Reputation for Confidence*

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*The views expressed herein are our own and do not necessarily reflect those of the ECB or the Eurosystem.

Motivation: Confidence and Monetary Communication

*"As always, there is no guarantee that statement language will be interpreted as intended. We know that. But communicating as much information as we are fairly **confident** in is desirable."*

- Pres. Patrick Harker, FRB-Philadelphia, Oct 2019 FOMC meeting

- Research Questions:
  1. How do central banks balance transparency and uncertainty in communication?
  2. How does public perception of the bank affect its communication strategy?
  3. Empirically, what is the relationship between Fed communication, confidence, and reputation for confidence?

This Paper: What we do

- **Theory:** Communication game with reputation mechanism
  - Central Bank (CB) sends announcement of signal, and sets policy
  - Public (P) updates beliefs about policy and CB info precision
  - Two features unknown to the public (asymmetric info) (Crawford and Sobel, 1982)
    1. CB's noisy signal of shock → ***Confidence*** = signal precision (Moscarini, 2007)
    2. CB's confidence → ***Reputation*** = public's belief over CB's confidence
  - Equilibrium message space endogenous to confidence and reputation
- **Empirics:** Test model implications with text data
  - Measure real-world message space of Fed from FOMC materials
  - Measure confidence and reputation with FOMC transcript and newspapers

H

This Paper: What we find

Theoretical Results:

1. Reputation for confidence prevents point-revelation in game
   - Reputation $\neq$ Confidence induces "misunderstanding" tension
   - Previously, need "inflation surprise" motive for tension between CB and P
2. Reputation acts as sensitivity of P's policy expectations to announcement
   - Reputation below confidence $\rightarrow$ more precise announcement

Empirical Results:

3. $\uparrow$ Confidence ($\downarrow$ Reputation) $\rightarrow$ more precise announcements
   - But less sensitive to reputation compared to model
4. Policy Implication: forward guidance precision?
   - Appropriate with low reputation and high confidence
   - But with high reputation: expectations overshoot
     $\hookrightarrow$ reputation falls, and future communication less effective

More

Related Literature

- **Cheap Talk Games:** Amador and Weill (2010); Austen-Smith (1990); Barro and Gordon (1983); Bassetto (2019); Crawford and Sobel (1982); Cukierman and Meltzer (1986); Moscarini (2007); and others...
- **Reputation-Building in Incomplete Information Settings** Amador and Phelan (2021); Backus and Driffill (1985); Benabou and Laroque (1992); Diamond (1989, 1991); Guembel and Rossetto (2009); Hansen and McMahon (2016); Iovino, La'O and Mascarenhas (2022); Kamenica and Gentzkow (2011); Kreps and Wilson (1982); Mailath and Samuelson (2001); Milgrom and Roberts (1982); Morris (2001); Ottaviani and Sørensen (2006a,b); Phelan (2006); Sobel (1985); and others...
- **Parameter Learning** Baley and Veldkamp (2022); Ghofrani (2023); King and Lu (2022); Kostyshyna and Petersen (2023); Rogoff (1985); Sastry (2025); and others...
- **Text Analysis of Central Bank Communication** Alexopoulos, Han, Kryvtsov and Zhang (2024); Aruoba and Drechsel (2025); Cieslak, Hansen, McMahon and Xiao (2023); Cieslak and McMahon (2023); Doh, Song and Yang (2020); Gáti and Handlan (2025); Handlan (2020, 2022); **?** ; and others...

Presentation Outline

Presentation Outline

Environment

- Players: central bank (CB) and public (P)
- Economic environment:
  - Phillips curve (Moscarini, 2007)

$$y_t = s(\pi_t - x_t), \qquad s > 0$$

where $x_t = \mathbb{E}_t^P[\pi_t]$ and $\mathbb{E}_t^i[\cdot] \equiv \mathbb{E}[\cdot|\mathcal{I}_t^i]$, $i = \{CB, P\}$

  - Inflation target shock (stand-in for demand shock or policy shock)

$$\omega_t \sim \mathcal{N}(0,1)$$

Information Structure

- P and CB do not observe $\omega_t \rightarrow$ CB observes noisy signal of it

$$\theta_t = \omega_t + \varepsilon_t, \qquad \varepsilon_t \sim \mathcal{N}(0, \sigma_\varepsilon^2)$$

- Confidence: CB's signal precision

$$H \equiv (1 + \sigma_\varepsilon^2)^{-1} \quad \in (0, 1]$$

- P does not observe $H \rightarrow$ Reputation: P's beliefs over CB's confidence
  - Prior belief ($\bar{H}_{t-1}$) from Γ distribution (Baley and Veldkamp, 2022)
  - Posterior ($\bar{H}_t$): P learns using Bayesian parameter learning from x_t vs. π_t

$$\bar{H}_{t-1} \equiv \mathbb{E}_t^P[H], \qquad \bar{H}_t \equiv \mathbb{E}_t^P[H | A_t, x_t, \pi_t]$$

  - With probability γ, P observes all CB info at period-end
    - Grim Trigger: If caught lying, P ignores future messages

Details

Actions, Losses, and Timing of Period t

1. Given $\bar{H}_{t-1}$ and H_{t-1}, central bank (CB) drafts message space $\mathcal{M}_t \subseteq \mathbb{R}$
2. Policy-relevant shock occurs (ω_t); CB observes a noisy signal (θ_t)
3. CB announces a message about the signal: $A_t(\theta_t) \in \mathcal{M}_t$
4. Public (P) updates beliefs about policy: $x_t = \text{argmin } \mathbb{E}_t^P[(x_t - \pi_t)^2 | A_t, \bar{H}_{t-1}]$
5. CB chooses a policy: $\pi_t = \text{argmin } \mathbb{E}_t^{CB}[(y_t - b)^2 + \lambda(\pi_t - \pi^* - \omega_t)^2]$
6. Losses realized
7. P updates CB's reputation ($\bar{H}_t$)
   - With prob. γ, P observes CB info and grim trigger if caught lying
   - Otherwise, reputation updates ($\bar{H}_t$) based on π_t vs. x_t
8. CB's confidence exogenously updates (H_t)
   - With prob. η, redrawn $H_t \sim \Gamma(a, d)$, and o/w, $H_t = H_{t-1}$

Presentation Outline

Central Bank Incentive to Announce Lies

- Suppose there are no restrictions on $\mathcal{M}_t$ or A_t selection
  - CB choose A_t to perfectly induce x_t to minimize loss
  - This involves "lying": choosing A'_t s.t. $\theta_t \neq A'_t$ More
    - Misunderstanding motive: need to lie about signal to equalize conditional forecast
    - Inflation surprise motive: induce lower x_t to increase $y_t = s(\pi_t - x_t)$
- Without restriction $\rightarrow$ P doesn't listen to A_t, babbling equilibrium
- Grimm trigger induces CB to pick A_t containing θ_t
  - Probability that P can "audit" the CB
  - With that mechanism, then the P will listen to the announcement
  - Gets us to equilibria where communication matters

Incentive Compatible Message Space

- Remove temptation for CB to lie by making intervals in $\mathcal{M}_t$ wider
  - Wider intervals make deviation to A'_t s.t. $\theta_t \notin A'_t$ more costly
  - Eventually, $\mathcal{M}_t$ will be such that, for any θ,

$$\mathcal{L}^{CB}(\cdot, \theta \in A_t) \leq \mathcal{L}^{CB}(\cdot, \theta \notin A'_t)$$

  - With this constraint, then the CB will choose the $A_t \in \mathcal{M}_t$ that contains θ_t
- Thus we impose the incentive compatibility constraint on $\mathcal{M}_t$
  - CB picks A_t that contains what it saw, θ_t
  - P updates policy expectations, x_t, based on A_t
- Lemma: $\mathcal{M}_t$ independent of observed θ_t

Presentation Outline

Perfect Bayesian Equilibrium with Communication

Definition (*Perfect Bayesian Equilibrium with Communication*)

Given reputation and confidence, a PBEC is π_t, x_t a message space $\mathcal{M}_t$, and an announcement A_t such that

- $\pi_t = \text{argmin } \mathcal{L}^{CB}\left(\pi_t, x_t(A_t, \bar{H}_{t-1}), \theta_t, H_{t-1}\right)$,
- $x_t = \text{argmin } \mathcal{L}^{P}(x_t, A_t, \bar{H}_{t-1})$,
- $\mathcal{M}_t$ *is* $\mathbb{R}$ *or a partition of* $\mathbb{R}$,
- $\mathcal{M}_t$ *induces CB to make an announcement* $A_t \in \mathcal{M}_t$ *such that* $\theta_t \in A_t$,
  - *P believes the announcement so* $\bar{\theta}_t = \mathbb{E}^P[\theta_t | \theta_t \in A_t, \bar{H}_{t-1}]$, *and*
  - *CB prefers* A_t *that induces* $\bar{\theta}_t$ *to any alternative* A'_t *that induces* $\bar{\theta}'_t$, *such that*

$$\mathcal{L}^{CB}\left(\cdot, \bar{\theta}_t(A_t)\right) \leq \mathcal{L}^{CB}\left(\cdot, \bar{\theta}'_t(A'_t)\right) \qquad \text{(Incentive Compatibility)}$$

Equilibrium Construction

- CB policy, π_t, best-response:

$$\pi_t^{BR} = \frac{1}{s^2+\lambda}(s^2 x_t + \lambda\pi^* + \lambda H\theta_t + sb)$$

- P expectations, x_t, best-response:

$$x_t^{BR} = \pi^* + \bar{H}_{t-1}\bar{\theta}_t + \frac{sb}{\lambda}$$

- Equilibrium inflation internalizes best-responses:

$$\pi_t^{eqb} = \pi^* + \frac{sb}{\lambda} + \frac{s^2\bar{H}_{t-1}\bar{\theta}_t + \lambda H\theta_t}{s^2+\lambda}$$

- Eq. message space, $\mathcal{M}_t$, depends on $H, \bar{H}_{t-1}$ and parameters (not on θ_t!)

$$\mathcal{M}_t = \mathcal{M}_t\left(H, \bar{H}_{t-1}, b, s, \lambda\right)$$

Details

Message Space for Announcements of θ

- Message space, $\mathcal{M}_t$, with I.C. is a partition (coarse communication)
  - Non-babbling equilibria with $\mathcal{M}_t = \mathbb{R}$ only in special conditions

Proposition (*Point Revelation*)

Point revealing the CB's signal (messages are singletons and $\bar{\theta}_t = \theta_t$) requires that

- $b = 0$, *and*
- $\bar{H}_{t-1} = H$ *or* $\theta_t = 0$

- P doesn't listen to point-revealed announcements if CB incentive to lie:
  - If reputation $\neq$ confidence $\implies$ CB wants to lie to offset "misinterpretation"
  - If $b > 0 \implies$ CB tempted to lie to induce "inflation surprise"

Details

Construction of Message Space

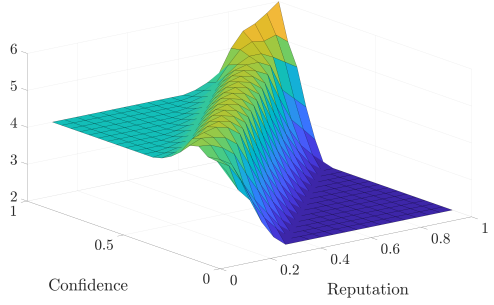
- Construct equilibrium using numerical algorithm for the message space
  - Choose π^*, s, λ consistent with literature, for now $b = 0$ (no inflation surprise)
  - Multiple equilibria $\rightarrow$ select finest partition
- Two simulation exercises:
  1. Simulate for many $(H, \bar{H})$ to approximate messages space patterns
  2. Simulate the repeated game for regressions
- Two features of the message space
  - Count: the number of messages
  - Span: the distance between the highest and lowest cutoffs

  $\hookrightarrow$ Variation only when 3 messages or more

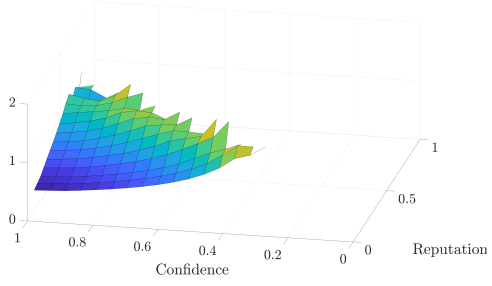
Calibration Shooting Algorithm

Numerical Derivatives (smoothed)

Number of Messages



Span: highest and lowest cutoff



- Increase in $\bar{H}/H$: decrease in count
- Increase in $\bar{H}/H$, when $H > \bar{H}$: increase in span

How to Communicate?

Lessons from the simulated game:

- Confidence $\rightarrow$ span/range of outcomes the messages need to address
  - E.g. above target inflation scenario vs. significantly above scenario
- Reputation $\rightarrow$ # of alternatives (given span, this pins precision)
  - E.g. "Inflation will be 3%" vs. "Inflation will be above target"
- Policy implication for communication:
  - Ratio of reputation to confidence matters
  - $\bar{H} > H$ should have coarse messages
  - Closer $\bar{H}$ is to H, more precise messages
  - Reputation falls after: forecast errors or extreme signals

Repeated Game

Regressions with Simulated Data

	count				span			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample	Full	$H \geq \bar{H}$	Full	$H \geq \bar{H}$	Full	$H \geq \bar{H}$	Full	$H \geq \bar{H}$
h	-0.256***	-0.298***			0.089	0.310***		
	(0.071)	(0.061)			(0.078)	(0.055)		
H			0.699**	0.741***			-0.959***	-0.703***
			(0.295)	(0.079)			(0.317)	(0.070)
$\bar{H}$			0.078	0.413***			-0.333***	-0.391***
			(0.112)	(0.070)			(0.119)	(0.064)
$H \times \bar{H}$			-0.216	-0.619***			0.661*	0.595***
			(0.334)	(0.123)			(0.360)	(0.112)
span	0.565***	0.964***	0.645***	1.065***				
	(0.071)	(0.061)	(0.060)	(0.024)				
count					0.620***	0.869***	0.767***	0.916***
					(0.078)	(0.055)	(0.072)	(0.021)
R^2	0.415	0.838	0.620	0.977	0.358	0.854	0.548	0.980
N	120	51	120	51	120	51	120	51

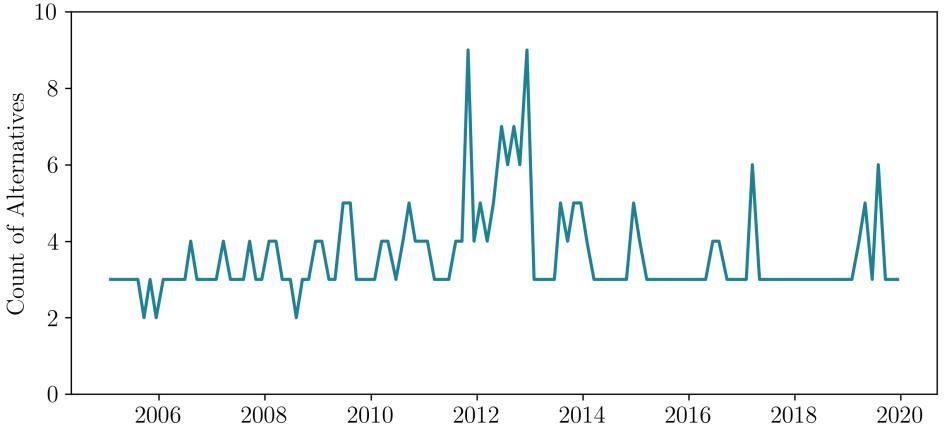
Presentation Outline

Measuring the Fed's Message Space

- Use *alternative statements* from internal FOMC materials (Tealbooks)
  - Drafts of the likely post-FOMC statement (B) and alternatives (5-year lag)
  - Ordering: relatively more dovish (A) to more hawkish (C/D)
  - Staff only writes additional alternatives if viewed as sufficiently different
- These alternatives vary in diversity and quantity over time
- Compute data counterparts to model variables:
  1. Count: number of alternative statements
  2. Span: compute distance spanned by all alternatives

Example Alts

Number of Alternative Statements

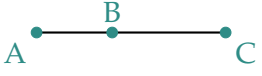


Measure Distance with LLMs

- Large-language model (BERT/distil-roberta): text $\rightarrow$ numerical vector
  - "Understands English patterns": originally trained to predict missing words
  - Foundation for modern LLMs (like ChatGPT)
  - Encodes word order, word choice, grammar of text with a 768-d vector

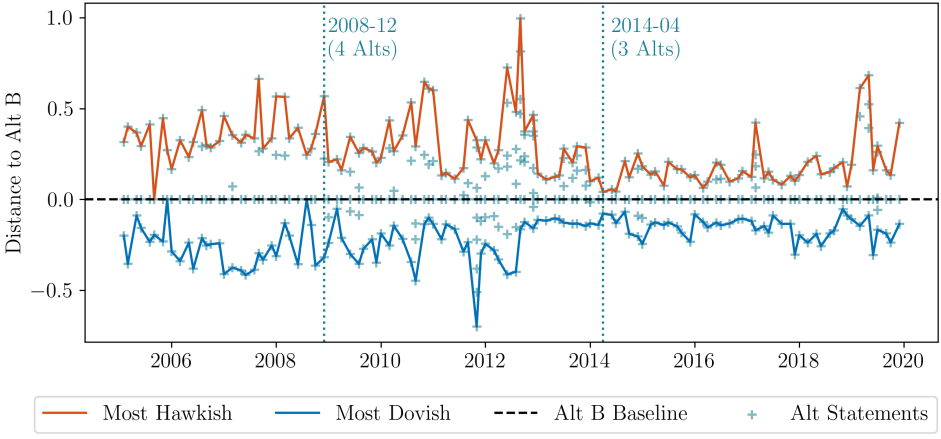
    $\hookrightarrow$ Euclidean space for comparing text (but no direct interpretation)

- Euclidean distance between vectors representing each alternative
  - Leverage ordering of alternatives in Tealbooks



Distance Between Alternative Statements

More Example Alts



Measuring Reputation and Confidence

- **Reputation ($\bar{H}_{t-1}$)** ≡ -1(Monetary Policy Uncertainty Index)
  - MPU Index with US top 10 newspapers from Baker, Bloom and Davis (2016)
  - Monthly share of articles with "uncertainty" and "monetary policy" words

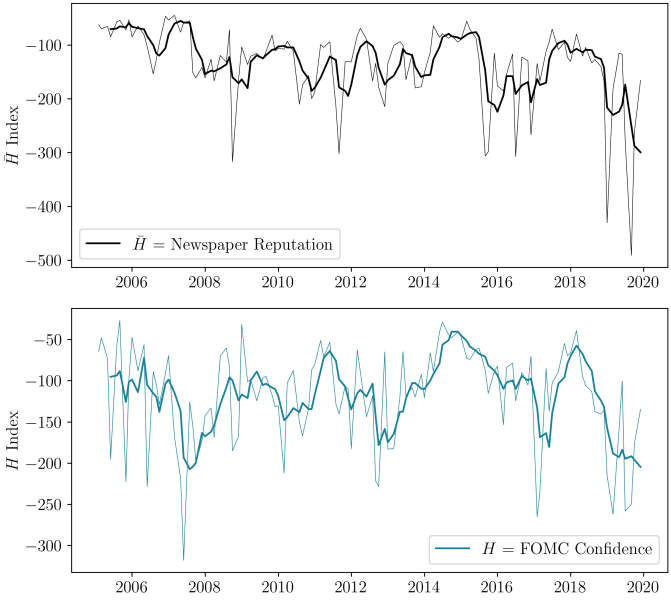
  ↪ Reputation for confidence is lower if there is more Fed+uncertainty news

- **Confidence (H_{t-1})** ≡ -1(Uncertainty Freq in Transcripts)
  - We apply same BBD "uncertainty" list to FOMC transcripts (Acosta, 2023)
  - Share of words spoken by FOMC member that were uncertainty words

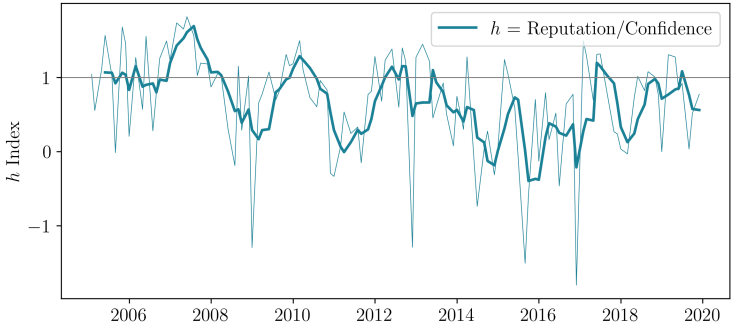
  ↪ Lower confidence if more of FOMC meeting discussing uncertainty

- **Reputation to confidence ratio (h_{t-1})** ≡ $-\frac{\bar{H}_{t-1}}{H_{t-1}}$

Reputation and Confidence Indices



Reputation to Confidence Ratio



Presentation Outline

Regression Specification

- We consider multiple specifications for different measures of communication:

$$M_t = \beta_1 h_{t-1} + controls_t + \epsilon_t$$
$$M_t = \beta_1 H_{t-1} + \beta_2 \bar{H}_{t-1} + controls_t + \epsilon_t$$

where $M_t \in \left\{ count_t, span_t, \frac{span_t}{count_t} \right\}$

- Controls:
  - Lagged change in VIX, Δvix_{t-1}
  - $span_t$ or $count_t$ when the other is dependent variable

- Baseline: log-transformed, standardized (z-scored), HAC standard errors

Regression Results

	(1) $count_t$	(2) $count_t$	(3) $count_t$	(4) $span_t$	(5) $span_t$	(6) $span_t$	(7) $\frac{span_t}{count_t}$	(8) $\frac{span_t}{count_t}$	(9) $\frac{span_t}{count_t}$
h_{t-1}	-0.192**			0.310***			0.362***		
	(0.084)			(0.076)			(0.088)		
H_{t-1}		0.046	-0.619		-0.313***	-0.499		-0.360***	-0.543
		(0.080)	(0.743)		(0.083)	(0.682)		(0.095)	(0.783)
$\bar{H}_{t-1}$		-0.314***	-0.935		0.236**	0.061		0.284**	0.112
		(0.103)	(0.766)		(0.098)	(0.659)		(0.114)	(0.756)
$H_{t-1} \times \bar{H}_{t-1}$			-1.070			-0.300			-0.296
			(1.227)			(1.053)			(1.214)
$span_t$	0.573***	0.518***	0.512***						
	(0.121)	(0.121)	(0.120)						
$count_t$				0.529***	0.516***	0.514***			
				(0.059)	(0.055)	(0.057)			
Δvix_{t-1}	-0.134**	-0.183***	-0.179***	0.095	0.085	0.086	0.112	0.105	0.106
	(0.053)	(0.055)	(0.056)	(0.088)	(0.087)	(0.087)	(0.101)	(0.100)	(0.100)
R^2	0.312	0.364	0.368	0.365	0.366	0.366	0.134	0.135	0.136
F-stat	7.742	6.791	5.565	37.360	30.174	23.891	8.458	5.725	4.441
F p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
N	119	119	119	119	119	119	119	119	119

Notes: HAC-robust standard errors with small sample correction in parentheses. * p<.1, ** p<.05, *** p<.01. Series are all log-transformed and standardized (z-scored). Regression sample covers 2005-2019.

SVAR Specification

- We allow all variables to be endogenous and depend on lags:

$$Y_t = [\Delta vix_{t-1},\ H_{t-1},\ \bar{H}_{t-1},\ \frac{span_t}{count_t}, ffr_t]$$

- Dynamic behavior:

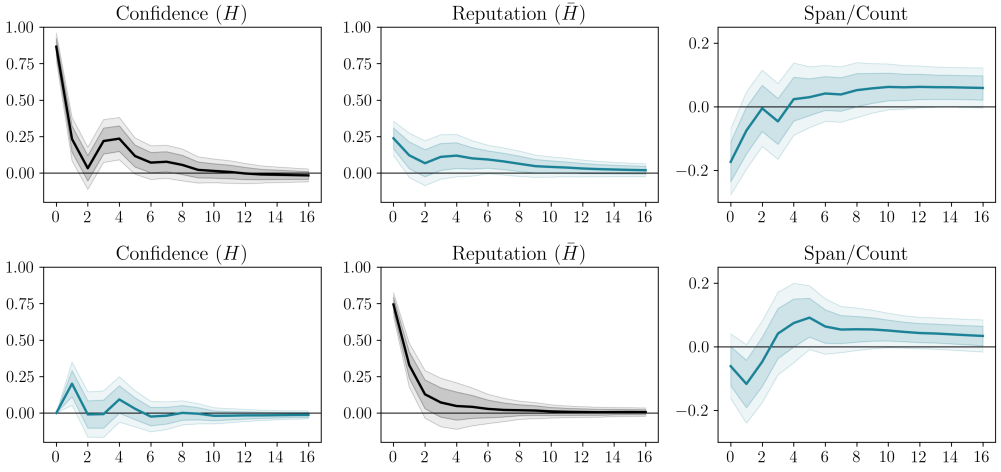
$$Y_t = B(L)Y_{t-1} + \varepsilon_t$$

where $B(L) = B_1 L + \cdots + B_p L^p$.

Identification and Estimation:

- Reduced-form VAR estimated via OLS with 4 lags ($\sim$6 months)
- Structural parameters via Cholesky decomposition
- Robustness: lags, timings
- Orthogonalized IRFs: 1 standard deviation impulse, 16 periods (2 years)

Select IRFs to Confidence and Reputation Shocks



Presentation Outline

Conclusion

- Communication game with *reputation for confidence*
- Evolving reputation rationalizes imprecise Fed communication
  - Varying number and width of alternative statements
  - If confidence were known, need "inflation surprise" motive
- Find equilibrium patterns in the FOMC text data
  - But, suggestive evidence of under-reaction to reputation
- Central Bank communication takeaway
  - Draft wide range of alternatives when confidence is low
  - Provide detailed, precise guidance in announcements when reputation is low
  - Too much precision with high reputation

  $\hookrightarrow$ Overshoot expectations $\implies \downarrow$ reputation, and risk communication tool

Thank You!

Measure Distance Between Statements

- Represent each text document numerically → BERT embedding vector
  - Large-language model trained on large English corpus
  - Encodes which words appear and the order of words
  - Vector representation is 768 dimensions
  - Dense space that encodes "context" of statement as vector
- Euclidean distance between two document vectors (A_1, A_2)

$$Distance = \sqrt{\sum_{i=1}^{768}(A_{1,i} - A_{2,i})^2}$$

- Robustness: different text measures and distance metrics in paper

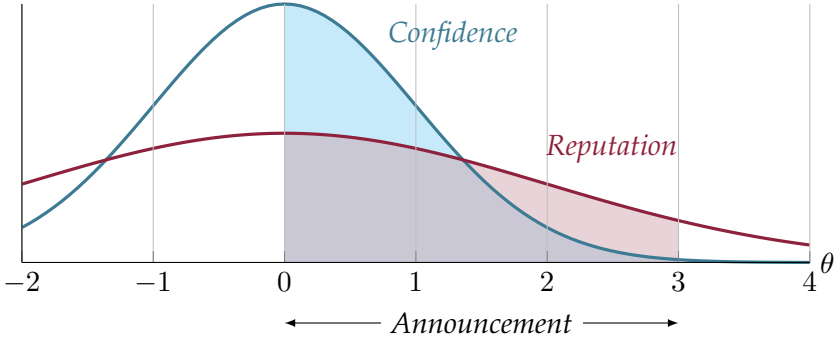
Back

Tension in the Game $\rightarrow$ Coarse Messages

- Tension when $b > 0 \implies$ inflation surprise
  - Phillips curve incentivizes CB to make $\pi > x$
  - Public does not trust point revealed announcement
- Tension when $\bar{H} \neq H \implies$ misunderstanding
  - Suppose point revealed announcement $\bar{\theta}$
  - Public conditional expectation of shock $\rightarrow \bar{H}\bar{\theta}$
  - But, $H\bar{\theta} \neq \bar{H}\bar{\theta}$, which induces breaking commitment
  - Want to exaggerate/underplay the announcement to account for different $H, \bar{H}$

Back

The Key Tension: Message Understanding



- The public's understanding of the announcement

$$\bar{\theta}_t = \mathbb{E}^P[\theta_t | \theta_t \in A_t, \bar{H}_{t-1}]$$

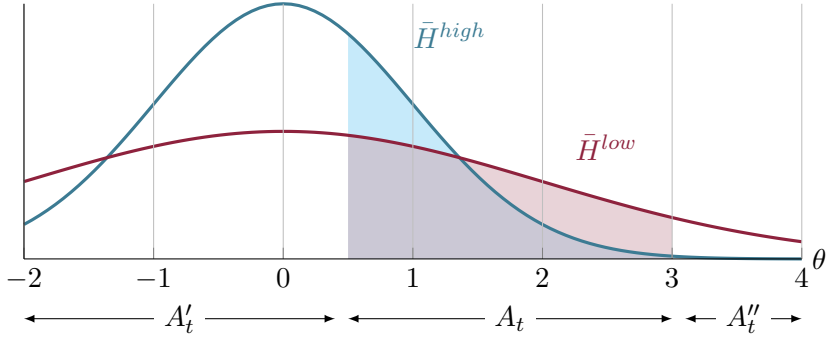
- CB wants to say "X" given H $\quad\leftrightarrow\quad$ P understands "Y" given $\bar{H}_{t-1}$

Back-Intro Back-MS Back-Prop

Message Interval to Public's Understanding

- Consider the same interval, $A_t \rightarrow$ reputation affects the interpretation

$$\bar{\theta}(\bar{H}^{high}) \neq \bar{\theta}(\bar{H}^{low}) = \mathbb{E}^P[\theta_t | \theta_t \in A_t, \bar{H}^{low}]$$



- To induce same $\bar{\theta}$, need different A_t intervals

Back-MS

Expectation Given Announcement

- Public's expectation conditional on $\theta \in A_t$, given $\bar{H}$

$$\bar{\theta}_t = \mathbb{E}^P[\theta \mid \theta \in A_t, \bar{H}_{t-1}] = \frac{\int_{A_t} \theta e^{-\bar{H}_{t-1}(\theta^2/2)}\, d\theta}{\int_{A_t} e^{-\bar{H}_{t-1}(\theta^2/2)}\, d\theta}$$

- Mechanically, $\bar{\theta}_t$ associated with $\theta \in A_t$ will be in A_t interval
- Normal distribution pushes $\bar{\theta}$ towards 0 within A_t
- Perceived precision of distribution affects P's expectation

Back-MS

Second Uncertainty Message?

- Why not allow communication of confidence (H) in separate message?
  - Tractability: Provides tension based on "misunderstanding" concerns
  - Empirical Evidence: uncertainty news interpreted as negative first-moment info (Baker et al. (2016); Loughran and Mcdonald (2016), and others)
- Central bank would not be able to point-reveal confidence (H) anyway
  - Communication constraint slackens as we increase reputation ($\bar{H}$)

    $\hookrightarrow$ allowing central bank to better optimize
  - Extension: a coarse + joint communication about confidence (work-in-progress)
- For today: messages about θ and P only learns about H from x vs π

Back-Intro Back-MS

Bayesian Parameter Learning

- P believes that $H \sim \Gamma(\alpha, \beta)$ $\quad \rightarrow \quad$ P's beliefs over θ are

$$\text{Prior:} \quad \theta \sim \mathcal{N}(0, \bar{H}_{t-1}^{-1}), \qquad \text{Posterior:} \quad \theta \sim \mathcal{N}(0, \bar{H}_t^{-1}).$$

- Reputation evolves as

$$\bar{H}_t = \frac{\alpha_t}{\beta_t},$$

$$\alpha_t = \alpha_{t-1} + \frac{1}{2}, \qquad \beta_t = \beta_{t-1} + \frac{(H\theta_t / \bar{H}_{t-1})^2}{2}.$$

Back - Model Setup Back - Repeated Game

Equilibrium Message Space Details

- $\mathcal{M}_t$ is partitioned with $K-1$ cutoffs into K interval announcements

$$A_k = [\theta_{k-1}, \theta_k)$$

- Incentive compatibility constraint used to construct candidate $\mathcal{M}_t$

$$\bar{\theta}_{k+1} = 2\frac{H}{\bar{H}}\theta_{k+1} - \frac{q}{\bar{H}} - \bar{\theta}_k$$

where

$$\bar{\theta}_k = \mathbb{E}^P[\theta|\theta \in A_k, \bar{H}_{t-1}]$$

and

$$q \equiv 2b\left(\frac{s}{\lambda} + \frac{1}{s}\right)$$

- Number of messages and width depends on the IC and $H, \bar{H}_t, b, s, \lambda$

Back

Calibration

- "New Keynesian" calibration

Parameter	Value	Target
π^*	2	Federal Reserve inflation target
s	12	Expected price duration of two quarters
λ	20	Rotemberg and Woodford (1997)
b	$\{0,0.02\}$	Moscarini (2007)
H	0.9	Benchmark of confident Fed

Back – Model Predictions Back – Repeated Game

Shooting Algorithm

- Solve for equilibrium message space using "shooting algorithm"
  - Conjecture a large number of messages, K
  - Incentive compatibility constraint $\rightarrow$ sequence of cutoffs
  - No equilibrium with K messages if cutoff doesn't exist or constraint is violated
  - Reduce K and repeat to find the finest partition with equilibrium
- 1-message equilibrium always exists
  - But, algorithm does not distinguish between point revelation and babbling

Back – Model Predictions Back – Repeated Game

Range of Alternatives for 2008-12

Back1 Back2

Alternative 1

Since the Committee's last meeting, labor market conditions have deteriorated, and the available data indicate that consumer spending, business investment, and industrial production have declined. Overall, the outlook for economic activity has weakened further. Meanwhile, inflationary pressures have diminished quickly. In light of the declines in the prices of energy and other commodities and the weaker prospects for economic activity, the Committee expects inflation to moderate in coming quarters and sees some risk that inflation could decline for a time below rates that best foster economic growth and price stability in the longer term. In support of its dual mandate, the Committee will seek to achieve a rate of inflation, as measured by the price index for personal consumption expenditures, of about 2 percent in the medium term. In current circumstances, the Committee judged that it was not useful to set a specific target for the federal funds rate. As a result of the large volume of reserves provided by the Federal Reserve's various liquidity facilities, the federal funds rate has declined to very low levels, and the Committee anticipates that weak economic conditions are likely to warrant federal funds rates near zero for some time. The focus of policy going forward will be to continue to support the functioning of financial markets and stimulate the economy through open market operations and other measures that entail the use of the Federal Reserve's balance sheet. In particular, as previously announced, over the next few quarters the Federal Reserve will purchase large quantities of agency debt and mortgage-backed securities to provide support to the mortgage and housing markets, and it stands ready to expand its purchases of agency debt and mortgage-backed securities as conditions warrant. The Committee is also evaluating the potential benefits of purchasing longer-term Treasury securities. Early next year, the Federal Reserve will also implement the Term Asset-Backed Securities Loan Facility to facilitate the extension of credit to households and small businesses. The Federal Reserve will continue to actively consider ways of using its balance sheet to further support credit markets and economic activity. In related actions, the Board of Governors today approved a 75 basis point decrease in the primary credit rate to 1/2 percent and established interest rates on required and excess reserve balances of 1/4 percent.

Labor market deteriorated, economic outlook is worse

Inflation below target

Things are so bad, not naming a target rate

Alternative 4

The Federal Open Market Committee decided today to keep its target for the federal funds rate at 1 percent. Reflecting in part the intensification of the financial strains earlier in the fall, the pace of economic activity appears to have slowed further, and the near-term outlook for growth has deteriorated. Moreover, the downside risks are significant. However, policy actions taken in recent months, including reductions in short-term interest rates to very low levels, extraordinary liquidity measures, and official steps to strengthen the financial system, should help over time to improve credit conditions and promote a return to moderate economic growth. As announced previously, the Federal Reserve will purchase a large volume of agency debt and mortgage-backed securities to provide support to the mortgage and housing markets and thus to broader economic activity. Early next year, the Federal Reserve will also implement the Term Asset-Backed Securities Loan Facility to help facilitate the extension of credit to households and small businesses. In light of the declines in the prices of energy and other commodities and the weaker prospects for economic activity, the Committee expects inflation to moderate in coming quarters to levels consistent with price stability. In view of the large volume of reserves provided by the Federal Reserve's various liquidity facilities, the Committee recognizes that the federal funds rate is likely to average significantly below the target rate for some time. The Committee will monitor economic and financial developments carefully in light of recent policy actions and will act as needed to promote sustainable economic growth and price stability.

Keep target rate

Economy is bad, but past easing is enough

Inflation consistent with target

Range of Alternatives for 2014-04

Back1 Back2

Alternative 1

Information received since the Federal Open Market Committee met in March indicates that growth in economic activity slowed sharply during the winter, in part reflecting adverse weather conditions, but suggests that it is picking up. Labor market indicators were mixed but on balance showed further improvement. The unemployment rate, however, remains elevated. Household spending and business fixed investment continued to advance, while the recovery in the housing sector remained slow. Fiscal policy is restraining economic growth, although the extent of restraint is diminishing. Inflation continues to run well below the Committee's longer-run objective even though longer-term inflation expectations have remained stable. Consistent with its statutory mandate, the Committee seeks to foster maximum employment and price stability. The Committee expects that, with appropriate policy accommodation, economic activity will expand at a moderate pace and labor market conditions will continue to improve gradually, moving toward those the Committee judges consistent with its dual mandate. The Committee sees the risks to the outlook for the economy and the labor market as nearly balanced. The Committee anticipates that inflation will gradually return to 2 percent. However, it recognizes that inflation persistently below its 2 percent objective could pose risks to economic performance, and it is monitoring inflation developments carefully for evidence that inflation will move back toward its objective over the medium term. The Committee has become somewhat less confident that there is sufficient underlying strength in the broader economy to support ongoing improvement in labor market conditions and to return inflation to 2 percent over the medium run. For this reason, the Committee decided to maintain the current pace of its asset purchases and await additional information bearing on the outlook for economic activity, the labor market, and inflation. The Committee will continue to add to its holdings of agency mortgage-backed securities at a pace of $25 billion per month and to its holdings of longer-term Treasury securities at a pace of $30 billion per month. The Committee is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities and of rolling over maturing Treasury securities at auction. The Committee's sizable and still-increasing holdings of longer-term securities should maintain downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative, which in turn should promote a stronger economic recovery and help to ensure that inflation, over time, is at the rate most consistent with the Committee's dual mandate. The Committee will closely monitor incoming information on economic and financial developments in coming months and will continue its purchases of Treasury and agency mortgage-backed securities, and employ its other policy tools as appropriate, until the outlook for the labor market has improved substantially in a context of price stability. If incoming information broadly supports the Committee's expectation of ongoing improvement in labor market conditions and inflation moving back toward its longer-run objective, the Committee will likely reduce the pace of asset purchases in further measured steps at future meetings. However, asset purchases are not on a preset course, and the Committee's decisions about their pace will remain contingent on the Committee's outlook for the labor market and inflation as well as its assessment of the likely efficacy and costs of such purchases. To support continued progress toward maximum employment and price stability, the Committee today reaffirmed its view that a highly accommodative stance of monetary policy remains appropriate. In determining how long to maintain the current 0 to 1/4 percent target range for the federal funds rate, the Committee will assess progress–both realized and expected–toward its objectives of maximum employment and 2 percent inflation. This assessment will take into account a wide range of information, including measures of labor market conditions, indicators of inflation pressures and inflation expectations, and readings on financial developments. The Committee anticipates, based on its assessment of these factors, that it will be appropriate to maintain the current target range for the federal funds rate for a considerable time after the asset purchase program ends, and at least as long as inflation between one and two years ahead is projected to be below 2 percent, provided that longer-term inflation expectations remain well anchored. When the Committee decides to begin to remove policy accommodation, it will take a balanced approach consistent with its longer-run goals of maximum employment and inflation of 2 percent. The Committee currently anticipates that, even after employment and inflation are near mandate-consistent levels, economic conditions may, for some time, warrant keeping the target federal funds rate below levels the Committee views as normal in the longer run.

Growth slowed, but picking up

Less confident inflation return to target in medium run

Keep target rate

Alternative 3

Information received since the Federal Open Market Committee met in March indicates that growth in economic activity is picking up as the effects of unusually severe winter weather and other transitory factors fade. Labor market indicators showed further improvement with payroll employment expanding at a solid pace. Household spending appears to be rising more quickly. Business fixed investment continues to advance, while the recovery in the housing sector remains slow. Fiscal policy is restraining economic growth, although the extent of restraint is diminishing. Inflation has been running below the Committee's longer-run objective, but longer-term inflation expectations have remained stable. Consistent with its statutory mandate, the Committee seeks to foster maximum employment and price stability. The Committee expects that, with appropriate policy accommodation, economic activity will expand at a moderate pace and labor market conditions will continue to improve gradually, moving toward those the Committee judges consistent with its dual mandate. The Committee sees the risks to the outlook for the economy and the labor market as nearly balanced. The Committee recognizes that inflation persistently below its 2 percent objective could pose risks to economic performance, and it is monitoring inflation developments carefully; however, the Committee continues to anticipate that inflation will move back toward its objective over the medium term. The Committee currently judges that there is sufficient underlying strength in the broader economy to support ongoing improvement in labor market conditions. In light of the cumulative progress toward maximum employment and the improvement in the outlook for labor market conditions since the inception of the current asset purchase program, the Committee decided to make a further measured reduction in the pace of its asset purchases. Beginning in May, the Committee will add to its holdings of agency mortgage-backed securities at a pace of $15 billion per month rather than $25 billion per month, and will add to its holdings of longer-term Treasury securities at a pace of $20 billion per month rather than $30 billion per month. The Committee is maintaining its existing policy of reinvesting principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities and of rolling over maturing Treasury securities at auction. The Committee's sizable and still-increasing holdings of longer-term securities should maintain downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative, which in turn should promote a stronger economic recovery and help to ensure that inflation, over time, is at the rate most consistent with the Committee's dual mandate. The Committee will closely monitor incoming information on economic and financial developments in coming months and will continue its purchases of Treasury and agency mortgage-backed securities, and employ its other policy tools as appropriate, until the outlook for the labor market has improved substantially in a context of price stability. If incoming information broadly supports the Committee's expectation of ongoing improvement in labor market conditions and inflation moving back toward its longer-run objective, the Committee will likely reduce the pace of asset purchases further at future meetings. However, asset purchases are not on a preset course, and the Committee's decisions about their pace will remain contingent on the Committee's outlook for the labor market and inflation as well as its assessment of the likely efficacy and costs of such purchases. To support continued progress toward maximum employment and price stability, the Committee today reaffirmed its view that a highly accommodative stance of monetary policy remains appropriate. In determining how long to maintain the current 0 to 1/4 percent target range for the federal funds rate, the Committee will assess progress–both realized and expected–toward its objectives of maximum employment and 2 percent inflation. This assessment will take into account a wide range of information, including measures of labor market conditions, indicators of inflation pressures and inflation expectations, and readings on financial developments. The Committee continues to anticipate, based on its assessment of these factors, that it likely will be appropriate to maintain the current target range for the federal funds rate for a considerable time after the asset purchase program ends, especially if projected inflation continues to run below the Committee's 2 percent longer-run goal, and provided that longer-term inflation expectations remain well anchored. When the Committee decides to begin to remove policy accommodation, it will take a balanced approach consistent with its longer-run goals of maximum employment and inflation of 2 percent. The Committee currently anticipates that, even after employment and inflation are near mandate-consistent levels, economic conditions may, for some time, warrant keeping the target federal funds rate below levels the Committee views as normal in the longer run.

Growth picking up, despite past slowing

Expects inflation return to target in medium run

Keep target rate

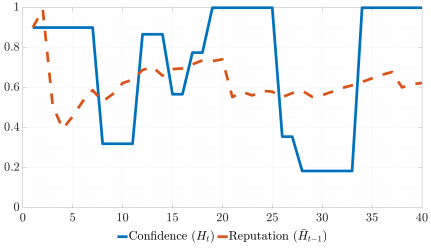
Repeated Game

- Simulate the repeated game with:
  1. **Reputation Evolving:** stage game repeated with evolving reputation, $\bar{H}_{t-1}$
  2. **Confidence Evolving:** H exogenously is redrawn
- For the simulation of the repeated games:
  - For same sequence of shocks and signals, solve stage game at each t
  - Reputation initialized at true confidence, $\bar{H}_0 = H_0 = 0.9$
  - Equilibrium multiplicity: focus on finest coarse equilibrium

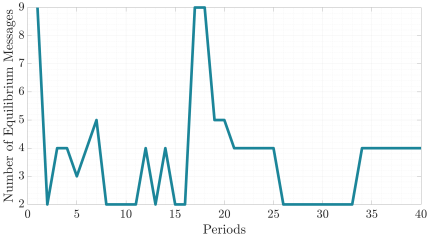
Calibration Shooting Algorithm Back

Simulation with H varying, $\bar{H}$ evolving, $b = 0$

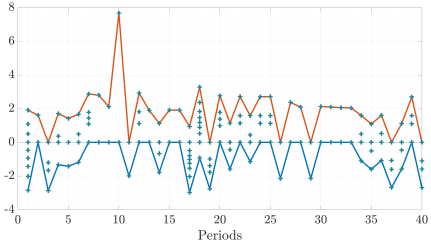
Confidence and Reputation



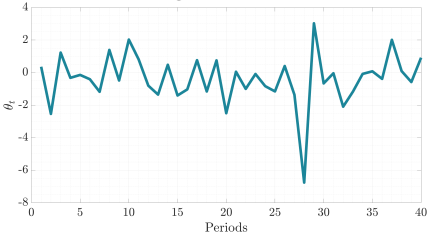
Number of messages



Message Space



Signals (θ)



Reputation for Confidence

- Reputation falls with extreme shocks or forecast errors
- If too detailed guidance when confidence is low or reputation is high

  $\hookrightarrow \downarrow$ reputation, thus lose communication tool effectiveness
- Discussion: SEP is example of precise communication

Learning Back