Disagreement About Monetary Policy

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Fed Sifts Options As Rate Cut Fails To Cheer Market

December 12, 2007, *Wall Street Journal*

Some on Wall Street yesterday criticized the Fed's actions so far as inadequate. "From talking to clients and traders, there is in their view no question the Fed has fallen way behind the curve," said David Greenlaw, economist at Morgan Stanley. "There's a growing sense the Fed doesn't get it."

Suddenly, Critics Are Taking Aim at Greenspan

April 1, 2001, *New York Times*

WASHINGTON, April 1 — He raised interest rates too much last year, a sudden chorus of critics is saying, and he has not cut them enough this year.

Under his leadership, the Fed is "behind the curve," Merrill Lynch recently told its clients.

Markets and central banks always seem to disagree about where economy is going and how policy will respond. Why?

And what does the answer imply about the power—or futility—of central bank communication as a tool for moving markets?

This Paper (I): How to Distinguish Observationally Close Models

Very simple signal-extraction model with Market and Fed who may have

1. different signals
2. different "model equations" (i.e., for monetary rule)
3. different priors (i.e., from differently reading public data)

Key idea: to disentangle these, need to study interest rate and real activity forecasts *together*

Theoretical results: "sign tests" to determine correct model

This Paper (II): Strong Evidence of "Agreeing to Disagree"

Main Results. In US since 1995, "bad macro news" in leading indicators predicts

- Surprise monetary loosening according to futures markets ($R^2 \approx 15\%$)
- Negative forecast errors (optimism) about employment in Blue Chip survey
- Relative optimism about employment for Blue Chip survey relative to the Fed

Model says: because "optimism" correlates with surprise cuts, heterogeneous priors are necessary, or asymmetric information + mis-specified policy rule is insufficient

Quantification. In calibrated model,

- "Fed information effects," or market learning about demand from Fed, almost negligible
- Heterogeneous priors are not: if Fed and Market agreed about value of public data, latter's beliefs would be 25% more sensitive to fundamentals.

Related Literature

- **Persuasion, information effects, and signaling channels of policy.** Theory: Morris and Shin (2002); James and Lawler (2011); Baeriswyl and Cornand (2010); and follow-up. Applications: Campbell, Evans, Fisher, and Justiniano (2012); Campbell, Fisher, Justiniano, and Melosi (2016); Nakamura and Steinsson (2018); Melosi (2016)
- **Omitted variables and monetary surprises.** Miranda-Agrippino (2015), Gertler and Karadi (2015), Miranda-Agrippino and Ricco (2021), Cieslak (2018), Karnaukh (2019), Bauer and Swanson (2020), Jarocinski and Karadi (2020)
- **Disagreement and heterogeneous priors.** Mankiw, Reis, and Wolfers (2003); Andrade, Crump, Eusepi, and Moench (2016); Andrade, Gaballo, Mengus, and Mojon (2019); Caballero and Simsek (2020)
- **Imperfect expectations in macro.** Coibion and Gorodnichenko (2012, 2015); Carroll (2003); Bordalo, Gennaioli, Ma, and Shleifer (2018); Broer and Kohlhas (2018); Angeletos, Huo, and Sastry (2020)

Outline

Set-up: Learning About Aggregate Demand

Microfoundation: CARA-Normal | Microfoundation: NK Model

		$t = 0$	$t = 1$	$t = 2$	later
		Policymaking and Prediction	Policy Announcement	Subsequent Learning	Realization of Output
Fed	**sees**	Z, F		S	$Y = a\theta - r$
	chooses	$r = \mathbb{E}_{F,0}[\theta]$			
Market	**sees**	Z	$r = \mathbb{E}_{F,0}[\theta]$	S	$Y = a\theta - r$
	chooses	$P = \mathbb{E}_{M,0}[r] = \mathbb{E}_{M,0}[\mathbb{E}_{F,0}[\theta]]$			restriction: $a \geq 1$ (incomplete stabilization)

$\theta \sim N(0, \tau_\theta^{-1})$ = AD or natural rate of interest
$Z \mid \theta \sim N(\theta, \tau_Z^{-1})$ = pre-announcement public signal
$F \mid \theta \sim N(0, \tau_F^{-1})$ = Fed's signal
$S \mid \theta \sim N(\theta, \tau_S^{-1})$ = post-announcement public signal

Set-up: Three Sources of Belief Differences

1. **Asymmetric information.** Fed observes F, but Market does not.
   Private signal in games (Morris and Shin, 2002); "informational advantage" (Romer and Romer, 2000)
2. **Heterogeneous confidence in public data.** Fed and Market can differently perceive precision of public data, and have beliefs

$$\mathbb{E}_{F,0}[\theta] = (\delta_Z^F - q^F)Z + \delta_F^F F \qquad \mathbb{E}_{M,0}[\theta] = (\delta_Z^M - q)Z$$

   where the δ's are correct precision weights.
   Heterogeneous priors (Harrison and Kreps, 1978)
3. **Different beliefs about the monetary rule.** Market perceives monetary rule as

$$\mathbb{E}_{M,0}[r] = (\delta_Z^F - q^F - w)Z + \delta_F^F F$$

   As if from adaptive learning (Bullard and Mitra, 2002; Bauer and Swanson, 2020)

Result 1: Monetary Surprises

Let the market's surprise about monetary policy be $\Delta := r - P$. The surprise can be written as

$$\Delta = \delta_F^F(F - \delta_Z^M Z) + \delta_F^F qZ + wZ$$

What's the disagreement about?
Not knowing F, being wrong on average about content of F, not knowing reaction to Z

Proposition: Monetary Surprises and Public Signals

The following are true:

- $q = 0$ and $w = 0 \Rightarrow \text{Cov}[\Delta, Z] = 0$ — Asymmetric info: only non-systematic errors
- $q \geq 0$ and $w \geq 0 \Rightarrow \text{Cov}[\Delta, Z] \geq 0$ — Deviations: necessary for systematic errors...
- $q \leq 0$ and $w \leq 0 \Rightarrow \text{Cov}[\Delta, Z] \leq 0$ — ...but not informative about type

Result 2: Forecast Errors and Revisions

$$Y - \mathbb{E}_{0,M}[Y] = (a - \delta_F^F)(\theta - \delta_Z^M Z) + \delta_F^F \epsilon_F + (a - \delta_F^F) q Z - wZ$$

Why are there forecast errors?
Not knowing F and θ, bias in predicting business cycle, bias in predicting policy (opposite sign)

Can show for all periods forecast errors + post-announcement revisions:

Proposition: Forecast Errors (or Revisions) and Public Signals

Let $\mathcal{X} = \{\mathbb{E}_{M,2}[Y] - \mathbb{E}_{M,1}[Y], (Y - \mathbb{E}_{M,t}[Y])_{t\in\{0,1,2\}}\}$. Then, for all $X \in \mathcal{X}$,

- $q = 0$ and $w = 0 \Rightarrow \text{Cov}[Z, X] = 0$
- $q \geq 0$ and $w \leq 0 \Rightarrow \text{Cov}[Z, X] \geq 0$
- $q \leq 0$ and $w \geq 0 \Rightarrow \text{Cov}[Z, X] \leq 0$

Result 3: Measured Disagreement about Y

$$\Delta^Y := \mathbb{E}_{F,0}[Y] - \mathbb{E}_{0,M}[Y] = a(\delta_Z^F Z + \delta_F^F F - \delta_Z^M Z) + a(q - q^F)Z - \Delta$$

Why are there disagreements about Y?

Efficiently used asymmetric information, differences in predicting demand, differences in predicting in predicting policy (opposite sign)

Proposition: Disagreement and Public Signals

The following are true:

- $q = q^F = 0$ and $w = 0 \Rightarrow \text{Cov}[Z, \Delta^Y] = 0$
- $q \geq \frac{a}{a - \delta_F^F} q^F$ and $w \leq 0 \Rightarrow \text{Cov}[Z, \Delta^Y] \geq 0$
- $q \leq q^F$ and $w \geq 0 \Rightarrow \text{Cov}[Z, \Delta^Y] \leq 0$

Taking Stock: An Empirical Roadmap

Theory says: we should jointly run regressions of

- Market interest rate forecast revisions
- Market output forecast errors (or revisions)
- Fed-to-Market output forecast disagreements

on pre-determined public signals to determine right model

Also in paper: interpretation of signaling or the “information effect” (Campbell, Evans, Fisher, and Justiniano, 2012; Nakamura and Steinsson, 2018) Link

Bottom line: regression in literature does not identify signaling, could be biased up or down

Numerical Example

Outline

Test 1: Do Public Signals Predict Surprises?

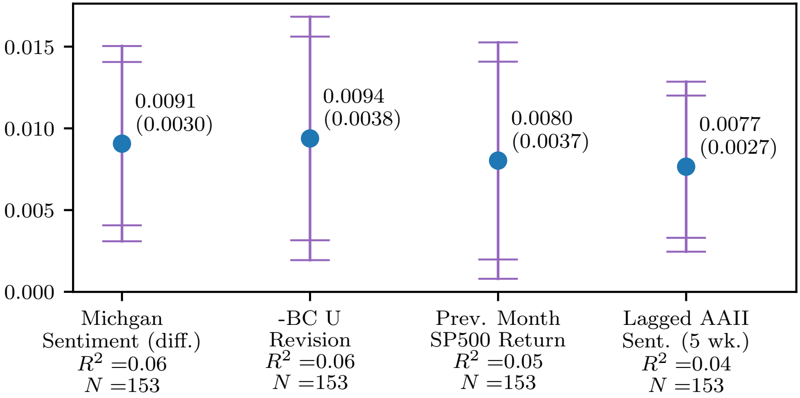
Test of Proposition 1:

$$\text{MonetarySurprise}_t = \beta^P \cdot \check{Z}_{t-1} + \epsilon_t$$

- $\text{MonetarySurprise}_t$ is "policy news shock" of Nakamura and Steinsson, 1995 to 2014
- $\check{Z}_{t-1}$ are each of the candidate public signals, normalized to zero mean + unit std. dev.
  - Change in consumer sentiment about labor market from Michigan Survey Definition
  - Revisions in Blue Chip forecasts about unemployment (next 3Q)
  - Monthly change in closing price of S&P 500
  - Bullishness about stocks from American Association of Individual Investors survey Definition
- **Sign predictions**
  - $\beta^p = 0$ under pure asymmetric information
  - $\beta^p > 0$ if markets under-weight $\check{Z}$ for predicting fundamentals and/or policy
  - $\beta^p < 0$ if markets over-weight $\check{Z}$ for predicting fundamentals and/or policy
- **Sample** of 153 scheduled FOMC meetings; **standard errors** HAC robust

Result: Public Signal Upticks ⇒ Surprise Tightening

$$\text{MonetarySurprise}_t = \beta^P \cdot \check{Z}_{t-1} + \epsilon_t$$



Bars: 90 and 95% confidence intervals

Other outcomes | Rolling regression | Scatterplot (Michigan) | Economic Outcomes | POOS | Event Study

Test 2: Public Signals and Forecast Errors

Test of Proposition 2:

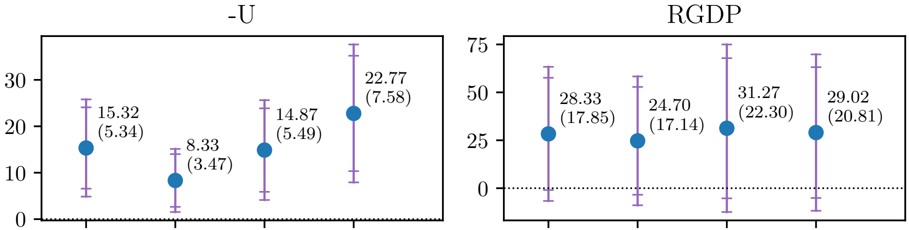
$$\underbrace{Y_{t+h} - \mathbb{E}_{BC,t}[Y_{t+h}]}_{\text{Forecast error}} = \alpha + \beta^{FCE} \cdot \hat{Z}_{t-1} + \epsilon_t$$

- Y_{t+h} is h-quarter ahead (i) negative unemployment rate or (ii) annualized real GDP growth
- $\mathbb{E}_{BC,t}[\cdot]$ denotes the Blue Chip Economic Indicators consensus forecast in t
- $\hat{Z}_{t-1}$ = "first-stage" predicted Surprise
  - Convenient for interpretation: one unit of $\hat{Z}$ = one basis point of surprise tightening
- **Sign predictions**
  - $\beta^{FCE} = 0$ under pure asymmetric information
  - $\beta^{FCE} > 0$ if markets only under-weight Z in their forecasts
  - $\beta^{FCE} < 0$ if markets only under-estimate Z in monetary rule
- 288 months from 1995 to Present; HAC-robust standard errors

Result: Good News ⇒ Underestimate Output

Test of Proposition 3:

$$Y_{t+h} - \mathbb{E}_{BC,t}[Y_{t+h}] = \alpha + \beta^{FCE} \cdot \hat{Z}_{t-1} + \epsilon_t$$



h	avg	1	2	3
R^2	0.23	0.16	0.21	0.25
N	288	288	288	288

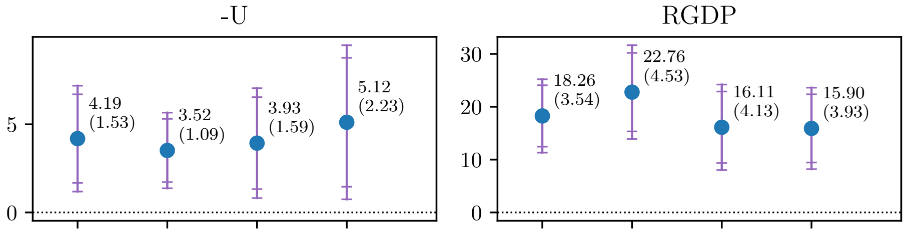
h	avg	1	2	3
R^2	0.06	0.03	0.04	0.03
N	288	288	288	288

Bars: 90 and 95% confidence intervals

PCE, Treasuries | GB - BC | Revisions | Stock Prices | Top + Bottom

Test 3: Bias Drives Greenbook to Blue Chip Disagreement

$$\mathbb{E}_{GB,t}[Y_{t+h}] - \mathbb{E}_{BC,t}[Y_{t+h}] = \alpha + \beta^{Di} \cdot \hat{Z}_{t-1} + \epsilon_t$$



h	avg	1	2	3
R^2	0.12	0.14	0.10	0.10
N	107	107	107	107

h	avg	1	2	3
R^2	0.22	0.26	0.13	0.11
N	107	107	107	107

Bars: 90 and 95% confidence intervals

Anecdotal Evidence from Minutes

Taking Stock: Empirical Results

Direct reading of results:
markets are half-step behind Fed in predicting *both* business cycle and monetary response

Via "sign tests" of the model:

1. Reject pure asymmetric information (as in classic signaling literature)
2. Reject *pure* mis-estimation of monetary rule (wrong sign for output errors, disagreements)
3. Suggest some heterogeneous priors necessary (Fed more "data sensitive")

Additional evidence:

- No evidence of large "information effects" after controlling for public signals Link
- Further upward revision in subsequent months of Blue Chip survey Link
- Limited discerning power in same-day stock returns and also (weak) evidence of a post-announcement drift Link

Outline

Parameter Estimates

Fit model to match key moments Link

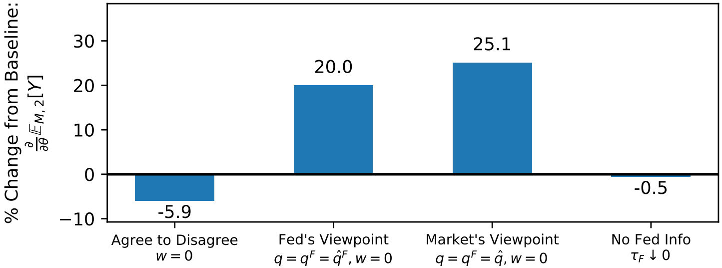
q	Bias for fundamentals	0.121
w	Bias for rule	0.007
q^F	Bias for Fed	0.089
a	$Y = a\theta - r$	1.100
τ_F	Precision: Fed	0.194
τ_Z	Precision: first public signal	20.99
τ_S	Precision: second public signal	6.849

Immediate take-aways

1. $q \gg w$: fundamentals bias is "bigger" in common units
2. $q^F + w < q$, $\frac{w}{q-q^F} = 0.22$: Market knows that Fed is more data sensitive, but not by how much
3. $\tau_Z, \tau_S \gg \tau_F$: Fed information is quite small. Weight in monetary rule $\approx 100 \cdot \tau_F/(1 + \tau_F + \tau_Z) = 1\%$

Counterfactuals: How Much Does Each Mechanism Matter?

How much do market beliefs $\frac{\partial}{\partial\theta}\mathbb{E}_{M,2}[Y]$ ($\approx$ stock price) vary with θ?



Key takeaways:

- Disagreement lowers volatility, since market expects Fed to over-stabilize
- Info effect tiny, and disagreement is "50x more important" in terms of belief effects

other exercises

Outline

Disagreement about Monetary Policy

How and why does the public disagree with central banks about future monetary policy? The path of the economy?

This paper: **theory**, **evidence**, **quantification** focusing on the US and Fed since 1995.

- Market and Fed differ in reaction to public signals, with former less data-sensitive
- Disagreement matters for beliefs and asset prices, while Fed info essentially does not

Thank you!

Consumer Sentiment about Labor Markets

Back

Michigan Survey of Consumers

- Once per month
- 500 respondents by telephone
- Various questions about own situation, macroeconomy, financial markets
- Survey-weighted to be nationally representative
- Survey highlights released to public by end of month; full micro-data available after about a month (or sooner if requested)

Labor market question

Question: How about people out of work during the coming 12 months–do you think that there will be more unemployment than now, about the same, or less?

Answers: 1. More unemployment; 2. About the same; 3. Less unemployment

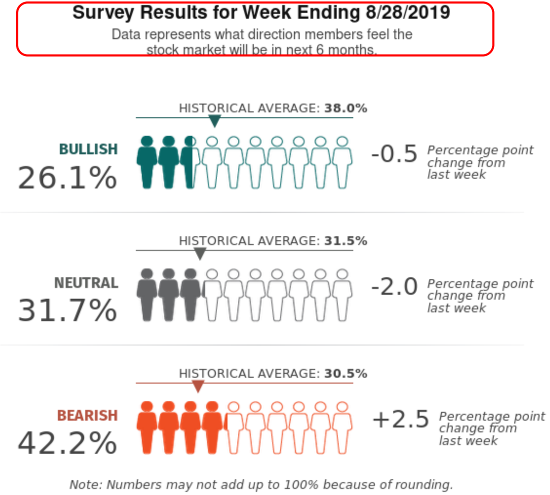
Coding: (Share = 3) - (Share = 1)

Investor Confidence from AAII Survey

Back

American Association of Individual Investors Survey

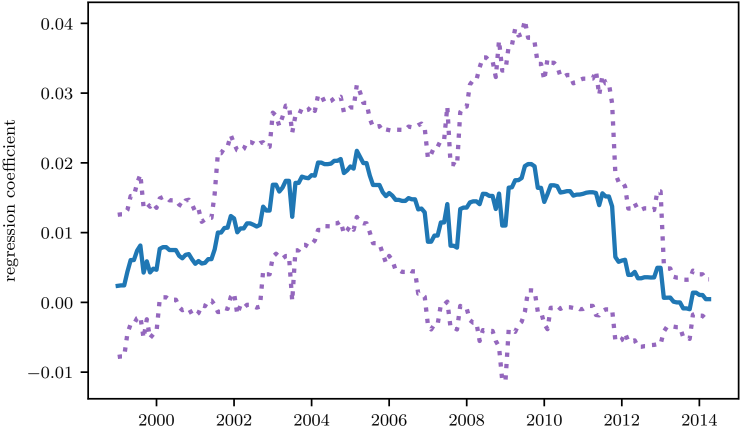
- Common indicator for optimism in financial press (e.g., *Wall Street Journal*)
- (Opposite-signed) significant predictor of future excess returns (Greenwood and Shleifer, 2014)



Rolling Regression Back 1

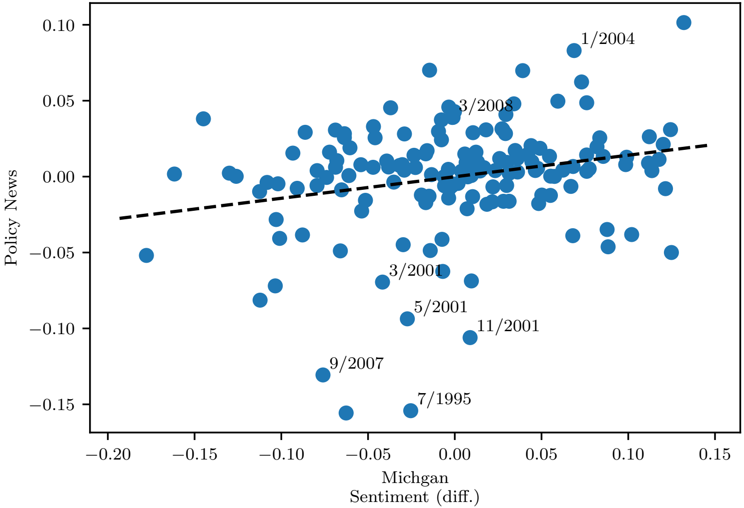
Re-estimate regression using last 60 months of data

$$\text{MonetarySurprise}_t = \beta^P \cdot \check{Z}_{t-1} + \epsilon_t$$



Scatterplot: Sentiment and Surprises

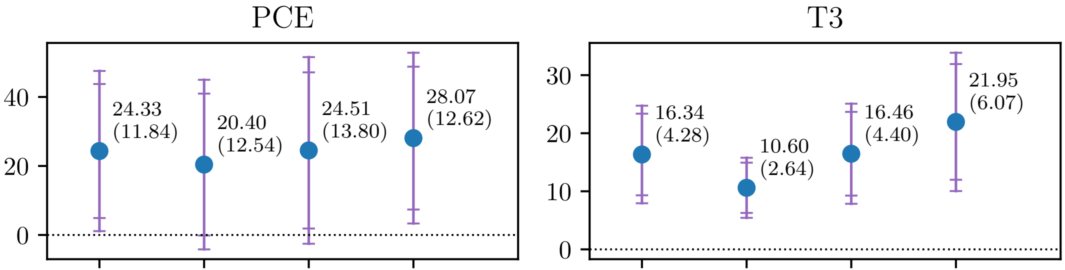
Back 1



Similar Story for Consumption, Treasuries

Back

$$\text{Outcome: } Y_{Q(t)+h} - \mathrm{E}_{B,t}[Y_{Q(t)+h}]$$



PCE

h	avg	1	2	3
R^2	0.06	0.03	0.04	0.05
N	288	288	288	288

T3

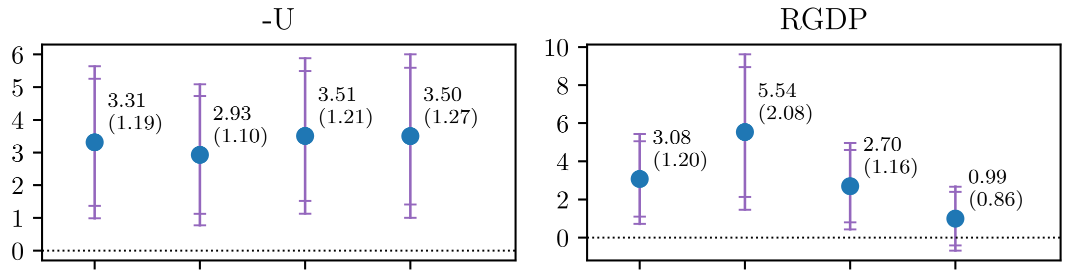
h	avg	1	2	3
R^2	0.15	0.15	0.14	0.13
N	288	288	288	288

Later Revisions of Blue Chip Surveys

Back

$$\mathbb{E}_{BC,t+2}[Y_{t+h}] - \mathbb{E}_{BC,t+1}[Y_{t+h}] = \alpha + \beta^{Dr} \cdot \hat{Z}_{t-1} + \epsilon_t$$

$$\text{Outcome: } \mathrm{E}_{B,t+2}[Y_{Q(t+1)+h}] - \mathrm{E}_{B,t+1}[Y_{Q(t+1)+h}]$$

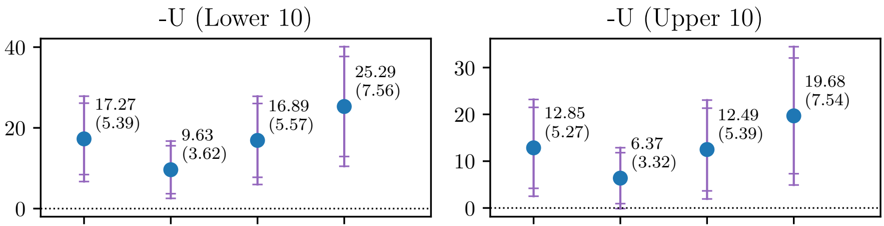


h	avg	1	2	3	h	avg	1	2	3
R^2	0.13	0.11	0.13	0.14	R^2	0.10	0.09	0.08	0.02
N	116	116	116	116	N	116	116	116	116

Effects on Tails of Distribution

Back

Outcome: $Y_{Q(t)+h} - \mathrm{E}_{B,t}[Y_{Q(t)+h}]$



h	avg	1	2	3
R^2	0.27	0.18	0.25	0.29
N	287	287	287	287

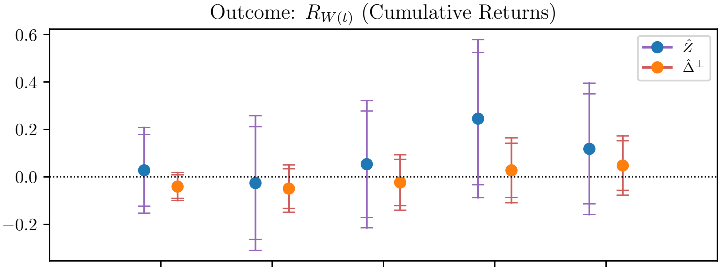
h	avg	1	2	3
R^2	0.16	0.09	0.15	0.19
N	287	287	287	287

Stock Price Effects

Back

$$R_{W(t)} = \alpha + \beta^Z \cdot \hat{Z}_{t-1} + \beta^\Delta \hat{\Delta}_t^\perp + \epsilon_{W(t)}$$

where t denotes the day of the relevant FOMC meeting and $R_{W(t)}$ is the cumulative return (sum of log returns) in a window $W(t)$ on or after t



h	0	1-5	6-10	11-15	16-20
R^2	0.01	0.01	0.00	0.01	0.01
N	153	153	153	153	153
t^D	0.72	0.16	0.65	1.22	0.54

Timeline for Calibration Back

January Blue Chip Survey (around the 10th): Forecast t

FOMC Meeting *if between 11th and end of month*: Shock t

February Blue Chip Survey (around the 10th): Forecast $t+1$

$t = 0$ — Forecasting

$t = 1$ — Announcement

$t = 2$ — More Learning

CARA-Normal Model back

- Trader (or continuum of clones) can invest position x in security with price P and payoff r
- Can submit limit orders or contingent demands $x(P)$
- Payoff $U = -\exp(-\alpha W)$, for $\alpha > 0$
- Standard result: can reduce to mean-variance problem

$$\max_{P \mapsto x} \mathbb{E}[E + x_i(r - P)] - \frac{\alpha}{2}\mathbb{V}[E + x_i(P - r)]$$

  where $\mathbb{E}$,$\mathbb{V}$ respectively return mean and variance under trader's beliefs.
- Demand is

$$x(P) = \frac{\mathbb{E}[r] - P}{\alpha \mathbb{V}[r]}$$

  from which it is clear only market clearing price, irrespective of α or perceived variance, is $P = \mathbb{E}[r]$.

Sketch of NK Micro-foundation back

- Representative household with the following preferences over consumption C_t and labor supply N_t:

$$\exp(\theta_d)\left(\log C_0 - \exp(-\theta_s)\frac{N_0^2}{2}\right) + \sum_{t=1}^{\infty}\beta^t\left(\log C_t - \frac{N_t^2}{2}\right)$$

  where (θ_d, θ_s) are respectively demand and supply shocks in period 0.
- Unconstrained natural rate is $r = \exp(\theta_d - \theta_s)/\beta$ in period 0, $1/\beta$ in all other times.
- Central bank observes only signals of $\theta_s + \theta_d$ and hence, in expectation, wants to target

$$\theta := \frac{\sigma_d^2 - \sigma_s^2}{\sigma_d^2 + \sigma_s^2}(\theta_d + \theta_s)$$

- Next observe $Y = \mathbb{E}[\log Y_0 \mid \theta, r] = a\theta - r$ for $a = \sigma_d^2/(\sigma_d^2 - \sigma_s^2) \geq 1$, assuming $\sigma_d^2 > \sigma_s^2$ (empirically reasonable).
- Higher $a \Rightarrow$ more trepidation about stabilizing θ because it may be a supply shock

Estimating Equation: More of the Autocorrelation Structure [Back]

For Michigan and AAII surveys, zoom in on timing with "event study":

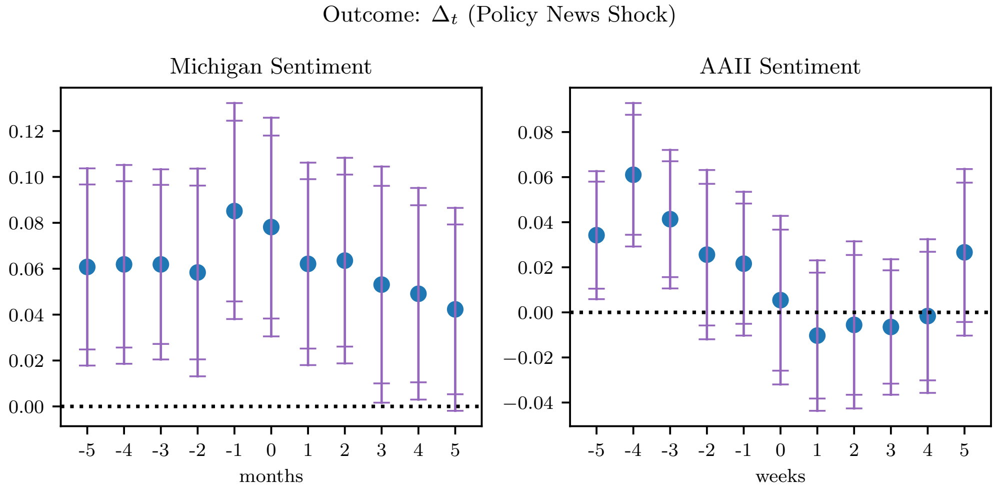
$$\text{MonetarySurprise}_t = \beta_h^P \cdot \check{Z}_{t+h} + \epsilon_t$$

for $h \in \{-H, \ldots, H-1, H\}$.

- **Version 1**: t are months; $\check{Z}_t$ is *level* of Michigan sentiment
- **Version 2**: t are weeks; $\check{Z}_t$ is AAII sentiment
- Previously described predictions hold for β_h^P for $h < 0$. I
- Sample of 153 scheduled FOMC meetings; standard errors HAC robust

Result: Spike Before Meeting Matters Most

Back



Results with Economic Outcomes back

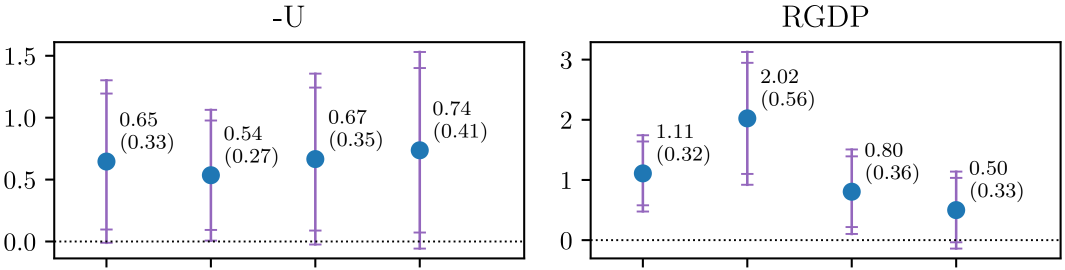
Predictor		No control	U Control	PC Control	NFP Control
Mich. Sentiment	β	0.0091	0.0092	0.0091	0.0092
	SE	(0.0030)	(0.0032)	(0.0028)	(0.0029)
	t-stat	2.97	2.91	3.31	3.14
BC U Rev.	β	0.0094	0.0074	0.0036	0.0042
	SE	(0.0038)	(0.0038)	(0.0050)	(0.0049)
	t-stat	2.47	1.95	0.71	0.87
S&P 500	β	0.0080	0.0077	0.0030	0.0050
	SE	(0.0037)	(0.0036)	(0.0027)	(0.0029)
	t-stat	2.18	2.20	1.40	1.74
AAII Sentiment	β	0.0077	0.0078	0.0030	0.0045
	SE	(0.0027)	(0.0026)	(0.0030)	(0.0027)
	t-stat	2.89	2.94	1.01	1.70

"Regular" Information Effect Regression

Back

$$\mathbb{E}_{BC,t+1}[Y_{t+h}] - \mathbb{E}_{BC,t}[Y_{t+h}] = \alpha + \beta \cdot \Delta + \epsilon_t$$

$$\text{Outcome: } \mathrm{E}_{B,t+1}[Y_{Q(t)+h}] - \mathrm{E}_{B,t}[Y_{Q(t)+h}]$$



h	avg	1	2	3
R^2	0.04	0.03	0.04	0.04
N	116	116	116	116

h	avg	1	2	3
R^2	0.07	0.10	0.03	0.03
N	116	116	116	116

Revisiting the Information Effect

- Key question: what is causal effect of Fed signaling via its policy actions?
- Campbell, Evans, Fisher, and Justiniano (2012) and Nakamura and Steinsson (2018) try to answer this by interpreting following moment, the **F**easible information effect:

$$i^F := \frac{\text{Cov}[\Delta, \mathbb{E}_{M,2}[Y] - \mathbb{E}_{M,0}[Y]]}{\text{Var}[\Delta]}$$

bracketing the announcement.

- Observe, in light of previous discussion, it actually contaminates two things:

$$i^F := \underbrace{\frac{\text{Cov}[\Delta, \mathbb{E}_{M,1}[Y] - \mathbb{E}_{M,0}[Y]]}{\text{Var}[\Delta]}}_{\text{Update from learning } r} + \underbrace{\frac{\text{Cov}[\Delta, \mathbb{E}_{M,2}[Y] - \mathbb{E}_{M,1}[Y]]}{\text{Var}[\Delta]}}_{\text{Correlation with later learning}}$$

$:= i^T$

Model 1: correcting under-reaction

Model 2: correcting over-reaction

Result: Interpreting the Information Effect

Back

Information effect could be smaller or larger than previously thought:

Proposition 3

Consider the regression-equation

$$\mathbb{E}_{M,2}[Y] - \mathbb{E}_{M,0}[Y] = \gamma^{\Delta}\Delta^{\perp} + \gamma^{Z} Z$$

where $\Delta^{\perp}$ is the residual of Δ from Z and $(\gamma^{\Delta}, \gamma^{Z})$ are the coefficients for a best linear predictor, and assume $\text{Cov}[\Delta, Z] > 0$. Then,

- $q = 0$ and $w = 0 \Rightarrow \gamma^{\Delta} = i^F = i^T$, $\gamma^Z = 0$ Efficient use of info
- $q \geq 0$ and $w \leq 0 \Rightarrow \gamma^{\Delta} = i^T \leq i^F$, $\gamma^Z \geq 0$ i^F is over-estimate (momentum)
- $q \leq 0$ and $w \geq 0 \Rightarrow \gamma^{\Delta} = i^T \geq i^F$, $\gamma^Z \leq 0$ i^F is under-estimate (mean-reversion)

Moments to Match

Back

	Moment	Value
1	R^2 from predicting surprises	0.15
2	β^{FCE} for BC	15.32
3	R^2 for FCE reg. (BC)	0.23
4	β^{FCE} for GB	12.06
5	β^{Z}, for BC Revisions	3.69
6	β^{Δ} for BC Revisions	0.10
7	β^{Y} from reg. below	22.69

Parameter	Value
q	0.121
q^F	0.089
w	0.007
τ_Z	20.99
τ_F	0.194
τ_S	6.849
a	1.100

Additional regression for "scaling":

$$Y_{Q(t)+h} = \alpha + \beta^{Y} \cdot \hat{Z}_{t-1} + \epsilon_t$$

Counterfactuals: How Much Does Each Mechanism Matter?

Back

	Scenario Name	Parameter Case	Percent Change from Baseline $\frac{\mathrm{d}}{\mathrm{d}\theta}\mathbb{E}_{M,0}[Y]$	$\frac{\mathrm{d}}{\mathrm{d}\theta}\mathbb{E}_{M,2}[Y]$	$\frac{\mathrm{d}}{\mathrm{d}\theta}r$	$\mathbb{V}[FCE^{Y}_{M,0}]$
1	Agree to disagree	$w = 0$	-11.8	-5.9	0.0	2.7
2	Fed's viewpoint	$q = q^F = \hat{q}^F,\ w = 0$	45.5	20.0	0.0	-9.0
3	Market's viewpoint	$q = q^F = \hat{q},\ w = 0$	40.7	25.1	-3.6	2.7
4	No errors	$q = q^F = w = 0$	59.1	5.3	10.3	-23.0
5	No Fed Info	$\tau_F \downarrow 0$	-1.8	-0.5	0.0	1.1

Theory: "Information Effect" in Model

Back 1 Back 2

Define information effect and feasible estimator,

$$i := \frac{\text{Cov}[\Delta, \mathbb{E}_{M,1}[Y] - \mathbb{E}_{M,0}[Y]]}{\text{Var}[\Delta]} \qquad i^F := \frac{\text{Cov}[\Delta, \mathbb{E}_{M,2}[Y] - \mathbb{E}_{M,0}[Y]]}{\text{Var}[\Delta]}$$

Corollary: Bias in the Information Effect

$i^F = i + B$ where

1. If $w = q = 0$, then $B = 0$.
2. If $w \leq 0$, $q \geq 0$, and $\text{Cov}[\Delta, Z] > 0$, then $B \geq 0$.
3. If $w \geq 0$, $q \leq 0$, and $\text{Cov}[\Delta, Z] > 0$, then $B \leq 0$

Additional Test: Revisiting the "Information Effect"

Back

Augmented "information effect" regression (cf., CEFJ (2012), NS (2018)) Theory

$$\mathbb{E}_{BC,t+1}[Y_{t+h}] - \mathbb{E}_{BC,t}[Y_{t+h}] = \alpha + \beta^Z \cdot \hat{Z}_{t-1} + \beta^\Delta \cdot \hat{\Delta}_t^\perp + \epsilon_t$$

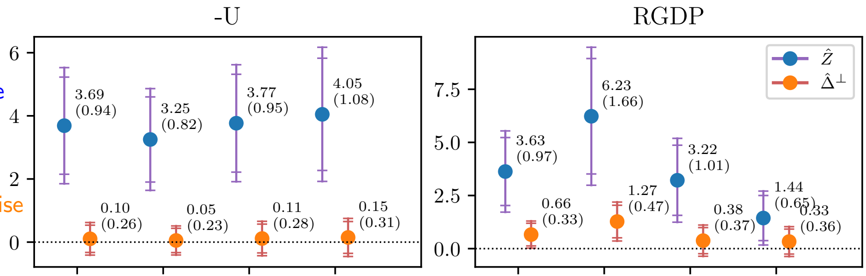
- $(\hat{Z}_{t-1}, \hat{\Delta}_t^\perp)$ are predicted and unpredicted components of monetary surprise
- **Timing.** Sample restricted so FOMC meeting happens between Blue Chip waves Picture
- **Sign predictions** for β^Z:
  - $\beta^Z = 0$ under pure asymmetric information (literature is "right")
  - $\beta^Z > 0$ if markets only under-weight Z in their forecasts
  - $\beta^Z < 0$ if markets only under-estimate Z in monetary rule

Result: Positive Bias in Information Effect

Back

Big, positive

Small, imprecise



h	avg	1	2	3
R^2	0.22	0.19	0.21	0.22
N	116	116	116	116
t^D	3.88	3.74	4.00	3.77

h	avg	1	2	3
R^2	0.14	0.18	0.09	0.05
N	116	116	116	116
t^D	2.91	3.00	2.67	1.69

"Regular" version

A Numerical Illustration of Opposite Biases

Back

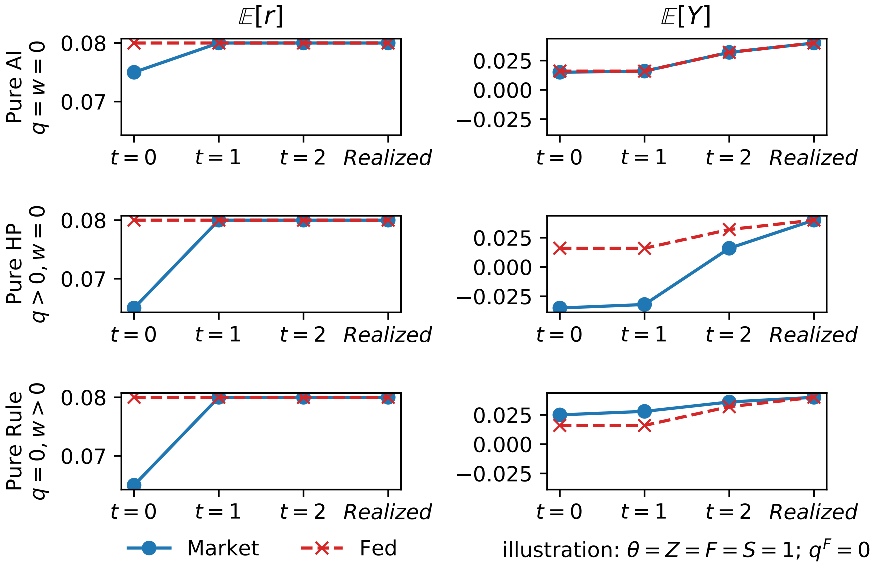


illustration: $\theta = Z = F = S = 1$; $q^F = 0$