	0.10	0.13	0.061
N	227	227	227	227	227

Table D.12. PMU vs. measures of public perceptions of uncertainty. The table projects proxies for public uncertainty on the PMU indices. BBD EPU is the economic policy uncertainty index from Baker et al. (2016); HRS MPU is the monetary policy uncertainty index from Husted et al. (2020); VXO is the implied volatility measure from S&P500 options; inflation and growth dispersion are calculated as the mean absolute deviation of forecasts for CPI inflation and real GDP growth across individuals in the Blue Chip Financial Forecast survey. We report the first principal component of forecast dispersions across horizons from the current quarter up to four quarters ahead. The sample period is 1987:08–2015:12. All variables are scaled by their standard deviations. HAC t-statistics with eight lags are reported in parentheses. The regressions are estimated at the frequency of the FOMC meetings.

A. Dependent variable: Greenbook CPI inflation nowcast h meetings ahead, $F_{t+h}(\pi_0)$

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$	$h=7$	$h=8$
$InfPMU_t$	0.029	-0.035	-0.063	-0.083	-0.181	-0.173	-0.109	-0.073
	(0.33)	(-0.38)	(-0.63)	(-0.63)	(-1.27)	(-1.16)	(-0.91)	(-0.87)
$\bar{R}^2$	-0.0036	-0.0033	-0.00051	0.0024	0.028	0.025	0.0073	0.00081
N	226	225	224	223	222	221	220	219

B. Dependent variable: Greenbook real GDP growth nowcast h meetings ahead, $F_{t+h}(g_0)$

	$h=1$	$h=2$	$h=3$	$h=4$	$h=5$	$h=6$	$h=7$	$h=8$
$EcoPMU_t$	-0.073	-0.059	-0.002	0.008	-0.050	-0.056	0.023	0.047
	(-0.92)	(-0.76)	(-0.03)	(0.09)	(-0.50)	(-0.52)	(0.21)	(0.39)
$\bar{R}^2$	0.00088	-0.00093	-0.0045	-0.0045	-0.0021	-0.0015	-0.0041	-0.0024
N	226	225	224	223	222	221	220	219

Table D.13. Predicting Macro Variables with PMU. The top panel reports estimates of predictive regressions for period-$t+h$ inflation using period-t inflation PMU as a predictor. The regression is estimated at the FOMC meeting frequency with the forecast horizon ranging from the next meeting ($h=1$) up to eight meetings ahead ($h=8$). To ensure the timing of the dependent variable is consistent with the timing of the meetings, we use Greenbook nowcasts at future meetings as the dependent variable. The regression is $E_{t+h,0q}(\pi) = \beta_0 + \beta_1 InfPMU_t + \varepsilon_{t+h}$. The bottom table reports analogous estimates for predictive regressions of real GDP growth. The coefficients are standardized. HAC standard errors to account for the overlap are reported in parentheses. The sample period is 1987:08–2015:12.

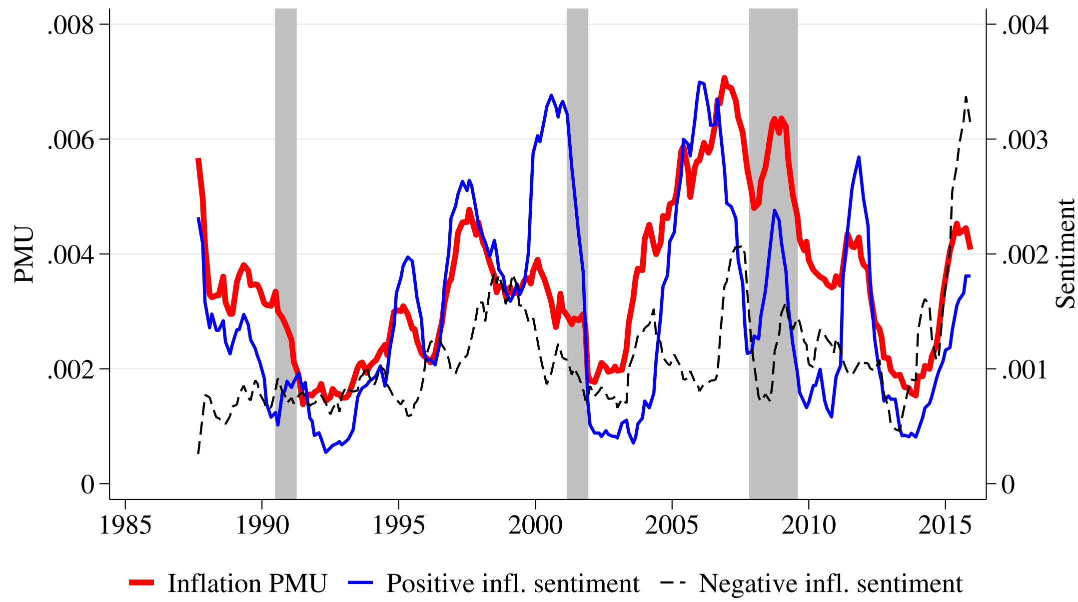

Figure D.2. Inflation PMU and inflation sentiment (FOMC members). The figure presents inflation PMU superimposed against positive and negative inflation sentiment. Positive (negative) sentiment indicates views of rising (declining) inflation. The series are smoothed averages over the last eight FOMC meetings and are measured from statements of FOMC members.

	(1) $F_t(\pi_4)$	(2) $InfSent_t$	(3) $InfPMU_t$
$InfPMU_t$	0.130***	0.302***	
	(3.00)	(2.77)	
$InfPos_t$			0.537***
			(4.90)
$InfNeg_t$			0.235***
			(3.85)
Trend inflation, τ_t	0.958***		
	(15.19)		
$\bar{R}^2$	0.86	0.087	0.35
N	227	227	227

Table D.14. Expected Inflation and Inflation PMU. The table documents the contemporaneous relationship (regressions) of expected inflation, inflation sentiment, and inflation PMU. $F_t(\pi_4)$ is Greenbook four-quarter ahead inflation forecast. τ_t is trend inflation constructed as in Section III of the paper. Sentiment and PMU indices are obtained from the text of FOMC members' statements in the economy round of the meeting. The coefficients are standardized. HAC standard errors with eight lags are reported in parentheses. The sample period is 1987:08–2015:12.

E. Narrative Assessment of the Role of Credibility Concerns

This appendix provides a narrative account of the evolving concerns for credibility in the FOMC policy deliberations. For this, we split the evolution of inflation concerns into four separate subsamples: (i) the mid-1990s, (ii) the post-2000 recession, (iii) recovery to GFC, and (iv) post-GFC Concerns.

E.1. Mid-1990s

In the second half of 1996, fears grew that a tight labor market would generate inflationary pressure. **Yellen** (San Francisco) noted in September 1996, *"The probability of an increase in inflation is clearly higher when labor market slack is lower. For that reason, I conclude that the risk of an increase in inflation has definitely risen, and I would characterize the economy as operating in an inflationary danger zone."* Discussing her policy view for that meeting, she said *"My concern is that a failure to shift policy just modestly in response to shifting inflationary risks could undermine the assumptions on which the markets' own stabilizing responses are based."*

In November 1996, the risk of a pick-up in inflation had not been borne out in the data, but some members remained concerned. **Meyer** (Board) spoke of the ongoing challenge that *"trend growth at the prevailing unemployment rate will ultimately prove to be inconsistent with stable inflation going forward."* **Broaddus** (Richmond) argued for a credibility-enhancing surprise: *"The projections do not show any further progress toward our basic longer-term price stability goal. And if that were the actual outcome over the next couple of years, the credibility of our longer-term strategy could be reduced, at least to some degree. For all these reasons, Mr. Chairman, I would still favor a 1/4 point increase in the funds rate today. Any tightening now obviously would surprise the markets. I recognize that that could have near-term consequences, but I think it could well help us over the longer run."*

By the meeting in December 1996, these worries had dissipated further; **Yellen** said *"So, I still feel that we need to avoid complacency about the potential for inflationary pressures to emerge from the labor market down the road. But while I think we cannot rule out the possibility that this long expansion is about to end with a period of stagflation and that that is a significant risk over the term of this forecast, that outcome is by no means a certainty. Capacity utilization, as a number of you have mentioned, is not strained at this point."* Though some, such as **Melzer** (St Louis), were still concerned about the risk of lost credibility: *"Economic forecasters have often interpreted our policy as a 3 percent cap on CPI inflation. Events in 1996 put us at considerable risk of losing credibility for even that modest goal. In my view, we should reaffirm our commitment to resist inflation above 3 percent."*

The fears continued for some members into the first half of 1997. **McDonough** (New York) expressed concerns that he and the NY Fed staff had. **Melzer** continued to argue for credibility-building measures; *"My reading of the economy supports the conclusion that we are at risk of losing* *the hard-won credibility of our commitment to hold inflation at 3 percent."* **Guynn** (Atlanta) said in May 1997 that *"With the economy having gotten to a point where it must be near full employment, if not beyond it, we have a unique opportunity with little downside risk to lean a bit more against the expected upward creep in inflation that most of us are forecasting and, in doing so, to underscore our resolve and credibility in the minds of financial market participants, business decisionmakers, and the general public."*

With a single 25bps rate increase in March 1997, the inflation credibility concerns persisted until the demand-dampening effects of the Asian financial crisis in 1997, and the LTCM collapse and Russian default. These events prompted the Fed to cut interest rates in late 1998 to calm markets and preemptively offset any negative impulses from the slowing global demand.

Once the economy had weathered the initial impact of those events, the FOMC's thoughts returned to the tight labor markets and the risk of inflation. In March 1999, **Broaddus** emphasized the importance of the Fed's credibility, alongside growing productivity, in helping to sustain robust final domestic demand growth: *"the high credibility of our low inflation strategy... supports the increases in real income and allows labor markets to operate at much lower unemployment levels without generating the potentially inflationary wage increases that have been typical historically. As I see it, maintaining this credibility is the key to what we can do to help sustain the expansion. In order to do that, I think we need to be sure we interpret the risks in the outlook as accurately as we can."* For this reason, **Broaddus** saw it was time to switch out of support mode and begin to signal the Fed's anti-inflation tendency, even if only in language, with emphasis on the upside inflation risks. *"What worries me the most, ironically, is that our high credibility may in some sense be permitting us to delay confronting this inflation risk. But if things ever begin to go in the other direction, I think they could unravel very quickly. So, as I said at the last meeting, I think it is time for us to get back in the ball game. In my view, a step toward an asymmetric directive would be a good way to do that."*

Ferguson (Board) was similarly concerned about the Fed's credibility. In December of 1999, he outlined his concerns to his colleagues: *"In the longer run, obviously, as others have indicated, we don't want to lose our ongoing battle with inflation expectations and inflation, or risk any damage to our own credibility... We should continue to recognize the benign effects of productivity improvements on unit cost structures, but we also should not be afraid to act in a well-modulated fashion in order to maintain our hard fought victory over inflation and also our credibility."*

Ultimately, inflation never took off. **Broaddus**, in May 1999, recognized that his fears had not been realized when he said: *"I know I have been crying wolf around this table for a long time and my fears have not been realized, but we have to take each day as it comes, I guess. So, wolf!"* This prompted laughter around the FOMC table. Of course, it is the credibility that he, and others, were so concerned about retaining that means they may have ultimately appeared wrong in their projection.

E.2. Post-2000 recession

A (small) recession started in 2001, and the terrorist attacks on September 11 2001 further added to concerns about the US economy and the financial system. In this period, the FOMC were little concerned about the inflation risks and downside risks started to dominate. In fact, FOMC members began to push the *use* of their credibility in allowing them to switch into support mode. This includes members like **Broaddus** who had so often argued for the need to take a hawkish stance to build credibility. In August 2001, he argued: *"And, of course, now I think we do have considerable credibility. And with the downside risks still quite substantial, as you and others have mentioned, I think we need to take advantage of that credibility. To say the same thing a bit differently: Unlike the situation in a number of earlier postwar episodes, we don't need a recession to contain inflation or inflation expectations at this point."* Similarly, **Parry** (San Francisco), in December 2001, argued *"With inflation well in hand and Federal Reserve credibility in good shape, I believe we have the flexibility to respond to these risks."*

E.3. Recovery to GFC

Though the formal recession had ended by the end of 2001, the trough in the interest rate cycle didn't come until 2003 (the FOMC last cut by 25bps at its June 2003 meeting). But even as the FOMC was still cutting, concerns about inflation started to build. In the March 2003 FOMC meeting, **Parry** says: *"As we all know, there are many risks to such an inflation forecast. In particular, we are uncertain about how much and how fast energy prices will pass through to other prices, about how much demand will increase from the economies abroad, and about whether stock prices or productivity growth will surge or fall. However, despite all the possible scenarios that could be constructed, the underlying tightness of labor markets and the recent extraordinary growth in demand imply a very high risk that core inflation will rise at a faster pace this year and next."* In the policy go-around, he indicates his desire to signal the FOMC's toughness on inflation – *"I also think it is important to reinforce to the public that we are focusing on the heightened inflation risks for the future."* However, at that time most members did not see this risk as unduly concerning; as **Hoenig** said – *"I am not convinced, however, that we need to be tightening aggressively. I think the gradual pace of tightening that we have followed is wise."*

It wasn't until the middle of 2004 that inflation uncertainty was combined with a clear directional element to the worries. The May 2004 FOMC meeting is when the *InfPMU* started to pick up strongly, accompanied by concerns of rising inflation. The discussion centered on the shifting balance of risks on inflation. **Geithner** (NY Fed) said *"We need to be more attentive now to the risk that a sustained increase in prices could materialize at an earlier point than had seemed likely, and we can afford, of course, to be less concerned with the risk of an unwelcome fall in the rate of inflation. The risks of being late compared with the risks of moving too early are now more symmetric. We need to adjust our statement accordingly, to position us to be ready to act soon if the numbers confirm the recent trend toward stronger employment growth."* Chair **Bernanke** thought about what this means for the risk-management approach to monetary policy: *"From a risk-management perspective, as we begin to raise rates we should weigh the risk of significantly impeding the labor market recovery against the risk of having to scramble to adjust to unexpectedly adverse inflation developments."*

By June, some members felt more convinced that the FOMC needed to start raising rates. **McTeer** (Dallas) was explicit in his views: *"As I indicated at our May meeting, I believe that the inflation risks are unambiguously on the upside and that we are behind the curve."* Even **Geithner** seemed to be coming around to this view: *"Developments since our last meeting support a reasonable degree of confidence in the strength of the expansion and somewhat more concern about the outlook for inflation.... We are somewhat more concerned about the inflation outlook...We face some risk that a modest increase in inflation expectations even after the recent moderation of those expectations will feed through to higher compensation growth."* The FOMC began a hiking cycle which took rates from 1% to 5.25% in June 2006.

The credibility issue also came up during the February 2005 special topic on "Price Objectives for Monetary Policy" in the context of whether the Fed should adopt an explicit inflation target. For example, **Santomero** (Philadelphia) emphasized the importance of the Fed's inflation-fighting credibility and argued that this would be further enhanced by being explicit about the numerical definition of the inflation goals. *"I also believe that moving to a regime of this type would increase flexibility and enhance our ability to achieve our other economic objectives. It is only because we had achieved a good deal of credibility over the years that we were able to lower the fed funds rate to 1 percent recently without igniting fears of inflation. And I would argue that this flexibility was important in contributing to the shallowness of the last recession."*

Though inflation remained contained over this period, the risks to the FOMC's credibility of getting it wrong were regularly emphasized. **Ferguson**, in March 2005, says: *"I find the baseline outlook to be credible and reasonable. But it is surrounded by a range of risks that I believe, as do others, are primarily on the upside... The economy is growing well and needs less and less stimulus; therefore, continuing to remove our accommodative policy at a measured pace seems to me reasonable."* On the approach to deal with risks, he favored signaling the committee's concerns: *"given the stage of the cycle, the skew in the general risk assessment that I outlined, and the need to manage market expectations, I think we should use our statement to signal our awareness that inflation pressures may have picked up. The incoming data are indicative of that. If we are wrong on the upside risks, both we and the market will adjust. On the other hand, if we fail to reflect the existence of these upside risks, we could easily be perceived as being behind the curve, with negative consequences in terms of inflation dynamics and, potentially, our own credibility."*

Even the FOMC members who believed inflation remained well in check expressed the importance of credibility. **Yellen** in November 2005 said: *"So I see no indication of the '70s style wage-price spiral in the offing. Overall, I judge our credibility to be very much intact. Of course, our credibility going forward does depend on continued vigilance. The economy now appears to be close* *to full employment, with a good deal of momentum. And annual core inflation, at least as judged by the core PCE measure, remains near the upper end of my comfort zone and, arguably, inflation risks are tilted somewhat to the upside. So with respect to policy, I support at a minimum the removal of any remaining policy accommodation...So a few more increases, including one today, seem to me likely to be required."*

Yellen also went on to support the use of stronger language than proposed with the Alternative B Bluebook option as also used to signal this stance: *"In implementing monetary policy, it seems to me that actions matter, but so do words, and I wanted to briefly open up the question of the statement. I think for today the words of alternative B should suffice, but Vincent has repeatedly suggested, and a number of you have emphasized, that we need to consider how to modify the statement language."* She pushed for language closer to the Alternative C statement as *"It eliminates the balance of risk statement and the policy accommodation language; and it substitutes a new forward-looking policy statement for the 'measured pace' phrasing."*

In March 2006, despite the significant tightening already completed, concerns remained about the upside to inflation. **Bernanke** summed up the committee discussion saying: *"I took from the group some sense of at least a slight upside risk to inflation, reflecting the increasing resource utilization; the fact that inflation is somewhat on the high side of what many people describe as their comfort zone; and the fact that, if inflation does rise, there will be costs to bringing it back down and maintaining our credibility."* While he goes on to state that he is *"not at all alarmist about inflation,"* he argued that *"it is very important for us to maintain our credibility on inflation and it would be somewhat expensive to bring that additional inflation back down. So my bottom line on inflation is that there is a very modest upside risk. Again, I think it's not a large risk but one that we probably should pay attention to."*

E.4. Post-GFC Concerns

Inflation was not the main concern during the GFC period of 2008-2011. But by 2012, FOMC members again started to worry. In March 2012, **Kocherlakota** (Minneapolis) expressed the minority view that it was time to start worrying about inflation picking up again. *"Indeed, my own outlook, like President George's, is that our accommodative policy will lead average PCE inflation to rise above 2 percent over the next two years. I'm less sanguine than she is that inflation will stabilize at that level, because that depends on policy choices, and we would have to make choices to make that happen."*

In the same meeting, others acknowledged this risk but also expressed concerns about a downside risk. Yellen said *"I'm concerned that we could be misled yet again by hopeful signs early in the year followed by tepid growth later, and that a premature move toward policy firming could end up driving inflation further below our objective and retard what is already a long-delayed return to maximum employment."*. The asymmetry in the ease of policy addressing the two risks was recognized, e.g., by Raskin (Board): *"How do we balance these risks? As Governor Yellen mentioned, I think there's an asymmetric nature to the upside and downside risks. We know what to do if inflation threatens to move persistently above target."*.

In August 2012, the debate concerned additional monetary stimulus. As **Powell** (Board) argued: *"On the list of potential costs, I would include inflation, the difficulty of exit, the risk of creating expectations we can't meet, the prospect of capital losses, market function, and the grab bag of stability issues."* Though others, such as **Tarullo** (Board), dismissed those concerns: *"As I've listened, not just today but over the course of the last couple of years, I think I hear three kinds of costs that people are concerned, rightly, about: inflation, market functioning, and credibility of us as a central bank. On inflation, with all due respect to those who have made the argument, I must say that I do find the arguments a little conclusory. That is, the specter of runaway inflation sometime out in the indefinite future, as I've heard it, doesn't seem to me backed by an enormous amount of linear analysis that gets us from here to there and where are the real problems. And I have to say, I've tested this proposition on a fairly wide variety of non-Fed — mostly, but not exclusively, academic — economists, and even those who are on the hawkish side tend to be not too concerned about that particular prospect. They are more concerned about the other two things."*

Our analysis in this paper ends in 2015. By October 2014, the FOMC's concern started to shift to bring inflation back up to the 2% target, which ultimately resulted in the Fed's adoption of the new flexible average inflation targeting (FAIT) framework in 2020. Over this period, and during the initial Covid-19 pandemic recovery through 2021, the Fed's considerations were tilted toward inflation undershooting the 2% target. With the rapid inflation surge, however, and the Fed's pivot in 2022, risk management focused on the upper inflation tails, as we study in this paper, has regained new relevance in recent years.