Internet Appendix for:

Policymakers' Uncertainty

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A. 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 A.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 A.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 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.

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

Figure A.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.

B. 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.

B.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. 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 **?** for more background on word embedding models.

Tables A.1 and A.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.[32] As described in the main text, 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 A.1 and A.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:

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.

[32] 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.

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 $ModPMU_t$.

B.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 A.1 or A.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

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

That is, we count the number of times topic-k words are immediately preceded or followed by (word-specific) positive and negative terms.[33] To obtain our final sentiment measure, we scale these counts by the number of total tokens in the economy round.

B.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

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

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.

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

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

and $Dove_t$ is defined analogously.

C. Additional Tables and Figures

C.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 C.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 C.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.

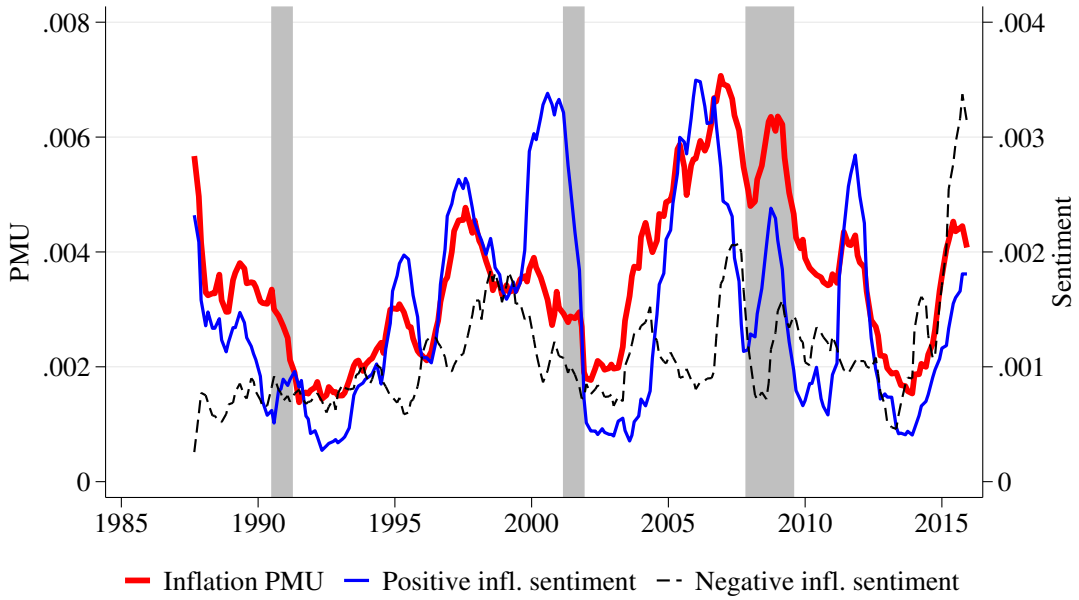

Figure C.2. Inflation PMU and inflation sentiment (FOMC members). The figure presents inflation PMU superimposed against positive and negative inflation sentiment. Positive (negative) sentiment indicates views of rising (declining) inflation. The series are smoothed averages over the last eight FOMC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

D. Proofs for Tail Risks Model

D.1. Proof of Lemma 1

Proof. The expression for expected inflation is immediate from the structure of the distribution described in (7).

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

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

■

D.2. Proof of Proposition 1

Proof. First note that (8), i.e. the equation that implicitly defines optimal policy $\hat{r}_{0,t}$ under fixed tail risks, has a unique solution. $\overline{\Pi}_{t,F}'(r_t)\left[\overline{\Pi}_{t,F}(r_t) - \pi^*\right]$ and $\overline{Y}_t'(r_t)\left[\overline{Y}(r_t) - y^*\right]$ are strictly increasing and continuous in r_t; limit to $-\infty$ as $r_t \to -\infty$; and limit to ∞ as $r_t \to \infty$. These properties jointly imply (8) has a unique solution.

We now show that the optimal policy with policy-dependent tail risks $\hat{r}_{1,t}$ must lie strictly above $\hat{r}_{0,t}$. We first show that (9) has no solution $r_t \leq \hat{r}_{0,t}$. On this range

$$\begin{gathered}\overline{\Pi}_t'(r_t)\left[\overline{\Pi}_t(r_t) - \pi^*\right] + \left(\sigma_{\pi,t}^2\right)'(r_t) = \\ \left[\overline{\Pi}_{t,F}'(r_t) + p'(r_t)\Delta_t\right]\left[\overline{\Pi}_t(r_t) - \pi^*\right] + \left(\sigma_{\pi,t}^2\right)'(r_t) = \\ \left[\overline{\Pi}_{t,F}'(r_t) + p'(r_t)\Delta_t\right]\left[\overline{\pi}_t - a_\pi r_t + p_t(r_t)\Delta - \pi^*\right] + \left(\sigma_{\pi,t}^2\right)'(r_t) < \\ \left[\overline{\Pi}_{t,F}'(r_t) + p'(r_t)\Delta_t\right]\left[\overline{\pi}_t - a_\pi r_t + p_t(r_t)\Delta_t - \pi^*\right] \leq \\ \left[\overline{\Pi}_{t,F}'(r_t) + p'(r_t)\Delta_t\right]\left[\overline{\pi}_t - a_\pi r_t + p_{0,t}\Delta_t - \pi^*\right] < \\ \overline{\Pi}_{t,F}'(r_t)\left[\overline{\pi}_t - a_\pi r_t + p_{0,t}\Delta_t - \pi^*\right] \leq -\lambda\overline{Y}_t'(r_t)\left[\overline{Y}_t(r_t) - y^*\right]\end{gathered}$$

The first two equalities arise from the assumed structure of the model. The first inequality holds because the variance of inflation is strictly decreasing in r_t by Lemma 1. The second holds because $p_t(\hat{r}_{0,t}) = p_{0,t}$ by assumption and so $p_t(r_t) \geq p_{0,t}$ for all $r_t \leq \hat{r}_{0,t}$. The third holds because $\overline{\pi}_t - a_\pi r_t + p_{0,t}\Delta - \pi^* > 0$ and $p'(r_t) < 0$. The final inequality holds due to the properties of the functions in expression (8) discussed above.

On the other hand, a solution to (9) must exist because the LHS (RHS) limits to ∞ ($-\infty$) as $r_t \to \infty$ and to $-\infty$ (∞) as $r_t \to -\infty$. Moreover, both the LHS and RHS are continuous in r_t. But by the above any solution is strictly above $\hat{r}_{0,t}$. ■

E. Narrative Assessment of the Role of Credibility Concerns

As described in the text, this appendix provides a more complete 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 sub-samples: (i) the Mid-1990s, (ii) Post-Y2K recession, (iii) Recovery to GFC, and (iv) Post-GFC Concerns.

The issue also came up during the February 2005 special topic on "Price Objectives for Monetary Policy" there was lots of discussion of whether the Fed should adopt an explicit inflation target and lots of discussion of credibility. For example, Santomero (Philadelphia) emphasised 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."

E.1. Mid-1990s

In the second half of 1996, there were growing fears 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, 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 on-going challenge that "trend growth at the prevailing unemployment rate will ultimately prove to be inconsistent with stable inflation going forward." Broadus (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, these worries has disappated 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 continue for some members into the first half of 1997. McDonough (New York) expresses concerns that he and the NY Fed staff have. Melzer continues 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."

There was only a single 25bps rate increase in March 1997 and these concerns persisted until the demand-dampening effects of the Asian Financial Crisis in 1997, and the LTCM Collapse and Russian Default prompted some cuts in interest rates in late 1998. These concerns prompted monetary easing to calm markets and preemptively offset any negative impulses from the slowing global demand.

The effects were, however, relatively mild and once the economy had weathered the initial effects, thoughts returned to the tight labour markets and the risk of inflation. In March 1999, Broaddus emphasised 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."

This is the reason that he sees it is time to switch out of support mode and begin to signal the Fed's anti-inflation tendency even if only in language and 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, recognised that his fears had not been realised 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-Y2K 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 argues: "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, argues "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* is starting to pick up strongly accompanied by concerns of rising inflation. The discussion centers on shifting balance of risks on inflation. Geithner (NY Fed) says "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." Bernanke (Chair) thinks 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 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 expectationseven after the recent moderation of those expectations will feed through to higher compensation growth." The FOMC duly began a hiking cycle which took rates from 1% to 5.25% in June 2006.

Though over this period inflation remains contained, the concerns about it and the risk to the FOMC's credibility of getting it wrong is regularly expressed. 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 favours signalling 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 members of committee that were optimistic that 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 was 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 langauge 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 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 ("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.", Yellen) and an asymmetry in the ease of policy addressing the two risks ("How do we balance these risks? As Governor Yellen mentioned, I think theres an asymmetric nature to the upside and downside risks.We know what to do if inflation threatens to move persistently above target.", Raskin).

In August 2012, the debate concerns more stimulus. As Powell (Board) argues: "On the list of potential costs, I would include inflation, the difficulty of exit, the risk of creating expectations we cant meet, the prospect of capital losses, market function, and the grab bag of stability issues." Though others, such as Tarullo, dismiss this: "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."[34]

These debates continue as the Fed continues its accommodative stance. And the lack of inflation means that the concers gradually diminish. By October 2014, the FOMC's concern is to bring inflation back up to target.

[34] "And lastly, on credibility, where I depart, I think, a little bit from what some of those who are inclined in my policy direction have said. I don't think I would want us to be saying that we will "do what it takes" because it isn't clear to me ultimately that we can do what it takes to solve the rather substantial economic problems that we face right now. My suggestion would be that we communicate an intention to "do what we can" and that we will continue to do what we can, with the appropriate set of costs and benefits being taken into account at each step of the way. Mr. Chairman, am I missing any wording issues that we're supposed to address here?"