Central Bank Communication

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June 2016

The views expressed in this paper are those of the authors and do not necessarily represent those of the IMF or IMF policy.

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Outline

- Motivation: The Key role for communication in monetary policy
- External communication: Macroeconomic Effects
  1. Monetary Policy Statements as Shocks?
  2. Communication interacting with Shocks?
  3. Monetary Policy Speeches as Shocks?
- Internal Communication: How much transparency?

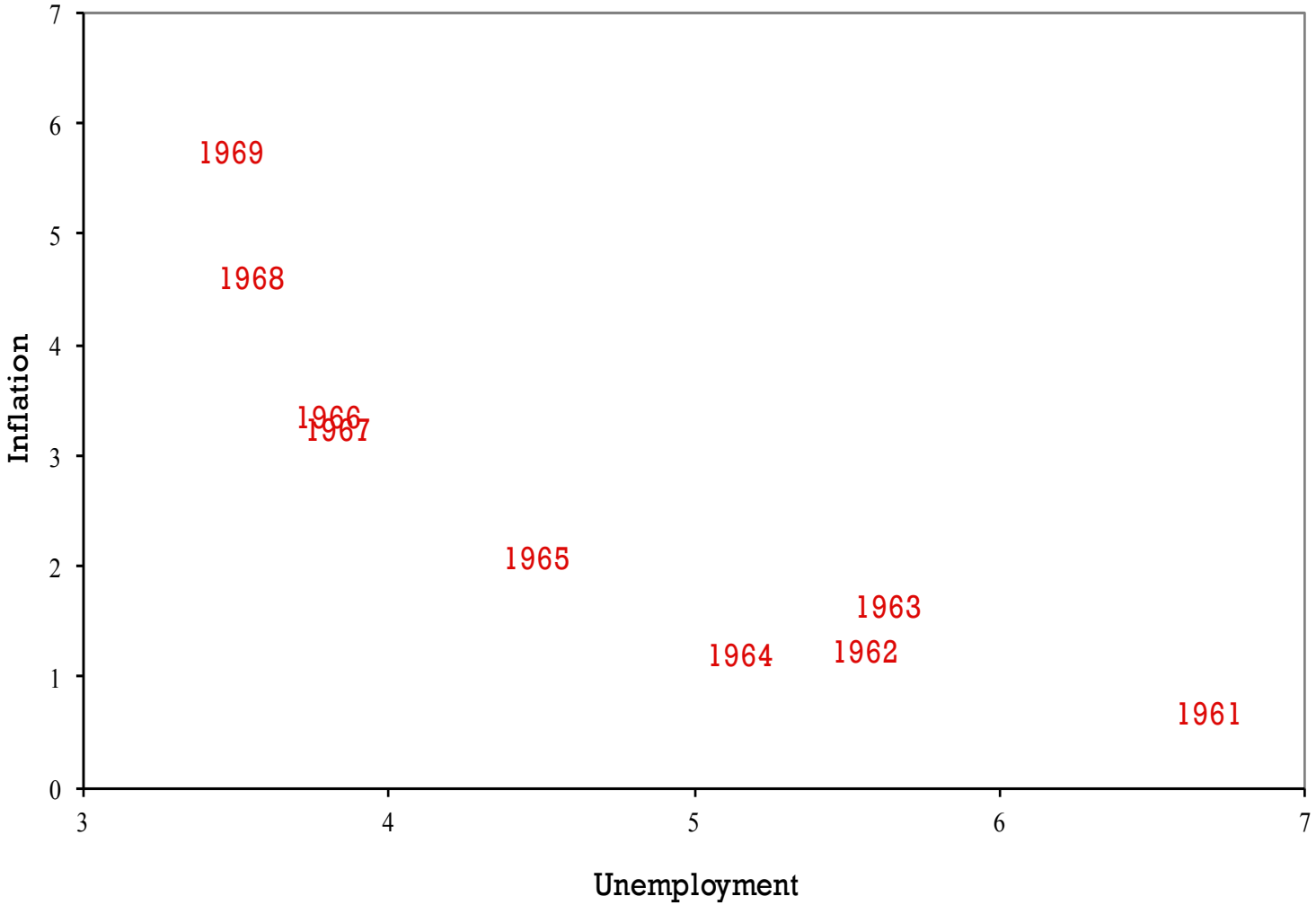
I will jump around flexibly: Please interupt

Paper in the context of my Monetary Policy research

1. "Understanding the Macroeconomic Effects of Working Capital in the UK" with BoE / IMF co-authors, *R&R, EJ*
2. "Perils of Quantitative Easing" with Peiris & Polemarchakis
3. "QE and the Bank Lending Channel in the UK" with BoE / BIS co-authors, *R&R, EJ*
4. "First Impressions Matter: Signalling as a Source of Policy Dynamics" with Hansen, *ReStud*
5. "Preferences or Private Assessments on a Monetary Policy Committee?" with Hansen & Velasco Rivera, *JME*
6. "Estimating Bayesian Decision Problems with Heterogeneous Expertise" with Hansen & Srisuma, *JAE*
7. "Transparency and Deliberation within the FOMC: A computational linguistics approach" with Hansen & Prat, *R&R, QJE*
8. "Understanding the macroeconomic effects of central bank communication" with Hansen, *JIE*
9. And various work in progress

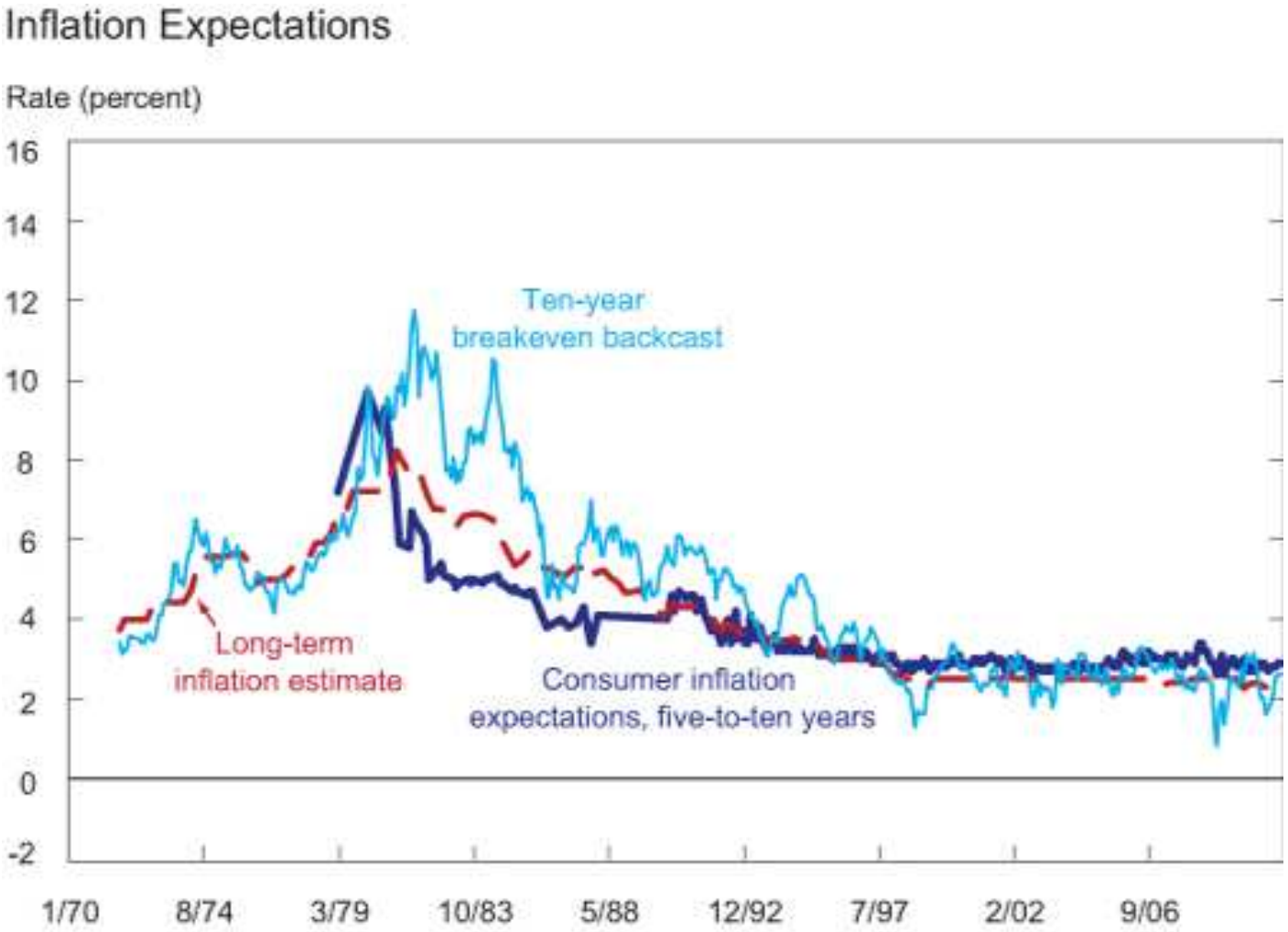
Motivation

The Phillips Curve 'Trade-off': US 1960s



The Phillips Curve 'Trade-off': US All

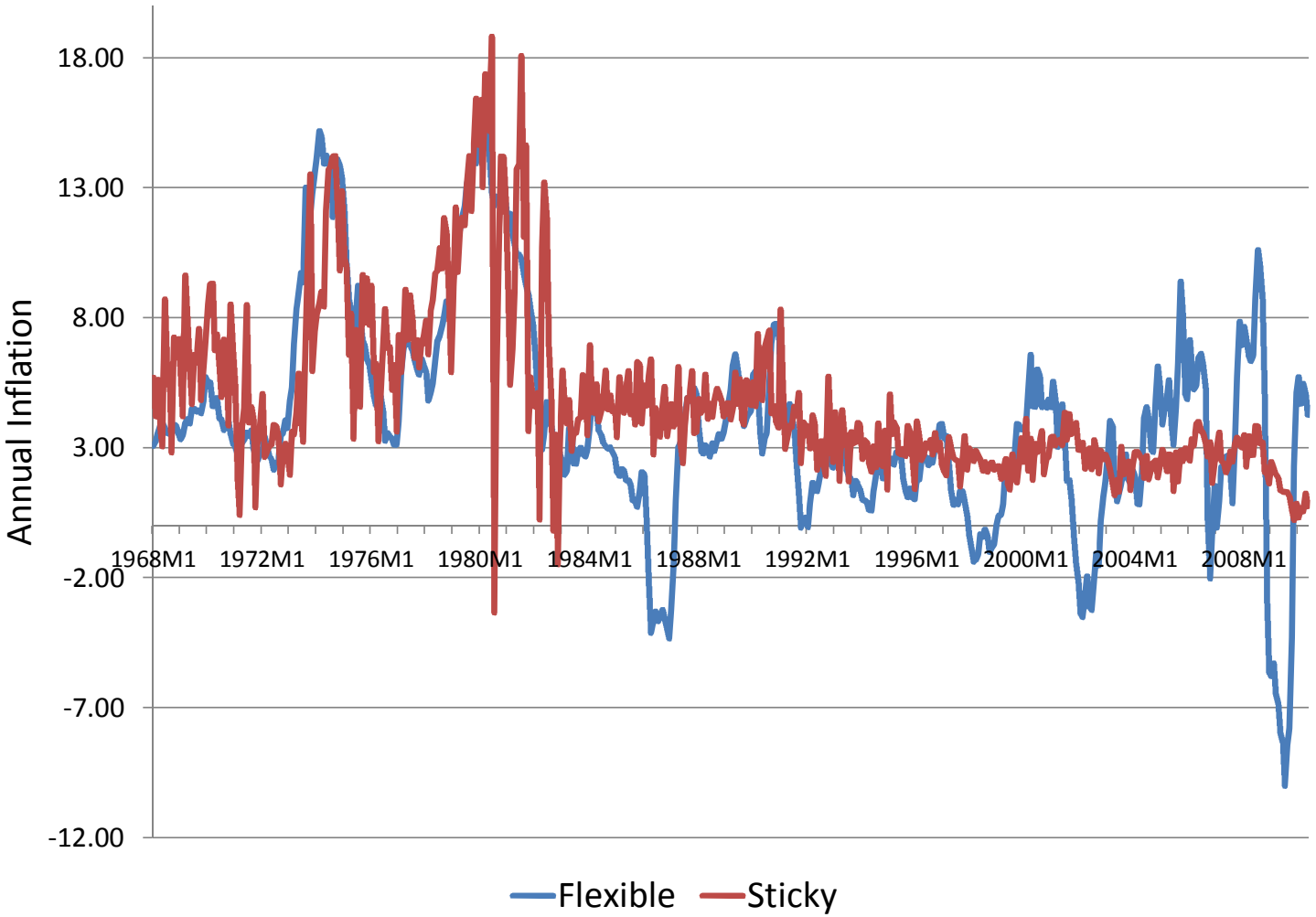
Monetary Policy and Expectations I



Sources: University of Michigan; Board of Governors of the Federal Reserve System; authors' calculations.

Source: Groen and Middeldorp

Monetary Policy and Expectations II



Monetary Policy and Expectations III

"There is not much doubt that the process of reducing inflation from around 15 per cent per annum in the mid-eighties to below 2 per cent in 1991 had an adverse impact on growth and employment during that period. I have often acknowledged that point, and indeed I know of no central banker who would claim with any confidence that inflation can be reduced from a high level to a low level without at least some, temporary, impact on growth and employment. ***The reasons for this are now widely understood and relate to the way in which a policy to reduce inflation interacts with expectations that inflation will continue at its previous pace.*** *But shortly after inflation was first reduced to the 0 to 2 per cent target in 1991, the economy began to grow again and unemployment began to fall."*

Donald T Brash, Governor of the Reserve Bank of New Zealand (February 2000)

External Central Bank Communications Now Central

- **Blinder (1998):**

  "expectations about future central bank behavior provide the essential link between short rates and long rates."

- **Bernanke (2003):**

  "A given [monetary] policy action... can have very different effects on the economy, depending (for example) on what the private sector infers... about the information that may have induced the policymaker to act, about the policymaker's objectives in taking the action..."

- **Gurkayanak, Sack and Swanson (2005):**

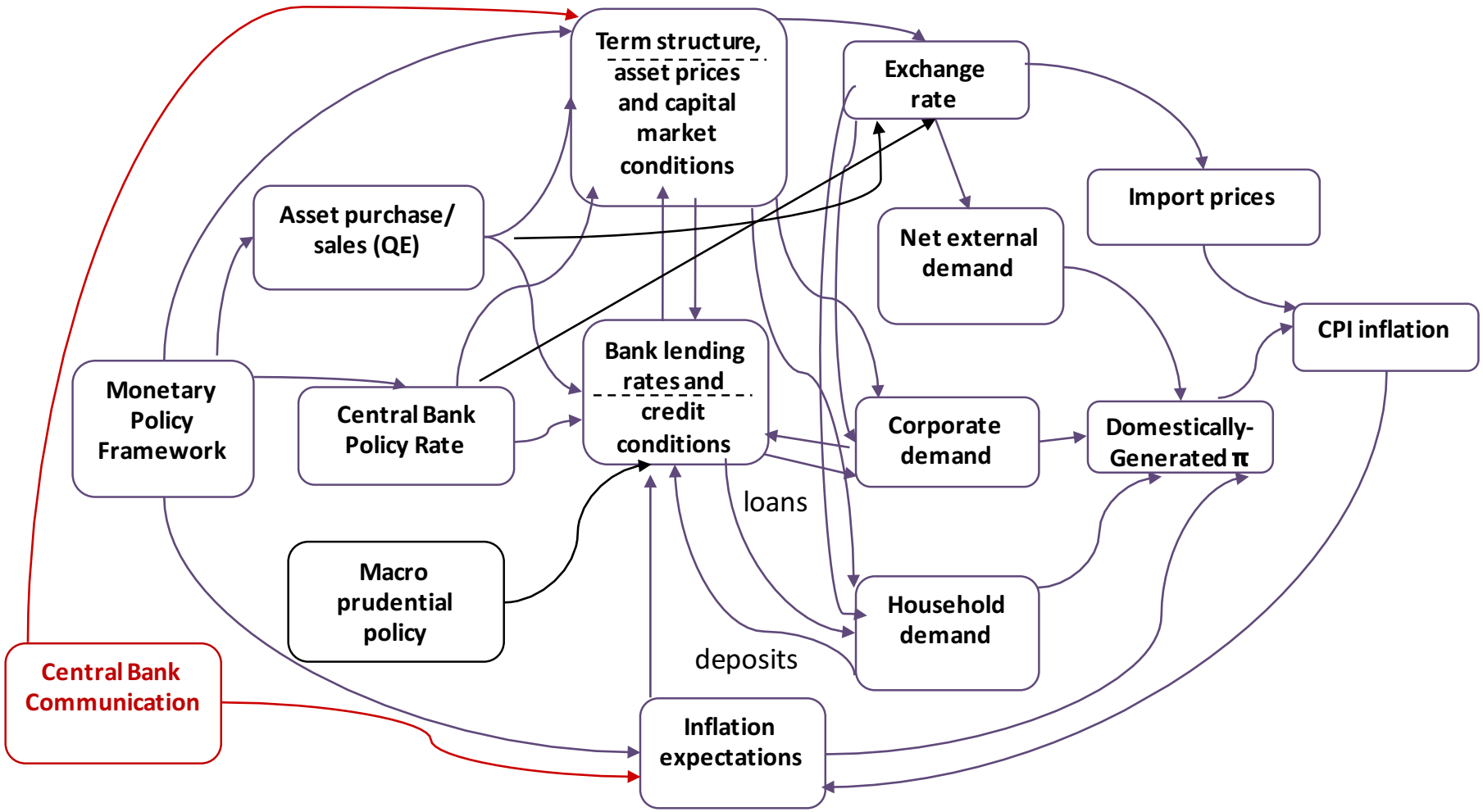
  Central bank statements move markets beyond the effect of the change in the current policy rate (event study).

- **Reis (2013):**

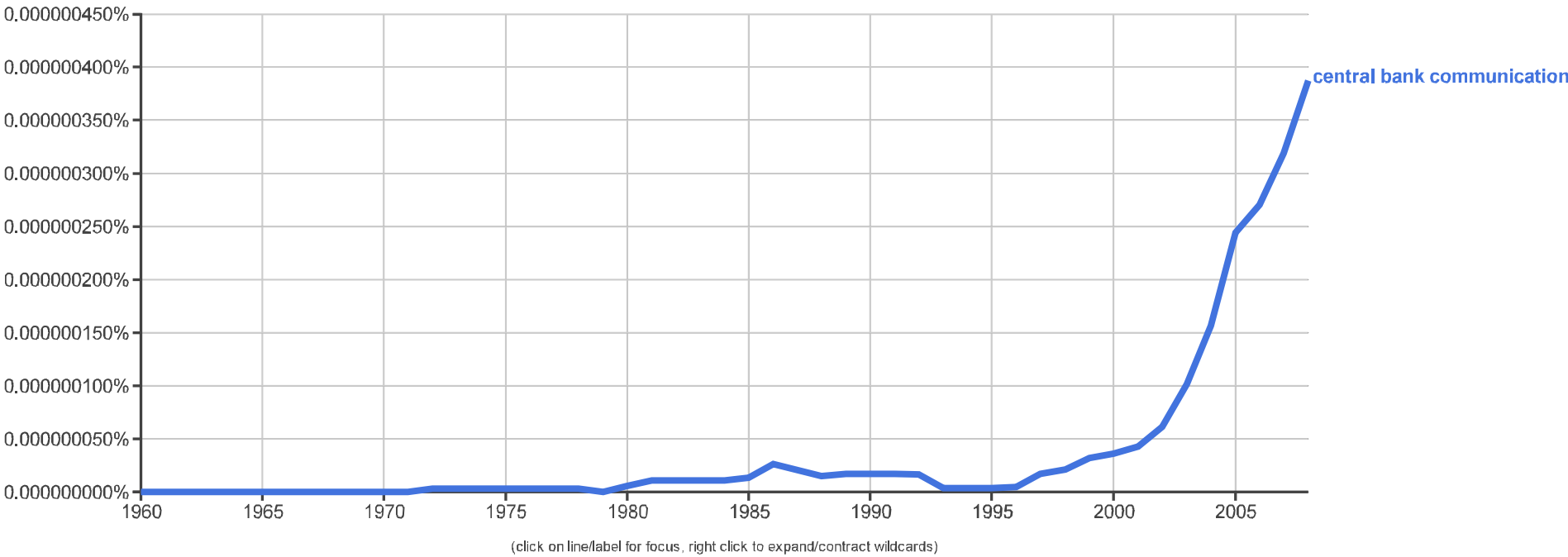
  Optimal communication strategy is part of central bank design.

Monetary Transmission Mechanism

Communications Channel



Central Bank Communication



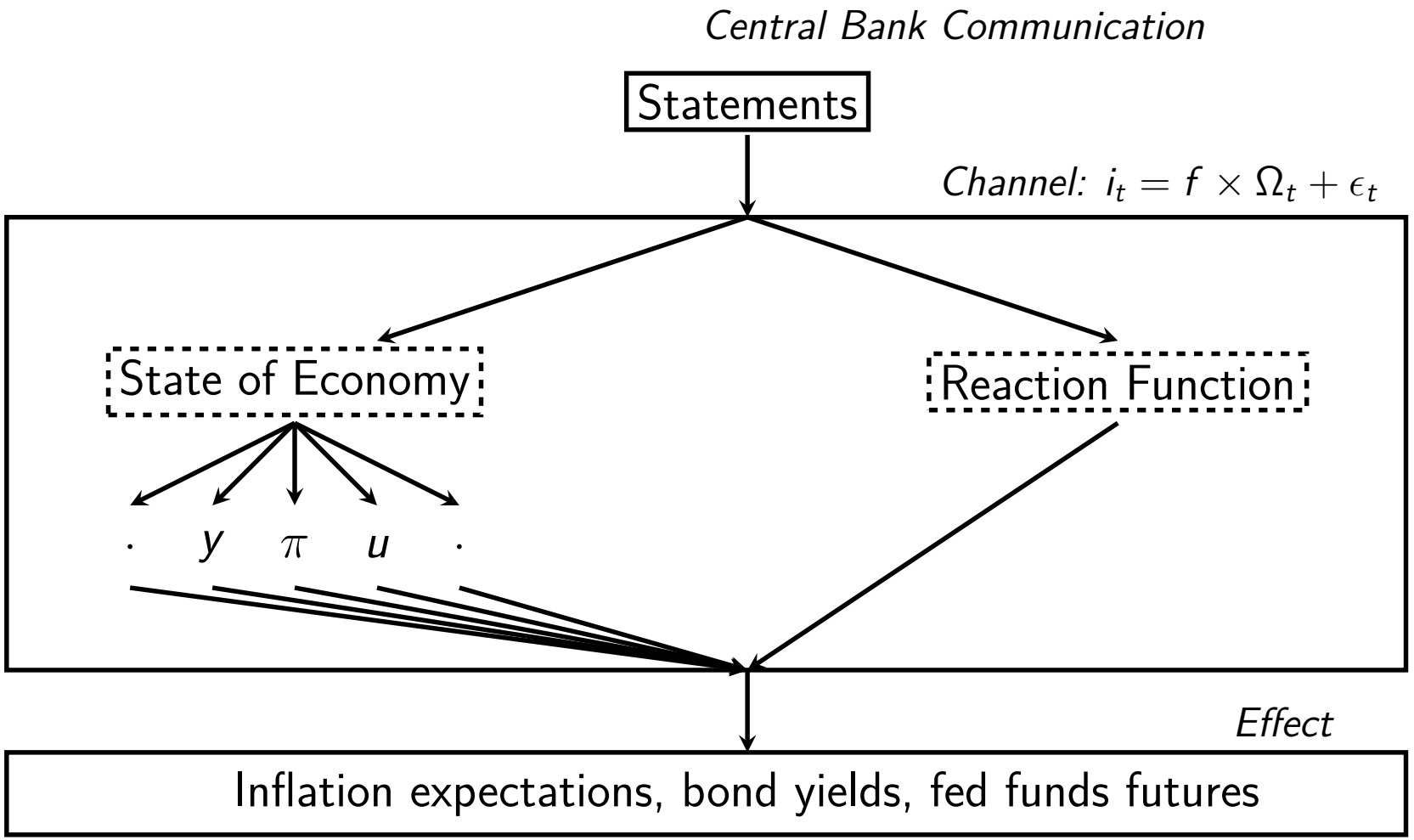
Our Empirical Approach

Research Projects

- Use novel techniques from the field of computational linguistics to investigate the role of central bank communication in shaping private sector inflation expectations and affecting the economy.
- Use machine learning outputs as inputs to conventional econometrics
- Empirical investigations (ultimately) covering:
  - Speeches, statements and minutes from meetings
  - Transcripts within meetings
- Extend the existing methodologies

Statements as Shocks

The Transmission of CB Communication

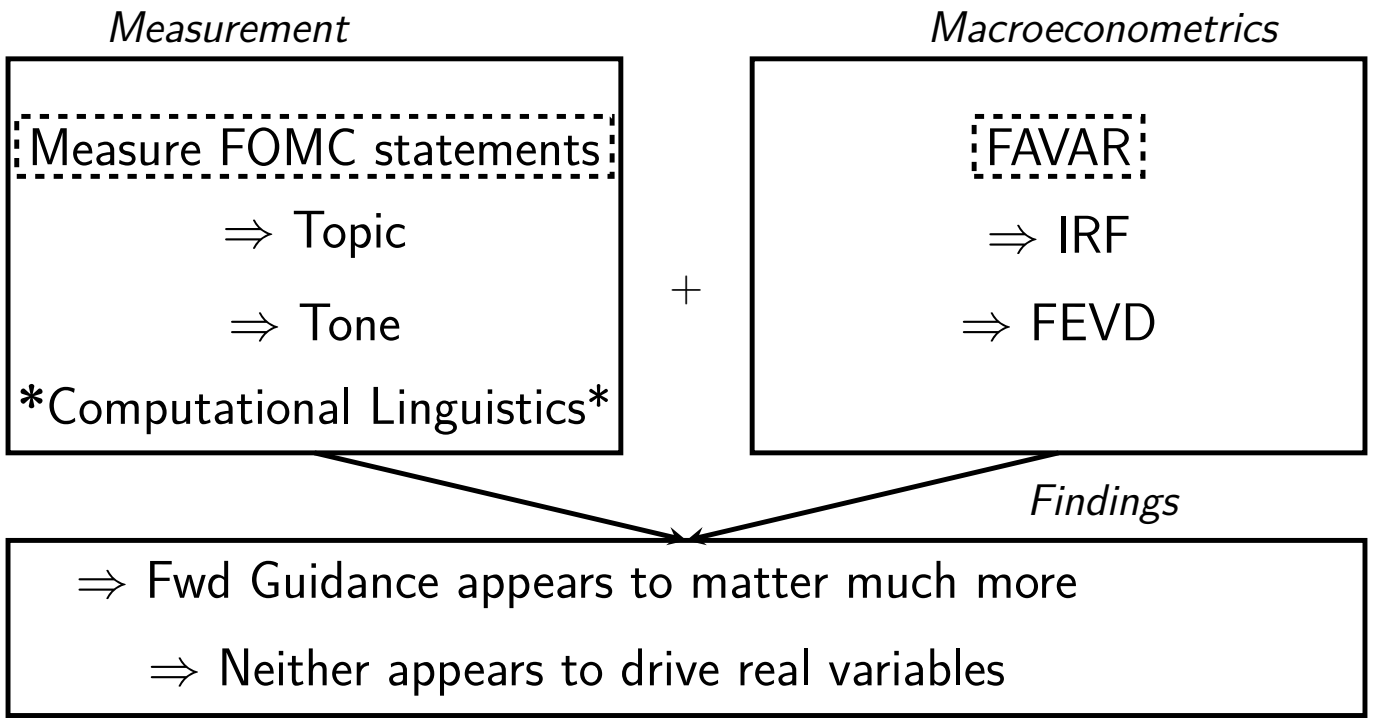


Our JIE paper

Research Questions

1. What does FOMC communicate in statements that drive markets?
2. Do these communications have real effects?

Current WiP examines at the effect of all communication on π^e



Topic: The Latent Dirichlet Allocation (LDA) model

- Blei, Ng and Jordan (2003) cited 11,500+ times
  - Hansen, McMahon and Prat (2014)
- LDA (and its extensions) estimates what fraction of each document in a collection is devoted to each of several "topics."
  - JSTOR example
- Great promise for economics more broadly.
- LDA is an unsupervised learning approach - we don't set probabilities

1. Start with words in statements
2. Tell the model how many topics there should be
3. Model will generate β_K **topic distributions**
   - the distribution over words for each topic
4. Model also generates θ_d **document distributions**

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1. Start with words in statements
2. Tell the model how many topics there should be
   - Perplexity scores
3. Model will generate β_K **topic distributions**
   - the distribution over words for each topic
4. Model also generates θ_d **document distributions**

Example statement: Yellen, March 2006, #51

Raw Data → Remove Stop Words → Stemming → Multi-word tokens = Bag of Words

We have noticed a change in the relationship between the core CPI and the chained core CPI, which suggested to us that maybe something is going on relating to substitution bias at the upper level of the index. You focused on the nonmarket component of the PCE, and I wondered if something unusual might be happening with the core CPI relative to other measures.

Example statement: Yellen, March 2006, #51

Raw Data → Remove Stop Words → Stemming → Multi-word tokens = Bag of Words

noticed change relationship between core CPI
chained core CPI suggested maybe something going
relating substitution bias upper level index focused
nonmarket component PCE wondered something
unusual happening core CPI relative measures

Example statement: Yellen, March 2006, #51

Raw Data → Remove Stop Words → Stemming → Multi-word tokens = Bag of Words

notic chang relationship between core CPI
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relat substitut bia upper level index focus
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Federal Funds Rate → fed fund rate → ffr
monetary policy → monetari polici → monpol

Example statement: Yellen, March 2006, #51

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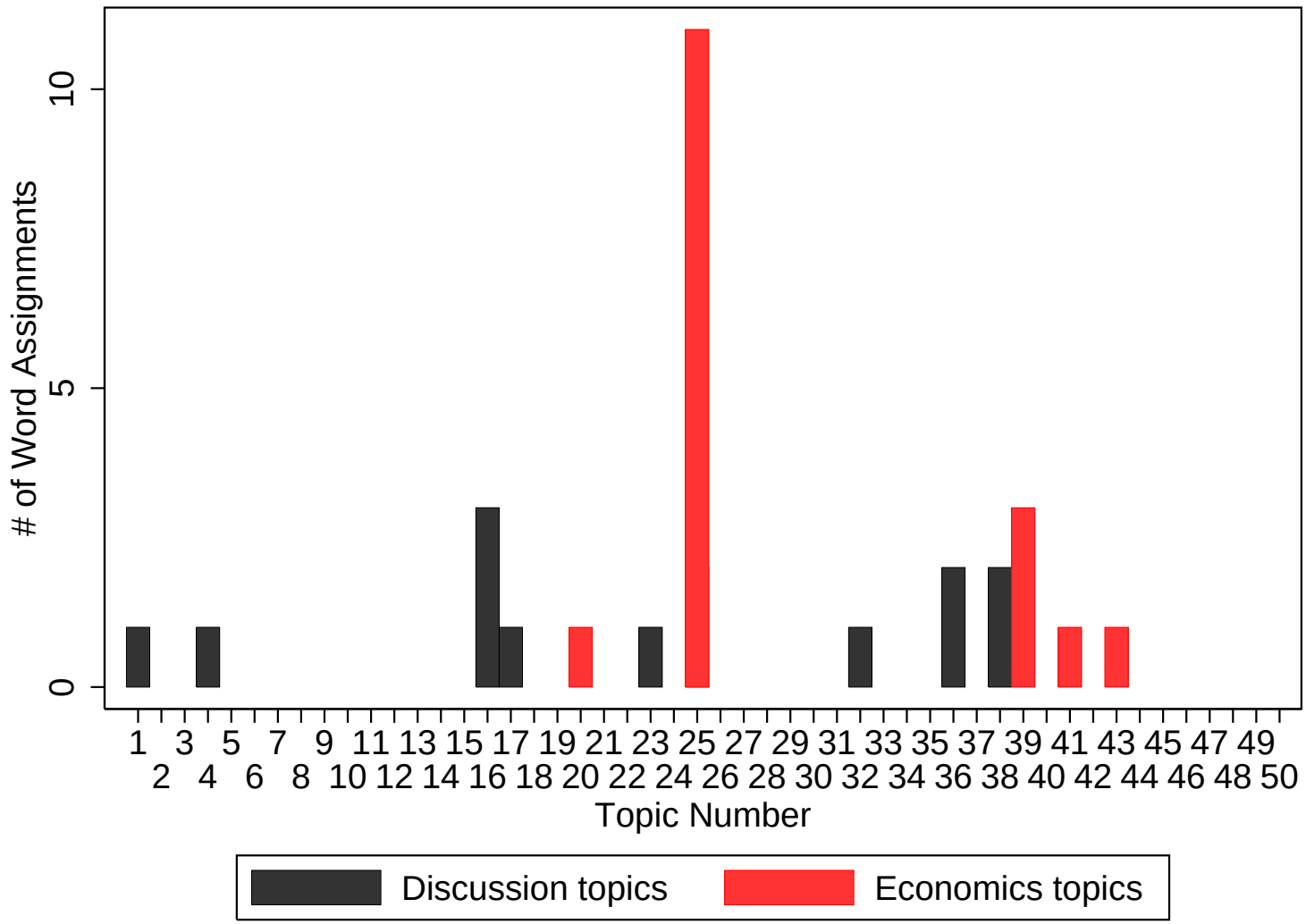
Example statement: Yellen, March 2006, #51

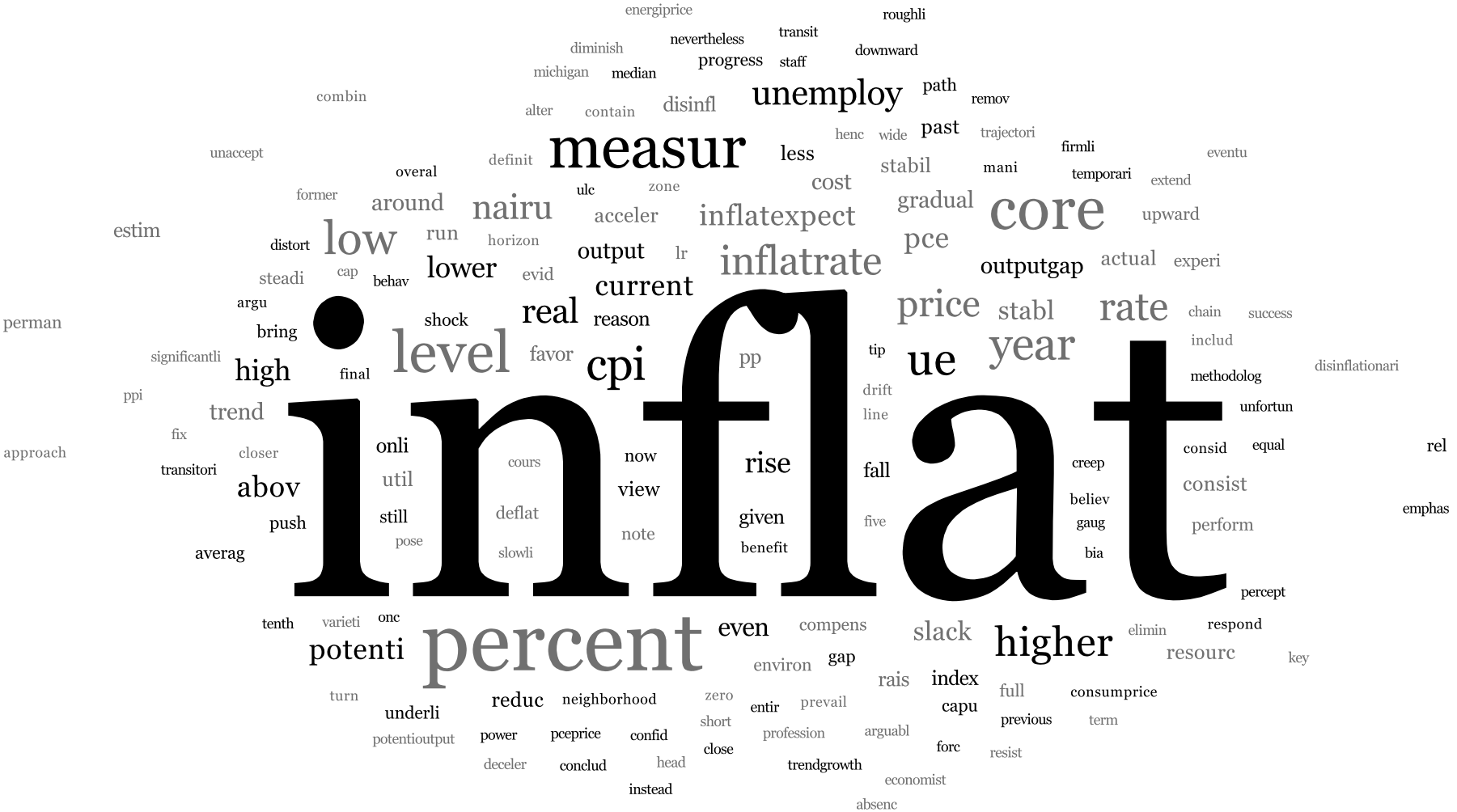
Allocation

17 39 39 1 25 25
41 25 25 25 36 36 38
43 25 20 25 39 16 23
25 25 25 32 38
16 4 25 25 16 25

Example statement: Yellen, March 2006, #51



Topic 25 - Inflation



Measuring Tone: Using Dictionary Methods

- This is simply word counting:
  1. Define a list of words: $\ell = (t_1, \ldots, t_N)$
  2. Count the words in document d: $n_d(\ell)$
  3. Use this alone to index d, or apply some normalization
- Common way of measuring market sentiment in the finance literature (e.g. Tetlock 2007 or Loughran and McDonald, 2011)
- Lots of dictionaries available - 105 Harvard IV dictionary lists

Monetary Measures of Tone

- We will use two "directional" word lists as in Apel, et al (2012):

Contraction	**Expansion**
decreas*	increas*
decelerat*	accelerat*
slow*	fast*
weak*	strong*
low*	high*
loss*	gain*
contract*	expand*

- Form a balance measure which is given by:

$$\text{Tone}_d = \frac{n_{+,d} - n_{-,d}}{n_d}$$

- Measure uncertainty/ambiguity (Loughran and McDonald, 2011):

$$\text{Uncertainty}_d = \frac{n_{Uncertainty,d}}{n_d} \quad (1)$$

Combining Topic and Tone

- Propose a simple way of combining these two approaches
  - measure topic-level tone
  - deals, somewhat, with the weakness of dictionary methods.
- Identify the paragraphs in which topic k makes up at least $\alpha = 0.5$ fraction of attention as measured by $\phi_{p,k,d}$ allocation.
- Compute the tone measures within that subset of paragraphs
- Advantages of automated techniques:
  - scalability with consistency
  - scalability to larger corpora
  - Reduces the biases that might creep in
  - Might pick up some nuance (while also missing other nuance)

Dimension 1: Stance of current monetary policy

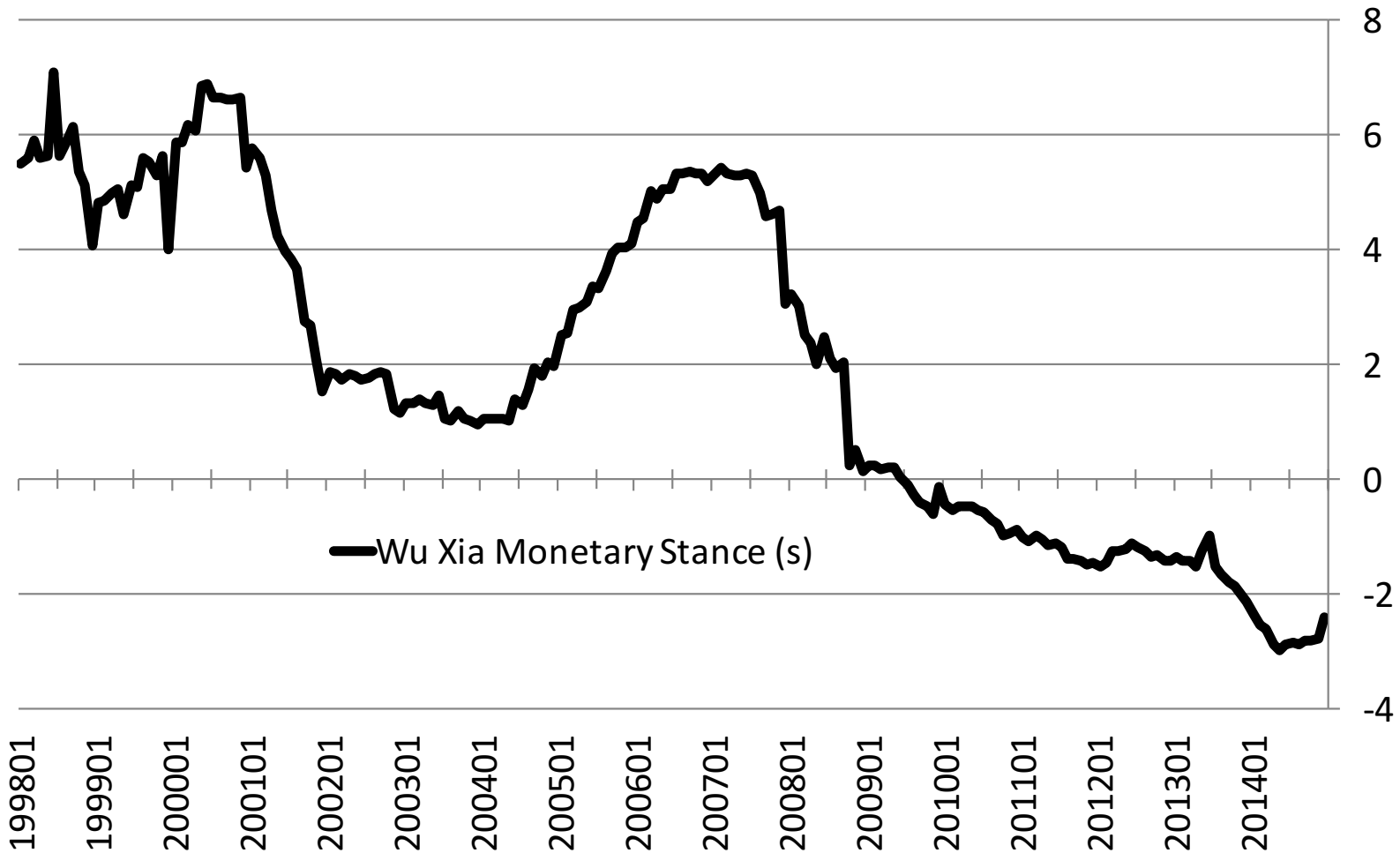


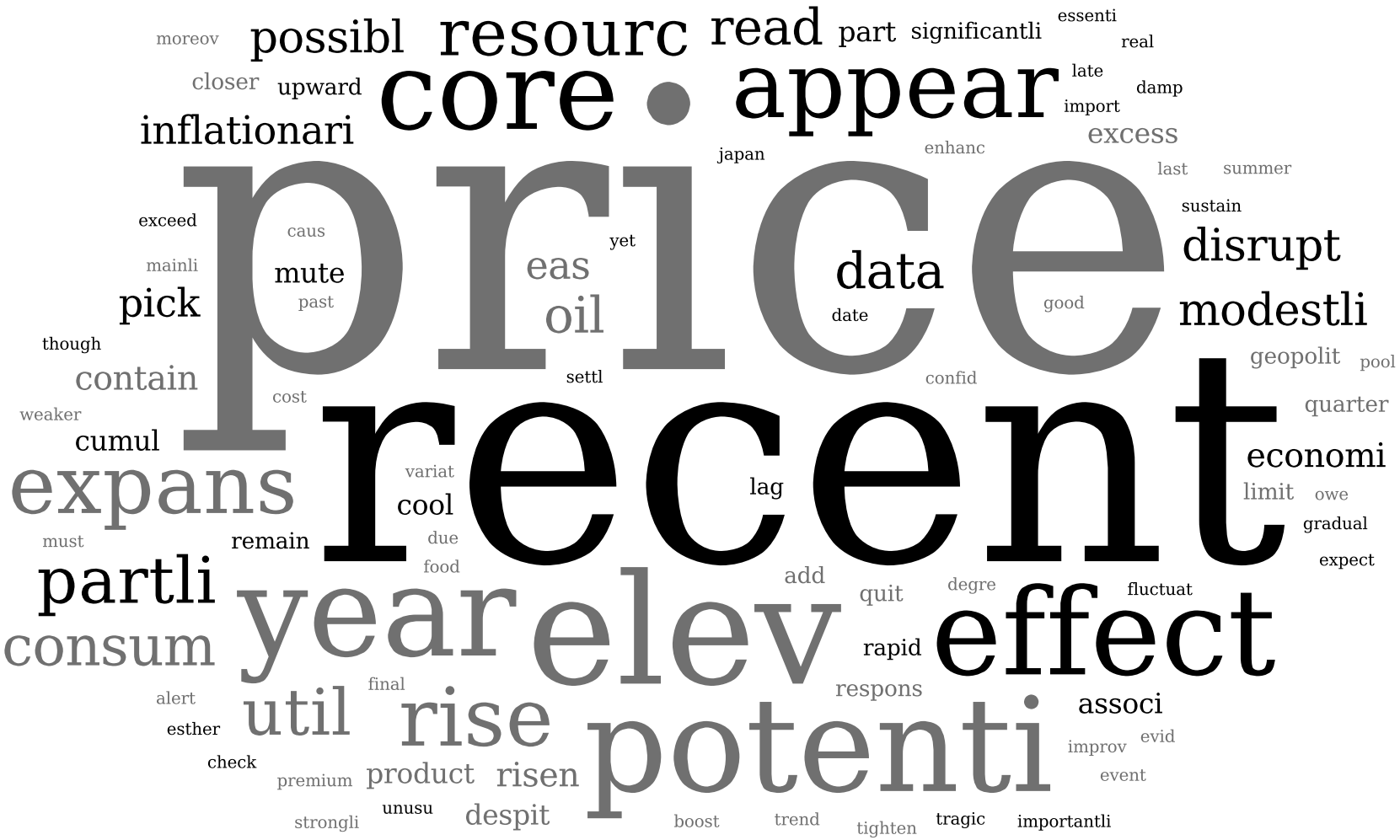
Figure: Federal Reserve Monetary Stance: Shadow rate from Wu and Xia (2014)

Dimension 2: Economic Situation

- Use the combination of a 15 topic LDA model applied to statements
  - Isolates the sentences of the statement about the state of the economy
- Then we measure the tone of *these* sentences
- We isolate 5 topics about the economic situation

Topic 2: A topic which focuses on inflation and prices.
Topic 14: Another topic concerning inflation and prices.
Topic 4: A topic covering the demand side of the outlook.
Topic 6: A topic about the labour market issues.
Topic 9: A topic covering the prospects for growth.

Topic 2: Economic Situation



EcSit_t

- For each statement, using this subset of sentences, we create:

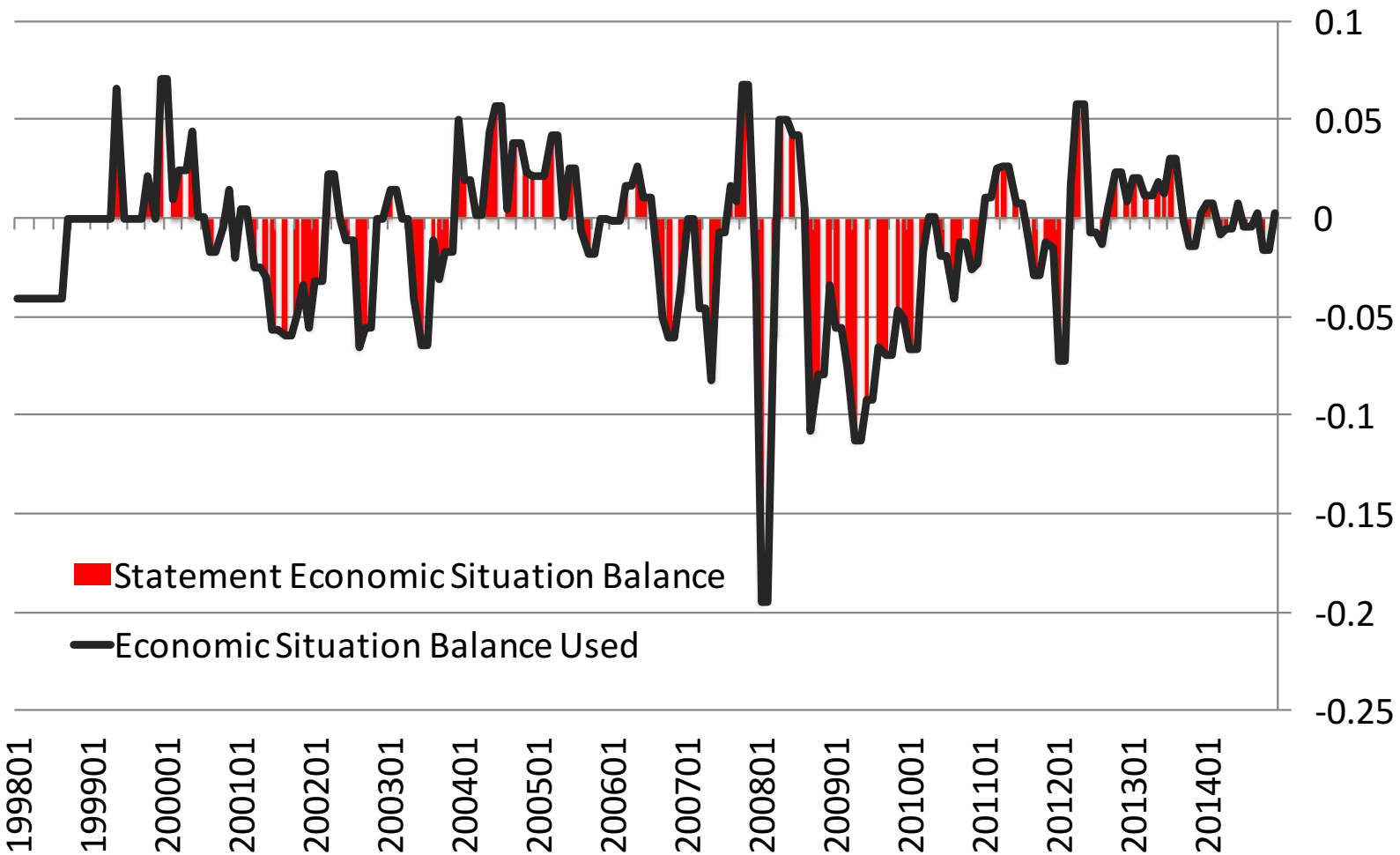
$$\text{EcSit}_t = \frac{n_{Pos,t} - n_{Neg,d}}{TotalWords_t^{EC}} \tag{2}$$

- January 2010 Statement

> *"Household spending is expanding at a moderate rate but remains constrained by a weak labor market, modest income growth, lower housing wealth, and tight credit."*

- Total of 18 (non-stop) words: Index value is $\frac{1-3}{18} = -0.111$.

EcSit_t



Dimension 3: Forward Guidance

- We manually identify the paragraphs about future interest rate moves
  - Guided by Campbell et al (2012)
  - Supervised algorithm can also do it for a large corpus
- Within these paragraphs we measure:

  Direction: Suggesting rates ↑ (+1) or ↓ (-1)

  Amount: Share (or words) dedicated to FG

  Uncertainty: Ambiguity index in these paragraphs

$$\mathrm{FG}_t = \frac{\mathrm{ShareFG}_t \times \mathrm{DirectionFG}_t}{\mathrm{Uncertainty}_t} \tag{3}$$

  - normalise the largest negative value = -1

FwdGuide$_t$: Type 1

E.g. December 2013

"To support continued progress toward maximum employment and price stability, the Committee today reaffirmed its view that a highly accommodative stance of monetary policy will remain appropriate for a considerable time after the asset purchase program ends and the economic recovery strengthens."

FwdGuide_t: Type 2

E.g. June 2012

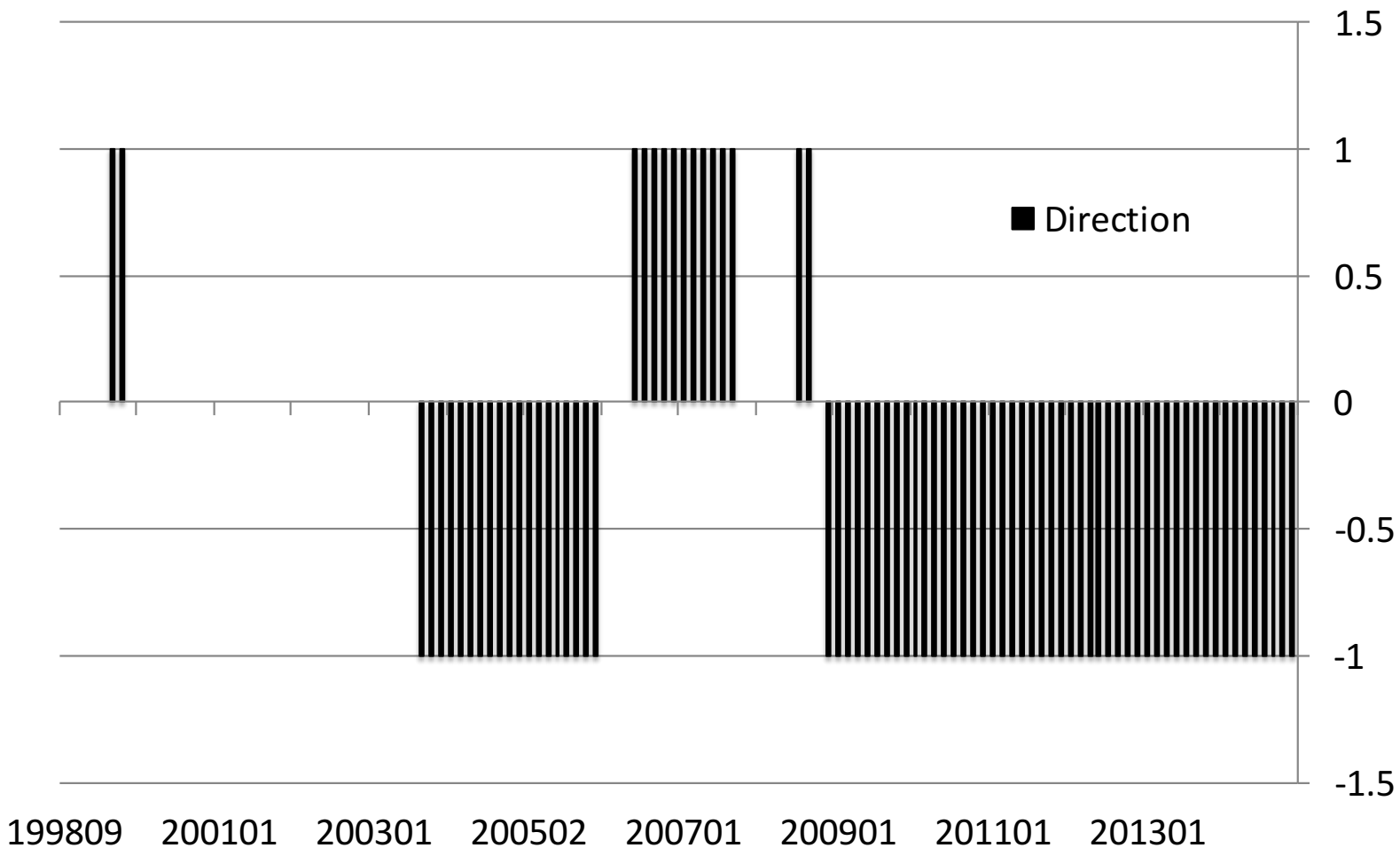
"To support a stronger economic recovery and to help ensure that inflation, over time, is at the rate most consistent with its dual mandate, the Committee expects to maintain a highly accommodative stance for monetary policy. In particular, the Committee decided today to keep the target range for the federal funds rate at 0 to 1/4 percent and currently anticipates that economic conditions–including low rates of resource utilization and a subdued outlook for inflation over the medium run–are likely to warrant exceptionally low levels for the federal funds rate at least through late 2014."

FwdGuide_t: Type 3

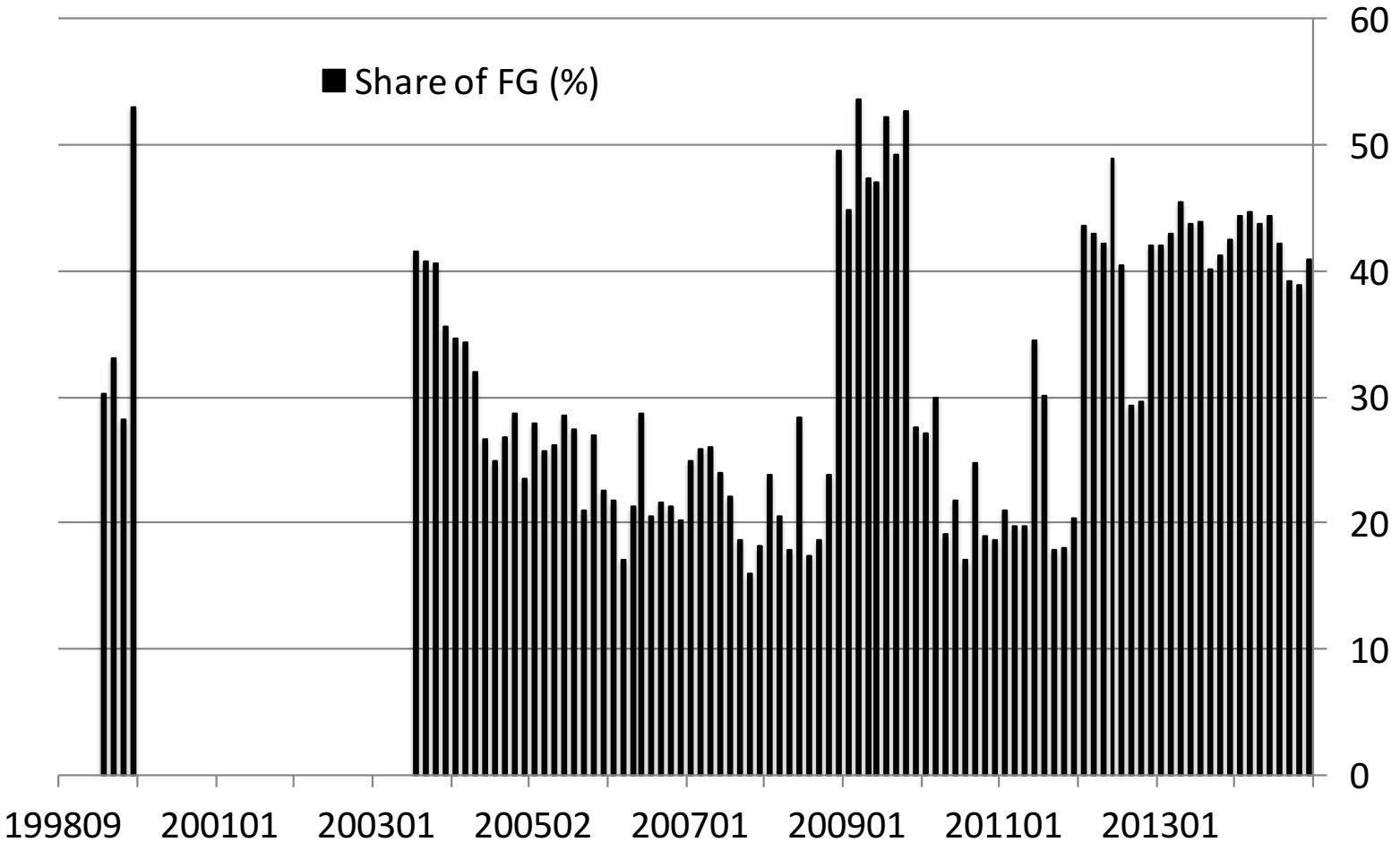
E.g. August 1999

"Today's increase in the federal funds rate, together with the policy action in June and the firming of conditions more generally in U.S. financial markets over recent months, should markedly diminish the risk of rising inflation going forward. As a consequence, the directive the Federal Open Market Committee adopted is symmetrical with regard to the outlook for policy over the near term."

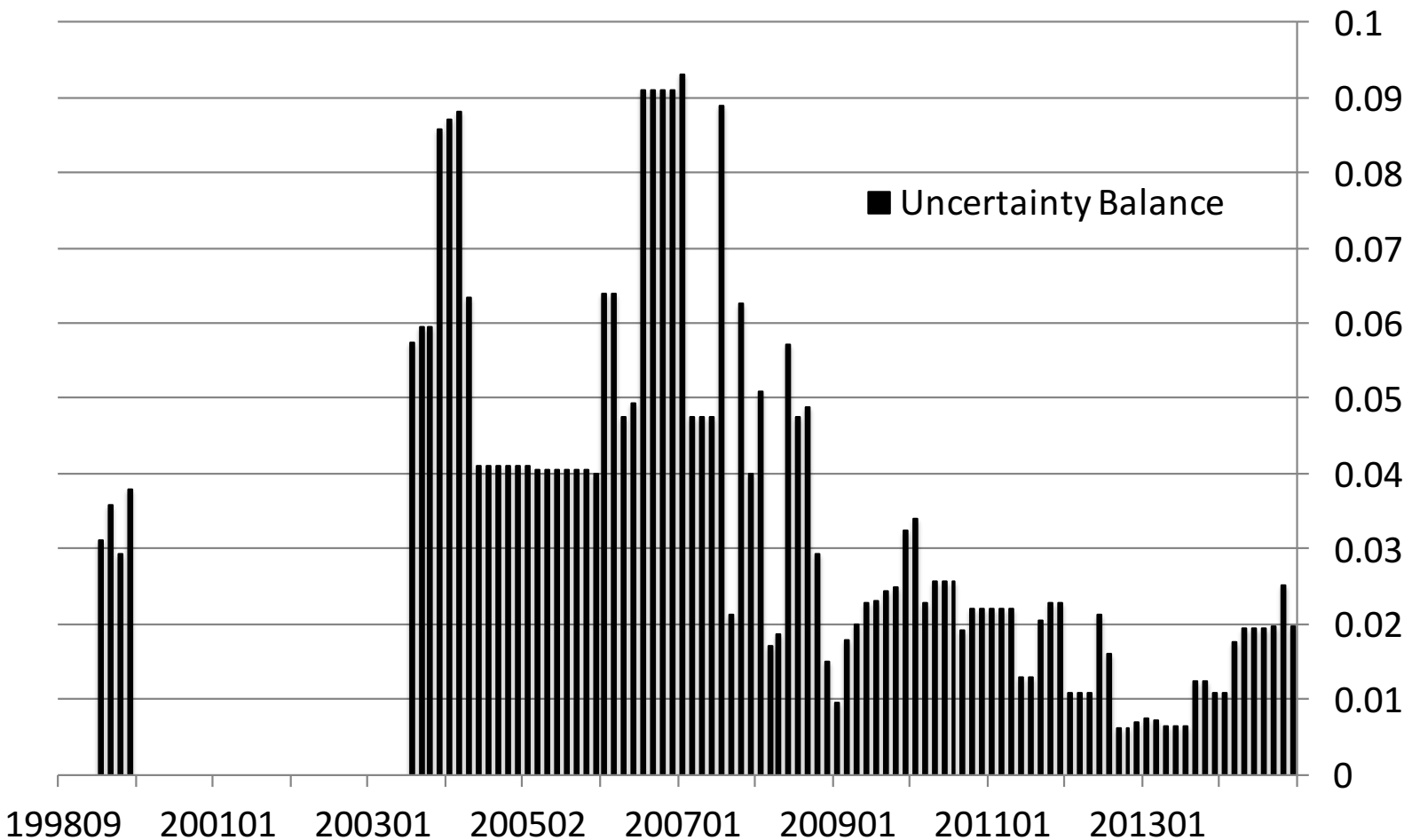
FwdGuide_t: Direction



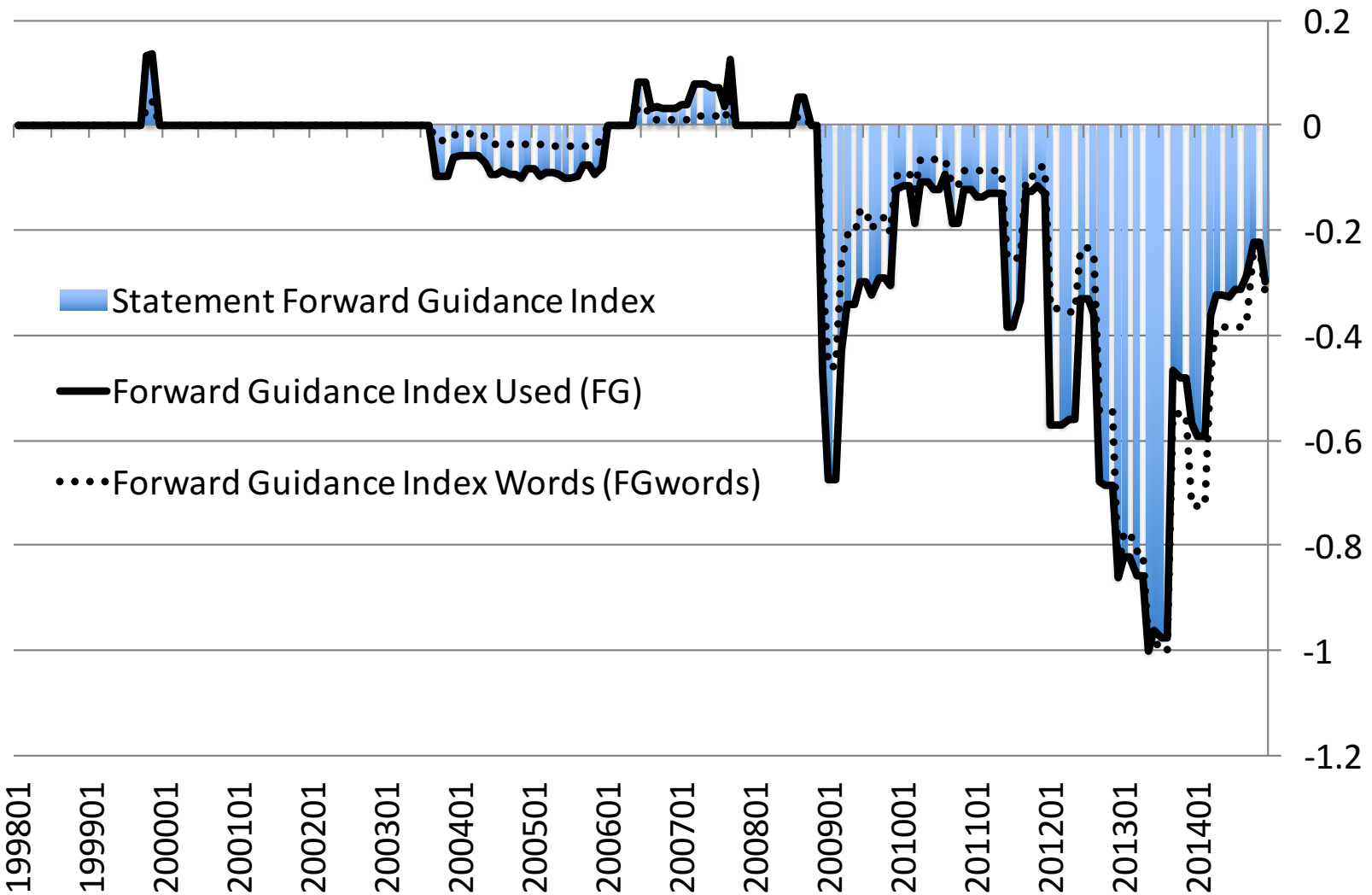
FwdGuide_t: Amount



FwdGuide_t: Uncertainty



FwdGuide_t: Overall



IRF analysis: $\mathrm{FwdGuide}_t$

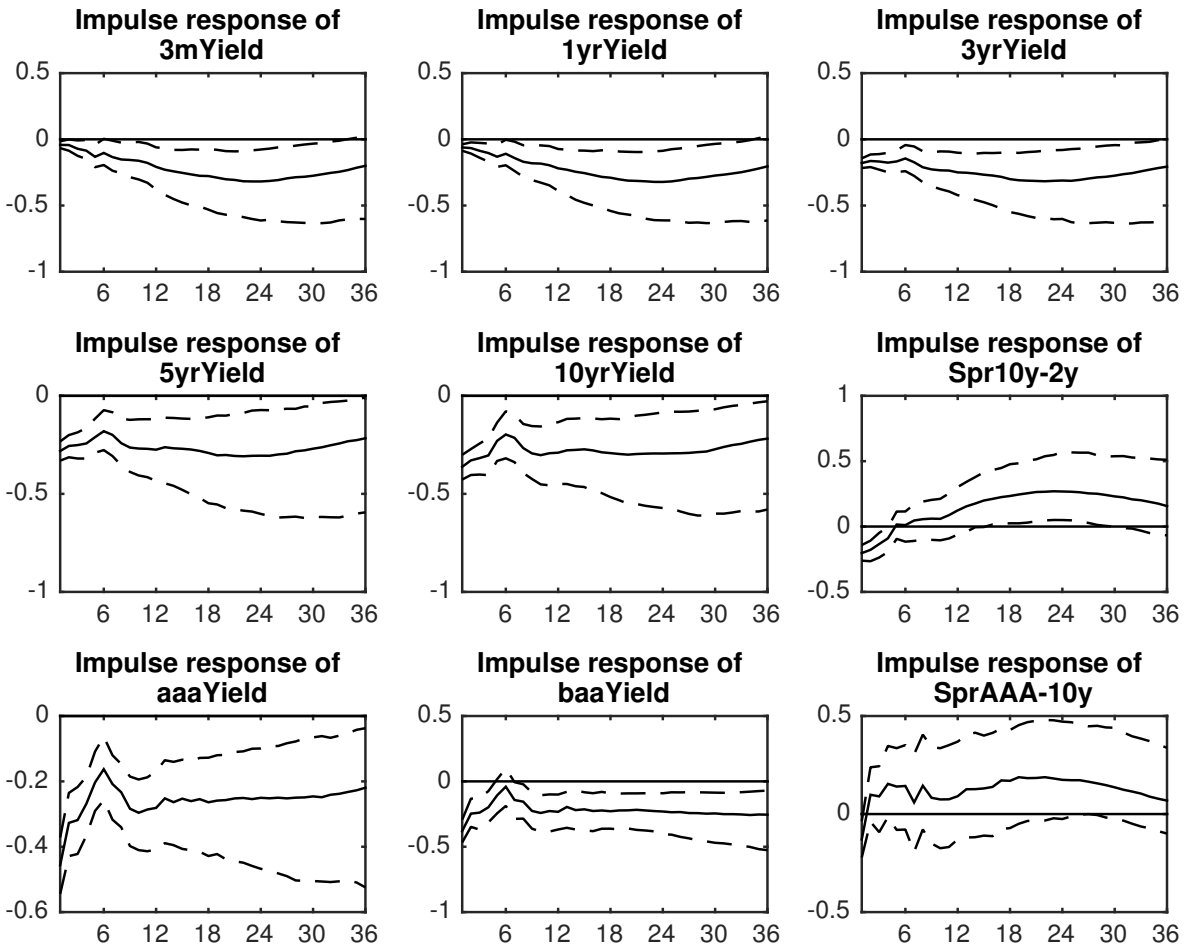


Figure: IRF Response to $\mathrm{FwdGuide}_t$ shock: Yields Reaction

IRF analysis: $\mathrm{FwdGuide}_t$

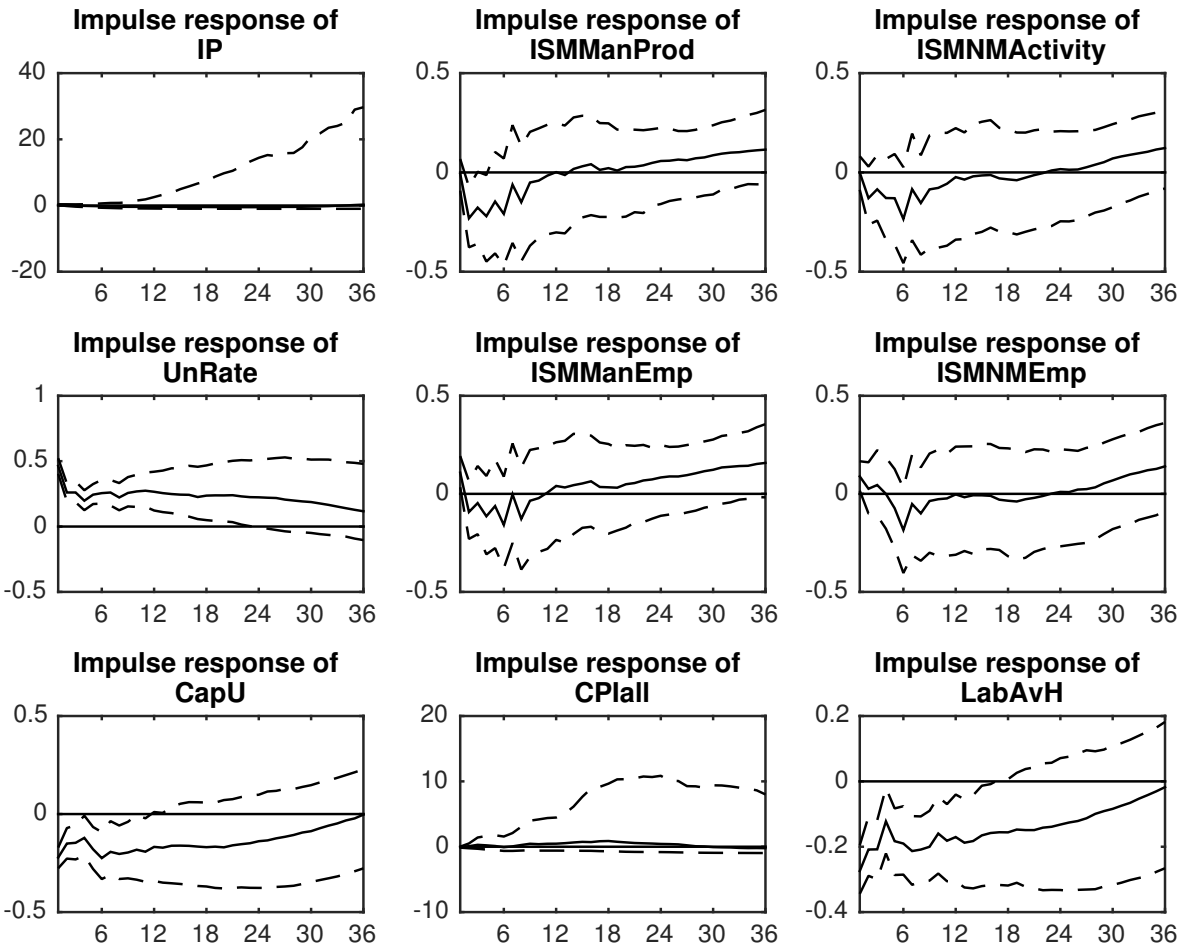


Figure: IRF Response to $\mathrm{FwdGuide}_t$ shock: Real Variables Reaction

IRF analysis: EcSit_t

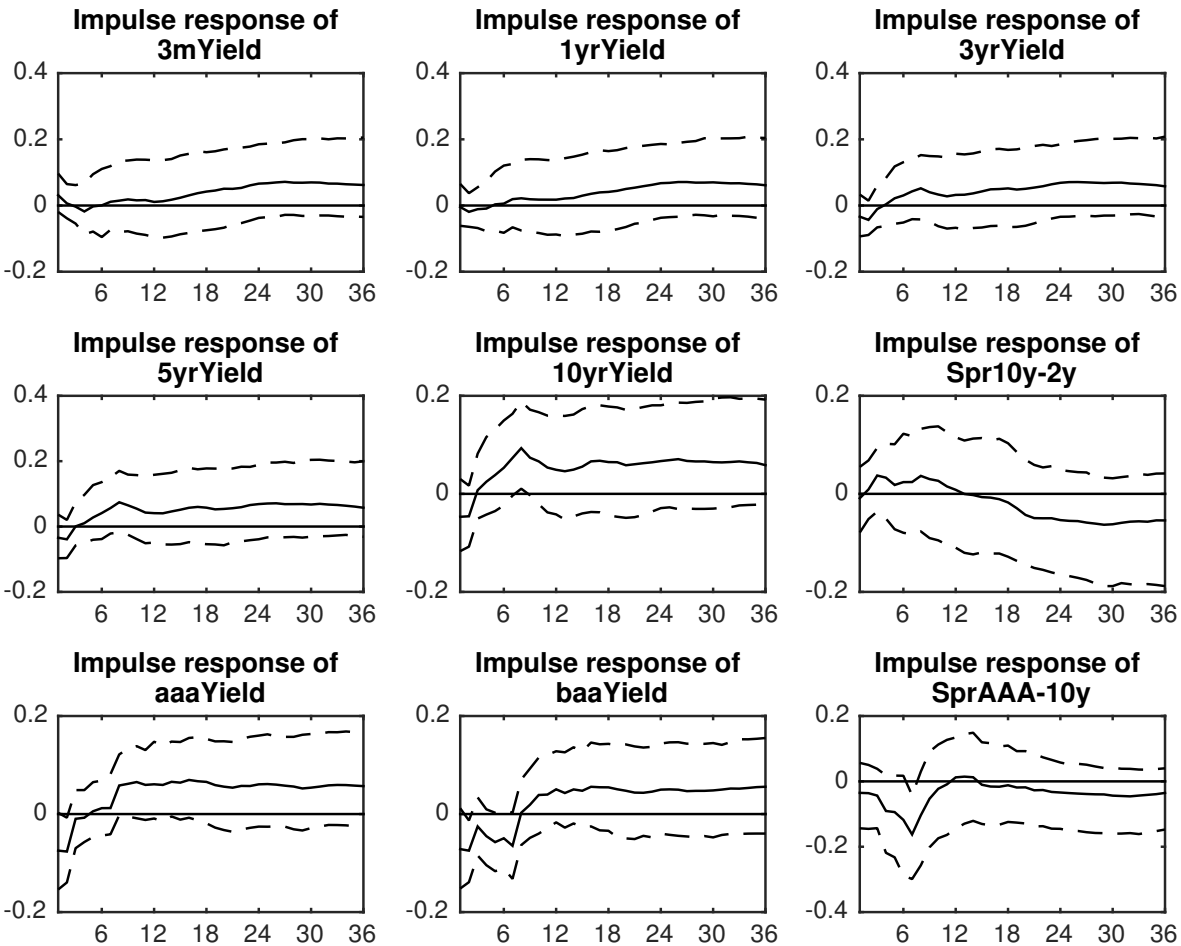


Figure: IRF Response to EcSit_t shock: Yields Reaction

IRF analysis: EcSit_t

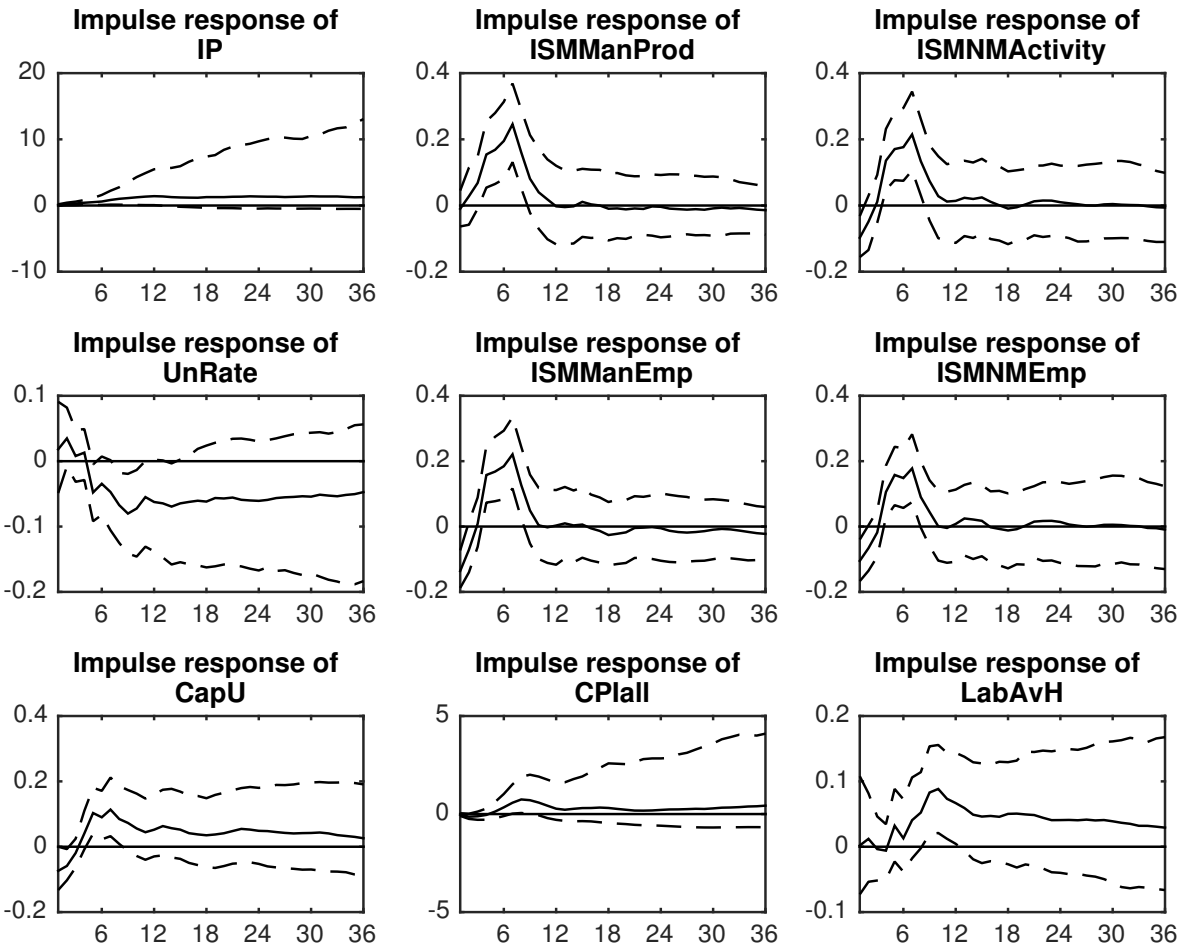


Figure: IRF Response to EcSit_t shock: Real Variables Reaction

Selected FEVD analysis

		Variance Decomposition				Share of Monetary Shock		
	Horizon	**Stance**	**EcSit**	**FG**	**Total**	**Stance**	**EcSit**	**FG**
3m Treasury Yield	1M	0.33	0.00	0.00	0.34	0.99	0.00	0.01
	6M	0.44	0.00	0.01	0.45	0.98	0.00	0.02
	12M	0.43	0.00	0.01	0.44	0.97	0.00	0.03
	60M	0.33	0.00	0.03	0.37	0.90	0.01	0.09
10yr Treasury Yield	1M	0.46	0.01	0.25	0.72	0.64	0.01	0.35
	6M	0.46	0.01	0.10	0.56	0.82	0.01	0.17
	12M	0.43	0.00	0.07	0.51	0.85	0.01	0.15
	60M	0.33	0.00	0.05	0.38	0.85	0.01	0.13
S&P 500	1M	0.03	0.00	0.01	0.04	0.76	0.06	0.18
	6M	0.04	0.00	0.01	0.05	0.75	0.06	0.19
	12M	0.06	0.00	0.01	0.08	0.78	0.05	0.17
	60M	0.11	0.00	0.02	0.13	0.81	0.03	0.15
Unemployment	1M	0.03	0.00	0.03	0.07	0.49	0.01	0.51
	6M	0.04	0.00	0.05	0.09	0.46	0.01	0.52
	12M	0.05	0.00	0.05	0.10	0.50	0.02	0.48
	60M	0.25	0.00	0.03	0.29	0.88	0.01	0.11
CPI	1M	0.04	0.00	0.00	0.04	0.93	0.02	0.05
	6M	0.04	0.00	0.01	0.05	0.81	0.05	0.14
	12M	0.07	0.00	0.01	0.08	0.84	0.04	0.12
	60M	0.11	0.00	0.01	0.12	0.86	0.03	0.11

Interaction with the Monetary Transmission Mechanism

Romer-Romer & Nakamura-Steinsson Shocks

Romer and Romer (2004) FFR changes "not taken in response to information about future economic developments."

Nakamura and Steinsson (2015) High frequency identification using a first principle component of unanticipated moves in interest rates up to 1 year of maturity.

Jorda Approach to Estimation

Basic Projection Approach:

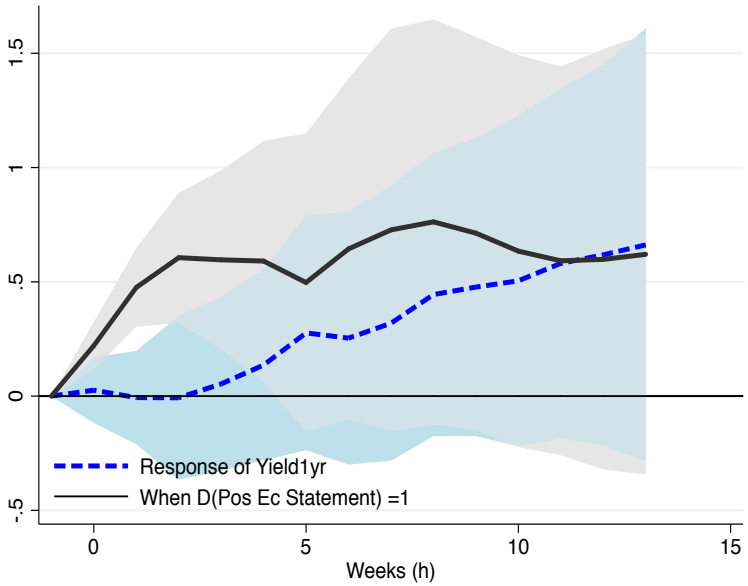
$$y_{i,t+h} = \alpha + \gamma_h \epsilon_t + \sum_{i=1}^{K} \phi_{h,i} W_{t-i} + \eta_t$$

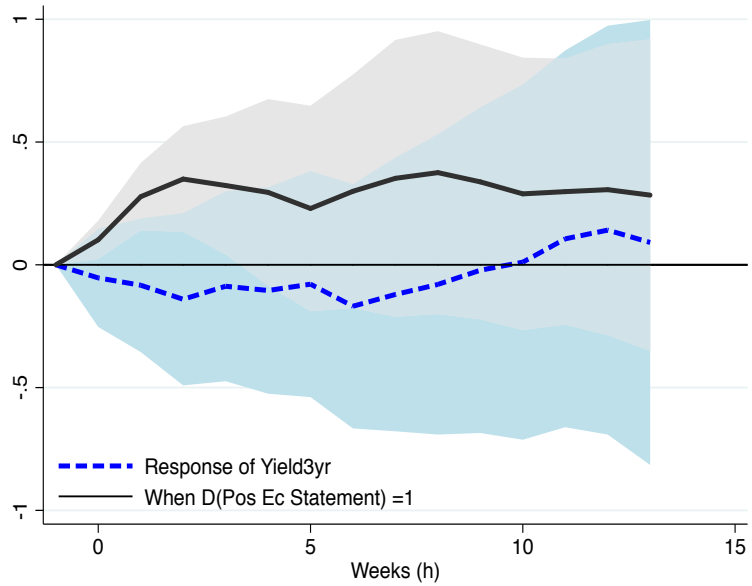
Projection Approach with Interaction:

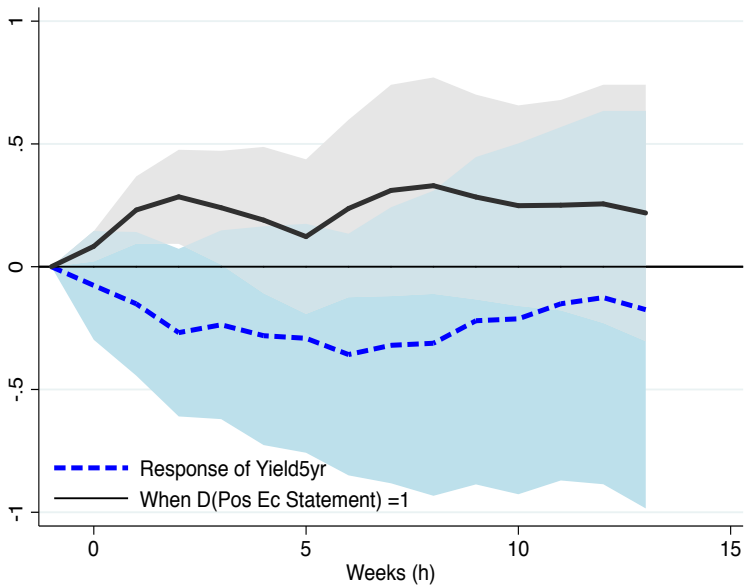
$$\begin{aligned} y_{i,t+h} =& \alpha + \phi_h \epsilon_t \times D_t + \gamma_h \epsilon_t \times (1 - D_t) \\ &+ \sum_{i=1}^{K} \phi_{h,i} W_{t-i} \times D_t + \sum_{i=1}^{K} \phi_{h,i} W_{t-i} \times (1 - D_t) + \eta_t \end{aligned}$$

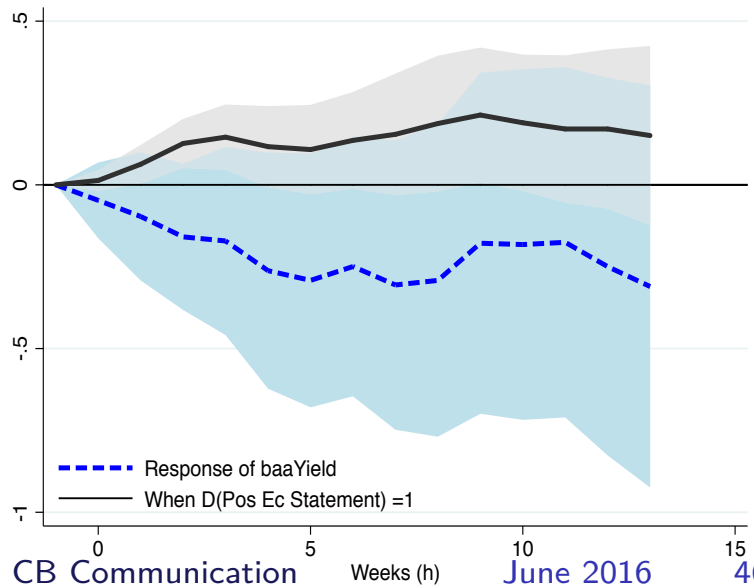
Local Projection Results

Issuing Positive Economic Statement



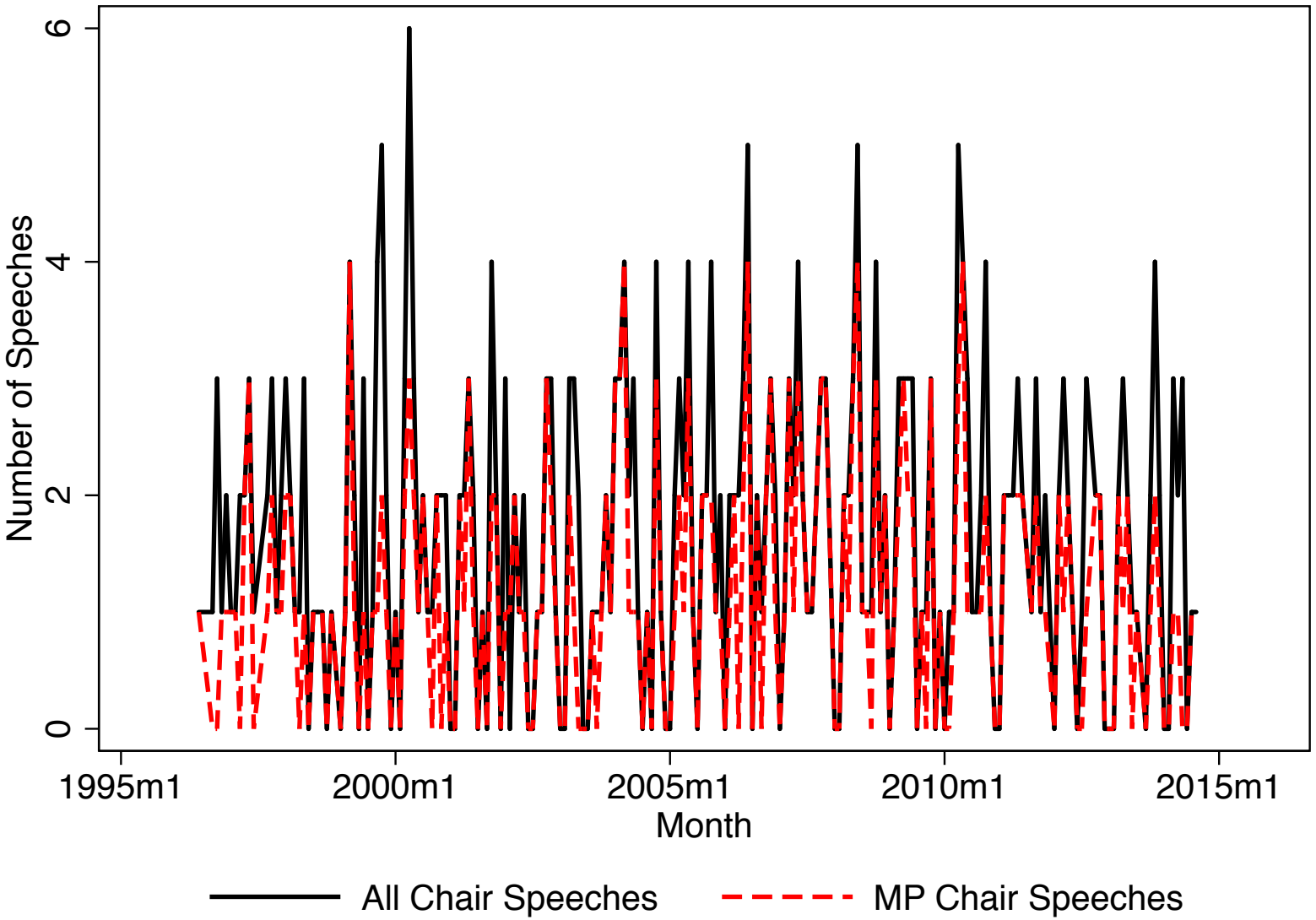




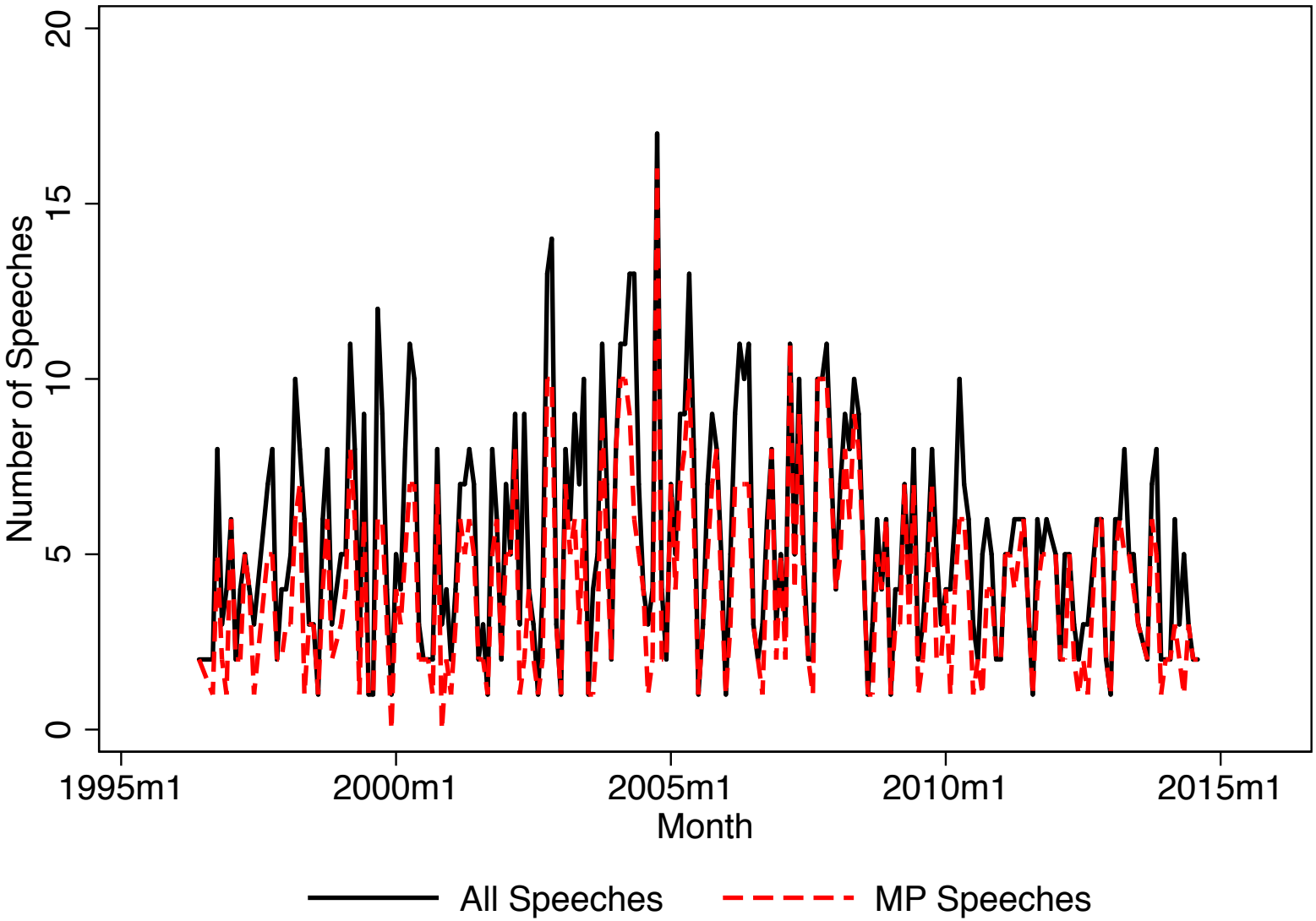


Shocks from Speeches

Frequency of Chair Speeches



Frequency of All FOMC Speeches



RR Shocks & Fed Statements/Minutes

1. We examine the relationship between language in Fed statements / minutes and the direction of the RR shocks.
2. Compute all unique two- and three-word phrases in Fed statements (bigrams/trigrams), and count their frequency in each documents.
3. Strip out endogenous variation in language driven by economic and financial conditions
   - Regress each term on lagged values of CPI and unemployment; and Vix, the SP500 level, and 3 year bond prices
   - Use the discretized residual rather than the raw count
4. Select the 1,000 most informative terms
5. Evaluate the quality of the classification:
   - 5.1 Draw half of the data, and estimate parameters on it.
   - 5.2 Use the estimates to classify the held-out documents.
   - 5.3 Compare the predicted and actual labels.

Most Informative Terms—Minutes

negative shock	**positive shock**
financi.market	polici.accommod
econom.activ	inflat.expect
busi.capit	growth.price
eas.action	inflat.pressur
monetari.aggreg	growth.price.stabil
polici.eas	remov.pace.measur
econom.growth	remov.pace
terrorist.attack	pace.measur
risk.continu	possibl.increas
capit.invest	monetari.polici

Classification Results—Minutes

	predicted	
actual	0	1
0	32.283	5.146
1	11.384	23.187

Speeches

We take the MLE estimates from the entire set of minutes, and use them to tag speeches by FOMC members.

Only keep speeches that contain at least ten terms in the set of 1,000 that are most informative in the minutes for distinguishing labels. (75% in total).

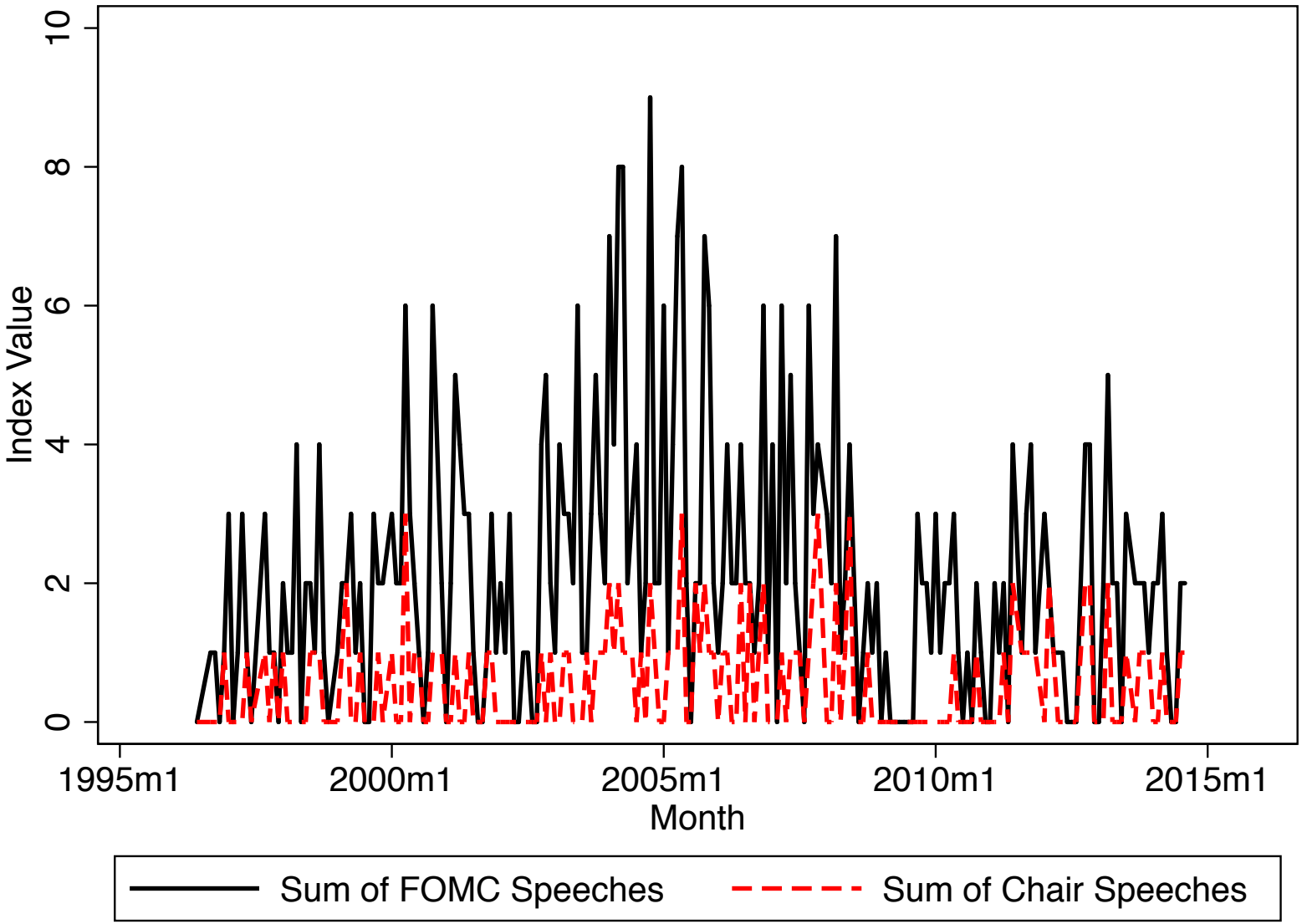
This gives us a panel of over 800 individual public communications, each associated with a monetary shock.

Our contribution to the labelling literature

One of the contributions of this approach concerns the way to label communications data:

1. more objective
2. more scalable
3. can allow us to tell different stories about what information get revealed during speeches (distinction between fitted vs residuals).

Labelled Speeches



Predictable RR Shocks? I

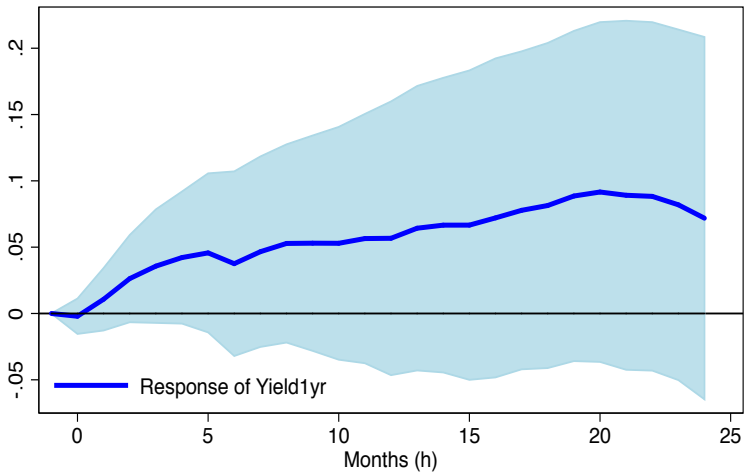
Main Regressors	(1) RR shocks	(2) RR shocks	(3) RR shocks	(4) RR shocks	(5) RR shocks
Sum of Chair Speeches (+2),	0.027				
	[0.463]				
Sum of Chair Speeches (+1),		-0.042			
		[0.160]			
Sum of Chair Speeches			0.017		
			[0.607]		
Sum of Chair Speeches (-1),				0.063***	
				[0.010]	
Sum of Chair Speeches (-2),					-0.018
					[0.412]
Constant	-0.020	0.016	-0.014	-0.044*	0.0062
	[0.436]	[0.489]	[0.595]	[0.078]	[0.812]
R-squared	0.013	0.029	0.004	0.069	0.005

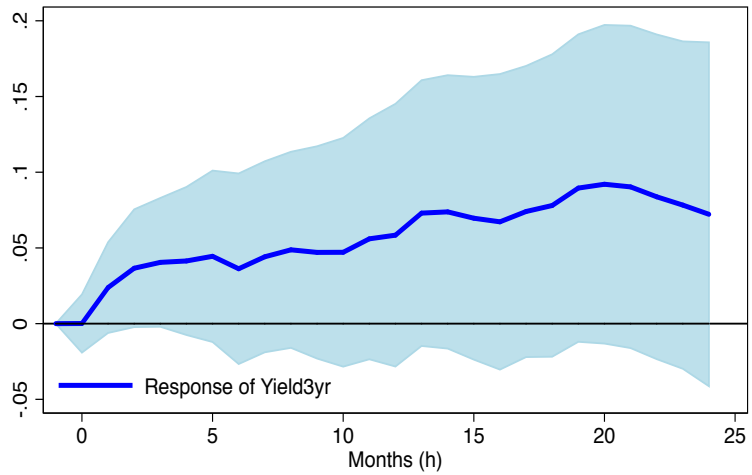
Predictable RR Shocks? II

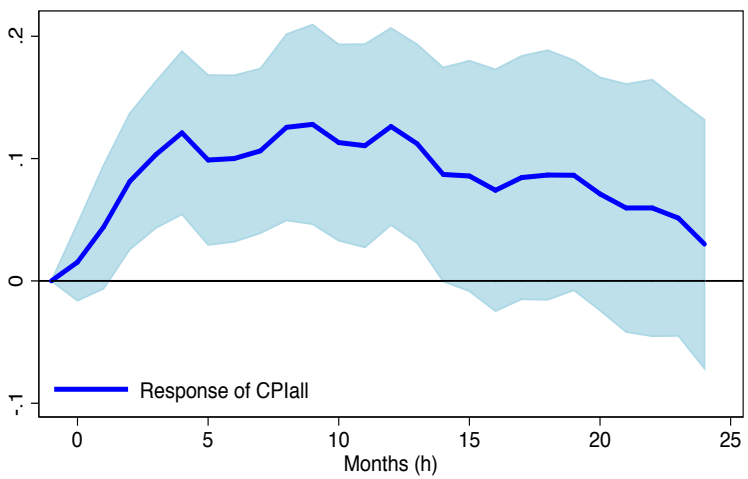
Main Regressors	(1) RR shocks
Sum of Chair Speeches	0.016
	[0.641]
Sum of Chair Speeches (-1),	0.062**
	[0.015]
Sum of Chair Speeches (-2),	-0.030
	[0.216]
BBD	-0.0023**
	[0.019]
D(NBER Recession)	-0.13*
	[0.056]
Constant	0.18**
	[0.038]
R-squared	0.208

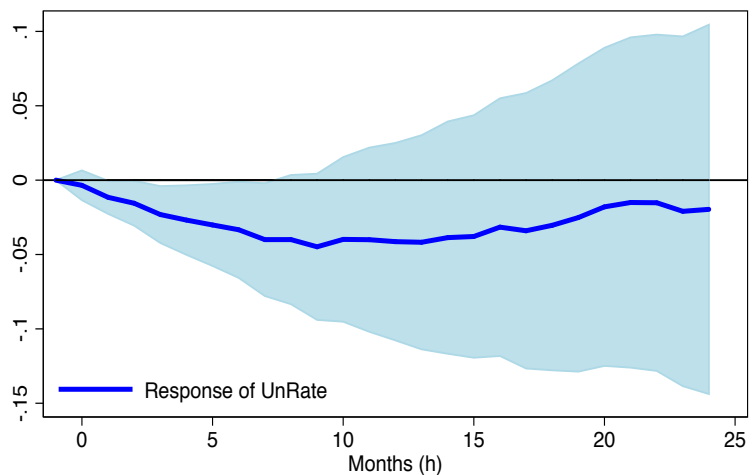
Local Projection Results

Hawkish Speech Shocks

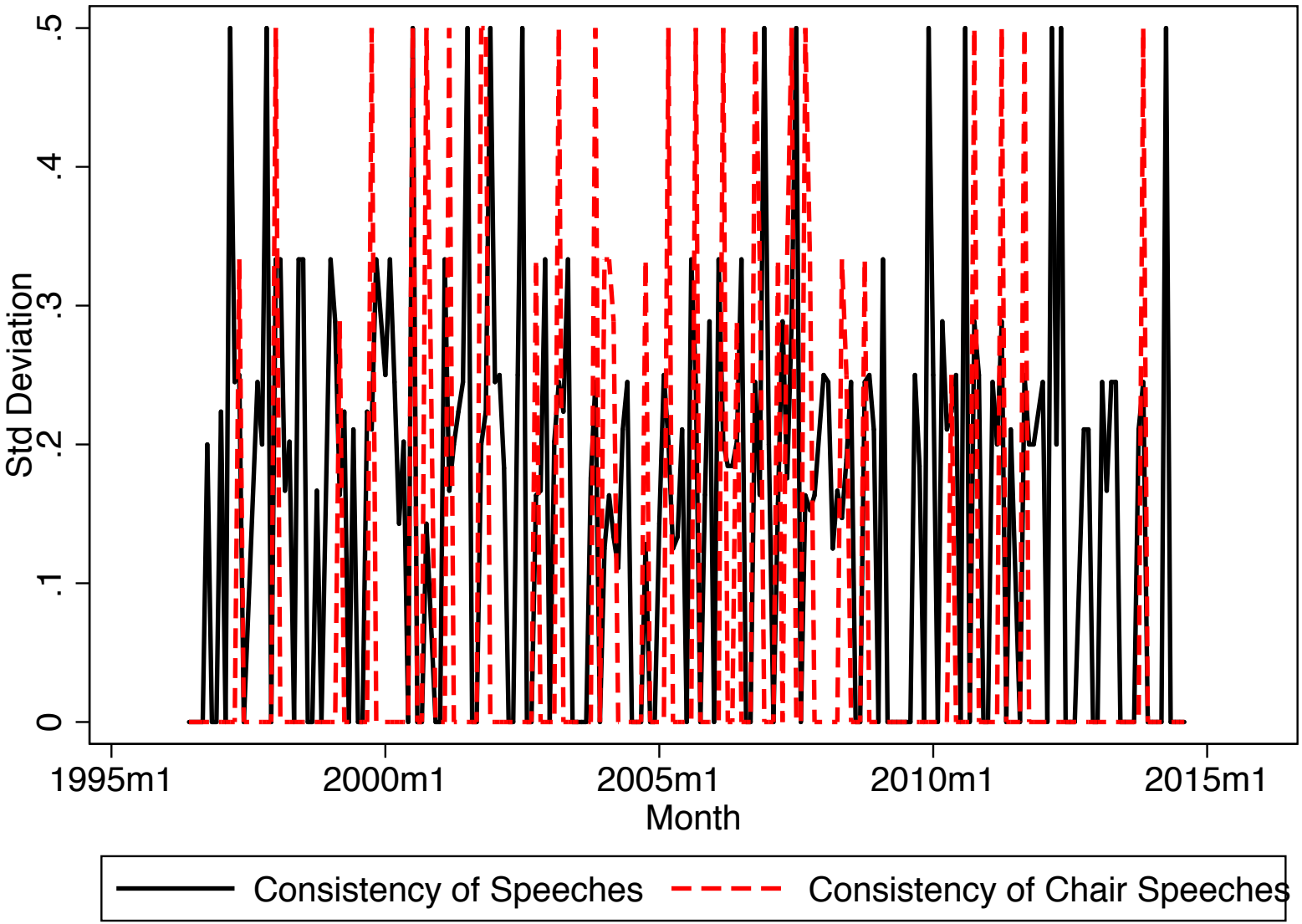






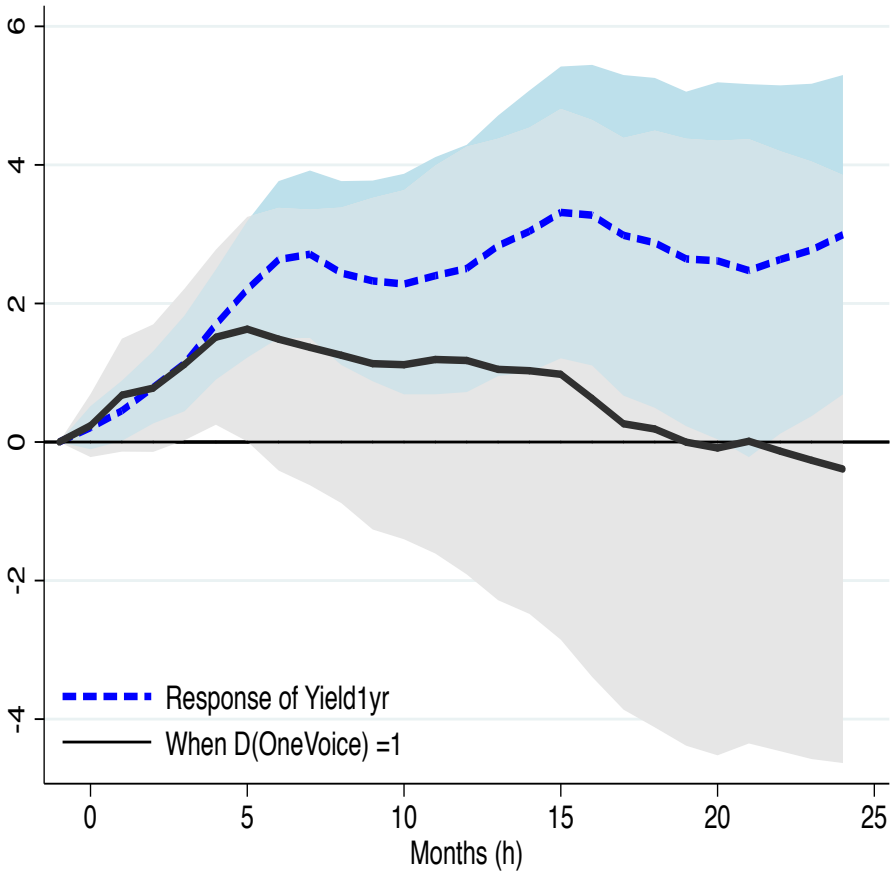


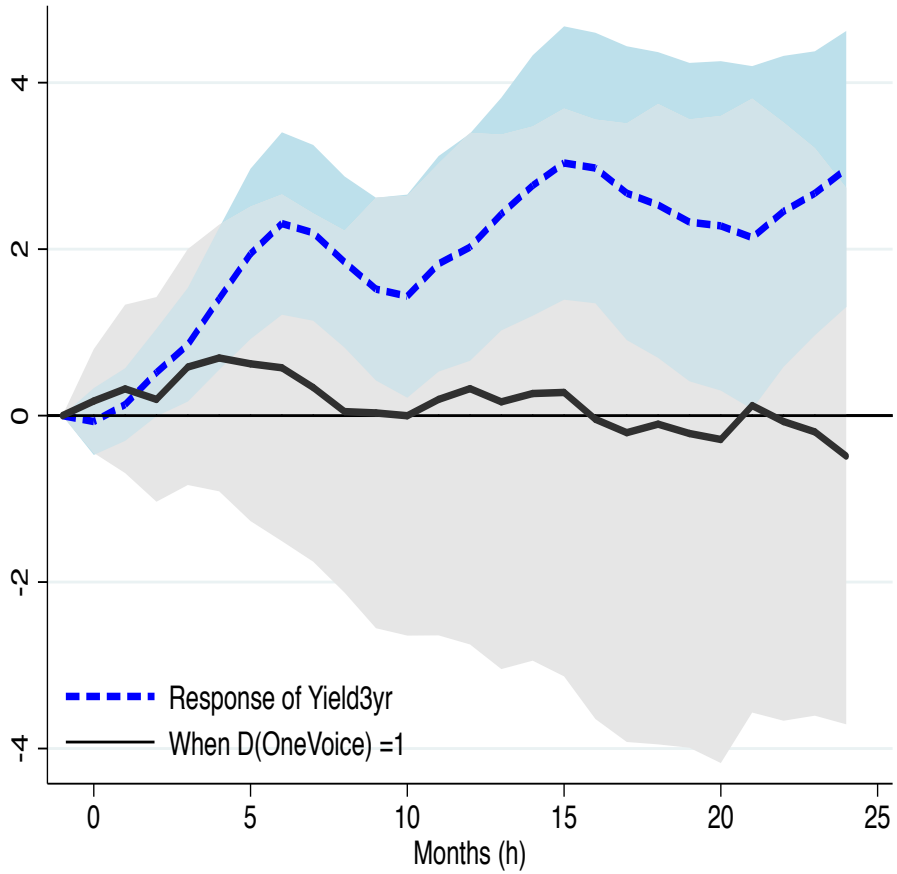
Consistent Speeches?



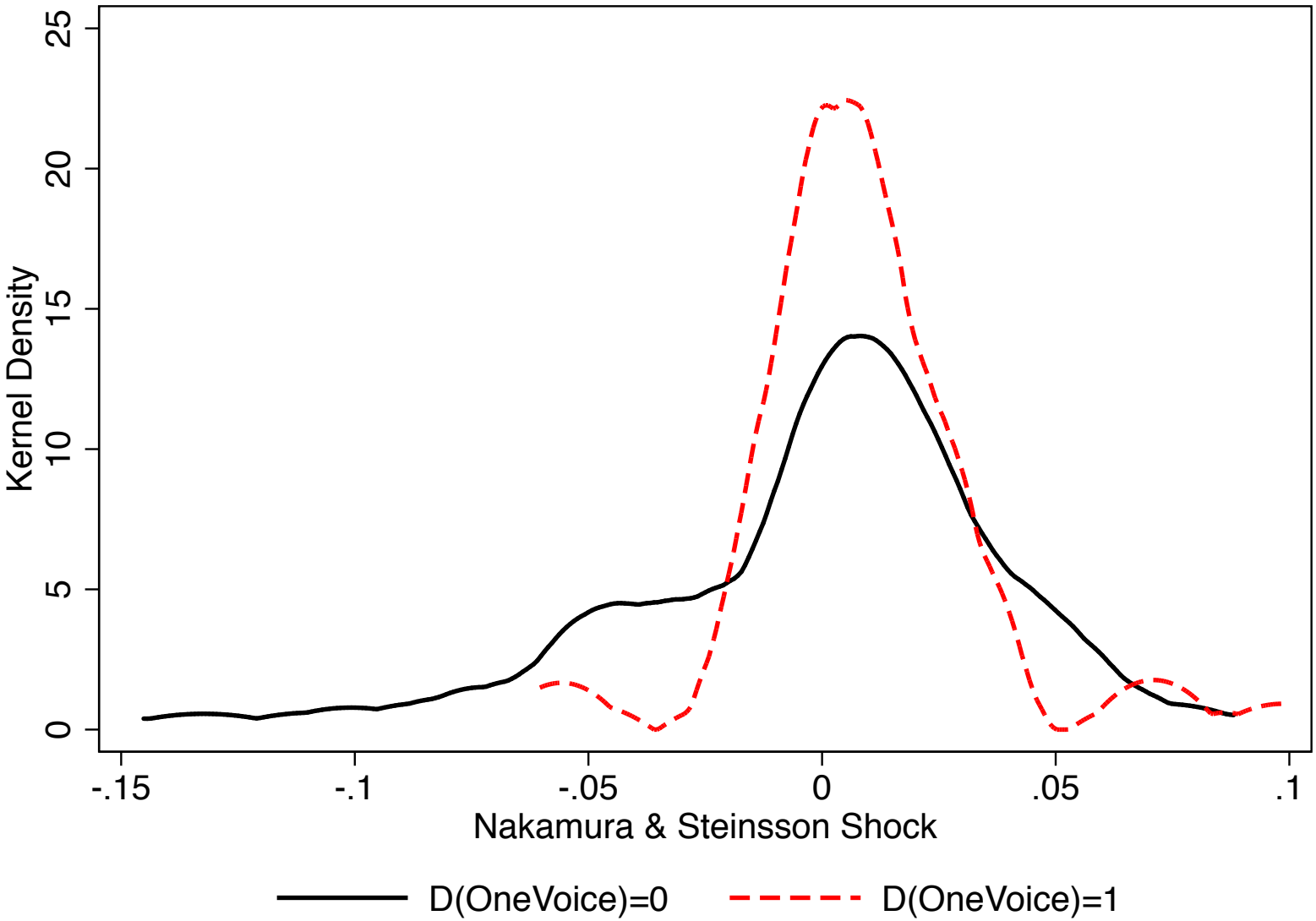
Local Projection Results

Speaking in One Voice

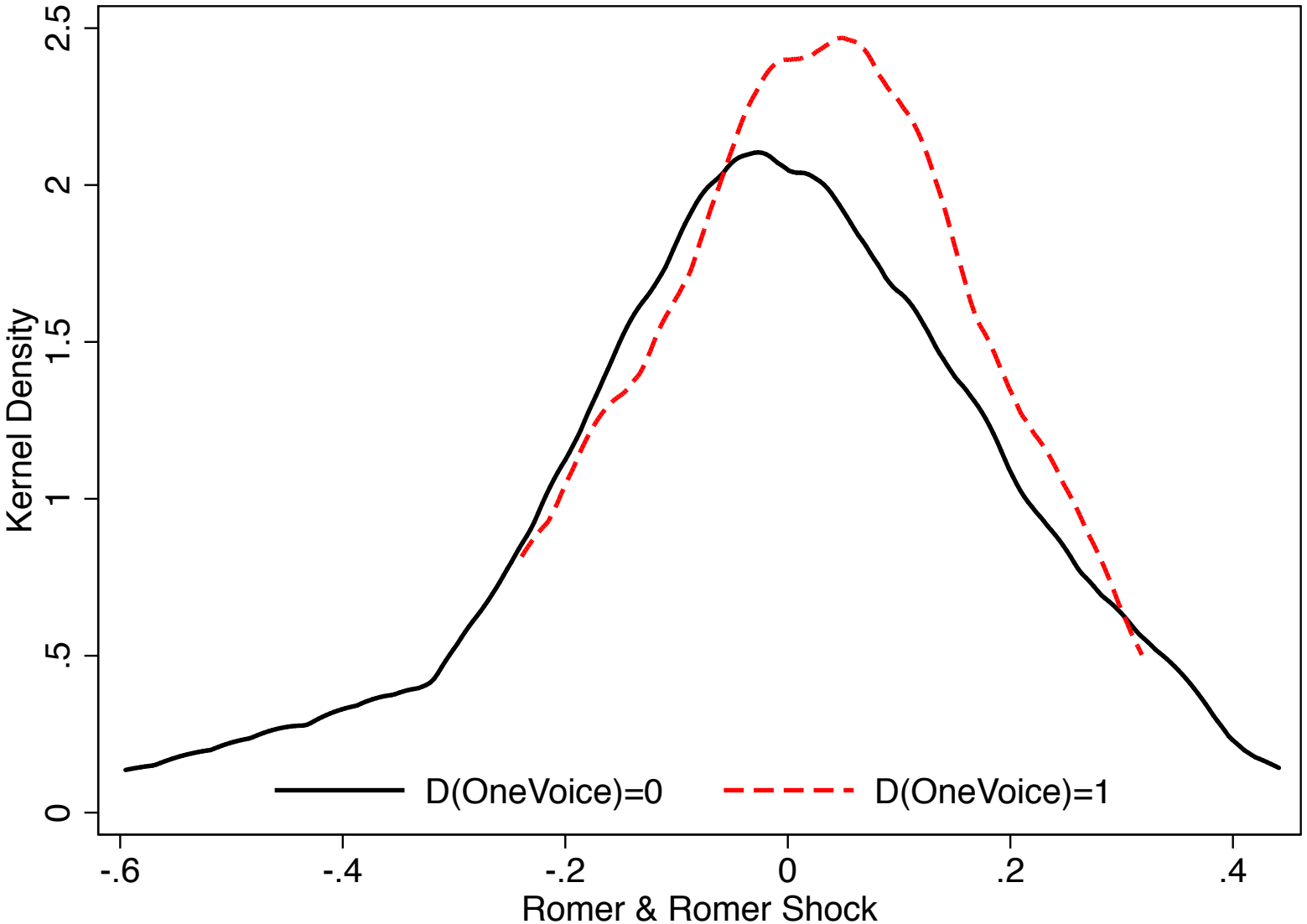




Speaking in One Voice?



Speaking in One Voice?



Internal Communication

Why care about deliberation within central banks?

- Committees are the dominant institution for monetary policy throughout the world.
- Primary observables are decisions and statements... but primary activity is deliberation.
- The advantage of a MPC is that it accumulates information:
  - "First Impressions Matter: Signalling as a Source of Policy Dynamics" (with S. Hansen)
  - "How Experts Decide: Preferences or Private Assessments on a Monetary Policy Committee?" (with S. Hansen and C. Velasco Rivera)
- Dispersion of views and statements also shown to have effects.

Transparency and Deliberation

Mario Draghi (2013): "It would be wise to have a richer communication about the rationale behind the decisions that the governing council takes."

	Fed (2014)	BoE (2014)	ECB (2014)
Minutes?	✓	✓	X
Transcripts?	✓	X	X

April 30, 2014: BoE to review of non-release of transcripts
July 3, 2014: ECB to release account of meetings

Specific goal of the Hansen, McMahon and Prat (2014) research

We want to study how transparency affects FOMC deliberation.
$\Rightarrow$ how is *internal deliberation* affected by greater *external communication*?

Greenspan's view before the Fed released transcripts

"**A considerable amount of free discussion and probing questioning by the participants of each other and of key FOMC staff members takes place.** In the wide-ranging debate, new ideas are often tested, many of which are rejected ... **The prevailing views of many participants change as evidence and insights emerge.** This process has proven to be a very effective procedure for gaining a consensus ... It could not function effectively if participants had to be concerned that their half-thought-through, but nonetheless potentially valuable, notions would soon be made public. **I fear in such a situation the public record would be a sterile set of bland pronouncements scarcely capturing the necessary debates which are required of monetary policymaking.**"

- Transparency: necessary for accountability but bad for deliberation?
- But might transparency also induce positive changes?

The World is Watching

"All the News That's Fit to Print"

The New York Times

VOL. CLXIII . . . No. 56,420 © 2014 The New York Times SATURDAY, FEBRUARY 22, 2014

Fed Misread Fiscal Crisis, Records Show

After Caution in 2008, Series of Bold Steps

By BINYAMIN APPELBAUM

WASHINGTON — On the morning after Lehman Brothers filed for bankruptcy in 2008, most Federal Reserve officials still believed that the American economy would keep growing despite the metastasizing financial crisis.

The Fed's policy-making committee voted unanimously against bolstering the economy by cutting interest rates, and several officials praised what they described as the decision to let Lehman fail, saying it would help to restore a sense of accountability on Wall Street.

James Bullard, president of the Federal Reserve Bank of St. Louis, urged his colleagues "to wait for some time to assess the impact of the Lehman bankruptcy filing, if any, on the national economy," according to transcripts of the Fed's 2008 meetings that it published on Friday.

DETROIT OUTLINES MAP TO SOLVENCY, STRESSING REPAIR

WAY OUT OF BANKRUPTCY

Balancing Act Worries Banks and Angers Retirees in City

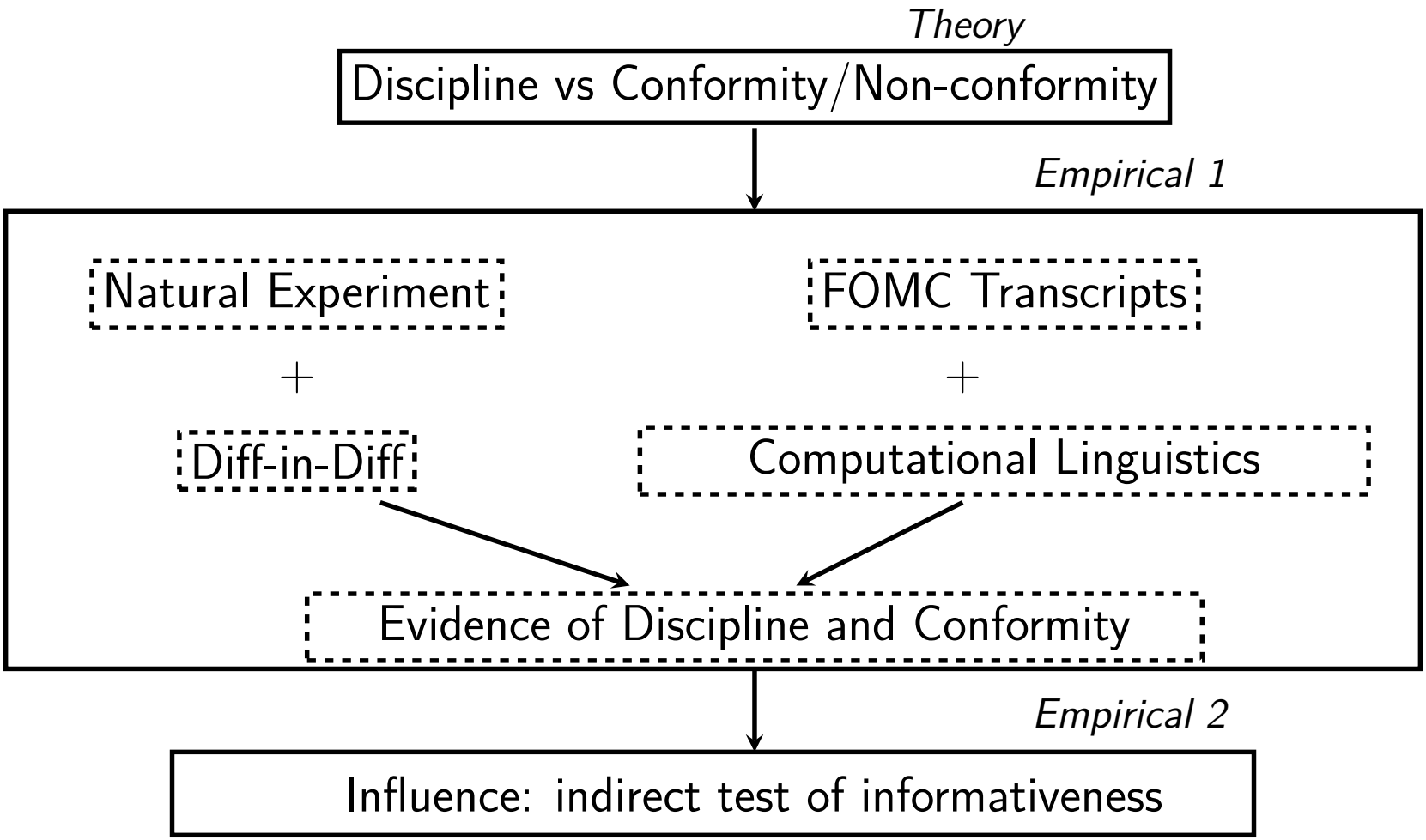
By MONICA DAVEY and MARY WILLIAMS WALSH

DETROIT — Seven months after this city entered bankruptcy, its leaders on Friday presented a federal judge with the first official road map to Detroit's future — documents designed to show how it aims to settle its $18 billion debt to creditors and make itself livable again.

But the proposal is less a vision for a brand-new city than a repair estimate for the old one. It is a document designed by lawyers and bankruptcy experts to find ways to pay off more than 100,000 creditors and then budget money over a period of years to create a

Deal Signed in Ukraine, but Sho

The outline of our analysis



Conclusion

Take-aways for Central Banks and Central Bank Design

- Communication is an important part of the central banks control and management of inflation expectations;
- US markets seem to learn most about the FOMC's policy preferences from monetary policy statements;
- The exact channels of the effects of communication remain an open area for research.