Speaking of Inflation:
The Influence of Fed Speeches on Expectations

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Motivation and Research Question

"I think monetary policy is 98% talk and 2% action, and communication is a big part."

- Ben Bernanke, former Fed Chair

Important elements for central bank communication:

- **Method**: is one form of communication more effective than others?
- **Sender**: does it matter who delivers the message?
- **Message**: what do central banks communicate about?
- **Recipient**: is the effect heterogeneous across different stakeholders?
- **Objective**: which variable do they want to affect?

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What We Do

1. Dataset contribution: collect Fed speeches and use textual analysis to extract
   - Inflationary Pressure Index (IPI)
     higher index $\Rightarrow$ Fed signals higher inflationary pressures
   - Hawkishness Index (HI) that reflects policy preference of speakers
     higher index $\Rightarrow$ more hawkish speaker

2. Empirical contribution

3. Theoretical contribution

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2. Empirical contribution: analyze signaling effect
   - Can speeches influence inflation expectations of hhs and professional forecasters?
   - Do policy preferences (i.e. hawkish vs. dovish) matter?
   - Does the state of the world (i.e. high vs. low inflation) matter?

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   - Does the state of the world (i.e. high vs. low inflation) matter?

3. Theoretical contribution
   - Build a stylized NK model of asymmetric information and signaling effects

Preview of empirical findings

1. Speeches affect expectations of all agents (sophisticated and non-sophisticated)
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     Delphic signaling: non-redundant information is conveyed to the public

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     Agents have a more precise private signal when inflation is high (rational inattention)

Related Literature

Role of central bank communication

- Impact on macro-financial variables

  Gürkaynak, Sack and Swanson (2005), Boukus and Rosenberg (2006), Blinder et al. (2008), Carvalho et al. (2016), Campbell et al. (2016), Melosi (2017)

- Information conveyed through language

  Lucca and Trebbi (2009), Bholat et al. (2015), Hansen and McMahon (2016), Shiller (2017), Haldane and McMahon (2018), Gardner, Scotti, and Vega (2022) , Shapiro and Wilson (2022)

Fed speeches

Neuhierl and Weber (2019), Ehrmann, Tietz, and Visser (2021), Malmendier, Nagel, and Yan (2021), Istrefi, Odendahl, and Sestieri (2021), Ahrens and McMahon (2021), Swanson (2023), Bauer and Swanson (2023), Swanson and Jayawickrema (2023)

Managing expectations

Pedemonte (2019), Coibion et al. (2021), Coibion, Gorodnichenko, and Weber (2022), D'Acunto et al. (2022), Kumar, Coibion, Afrouzi, and Gorodnichenko (2015), McMahon and Rholes (2022)

Data

Constructing Inflationary Pressure Index

- Collect speeches by 7 members of Board of Governors and 12 regional Fed presidents
  January 1995 until December 2023, 72 speakers, $\sim$ 4916 speeches
- Split all the speeches into sentences
- Identify a sentence as being about inflation if it contains one of the identifiers
  - *inflation*
  - *price*

  $\Rightarrow$ 82,099 sentences about inflation
- Pair each identifier with the closest modifier
  new dictionary based on economic intuition, similar to Gardner, Scotti, and Vega (2022)
- Score each pair based on modifier $(+1)$ additive or (-1) subtractive

Identifiers and Modifiers

Identifiers	Additive Modifiers (+1)	Subtractive Modifiers (−1)
inflation, price	boost, climb, elevat, escalat, expand, foster, height, high, increas, intensify, jump, persist, pressure, moderate, rise, risk remain, rising, rose, risen, soar, solid, spik, sustain, strong, strength, surg, upward, up, upside risk	below, collapse, damp, deteriorat, declin, diminish, down, drop, eas, fall, low, modest, moderated, muted, plummet, reduction, restrain, retreat, set back, slow, soft, subdued, weak

Example Sentences

Date	Speaker	Inflation Pressure	Example sentences
2004-10-29	Total	-5	
	R. Ferguson	-5	*That should gradually return the economy to full utilization of its resources, while inflation remains subdued.*
2005-10-18	Total	94	
	J. Yellen	27	*And a key question is whether higher energy prices also will elevate core inflation.*
	A. Greenspan	20	*Additionally, the longer-term crude price has presumably been driven up by renewed fears of supply disruptions in the middle east and elsewhere.*

Inflationary Pressure Index

- Sum the scores across speeches at the daily/monthly/quarterly frequency
- Higher index reflects higher current or future inflationary pressures
- Not an assessment of whether outlook is good or bad (inflation close or far from target)
- Index captures both number of speeches and tone

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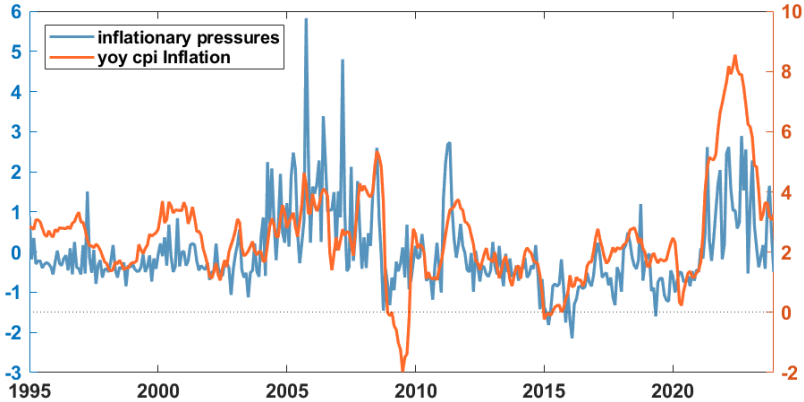

Expectations and Controls

Inflation Expectations

- Households: median 12m Michigan Survey of Consumers (MSC)
- Professionals: median 1Y Survey of Professional Forecasters (SPF)

Controls

- Macro-Financial variables: $\sim$ 120 series in FRED-MD and $\sim$ 240 in FRED-QD assembled in McCracken and Ng (2016) transformed to be stationary
- FOMC quantitative projections: Humphrey-Hawkins reports and SEP (since 2007M10)

Does the IPI Affect Expectations?

Methodology

... following Belloni and Chernozhukov (2013)

First step: Least absolute shrinkage and selection operator (LASSO)

- Regress MSC or SPF 1y ahead expectations on FRED-MD/QD dataset

Second Step: Regress expectations on selected regressors

$$\underbrace{E_t \pi_{t+h}}_{\text{MSC or SPF}} = \alpha + \beta IPI_{t-1} + \gamma' \underbrace{X_{t-1}}_{\text{selected in first step and SEP}} + u_t$$

- Timing: IPI_{t-1} is the previous month IPI for MSC and the IPI of the first month of the quarter in which the forecasts are made for the SPF.

- Controls include FOMC projections from SEP when available

Controls selected in first step: LASSO

MSC	PPI by Commodity: Final Demand: Finished Goods CPI: Commodities PCE: Durable goods Manufacturers' Unfilled Orders: Durable Goods
SPF	CPI : All Items Less Food and Energy Capacity Utilization: Manufacturing Real Revolving Credit Owned and Securitized

Inflationary Pressure Index and Expectations

	MSC			
	1995:m1-2023:m12		**1995:m1-2007:m12**	**2008:m1-2023:m12**
IPI	$0.09^{\dagger}$	0.14*		
	(0.05)	(0.07)		
SEP		$0.30^{\dagger}$		
		(0.16)		
Obs	347	87		
	SPF			
	1995:Q1-2023:Q4		**1995:Q1-2007:Q4**	**2008:Q1-2023:Q4**
IPI	0.07***	0.07***		
	(0.03)	(0.02)		
SEP		0.18***		
		(0.06)		
Obs	116	82		

- $1\sigma \uparrow$ IPI: hhs expect 0.14pp $\uparrow$ and professional forecasters expect 0.07pp $\uparrow$ inflation next 12 months
- 1pp $\uparrow$ SEP: hhs expect 0.30pp $\uparrow$ and professional forecasters expect 0.18pp $\uparrow$ inflation next 12 months

Inflationary Pressure Index and Expectations

	MSC					
	1995:m1-2023:m12		**1995:m1-2007:m12**		**2008:m1-2023:m12**	
IPI	0.09†	0.14*	0.02	0.23**	0.27***	0.19**
	(0.05)	(0.07)	(0.04)	(0.07)	(0.06)	(0.08)
SEP		0.30†		-0.02		0.65**
		(0.16)		(0.08)		(0.24)
Obs	347	87	155	24	192	63
	SPF					
	1995:Q1-2023:Q4		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
IPI	0.07***	0.07***	0.05†	0.04*	0.12***	0.06**
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
SEP		0.18***		0.06		0.17***
		(0.06)		(0.10)		(0.08)
Obs	116	82	52	23	62	59

- $1\sigma \uparrow$ IPI: hhs expect 0.14pp $\uparrow$ and professional forecasters expect 0.07pp $\uparrow$ inflation next 12 months
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Results are robust to:

- using mean forecast rather than median forecast
- excluding index outliers (5% of the sample)
- adding def-disinflation as identifiers
- using principal components instead of LASSO
- using shock first approach to account for confounding effects
- including additional lag of inflation pressure index and controls
- using contemporaneous controls
- alternative household expectations NY Fed SCE

Do Policy Preferences Matter?

Hawkishness Index

- Extract a naive hawkishness indicator (HI) from FOMC speeches
  - Assume policy preference of a speaker constant over time (Istrefi 2018)
  - Count the number of times each speaker says *inflation, prices and unemployment*
  - Hawkishness by speaker: (#inflation + #price)/(# unemployment)
  - HI: sum hawkishness of speakers giving speech on that day/month/quarter
  - Hawkishness Dummy: one if hawkishness index greater than real time mean

$$HD_t = \mathbb{1}\left(HI_t \geq \overline{HI}_{t_0:t-1}\right). \tag{1}$$

- Interact hawkishness dummy with inflationary pressure index
- Add interaction term $HD_t^* IPI_t$ to the regression

Inflationary Pressure Index and Hawkishness Index

$$E_t\pi_{t+h} = \alpha + \beta IPI_{t-1} + \delta IPI_{t-1} * HI_{t-1} + \gamma' X_{t-1} + u_t$$

	MSC		SPF	
IPI	0.15*	0.15†	0.12***	0.12***
	(0.07)	(0.08)	(0.04)	(0.03)
IPI*HI	-0.12	0.06	-0.11**	-0.10***
	(0.09)	(0.15)	(0.06)	(0.04)
SEP		0.22		0.17***
		(0.14)		(0.06)
Obs	347	87	116	82

When the inflationary pressure index is high, a higher hawkishness index (high determination to fight inflation) decreases inflation expectations of experts.

Do policy preferences of the Fed matter?

Possible mechanism...

increase in the inflationary pressure index

$\Downarrow$

a way for FOMC members to remark their determination to fight inflation and justify an upcoming policy rate hike that will lower inflation

$\Downarrow$

sophisticated agents should be able to anticipate this and increase their inflation expectations less

$\Downarrow$

smaller signaling effect

Does the Level of Inflation Matter?

State-Dependence: Inflationary Pressure Index

Does the effect of FED communication through speeches change when inflation is high?

	MSC				SPF			
	low		high		low		high	
IPI	0.11*	0.11*	0.02	0.04	0.08***	0.10***	0.01	0.01
	(0.05)	(0.05)	(0.07)	(0.09)	(0.04)	(0.02)	(0.04)	(0.03)
SEP		-0.15		0.98**		0.12*		0.29***
		(0.09)		(0.28)		(0.06)		(0.10)
Obs	249	63	98	24	83	58	33	24
R-squared	0.37	0.38	0.66	0.65	0.76	0.78	0.75	0.80

Table: State-dependent results. Periods of high inflation are defined as times when the growth rate of the year-over-year CPI all items index exceeds 3%. 95Q2, 96Q3, 00Q1-01Q2,04Q4,05Q1,05Q3-06Q3, 07Q4-08Q3,11Q2-11Q4,22Q2-23Q4

Empirical Results: Main Takeaways

1. Communication affects expectations of all agents (sophisticated and non-sophisticated)
   - Higher IPI $\Rightarrow$ higher expectations

2. Policy stance matters for sophisticated agents
   - Expectations of sophisticated agents respond less when policy is hawkish

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Next: Build a model to rationalize these findings...

The Model

The Model

- Stylized New Keynesian model with asymmetric information between private sector and the central bank regarding TFP shock ϵ_t^A
- All agents observe the history of realized shocks and know the structure of the economy
- The private sector and central bank receive orthogonal news regarding the future realization of technology

$$s_t^P = \epsilon_{t+1}^a + \eta_t^P$$
$$s_t^C = \epsilon_{t+1}^a + \eta_t^C$$

with noise $\eta_t^P \sim \mathcal{N}\left(0, \sigma_{\eta,P}^2\right)$ and $\eta_t^C \sim \mathcal{N}\left(0, \sigma_{\eta,C}^2\right)$

- The central bank announces its forecast about inflation to the private sector: $E_t^C \pi_{t+1}$
- The private sector tries to learn the central bank's view about the future realization of the shock $\Rightarrow$ solves a signal extraction problem

Model prediction: Delphic announcement

The central bank observes a negative signal regarding the future realization of technology

$$\Downarrow$$

The central bank expects the natural rate to rise

$$R^*_{t+1} = -\sigma\omega\epsilon^A_{t+1} \quad \uparrow$$

$$\Downarrow$$

Inducing the policymaker to expect inflationary pressure to rise

$$E^C_t \pi_{t+1} \quad \uparrow$$

$$\Downarrow$$

Empirical fact 1

The central bank communicates the higher inflation rate to the private sector

rising their inflation expectations

$$E^P_t \pi_{t+1} \quad \uparrow$$

Odyssean announcement

- The central bank announces its forecast about inflation to the private sector: $E_t^C \pi_{t+1}$ as well as communicating its change in response to inflation

e.g. assuming inflationary pressures are expected, the central bank announces that it will respond more strongly than previously expected to inflation deviations from target:

$$\overline{\phi}_\pi > \underline{\phi}_\pi = \phi_\pi$$

and the central bank backs it by announcing: $E_t^C R_{t+1}$

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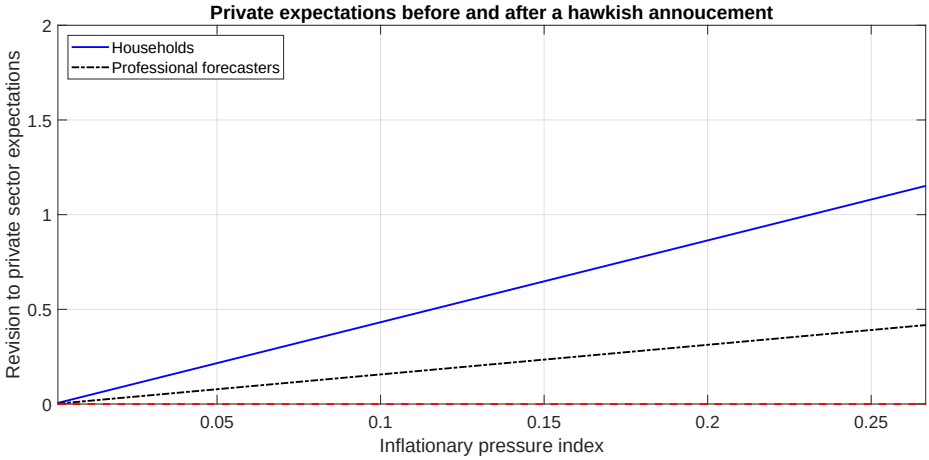
- We consider two cases:
  - sophisticated agents: pay attention to the Odyssean announcements ($\phi_\pi = \overline{\phi}_\pi$)
  - non-sophisticated agents: do not pay attention to the Odyssean announcements ($\phi_\pi = \underline{\phi}_\pi$)

Model prediction: Odyssean announcement



Parameters: $\beta = 0.975$, $\sigma = 0.5$, $\kappa = 0.5$, $\eta = 2$, $\underline{\phi}_\pi = 1.25$, $\overline{\phi}_\pi = 2.75$, $\phi_x = 0.0$, $\sigma_a = \sigma_{\eta,P} = \sigma_{\eta,C} = 1.5$

Empirical fact 2 Experts increase their expectations less than hhs when Fed more hawkish

Model predictions

- We show that Delphic announcements lead to signaling effects for all agents
  (empirical result #1)
- The hawk's projection (Odyssean announcement) leads to smaller signaling effects for sophisticated agents
  (empirical result #2)
- A more precise private signal when inflation is high leads to smaller signaling effects for all agents
  (empirical result #3)

Policy implications

- Central banks can rely on speeches as well as projections to affect expectations
  - Switch to transparency pays off: expectations are affected by Fed communication
- Are expectations affected in the intended way?
  - Policy stance matters for sophisticated agents
  - Signaling effect is stronger in good times (low inflation) compared to bad times (high inflation)
- How should bad news about inflation be delivered?
  - Truthful information paired with Odyssean announcement for experts
  - But what about non-experts?

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Mean forecasts

	MSC					
	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
IPI	0.09	0.22*	-0.05	0.28*	0.36***	0.31**
	(0.07)	(0.11)	(0.06)	(0.12)	(0.09)	(0.12)
SEP		0.50*		0.11		0.95**
		(0.23)		(0.16)		(0.30)
R-Squared	0.72	0.74	0.57	0.59	0.80	0.80
Observations	347	87	155	24	192	63
	SPF					
	1995:Q1-2023:Q4		1995:Q1-2007:Q4		2008:Q1-2023:Q4	
IPI	0.06**	0.07***	0.03	0.05*	0.13***	0.06*
	(0.03)	(0.02)	(0.03)	(0.02)	(0.04)	(0.04)
SEP		0.22***		0.15		0.26***
		(0.07)		(0.10)		(0.10)
R-Squared	0.78	0.86	0.70	0.65	0.86	0.89
Observations	116	82	52	23	64	59

Table: LHS: Mean inflation forecasts of MSC 12m ahead and SPF 1Y ahead. back

Excluding outliers

	MSC					
	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
IPI	0.13*	0.16*	0.01	0.19**	0.34***	0.32**
	(0.06)	(0.09)	(0.06)	(0.07)	(0.07)	(0.09)
SEP		0.22		-0.10		0.46*
		(0.14)		(0.09)		(0.21)
R-Squared	0.62	0.67	0.46	0.52	0.76	0.79
Observations	330	83	147	23	182	60
	SPF					
	1995:Q1-2023:Q4		1995:Q1-2007:Q4		2008:Q1-2023:Q4	
IPI	0.09***	0.11***	0.06	0.10**	0.12***	0.08**
	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
SEP		0.20***		0.06		0.22**
		(0.07)		(0.10)		(0.09)
R-Squared	0.79	0.87	0.71	0.71	0.87	0.90
Observations	109	76	49	20	61	56

Table: Outliers defined as top 5% of observations of the IPI. back

Add Identifiers

	MSC					
	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
IPI	0.10†	0.15**	-0.04	-0.01	0.19**	0.11†
	(0.05)	(0.06)	(0.05)	(0.07)	(0.07)	(0.06)
SEP		0.55***		0.46***		0.67***
		(0.13)		(0.12)		(0.15)
R-Squared	0.57	0.71	0.28	0.66	0.55	0.74
Observations	347	87	155	24	192	63
	SPF					
	1995:Q1-2023:Q4		1995:Q1-2007:Q4		2008:Q1-2023:Q4	
IPI	0.07***	0.07***	0.04	0.04*	0.12***	0.07**
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
SEP		0.20***		0.07		0.20***
		(0.06)		(0.10)		(0.08)
R-Squared	0.80	0.86	0.75	0.64	0.88	0.90
Observations	116	82	52	23	64	59

Table: Add identifiers "deflation" and "disinflation" (score = -1) to identifiers list. back

Principal Components

	MSC					
	1995:m1-2023:m12		**1995:m1-2007:m12**		**2008:m1-2023:m12**	
IPI	0.13*	0.17*	0.06	0.17***	0.32***	0.16†
	(0.05)	(0.07)	(0.04)	(0.04)	(0.08)	(0.10)
SEP		0.49**		0.01		0.83***
		(0.15)		(0.08)		(0.22)
R-Squared	0.59	0.71	0.47	0.64	0.67	0.76
Observations	347	87	155	24	192	63
	SPF					
	1995:Q1-2023:Q4		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
IPI	0.06	0.07***	−0.12***	−0.01	0.16***	0.05
	(0.05)	(0.02)	(0.05)	(0.03)	(0.05)	(0.04)
SEP		0.43***		0.30***		0.48***
		(0.06)		(0.09)		(0.07)
R-Squared	0.49	0.80	0.45	0.47	0.70	0.86
Observations	116	82	52	23	64	59

Table: First step: PCA on FRED-MD or FRED-QD datasets. Second step: regress expectations on pc extracted in first step. Number of pc included in second step regressions is three for MCS and four for SPF. back

Shock first approach

	MSC					
	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
IPI	0.55***	0.40**	0.39***	0.30***	0.74***	0.52***
	(0.05)	(0.09)	(0.05)	(0.04)	(0.05)	(0.10)
SEP		0.48**		-0.04		0.45**
		(0.13)		(0.08)		(0.13)
Observations	347	87	155	24	192	63
	SPF					
	1995:Q1-2023:Q4		1995:Q1-2007:Q4		2008:Q1-2023:Q4	
IPI	0.02	0.06**	−0.07	0.02	0.01	0.01
	(0.08)	(0.03)	(0.08)	(0.03)	(0.10)	(0.04)
SEP		0.54***		0.39***		0.57***
		(0.04)		(0.07)		(0.04)
Observations	116	82	52	23	64	59

Table: First step: regress IPI on FRED-MD and FRED-QD datasets and construct residuals. Step 2: regress expectations on residuals constructed in step one.

back

Additional lags

	MSC					
	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
IPI	0.08	0.13	0.02	0.26***	0.23***	0.16*
	(0.05)	(0.08)	(0.04)	(0.07)	(0.06)	(0.08)
IPI lagged	0.00	0.29*	0.01	0.01	0.05	0.62**
	(0.05)	(0.16)	(0.04)	(0.07)	(0.06)	(0.23)
SEP		0.01*		0.01		0.06**
	(0.07)	(0.07)	(0.05)	(0.05)	(0.07)	(0.07)
R-Squared	0.65	0.70	0.51	0.64	0.78	0.80
Observations	347	87	155	24	192	63
	SPF					
	1995:Q1-2023:Q4		1995:Q1-2007:Q4		2008:Q1-2023:Q4	
IPI	0.06**	0.07***	0.02	0.06**	0.11***	0.06**
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
IPI lagged	0.00	−0.01	0.01	−0.07**	−0.02	−0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
SEP		0.21***		0.05		0.22**
		(0.06)		(0.09)		(0.09)
R-Squared	0.79	0.86	0.75	0.68	0.86	0.89
Observations	115	82	51	23	63	58

Table: RHS: Two lags of regressors and IPI in step two. back

Contemporaneous controls

	MSC					
	1995:m1-2023:m12		**1995:m1-2007:m12**		**2008:m1-2023:m12**	
IPI	0.11*	0.17*	0.07*	0.20***	0.26***	0.23**
	(0.05)	(0.07)	(0.04)	(0.04)	(0.07)	(0.09)
SEP		0.28†		-0.01		0.44†
		(0.17)		(0.07)		(0.25)
R-Squared	0.63	0.69	0.50	0.67	0.73	0.75
Observations	347	87	155	24	192	63
	SPF					
	1995:Q1-2023:Q4		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
IPI	0.05**	0.06***	0.01	0.03	0.11***	0.06**
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
SEP		0.23***		0.11		0.26***
		(0.06)		(0.10)		(0.07)
R-Squared	0.81	0.87	0.78	0.65	0.88	0.90
Observations	116	82	52	23	62	59

Table: RHS: contemporaneous controls and SEP. back

Alternative household expectations: NY Fed SCE

	One Year Ahead		Three Years Ahead	
	Model 1	Model 2	Model 1	Model 2
IPI	0.06	0.14*	0.05**	0.11***
	(0.05)	(0.08)	(0.05)	(0.04)
SEP		−0.25		−0.04
		(0.25)		(0.04)
R-Squared	0.95	0.95	0.81	0.86
Observations	127	41	127	41

Table: LHS: NY-Fed SCE expectations, Median one- and three-year-ahead expected inflation rate, 2013M1-2023M12.

back

Media Coverage of FOMC Speeches

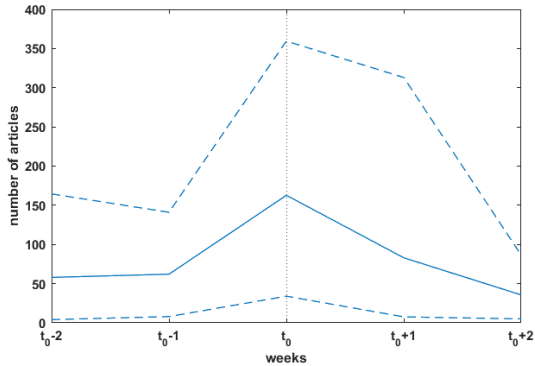

Figure: Average number of articles from US journals covering FOMC speeches by all members, excluding Chair and NY-FED president, January 1st to April 10th 2023. t_0 is the week in which the speeches are given. Source: Factiva