

Policymakers' Uncertainty

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Presented by:

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Personal Motivation

- Background
 - Currently: Fixed Income Trader/Market Maker @ Santander
 - Previously: Quantitative Portfolio Manager, Risk Manager
- Why this paper? Better understand Fed microstructure

Overview – Intro

- “The researchers used a Natural Language Processing (NLP) model that allowed them to cluster close-meaning words used by FOMC members and investigated how terms signifying “uncertainty” about economic outcomes, inflation and real growth, were correlated with policy decisions.”
- Paper on NLP, not trading/portfolio management



[How Uncertainty May Affect the Federal Reserve's Interest Rate Decisions | Duke's Fuqua School of Business](#)

Overview – Conclusions

- The FOMC members' uncertainty about inflation strongly predicts a more hawkish policy stance that is not explained either by the internal Fed's forecasts or by the measures of public uncertainty.
- In contrast, policymakers' uncertainty about growth has no impact on policy decisions beyond these standard controls.
- The desire to maintain inflation credibility is an important driver of the FOMC's decisions.

Sections

- I: Introduction
- II: Uncertainty and Optimal Monetary Policy
- III: Measuring Policymakers' Uncertainty and Policy Stance with Text
- IV: (How) Does Uncertainty Affect Policy Stance
- V: The Role of Credibility in Policymaking
- VI: Conclusion

S1: Introduction

- Two broad types of uncertainty that impact policy:
 - 1. “Fed-driven uncertainty”: uncertainty about the variables that the Fed targets, such as output and inflation, that is induced by the policy choice itself.
 - 2. uncertainty inherent in the economy or financial markets, but importantly, it is not affected directly by the policy choice.
- Three kinds of measures to describe the policymaking process
 - 1. We generate textual measures of FOMC policymakers’ perceived uncertainty (PMU, for short) distinguishing uncertainty about inflation and real economy (as well as financial markets)
 - 2. We construct measures of FOMC members’ sentiment capturing their directional views on the real economy and inflation.
 - 3. We develop a new textual measure of the policy stance based on the balance of hawkish and dovish language—the hawk-dove score—of the FOMC members.

S1: Introduction

- With minor exceptions, the meetings during our sample are comprised of two key monetary policy rounds, each serving different objectives. In the first round, which we refer to as the economy round, policymakers discuss the economic and financial market developments and the baseline outlook. This step lays the foundation for the second round—the policy round—which contains discussions about the appropriate policy choice and during which the policy decision takes place.

S2: Uncertainty and Optimal Monetary Policy

- *We lay out the different theoretical channels proposed in the literature through which uncertainty can affect monetary policy and illustrate the effects of uncertainty on policy in a simple framework.*

To clarify the impact that uncertainty can have on monetary policy choices, we introduce a simple static framework capturing the decision problem of the policymaker. Assume that the policymaker has a standard quadratic loss function over deviations of inflation from target and the output gap:

$$L(\pi, y) = (\tilde{\pi}_i)^2 + \lambda (\tilde{y}_i)^2, \quad (1)$$

where $\tilde{\pi}_i = \pi_i - \pi^*$, $\tilde{y}_i = y_i - y^*$, π^* is the inflation target and y^* is the medium-term potential output. The subscript i indicates that economic outcomes depend on the policy.

As is standard in these environments, decisions depend on minimizing expected losses. Let $\bar{L}_i$ be the expected loss from choosing r_i . The decision to tighten monetary policy follows if $\bar{L}_1 < \bar{L}_0$ which is given by:⁵

$$\bar{L}_1 < \bar{L}_0 : \delta\bar{\pi}_0 + \lambda\phi\bar{y}_0 > \frac{\delta^2 + \lambda\phi^2}{2} + \frac{\overbrace{(\sigma_{\pi,1}^2 - \sigma_{\pi,0}^2)}^{\equiv \Delta\sigma_{\pi,1}^2} + \lambda \overbrace{(\sigma_{y,1}^2 - \sigma_{y,0}^2)}^{\equiv \Delta\sigma_{y,1}^2}}{2} \quad (2)$$

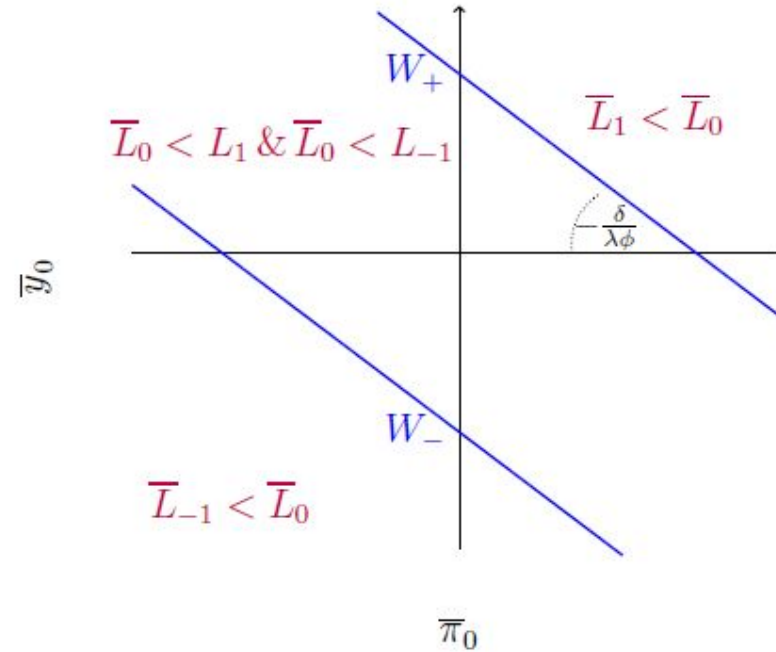


Figure 1. No Fed-driven uncertainty. This figure presents the decision boundaries for a policymaker when the mean forecast is $\bar{\pi}_0$ and $\bar{y}_0$. The figure is drawn for $\Delta\sigma_{\pi,i}^2 = \Delta\sigma_{y,i}^2 = 0$.

Figure 1 depicts the decision rule for both tightening and loosening using indifference curves. The slope of the decision boundary is determined by the relative sensitivity of output and inflation to the alternative interest rate, as well as the weight λ that the policymaker attaches to output.⁶ The curves trace out combinations of mean inflation and output for which $\Delta\sigma_{\pi,1}^2$, $\Delta\sigma_{y,1}^2$, $\Delta\sigma_{\pi,-1}^2$, and $\Delta\sigma_{y,-1}^2$ are all zero. Points to the northeast of the upper line (intercept is $W_+ \equiv \frac{\delta^2 + \lambda\phi^2}{2}$) represent combinations of inflation and output deviations under the baseline such that the policymaker will choose r_1 . Points to the southwest of the lower line (intercept is $W_- \equiv -\frac{\delta^2 + \lambda\phi^2}{2}$) indicate where the policymaker will choose r_{-1} .

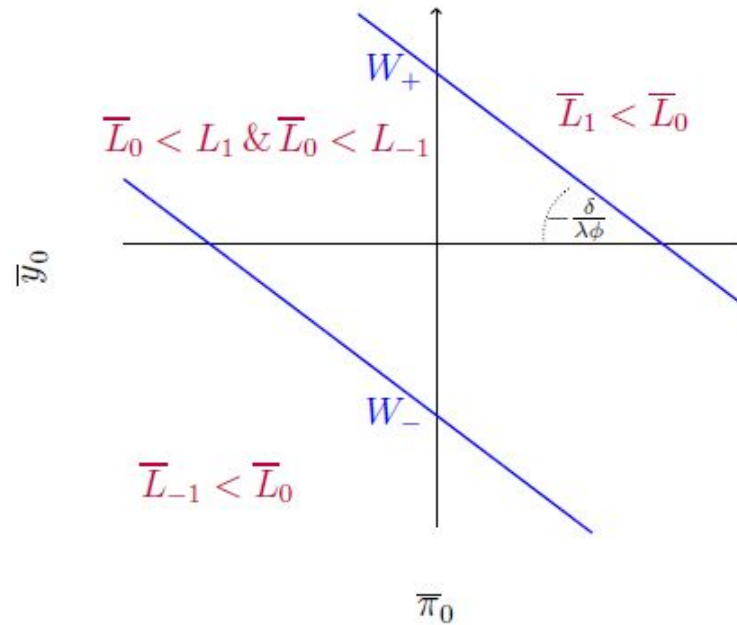
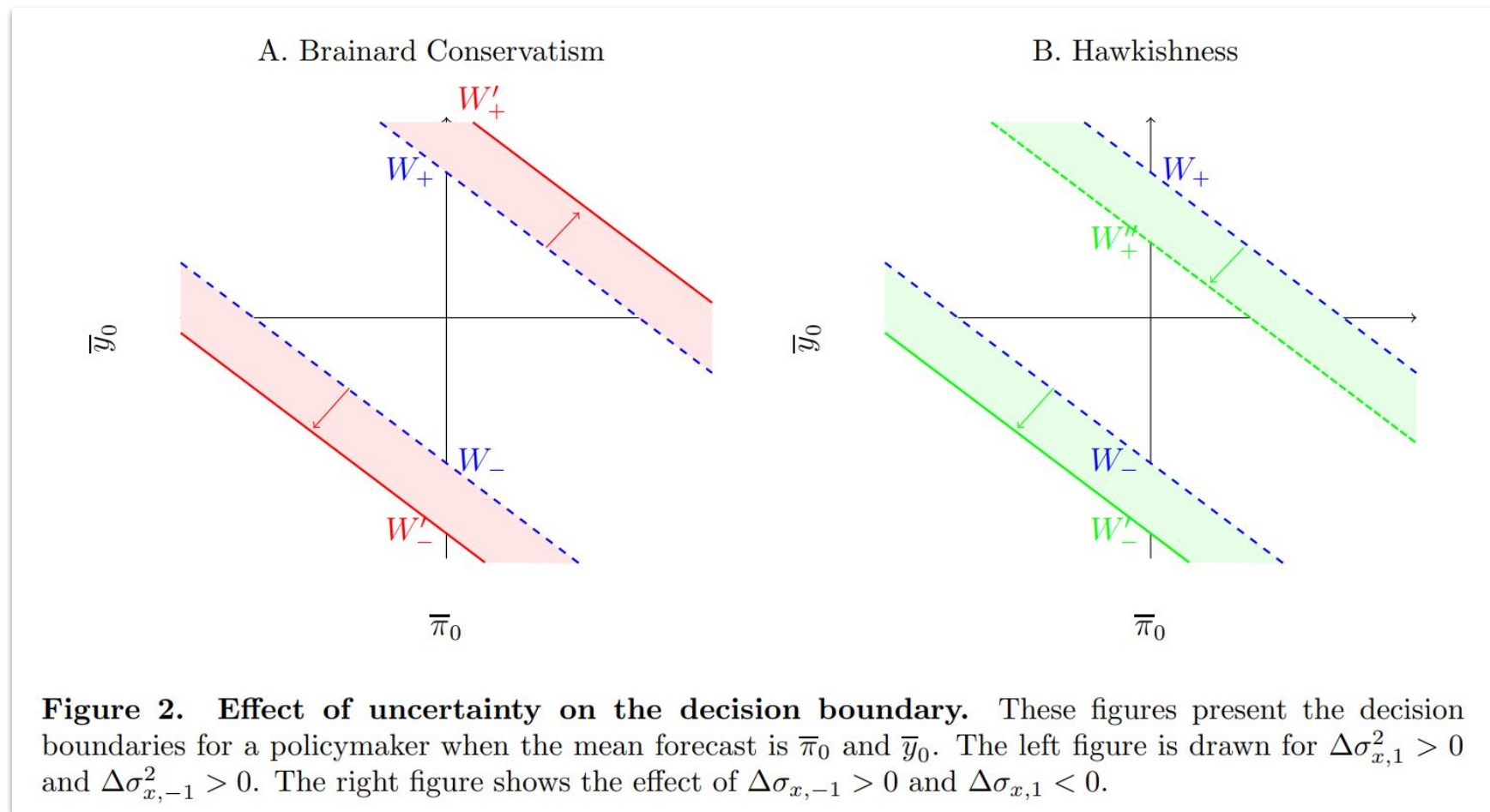


Figure 1. No Fed-driven uncertainty. This figure presents the decision boundaries for a policymaker when the mean forecast is $\bar{\pi}_0$ and $\bar{y}_0$. The figure is drawn for $\Delta\sigma_{\pi,i}^2 = \Delta\sigma_{y,i}^2 = 0$.



- Brainard (1967): The famous result is that optimal policy should be less aggressive relative to policy pursued under certainty—a result known as the Brainard conservatism principle.

S3: Measuring Policymakers' Uncertainty and Policy Stance with Text

- *We discuss our empirical strategy, the measurement of policymakers' uncertainty via the PMU indices, sentiment and policy stance from FOMC transcripts.*
- Since FOMC members' views on uncertainty are not recorded in structured surveys over our whole sample period, we instead approximate them using the text of FOMC meeting transcripts.
- The sample period we consider consists of the 228 meetings from August 1987 (the first meeting of Alan Greenspan's chairmanship) through December 2015 (the last meeting for which a transcript was available at the time of data processing)

- Regular FOMC meetings occur eight times per year, with occasional special meetings convened via conference call during times of macroeconomic turbulence. Since the format of these calls is somewhat irregular, we only consider regular meetings in our analysis.
- The typical composition of the FOMC consists of 19 members, of which twelve are regional Fed Presidents and seven are Governors. During our sample, a total of 75 unique FOMC members appear in the transcripts in at least one meeting.

- While uncertainty language might appear in the policy round in discussion of economic conditions related to policy stance, it also reflects other factors such as hesitance about the correct policy stance, or how to communicate uncertainty to the public. In practice, separating out these distinct forms of uncertainty is a formidable challenge and, for this reason, we do not use uncertainty language in the policy round to measure uncertainty about economic conditions.
- We begin with the four base terms 'uncertain', 'uncertainty', 'risk', and 'risks'. We then use a word embedding model—specifically the Continuous Bag-of-Words model (Mikolov et al., 2013)—applied to FOMC transcripts to generate an expanded set of terms.

risk			risks			uncertain			uncertainty		
Term	Similarity	Count in Econ Discussion	Term	Similarity	Count in Econ Discus	Term	Similarity	Count in Econ Discussion	Term	Similarity	Count in Econ Discussion
risks	0.691266	3183	downside risk*	0.737511	1118	!onfident	0.460385	367	uncertainties	0.65845	505
downside risk*	0.59828	1118	upside risk*	0.704978	585	fragile	0.455998	157	anxiety	0.515023	70
threat	0.594511	135	risk	0.691266	3236	!sanguine	0.442406	101	angst	0.433309	24
upside risk*	0.522107	585	threat	0.52743	135	murky	0.43732	24	skepticism	0.430759	68
danger	0.502593	121	skewed	0.501801	101	unclear	0.436552	57	tension	0.427094	101
probability	0.484233	524	uncertainties	0.48339	505	wary	0.428437	41	uncertain	0.426752	399
possibility	0.475492	1010	downside	0.449301	707	uncertainty	0.426752	2317	caution	0.423748	445
likelihood	0.469565	224	tilted	0.448698	119	unsure	0.423955	14	downside risk*	0.418226	1118
vulnerability	0.439843	72	danger	0.445836	121	poor	0.411094	194	challenges	0.414084	174
dangers	0.406005	28	dangers	0.439822	28	dependent	0.406995	119	pessimism	0.411988	179
headwind	0.402709	38	fatter	0.434411	14	apprehensive	0.404002	11	fragility	0.401378	106
chances	0.386979	65	outcomes	0.420205	291	vulnerable	0.401095	203	gloom	0.380074	65
fragility	0.374305	106	probability	0.412639	524	stressed	0.397458	53	conflict	0.370107	47
risktaking	0.373512	50	skew	0.40086	29	challenging	0.391555	71	risks	0.362784	3183
challenges	0.348706	174	challenges	0.395508	174	bullish	0.38583	65	volatility	0.359692	360
prospect	0.347213	242	junction	0.393311	114	bleak	0.385454	52	concerns	0.359599	628
unwelcome	0.345361	42	modal	0.391584	131	skeptical	0.384238	169	!clarity	0.352539	89
sensitivity	0.343196	82	headwinds	0.385167	288	attuned	0.383523	15	sensitivity	0.348326	82
probabilities	0.342825	87	vulnerabilities	0.378889	59	uncertainties	0.383365	505	unease	0.347682	25
breakout	0.34249	39	probabilities	0.375555	87	vigilant	0.382641	55	publicity	0.346734	31
uncertainty	0.341431	2317	concerns	0.374206	628	cautious	0.378045	537	fog	0.343423	20
consequences	0.339106	367	breakout	0.372844	39	grim	0.376893	34	headwinds	0.341591	288
concern* that	0.33652	678	possibilities	0.369255	98	jury	0.376789	20	risk	0.341431	3236
odds	0.332704	190	uncertainty	0.362784	2317	agnostic	0.375537	31	surrounding	0.340727	163
fatter	0.331849	14	vulnerability	0.355743	72	!optimistic	0.372549	1249	worries	0.337692	132
concern	0.326579	1047	directive	0.355738	29	muted	0.365712	87	!certainty	0.332492	91
potentially	0.322536	275	tensions	0.35208	51	unsettled	0.362423	22	doubts	0.328778	65
concerns	0.318465	628	crosscurrents	0.350524	49	concern* about	0.361507	1634	concern	0.327687	1047
tension	0.313301	101	odds	0.343869	190	buoyant	0.360631	70	optimism	0.32465	498
spiral	0.312127	69	threats	0.33815	36	disruptive	0.359961	50	pain	0.323275	31
possibly	0.309975	290	fragility	0.337531	106	depend	0.359918	198	ambiguity	0.322258	18
eastly	0.309472	63	symmetrie	0.336238	57	skittish	0.35904	18	error	0.320998	234
challenge	0.307298	179	asymmetry	0.333936	25	jittery	0.358658	11	skittishness	0.319675	9
urgency	0.303853	28	skews	0.33296	14	precarious	0.357391	22	nervousness	0.319648	31
instability	0.303578	91	urgency	0.3309	28	fog	0.357145	20	unknown	0.316516	32
unease	0.303215	25	skewness	0.330203	7	fluid	0.357016	12	tensions	0.314929	51
vulnerabilities	0.302247	59	tension	0.325514	101	!onvinced	0.354622	173	imponderables	0.314825	10
fear	0.299544	194	headwind	0.323167	38	pessimistic	0.354016	430	upside risk*	0.313048	585
skewness	0.298903	7	vigilant	0.319233	55	!upbeat	0.352921	217	debate	0.312722	168
trap	0.297911	58	drags	0.31894	75	destabilizing	0.35242	22	awareness	0.312388	26
overshoot	0.296446	53	eastpush	0.318601	4	precise	0.352262	81	uncertaintyin	0.310427	3
problem	0.295296	1221	possibility	0.318443	1010	uncomfortable	0.348358	102	disagreement	0.304366	57
skew	0.29475	29	balanced	0.317706	646	assessing	0.345848	110	admits	0.302832	3
worries	0.294228	132	tails	0.31724	28	damaging	0.342869	39	science	0.29633	31
threats	0.294017	36	challenge	0.316888	179	satisfactory	0.339921	66	apprehension	0.292553	16
repercussions	0.289451	23	likelihood	0.315145	224	anxious	0.33839	40	headwind	0.290777	38
skewed	0.287008	101	imponderables	0.31498	10	worried	0.337316	410	instability	0.290598	91
volatility	0.284335	360	considerations	0.311688	184	ambiguous	0.335987	32	troubles	0.288294	35
doubts	0.283668	65	consequences	0.306922	367	problematic	0.33498	78	questions	0.288182	698
junction	0.283524	114	leaning	0.305052	38	daunting	0.332674	19	worry	0.286513	402

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

- Example of Inflation topic.

[illegible][illegible]

Figure 3. 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. Full details of the construction are in appendix B.

A. Summary statistics for PMU indices						
	Mean(%)	Median(%)	St.dev.(%)	P10(%)	P90(%)	AR(1)
$InfPMU_t$	0.302	0.276	0.153	0.131	0.529	0.550
$EcoPMU_t$	0.388	0.386	0.138	0.226	0.566	0.463
$MktPMU_t$	0.222	0.180	0.149	0.071	0.426	0.571
$ModPMU_t$	0.066	0.061	0.044	0.018	0.119	0.107

B. Correlations of topic-specific PMU indices			
	$InfPMU$	$EcoPMU$	$MktPMU$
$EcoPMU$	0.0735		
$MktPMU$	0.1218	0.3754	
$ModPMU$	0.2218	0.1131	0.0957

Table A-12. 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. Panel A expresses the summary statistics for PMU in percentages (e.g., the number 0.302 for the mean inflation PMU implies that on average uncertainty-related mentions constitute 0.302% of all words in the economy round). Column “AR(1)” reports the first order autoregressive coefficient (at the meeting frequency). Panel B reports the pairwise correlations between topic-specific PMU indices.

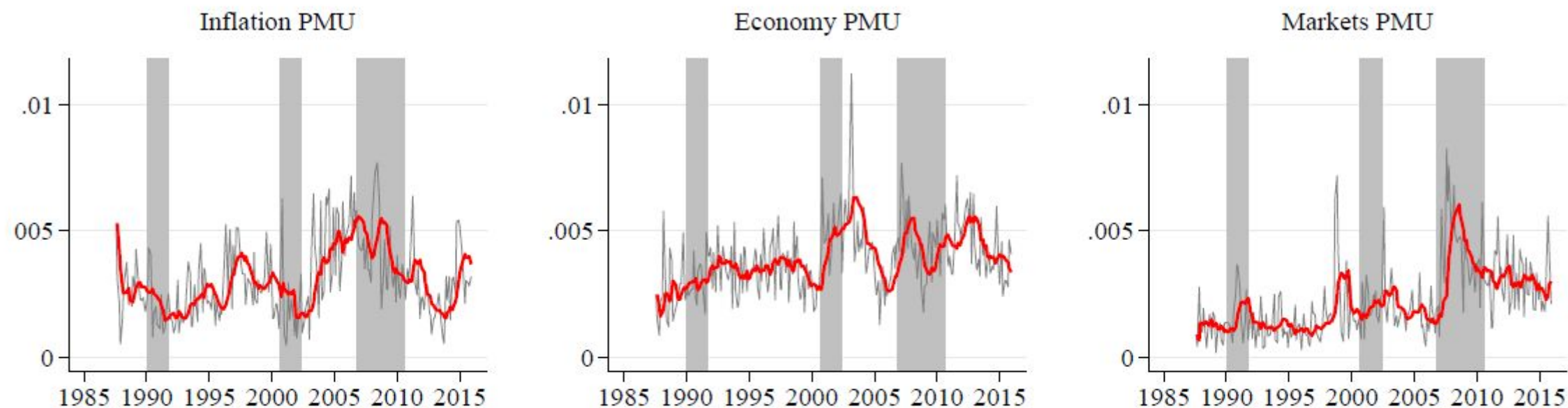


Figure 4. Topic-specific PMU Time Series. This figure displays the time series of the topic-specific PMU measures during the sample period 1987:08–2015:12. The grey curves represent the raw time series. The red curves are moving averages over the last eight meetings. The y-axis is expressed as the fraction of total economy round words contained in topic- k uncertainty sentences. Recessionary periods are shaded.

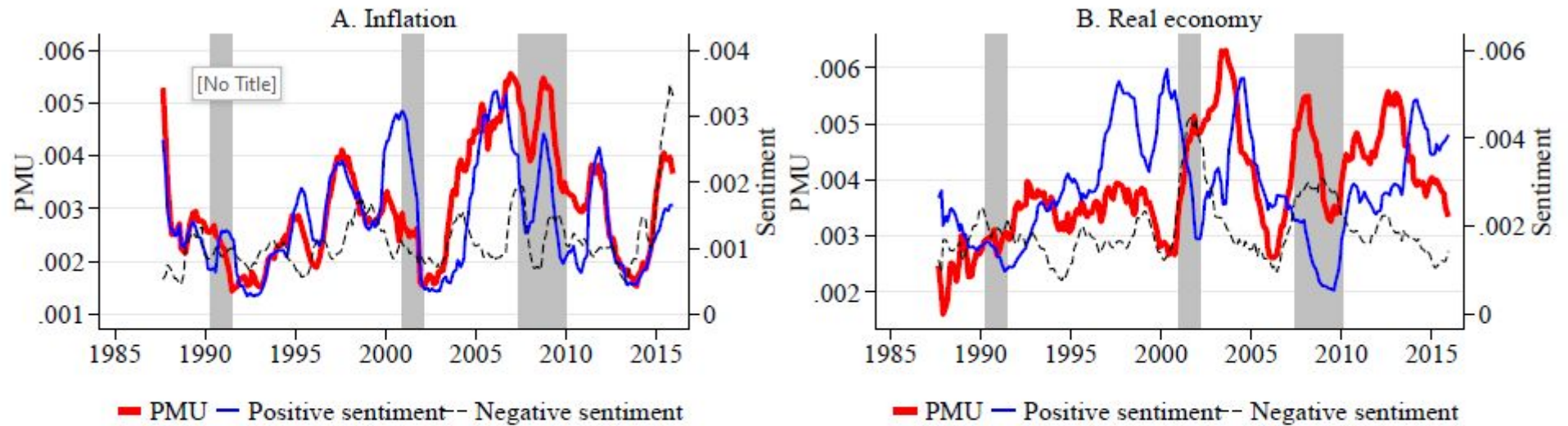


Figure 5. PMU and Sentiment This figure presents inflation and economy PMU indices superimposed against negative and positive sentiment. Positive (negative) sentiment indicates views of rising (declining) inflation or output. All text-based series are smoothed averages over the last eight FOMC meetings.

- Importantly, to avoid a mechanical relationship between PMU and sentiment, in sentiment construction we exclude all sentences that we use to obtain the PMU indices.

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 (0.62)	-0.038 (-0.48)	-0.042 (-0.38)	0.011 (0.08)	-0.107 (-0.69)	-0.070 (-0.42)	0.038 (0.27)	0.044 (0.45)
$InfNeg_t$	-0.260*** (-3.49)	-0.164* (-1.87)	0.012 (0.18)	0.093 (1.30)	0.086 (1.04)	0.010 (0.17)	-0.058 (-0.98)	-0.025 (-0.39)
$InfPos_t$	0.173*** (3.81)	0.144*** (2.67)	0.025 (0.38)	-0.131 (-1.32)	-0.100 (-0.97)	-0.120 (-1.42)	-0.169* (-1.80)	-0.138 (-1.47)
$\bar{F}_t(\pi)$	0.560*** (8.46)	0.457*** (6.91)	0.378*** (4.30)	0.351*** (3.39)	0.319*** (2.82)	0.321*** (2.90)	0.337*** (3.73)	0.335*** (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 (-1.60)	-0.058 (-1.15)	0.032 (0.69)	0.069 (1.03)	0.029 (0.36)	-0.001 (-0.02)	0.087 (1.01)	0.113 (1.23)
$EcoNeg_t$	-0.150*** (-2.92)	-0.163** (-2.40)	-0.220*** (-2.65)	-0.275*** (-3.00)	-0.313*** (-4.29)	-0.226** (-2.28)	-0.238** (-2.05)	-0.237** (-2.32)
$EcoPos_t$	0.116** (2.39)	0.127** (2.17)	0.147** (2.07)	0.149* (1.68)	0.151* (1.72)	0.193** (2.25)	0.203** (2.30)	0.190** (2.14)
$\bar{F}_t(g)$	0.623*** (7.20)	0.553*** (5.78)	0.401*** (5.03)	0.287*** (3.20)	0.227** (2.12)	0.174 (1.31)	0.112 (0.80)	0.075 (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 I. Predicting macro variables with textual measures of uncertainty and sentiment. The table reports predictive regressions of inflation and real GDP growth by textual PMU and sentiment indices derived from the economy round of the FOMC meeting transcripts. The regressions are 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 make sure that the timing of the depend variable is consistent with the timing of the meetings, we use Greenbook nowcasts at future meetings as the dependent variable. The regression is $F_{t+h}(\pi_0) = \beta_0 + \beta_1 InfPMU_t + \beta_2 InfPos_t + \beta_3 InfNeg_t + \beta_4 \bar{F}_t(\pi) + \varepsilon_{t+h}$, where $F_{t+h}(\pi_0)$ is the CPI inflation nowcast at meeting $t+h$, and $\bar{F}_t(\pi)$ is the average forecast (across horizons) given at meeting t . We estimate analogous regressions for the 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.

III.C. Measuring policy stance

To assess the FOMC's policy stance in each meeting, we measure the frequency of occurrence of language indicating hawkishness and dovishness, scaled by the overall length (number of words) of the policy round. We exclude statements made by the staff in the policy round to focus on the FOMC member's policy views. Our classification of hawkish and dovish language takes into consideration both conventional policy as well as the unconventional tools during the zero-lower-bound period. This allows us to obtain a consistent measure

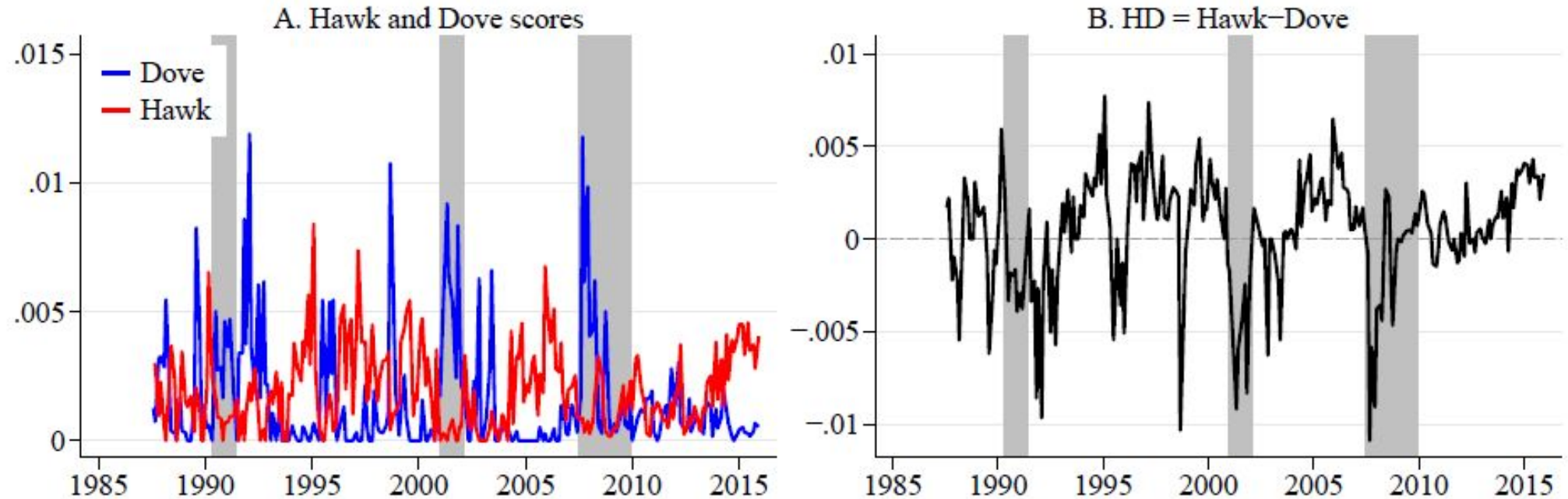


Figure 6. Textual measures of policy stance. The figure presents textual measures of policy preferences derived from the statements of FOMC members during the policy round of the FOMC meetings.

B.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 $Hawk'_t$ to be the count of terms in {tight*, hike*, increas*, hawkish, taper, liftoff} in policy sentences; and $Dove'_t$ 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.

B.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.

B.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

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

and $Dove_t$ is defined analogously.

A. FFR target changes and Romer-Romer shocks

	(1) HD_t	(2) ΔFFR_t	(3) ΔFFR_t	(4) ΔFFR_t	(5) RR_t	(6) RR_t
HD_t			0.497*** (6.83)	0.334*** (5.30)	0.506*** (4.95)	0.601*** (5.04)
$F_t(\pi_4)$	0.613*** (3.64)	0.684*** (3.79)		0.523*** (2.97)		0.115 (0.73)
$F_t(g_0)$	0.382*** (2.99)	0.546*** (6.60)		0.456*** (5.75)		-0.085 (-1.14)
τ_t	-0.695*** (-3.81)	-0.374*** (-3.30)		-0.226** (-2.06)		0.043 (0.26)
$FR_t(\pi_3)$	0.073 (1.43)	0.051 (0.86)		0.022 (0.39)		0.088 (1.30)
$FR_t(g_1)$	0.152*** (2.79)	0.136** (2.30)		0.092 (1.32)		-0.168** (-2.55)
$L.FFR_t$		0.587 (1.14)	1.766*** (3.18)	-0.091 (-0.15)		
$L2.FFR_t$		-0.875* (-1.84)	-1.801*** (-3.40)	-0.159 (-0.29)		
$\bar{R}^2$	0.29	0.52	0.45	0.59	0.25	0.30
N	227	169	169	169	163	163

B. Market-based measures of monetary policy surprises

	(1) GSS target	(2) GSS path	(3) GK MP0	(4) GK ED12m	(5) NS news
HD_t	0.169 (1.33)	0.178*** (2.74)	0.382*** (4.00)	0.409*** (4.92)	0.290** (2.33)
R^2	0.028	0.032	0.15	0.17	0.084
N	196	196	190	199	154

To validate HD_t as a measure of policy stance, we analyze its relationship with common proxies in the literature: deviations of the policy rate from a Taylor rule and high-frequency monetary policy surprises obtained from changes in market interest rates around FOMC announcements. The results of the regressions, all of which are estimated at meeting frequency, are in Table II.

²⁹Following Coibion and Gorodnichenko (2012), as Greenbook controls, we use longer-term CPI inflation forecasts (four quarters ahead, $F_t(\pi_4)$), and current quarter real GDP growth forecast (nowcast, $F_t(g_0)$). 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. The trend inflation variable τ_t is constructed as the discounted moving average of past core inflation following Cieslak and Povala (2015). Including trend inflation allows the regression to capture the effect of deviations of expected inflation from the target on the policy rate.

Table II. Validity of textual measures of policy stance. The table reports regressions of various measures of monetary policy stance on the textual HD score derived from the policy round of the FOMC meeting transcripts. Panel A reports regressions of changes in the FFR target and Romer-Romer shocks on the HD variable, with and without Greenbook controls (forecasts $F_t(\cdot)$ and forecast updates $FR_t(\cdot)$). The τ_t variable controls for the perceived inflation target. The sample period is 1987:08–2015:12 in column (1); 1987:08–2008:12 in columns (2)–(4), i.e., excluding the zero-lower bound episode, and 1987:08–2007:12 in columns (5)–(6), when Romer-Romer shocks are available from Ramey (2016). HAC t-statistics with eight lags are reported in parentheses. Panel B reports regressions of monetary policy surprises on the HD variable. Columns (1) and (2) contain high-frequency target and path surprises following the approach of Gürkaynak et al. (2005) as updated by Swanson (2018) (1991:07–2015:10 sample). Columns (3) and (4) use shocks from Gertler and Karadi (2015) obtained from the current month fed fund futures (MP0, sample 1988:11–2012:06) and 12-month ahead Eurodollar futures (ED12m, sample 1987:08–2012:06). Column (5) is based on surprises from Nakamura and Steinsson (2018) (sample 1995:02–2014:03). Robust t-statistics are reported in parentheses. All regressions are estimated at the frequency of FOMC meetings. The coefficients are standardized.

One motivation for gauging policy stance from text is that such measure is likely to reflect broader forward-looking views on policy, as opposed to just the contemporaneous action. To evaluate this property, in Table III we use HD_t to forecast the future path of policy rates. The HD_t variable remains a significant predictor of FFR target changes up to eight meetings ahead, controlling for the meeting- t Greenbook forecasts. Figure A-2 plots the time series of HD_t against the policy rate, showing that fluctuations in HD_t generally lead policy rate movements.

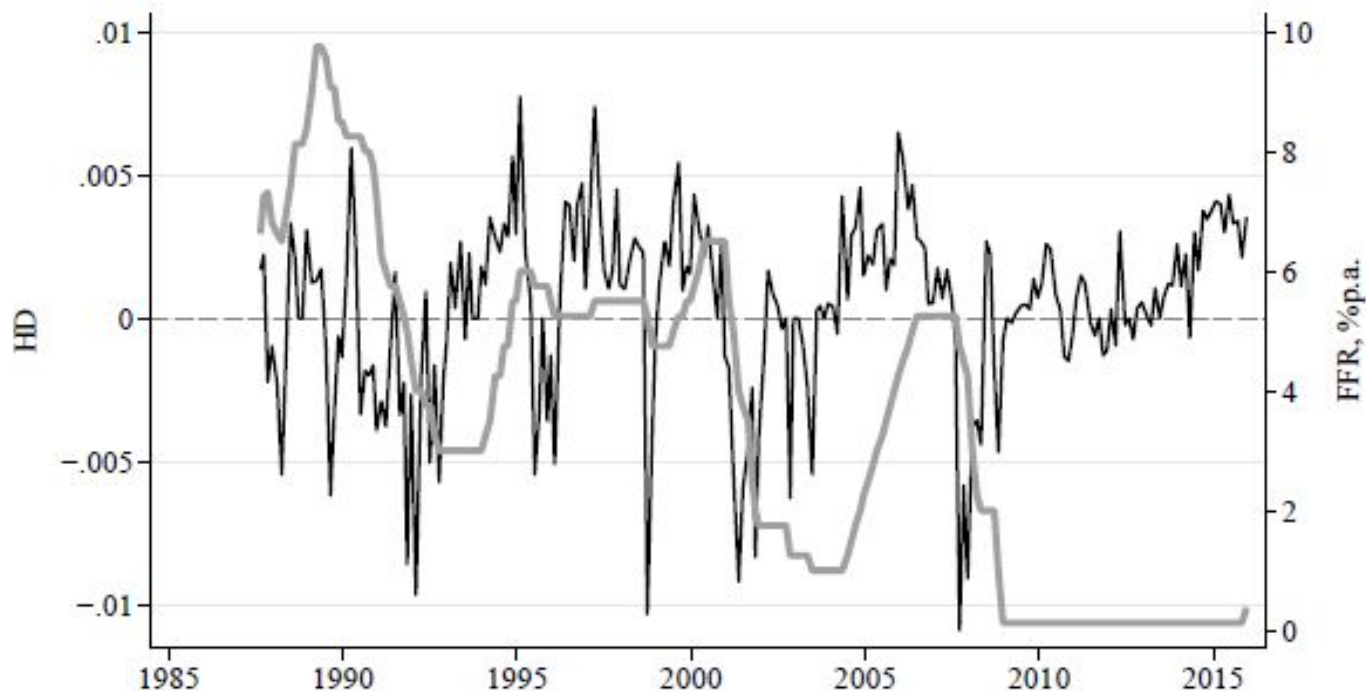


Figure A-2. Hawk-dove policy score and FFR target. The figure superimposes the hawk-dove score HD constructed for FOMC members in the policy round of the meeting against the FFR target.

Dependent variable: Change in FFR target over subsequent h meetings, $\Delta FFR_{t+h,t} = FFR_{t+h} - FFR_t$

	(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	0.080*** (3.29)	0.12*** (2.71)	0.20*** (2.75)	0.25*** (2.83)	0.25*** (2.71)	0.23** (2.36)	0.21* (1.88)	0.23* (1.83)
GB controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$\bar{R}^2$	0.45	0.48	0.48	0.48	0.50	0.51	0.53	0.53
$\Delta \bar{R}^2$	0.039	0.028	0.039	0.036	0.024	0.012	0.0068	0.0064
N	162	162	162	162	162	162	162	162

Table III. Validity of textual measures of policy stance. The table reports predictive regressions of changes in the FFR target rate over h meetings ahead by the textual measure of policy stance HD . The regressions are estimated at the frequency of FOMC meetings, controlling for Greenbook forecasts, trend inflation τ_t and two lags (t and $t - 1$) of the FFR target (the same controls as in Table II). All explanatory variables (except the lagged FFR target) are measured as of meeting t . The dependent variables (future changes in the FFR target) span the horizon from the next meeting up to eight meetings ahead. The maximum sample (for the eight-meetings-ahead forecast) uses data over the 1987:08–2008:12 period. The HD variable is standardized, FFR is expressed in percent. HAC standard errors to account for overlapping data are reported in parentheses.

S4: (How) Does Uncertainty Affect Policy Stance

- *We analyze the effect of uncertainty on policy stance.*
- The financial markets-based measures are themselves insignificant, echoing Cieslak and Vissing-Jorgensen (2021) that the Fed reacts to financial markets only to the extent that they affect the Fed's beliefs about the real economy.
- We find that InfPMU is correlated with the absolute value of past inflation forecast errors in the Greenbook, but not by the directional errors.

Dependent variable: HD_t policy stance score							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$InfPMU_t$	0.341*** (3.39)		0.281*** (3.89)	0.291*** (4.06)	0.177*** (2.79)	0.183*** (2.80)	0.159** (2.32)
$EcoPMU_t$	-0.238*** (-3.97)		-0.151*** (-3.10)	-0.128** (-2.37)	-0.124* (-1.69)	-0.116 (-1.50)	-0.105 (-1.46)
$MktPMU_t$				-0.069 (-0.70)			-0.120 (-1.19)
$InfSent_t$		0.204** (2.54)	0.085 (1.17)	0.081 (1.08)	0.066 (1.16)	0.088 (1.52)	0.063 (1.07)
$EcoSent_t$		0.498*** (5.71)	0.471*** (5.91)	0.436*** (5.60)	0.392*** (4.38)	0.374*** (3.62)	0.347*** (3.91)
$MktSent_t$				0.048 (0.66)			0.038 (0.54)
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
$\bar{R}^2$	0.15	0.30	0.38	0.38	0.43	0.44	0.45
N	227	227	227	227	227	227	227

Table IV. Predicting policy stance with PMU at the meeting-level. The table reports regressions of the policy stance score HD on topic-specific PMU indices. The controls include textual sentiment measures, GB forecasts, and proxies for public perceived uncertainty. 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 staff and FOMC members in the economy round of the meeting. All regressions are estimated at the frequency of FOMC meetings. The coefficients are standardized. HAC t-statistics with eight lags are reported in parentheses. The sample period is 1987:08–2015:12.

Dependent variable: Meeting-level HD_t policy stance score			
	(1)	(2)	(3)
$InfPMU_t$ (FOMC)	0.180*** (2.84)		0.183*** (3.18)
$EcoPMU_t$ (FOMC)	-0.093 (-1.48)		-0.087 (-1.36)
$InfPMU_t$ (Staff)		0.109* (1.81)	0.011 (0.23)
$EcoPMU_t$ (Staff)		-0.137* (-1.93)	-0.038 (-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 V. 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.

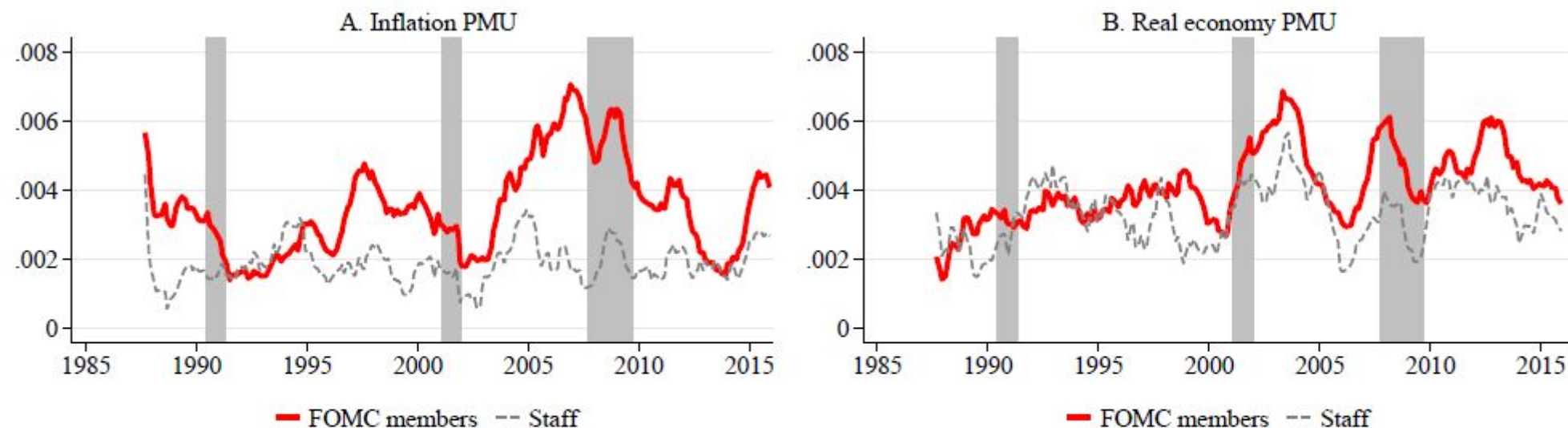


Figure 7. PMU of FOMC members vs. staff. This figure presents inflation and economy PMU indices constructed separately for FOMC members and the staff. Each uncertainty index is scaled relative to the overall length of the statements made by FOMC members or staff, respectively, in the economy round of the meeting. The series are smoothed averages over the last eight FOMC meetings.

- The entire effect of inflation PMU on policy stance stems from the views of the FOMC members and not the staff. If inflation credibility concerns are indeed an important driver of policy, we would expect them to primarily affect the uncertainty perceived by the actual decision makers, and less so the views of the staff.

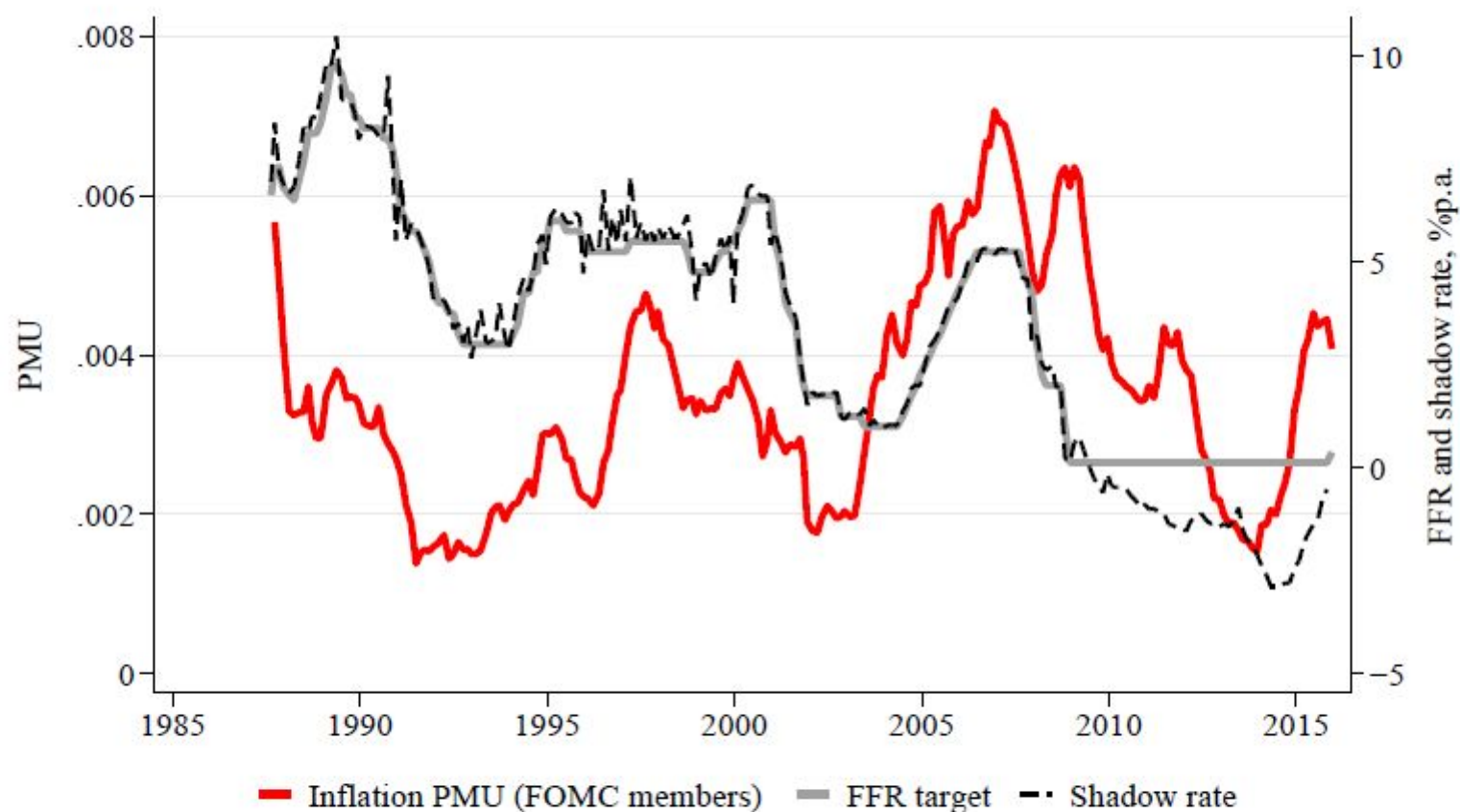


Figure 9. Inflation PMU and policy rate. The figure superimposes the inflation PMU of FOMC members measured in the economy round of the meeting against the policy rate: FFR target and the shadow rate from Wu and Xia (2016). The PMU is smoothed over eight meetings.

Dependent variable: Individual meeting-level HD_{it} policy stance score						
	(1)	(2)	(3)	(4)	(5)	(6)
$InfPMU_{it}$ (ind)	0.12*** (2.86)	0.12*** (2.82)	0.00014 (0.00)	-0.011 (-0.30)	0.11** (2.62)	-0.0097 (-0.25)
$EcoPMU_{it}$ (ind)	-0.074 (-1.65)	-0.058 (-1.43)	0.018 (0.45)	0.012 (0.30)	-0.041 (-1.03)	0.011 (0.29)
$InfPMU_t$ (agg)			0.93*** (4.97)			
$EcoPMU_t$ (agg)			-0.74*** (-3.63)			
$MktPMU_{it}$ (ind)					-0.16*** (-2.70)	0.011 (0.25)
$ModPMU_{it}$ (ind)					-0.071 (-0.64)	-0.15 (-1.38)
$OthPMU_{it}$ (ind)					-0.19*** (-4.20)	-0.11** (-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 VI. Uncertainty of FOMC members: individual-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.

S5: The Role of Credibility in Policymaking

- *We relate these findings to the narrative evidence on policymakers' concern with credibility.*
- Credibility allows the FOMC to better manage economic expectations, as “achieving through word and deed” well-anchored inflation expectations can lead to better policy outcomes (Bernanke, 2022).
- Carvalho et al. (2022) and G´ati (2022) find that optimal policy responds aggressively to movements in the long-run inflation expectations. Our findings suggest that, over the 1987–2015 sample, the FOMC has been preemptively aggressive to prevent the feared changes in inflation expectations.
- Our findings suggest that policymakers are preemptively aggressive to the feared changes in expectations. As attempted by Powell (2022), monetary policy can endogenously prevent moves in long-run expected inflation by regularly affirming the resolve to fight inflation.

S6: Conclusions

- A higher real-economy and financial markets PMU predict a looser policy stance.
- Given that neither inflation sentiment nor PMU predict future inflation outcomes, policymakers' inflation beliefs in the meeting are an expression of worry that does not materialize in the sample we study.
- By contrast, higher inflation PMU predicts a more hawkish policy stance, and its effect remains robust to controlling for a variety of plausible confounding factors.

Improvements/Next Steps

- Too much analytical work for small practical results
- Transcripts available with 5y delay – how to use the model?
- Seems like authors created elaborated framework and then tried to prove it's meaningful
- Academic proofs