DEC | DUBROVNIK ECONOMIC CONFERENCE

HRVATSKA NARODNA BANKA
EUROSUSTAV

31st DUBROVNIK ECONOMIC CONFERENCE

June 6 – 9, 2025, Dubrovnik, Croatia

Michael McMahon

Central Bank Communication and Policy Surprises

Draft version

Please do not quote

Central Bank Communication and Policy Surprises

Michael McMahon[1]

31st Dubrovnik Economic Conference, June 2025

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Irish Fiscal Advisory Council

Motivation

Fed communication is a complex information bundle

1. Monetary news: Fed exogenously changes (expected) short rate

   Traditional view; large literature

2. Fundamental news: Fed reveals private information about economy

   Romer & Romer (2000); Campbell, Evans, Fisher & Justiniano (2012); Nakamura & Steinsson (2018); Jarocinski & Karadi (2020)

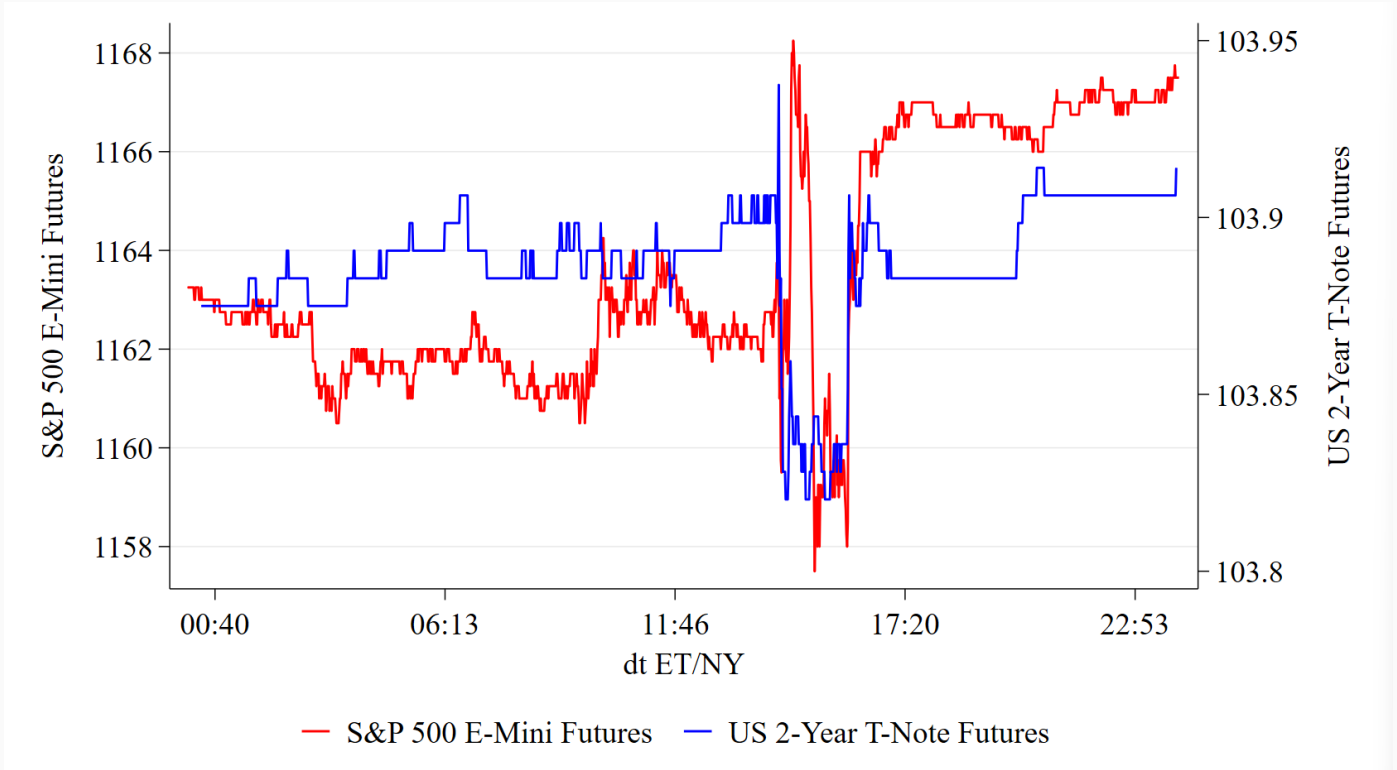
3. Risk-premium news: Fed influences amount or price of risk perceived by investors

   Bernanke & Kuttner (2005); Hanson & Stein (2015); Cieslak and Pang (2021); Kekre & Lenel (2022); Pflueger & Rinaldi (2022)

Not mutually exclusive

Hansen, McMahon & Tong (2018); Ahrens, Erdemlioglu, McMahon, Neely & Yang (2023); Cieslak & McMahon (2023)

What we would like: More May 2005 events!



"The only surprise in this paragraph - we thought - was the dropping of its reference to longer-term inflation expectations remaining well contained. However, this omission was inadvertent, and a corrected statement with that phrase added was reissued just before 4:00 p.m."

Different Informational Assumptions

Key Observation

Market is often surprised in terms of asset prices - points to surprises as being a potentially insightful source of knowledge on the effects of communication.

Different Informational Assumptions

× Full information, rational expectations
- Often augmented with committment in monetary policy

✓ Asymmetric information, rational expectations
- Central bank assumed to have superior information

✓ Imperfect information for all
- Evolving picture as information reveals itself
- Admits (*perceived*) mistakes as a possibility

This Paper

Two Overarching Questions

1. Interested in the better understanding the effects of communication, how can we interpret monetary policy surprises in the face of time-varying reaction functions?
2. What can we learn about the effects of communication from perceived mistakes?

1. Time-varying reaction functions
   - Role and implication
   - What is the evidence on them
2. Try to use some expensive RAs to look at the role in practice
3. Markow-Switching: link the reaction function shifts and surprises
4. Examine the role for (*perceived*) mistakes

Preliminaries

Notation

- Let X_t^i represent i's data at time t; $i \in \{CB, M\}$
  - For ease, no label $\equiv CB$
- i_t is the interest rate chosen at date t
- Reaction Function is approximately linear: $i_t = f(x_t; \psi_t) + \epsilon_t$
  - ψ_t is a row vector of (potentially) time-varying coefficients.
- I will speak of the market as a representative agent
  - Heterogeneity is clearly important and interesting
  - Proposal to look at it...
- $\mathbb{E}[\,.\,]$ will refer to market expectations
  - Any CB expectations are implicit in the time-t variables X_t
  - t' captures post-announement version of t variable.

The Monetary Reaction Function

An equivalence?

- Standard approach in models:

$$i_t = \psi X_t + \epsilon_t$$

- Alternative:

$$i_t = \psi_t X_t$$

  - May be optimal to vary reaction function:
    - Uncertainty – Brainard (1967), robust control, Cieslak et al (2023)
    - Changing preferences of central bankers
    - Central banks learning the structure of the economy over time
    - Time variation in the persistence of shocks
    - Variation in the volatility of the economy
- There is always an equivalent ϵ_t to match i_t despite fixed ψ

Some views from the profession

"But it is important to recall that, while such rules were estimates of actual stances of past policy – positive descriptions of central bank behaviour – they have been re-interpreted as guides for what the central bank should do in all circumstances – normative prescriptions. Taking the past as a strict guide to the future is to assume that the nature shocks does not change and that the structure of the economy remains constant."
Mark Carney, "λ".

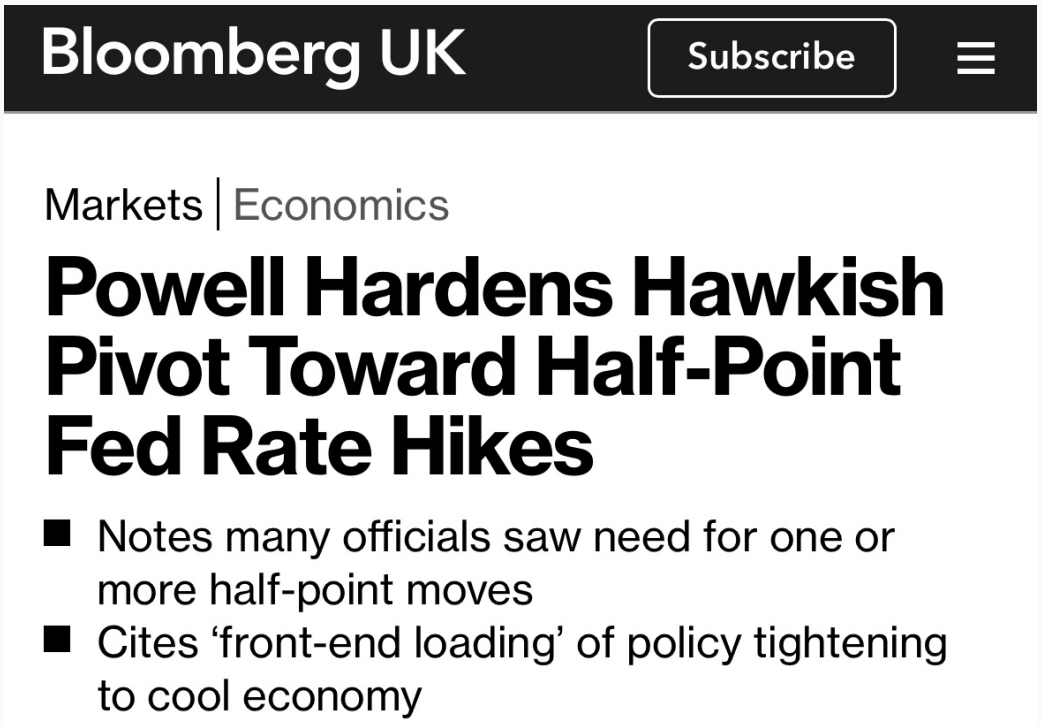
Some views from the profession

"However, these modifications would make the policy rule more complex and more difficult to understand. Even with many such modifications, it is difficult to see how such algebraic policy rules could be sufficiently encompassing... While the analysis of these issues can be aided by quantitative methods, it is difficult to formulate them into a precise algebraic formula. Moreover, there will be episodes where monetary policy will need to be adjusted to deal with special factors...The Fed would need more than a simple policy rule as a guide in such cases."

Taylor (1993)

Some views from the profession

- Lots of evidence of empirical changes in reaction functions
  - Before and after Volcker (Clarida et al, 2000)
  - Markov-Switching DSGE model (Bianchi and Melosi, 2013)
  - Substantial drift in estimated reaction function in a New Keynesian model (Fernandez-Villaverde and Rubio-Ramirez, 2008, 2010)



Some views from the profession

Aside from introspection: Byrne, Goodhead, McMahon and Parle (2022)

- Emphasise *Assessment Function*:
  - Maps observables (X_t) to latent policy-relevant states (e.g. inflationary state of the economy)
  - Policy then reacts to these latent states
- Captures two important analytical steps:
  1. *Evaluation*
     Maps data to latent current state of the economy
  2. *Projection*
     Maps latent current state to the likely future state
- Even without changes in preferences, either could be the source of time-variation in mapping between X_t and i_t.

Importance of the distinction I

- Distinction is not innocuous:
  - State dependence of the effects of different monetary policy effects
  - Different Dynamics
- Illustration via Bauer and Swanson (2022):

$$x_t = \rho x_{t-1} - \theta i_{t-1} + \eta_t$$
$$i_t = \psi_t x_t + \epsilon_t$$
$$\psi_t = \psi_{t-1} + u_t$$

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- Assume that there is a once and for all shock in period $t = 1$.
  - ϵ_1
  - u_1
- Allow the starting position of the economy - x_0 to vary

Importance of the distinction II

- Impulse Responses of i_t to each type of monetary shock:

	i_N
ϵ_1	$\psi_0 \left((\rho - \theta\psi_0)^N x_0 - \theta (\rho - \theta\psi_0)^{N-2} \epsilon_1 \right)$
u_1	$(\psi_0 + u_1) \left((\rho - \theta (\psi_0 + u_1))^{N-1} (\rho - \theta\psi_0) x_0 \right)$

- Impulse Responses of x_t to each type of monetary shock:

	x_N
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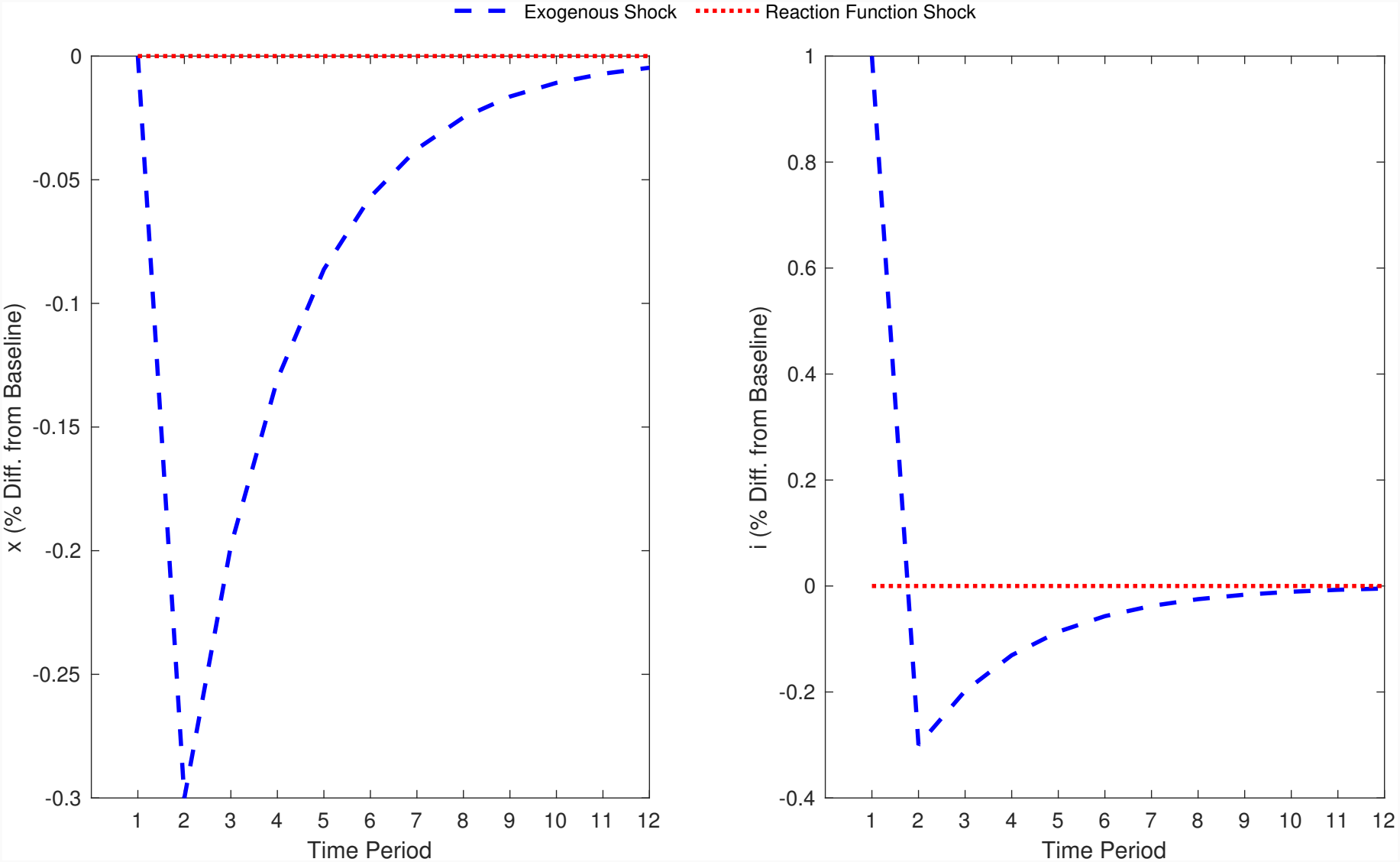
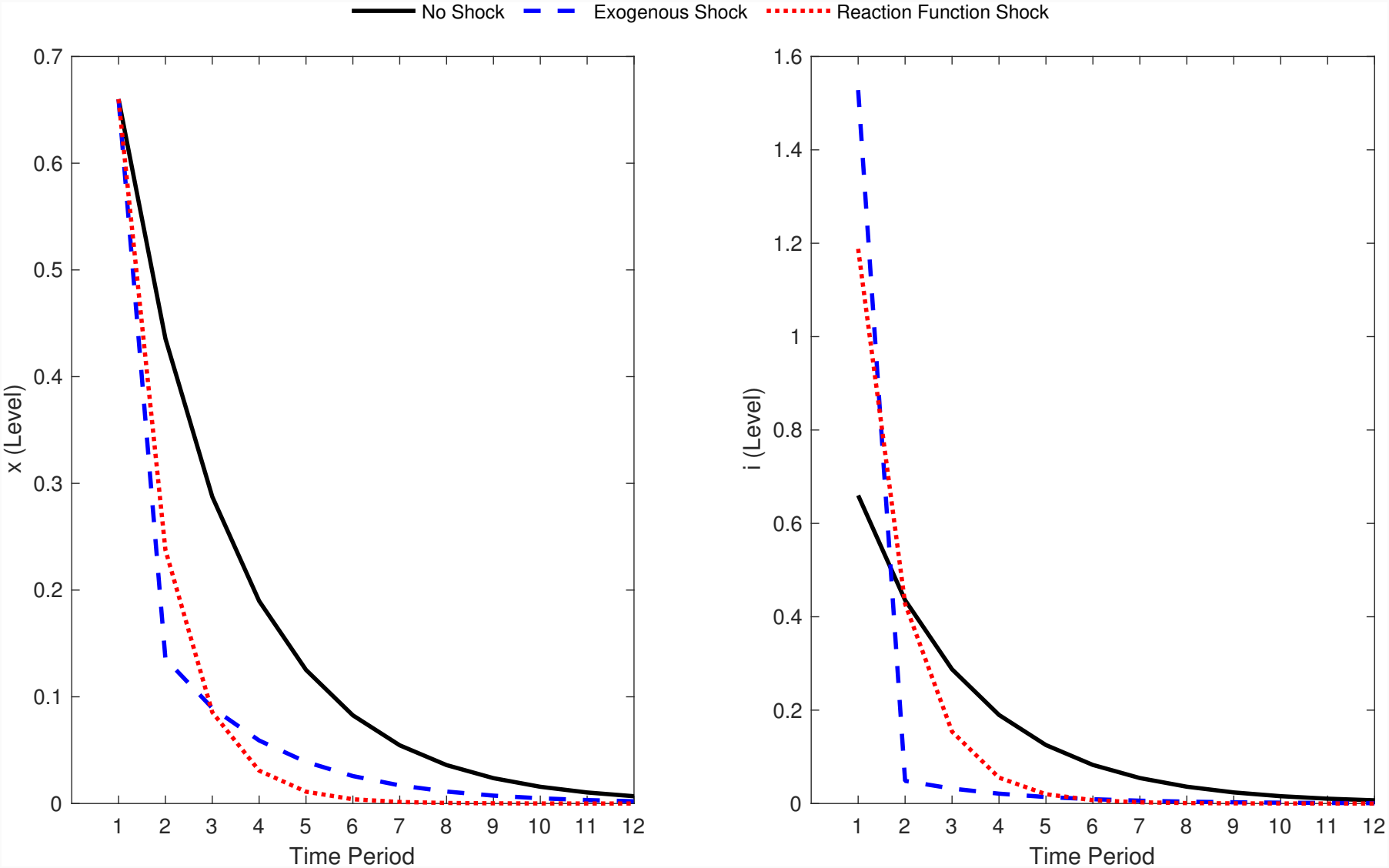
u_1	$(\rho - \theta (\psi_0 + u_1))^{N-1} (\rho - \theta\psi_0) x_0$

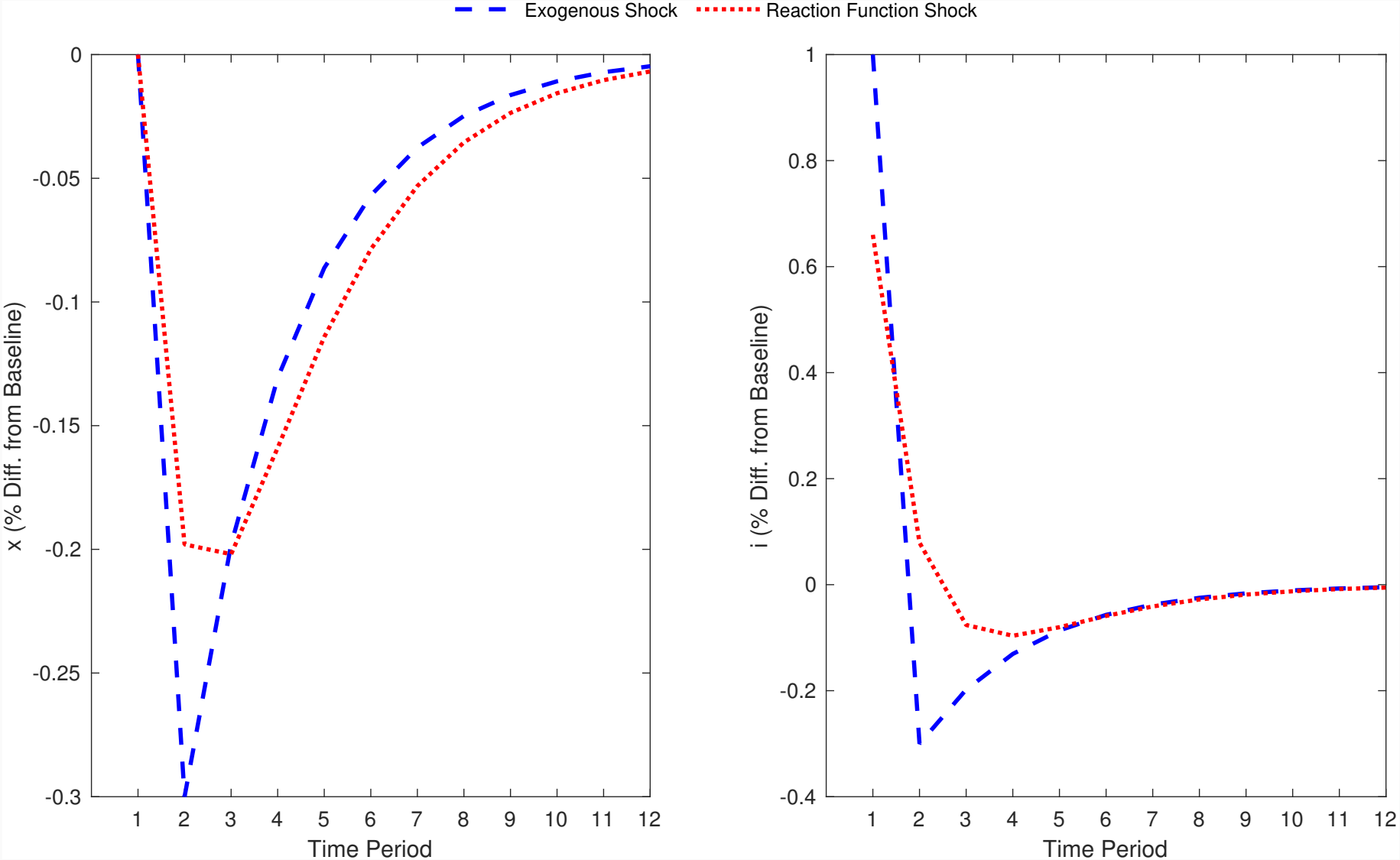
IRF: Different Monetary Shocks, $x_0 = 0, \eta_1 = 0$



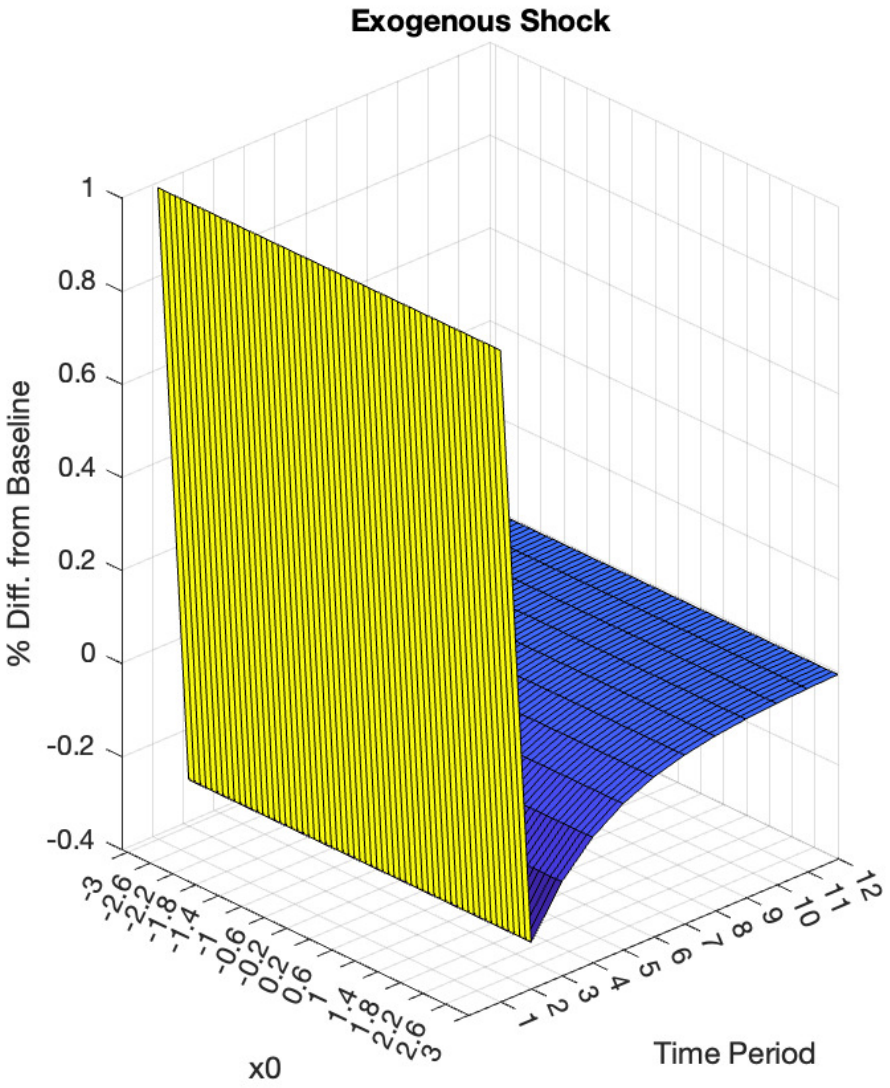
IRF: Different Monetary Shocks, $x_0 = 1, \eta_1 = 0$

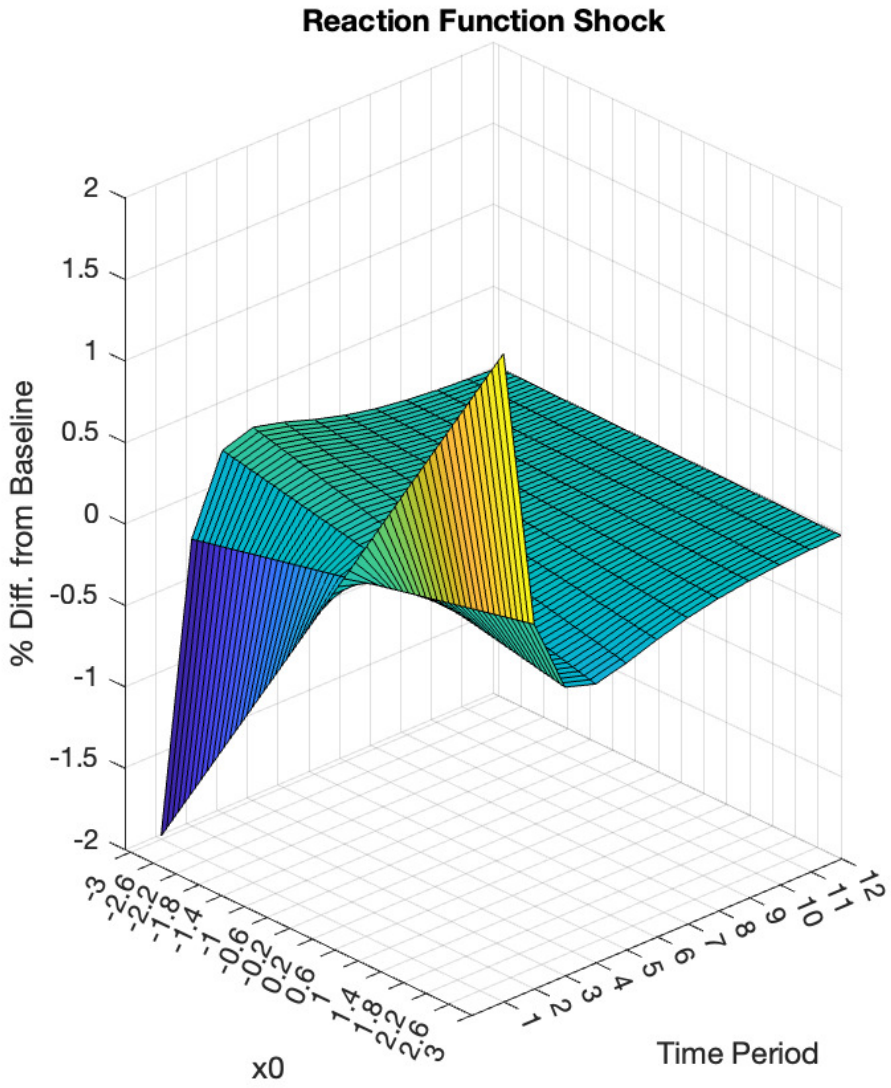


IRF: Different Monetary Shocks, $x_0 = 1, \eta_1 = 0$



Int Rate IRF by Type of Monetary Shocks: Varying x_0





Surprises Decomposed

Market perceptions matter for surprises

- We allow the CB Reaction Function to be:

$$i_t = \psi_t X_t + \epsilon_t$$

- For surprises, what the market believes matters:

1. What the market thinks is the right thing to do:

$$i_t^M = \psi_t^M X_t^M + \epsilon_t^M$$

2. What the market predicts the CB will do:

$$\mathbb{E}[\, i_t \,] = \mathbb{E}[\, \psi_t X_t \,] + \mathbb{E}[\, \epsilon_t \,]$$

Market Surprises - Definitions

Definition of a surprise Δ_t

$$\begin{aligned}\Delta_t &= i_t - \mathbb{E}[\, i_t \,] \\ &= \psi_t X_t - \mathbb{E}[\, \psi_t X_t \,] + \epsilon_t - \mathbb{E}[\, \epsilon_t \,]\end{aligned}$$

- ψ_t and x_t may be determined jointly.
  - Allow ψ_t to be a function of the endogenous variables
- Define the market forecast error of z:

$$e_t^z = z_t - \mathbb{E}[\, z_t \,]$$

Market Surprises - A decomposition

$$
\begin{aligned}
\Delta_t &= \psi_t X_t - \mathbb{E}[\,\psi_t X_t\,] + \epsilon_t - \mathbb{E}[\,\epsilon_t\,] \\
&= \psi_t X_t - \left(\psi_t - e_t^{\psi}\right)(X_t - e_t^{x}) + Cov(\psi_t, X_t) + \epsilon_t - \mathbb{E}[\,\epsilon_t\,] \\
&= e_t^{\psi} X_t + \psi_t e_t^{X} + e_t^{\psi} e_t^{X} + Cov(\psi_t, X_t) + e_t^{\epsilon}
\end{aligned}
$$

Market Surprises - A decomposition

$$\begin{aligned}\Delta_t &= \psi_t X_t - \mathbb{E}[\,\psi_t X_t\,] + \epsilon_t - \mathbb{E}[\,\epsilon_t\,] \\ &= \psi_t X_t - \left(\psi_t - e_t^{\psi}\right)(X_t - e_t^{X}) + Cov(\psi_t, X_t) + \epsilon_t - \mathbb{E}[\,\epsilon_t\,] \\ &= e_t^{\psi} X_t + \psi_t e_t^{X} + e_t^{\psi} e_t^{X} + Cov(\psi_t, X_t) + e_t^{\epsilon}\end{aligned}$$

Element(s) of Surprise

- $e_t^{\psi} X_t \equiv$ reaction function surprise
- $\psi_t e_t^{X} \equiv$ information surprise
- $e_t^{\psi} e_t^{X} \equiv$ INTERACTION surprise
- $Cov(\psi_t, X_t) \equiv$ covariance
- $e_t^{\epsilon} \equiv$ monetary policy shock surprise

Expensive RAs

Example 1: 01/05/2019 $\Rightarrow$ Surprise

- "Today's meeting further reduced the odds of a rate cut in response to low inflation, which we already saw as quite unlikely."
- $\Rightarrow$ **Economic Reassessment**:
  - "Second, on inflation, Powell emphasized that core inflation "actually ran pretty close to 2 percent for much of 2018" and attributed the recent decline largely to "transitory factors" influencing categories such as portfolio management and apparel, as we have also emphasized. He pointed as an example to the case of cell phone services in 2017, when Fed officials forecasted that the drop in inflation would be temporary and were proven correct. To help look through these transitory factors, Powell pointed to the Dallas Fed trimmed mean measure, which has continued to run at roughly 2%."

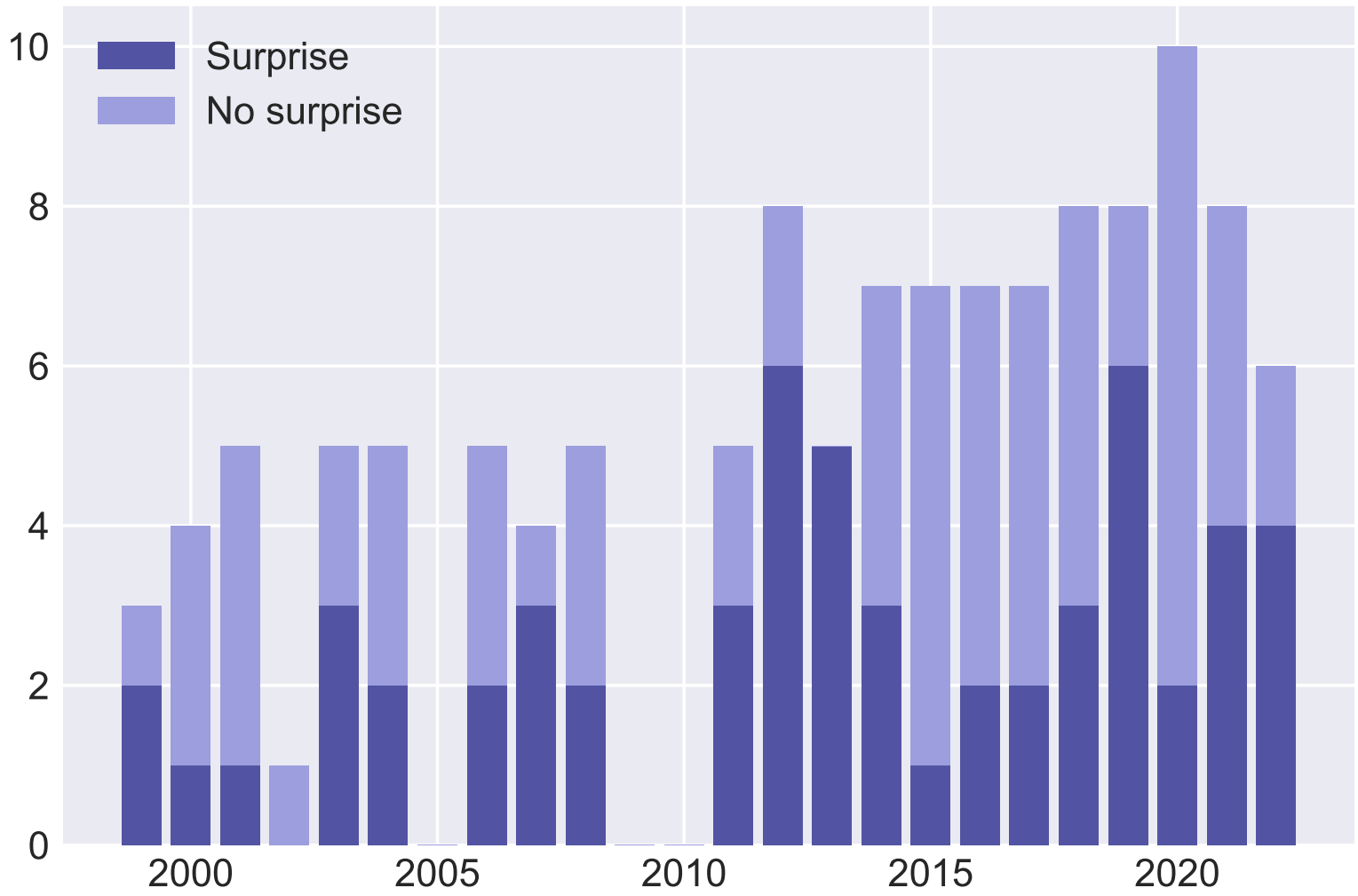
Example 2: 31/07/2019 $\Rightarrow$ **No surprise**

- "We see the results of today's meeting as consistent with our baseline expectation that easing will end with a second 25bp cut, for a total funds rate recalibration of 50bp."

Example 3: 30/10/2019 $\Rightarrow$ **Surprise**

- "We had expected the FOMC to use today's meeting to clarify that it does not anticipate further easing, and the messages from the statement and the press conference were even firmer than we had anticipated."
- $\Rightarrow$ **Preferences**:
  - "The bar that Powell set for additional cuts – developments "that cause a material reassessment of our outlook" – appears to be quite high. In practice, we think this would likely mean a few pieces of very weak data or a combination of trade war escalation, an adverse market reaction, and fairly bad data. We therefore see just a 15% chance of a cut at the December meeting."

Analysis of Large Wall Street Bank's Economics Analysis



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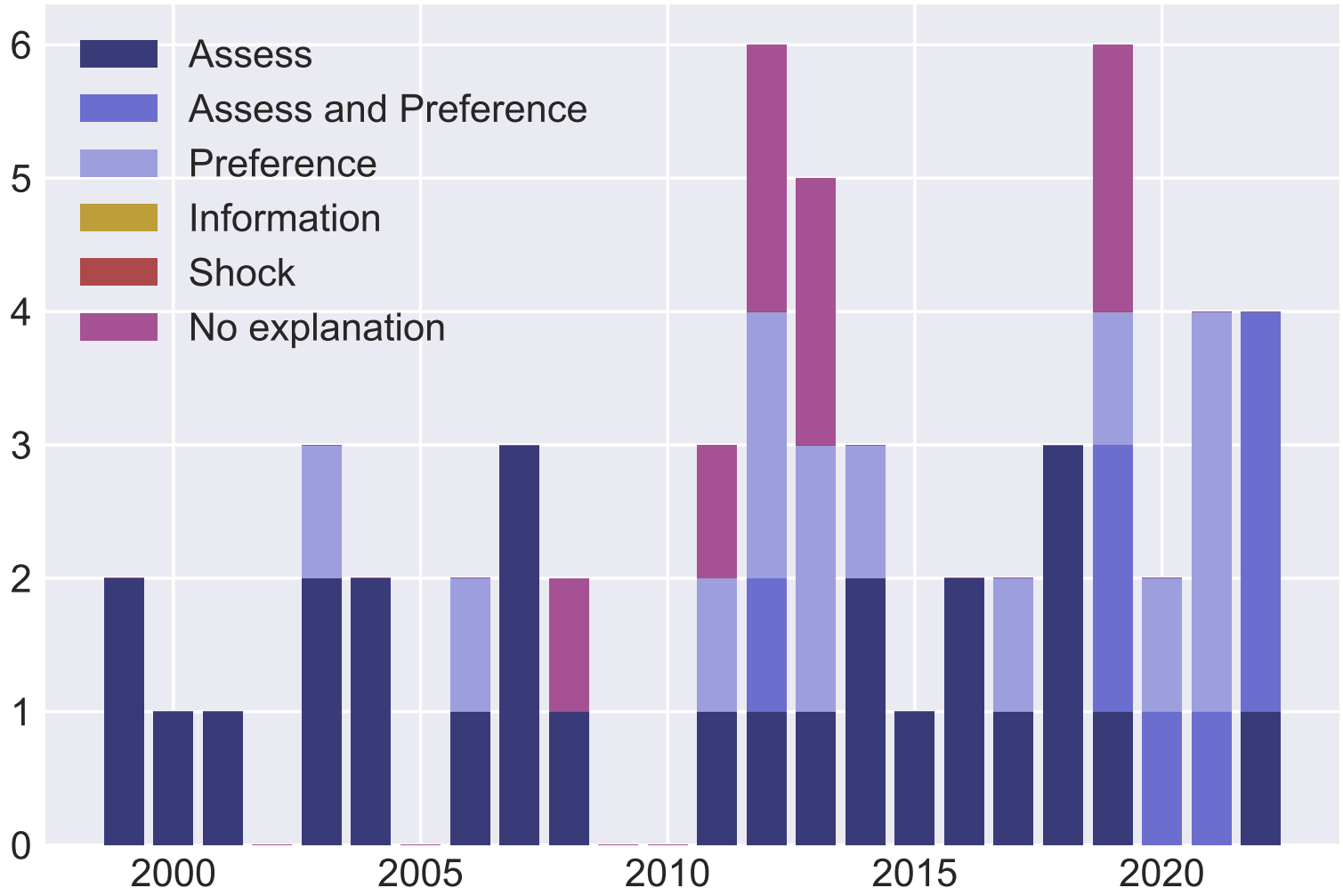


January 2006

"The Committee once again said that 'core inflation has remained relatively low in recent months.' That description seems inconsistent with the clear uptrend in the higher frequency data for core CPI, specifically the 2.8% rise in the 3 months ended in December. In addition, even though the 3-month measure of core PCE inflation does not show a clear updrift, it nevertheless has hovered around 2%. It seems somewhat curious to refer to the consistent pattern of core PCE near the upper end of the comfort zone as 'relatively low.' "

September 2007: Dovish MP

"The FOMC, as we expected, maintained the federal funds rate target at 5.25%, explicitly mentioned the financial market turbulence and tighter credit conditions in the outlook paragraph, and elevated the downside risks to growth in the policy paragraph. The Committee did not get all the way to neutral, as we thought it might, but instead retained the reference to inflation risk as the 'predominant policy concern'. However, the Committee did what was most important by giving due consideration to recent financial market developments. The explicit recognition of downside risks related to the widening of credit spreads both reassures markets that the FOMC understands the risks posed by recent developments and positions the Committee to more quickly respond to a realization of those downside risks."

March 2008: Hawkish MP

"The message today was that, despite the further marking down of expectations for near-term growth and the continuing focus on downside risks to growth, the Committee has not taken its eye off of inflation. By cutting 'only' 75 basis points, the FOMC may have also signaled a desire to take back control of monetary policy from the markets and to reinforce its commitment to price stability. Lurking in the shadows, but unsaid, may have been increased angst about the dollar... It is hard to predict what lies ahead given the recent turbulence in financial markets and persistence of systemic risk. The Fed will continue to monitor economic conditions and financial markets closely and is willing to ease policy further if needed. But today's action and statement suggest that the Committee wants to slow the rate of decline in the federal funds rate and may not expect to go below, or at least much below, 2%."

September 2012

"The apparent misalignment between participants' macro forecasts and the Committee's new funds rate guidance suggests that there has been a shift in the FOMC's reaction function. The Committee appears to have increased its emphasis on the full employment portion of its dual mandate. That would explain why it chose to extend the funds rate guidance even as it revised downward its unemployment rate projection. Such a shift in emphasis could be temporary, consistent with what the Chairman calls a "balanced approach" to monetary policy. That approach would argue, for instance, for a greater emphasis on bringing the unemployment rate down when the unemployment gap is especially wide, provided inflation is still near its target. We wrote a piece earlier this year about a potential shift in the Committee's reaction function. Today's FOMC announcement provides the strongest evidence yet that such a shift has taken place."

August 2010: Little news

"The FOMC statement surprised us in, unfortunately, two ways....

We took two important messages from the statement: First, the staff and the Committee's forecasts have now diverged significantly from ours, with weaker growth than MA in both 2010 and 2011. Second, the question now is not how late they will tighten, but whether, when, and how they will ease. That puts us in a challenging situation. The Committee appears to have moved closer to easing, but that would not fit with our forecast, at least based on the Committee's apparent long-standing tolerance for such a grim outlook."

November 2010

"The only surprise for us was that the statement referred to inflation as being 'somewhat low' relative to levels consistent with its dual mandate, in contrast to the sharper language used by the Chairman earlier that inflation was 'too low.' This is another area where the statement was a bit less aggressive than we anticipated."

Information Effects

- January 2010: "The explicit reference to bank lending, which has been contracting for some time, may suggest that the updated quarterly Senior Loan Officer Opinion Survey on the willingness to lend to various sectors was worse than expected. The Committee received this report before the meeting; the rest of us will get it next week."
- August 2010: "The Committee may know something that we don't. Perhaps the upcoming Senior Loan Officer Survey has very bad news about lending standards."

Recent Econometric Evidence on MP shocks

- Little evidence of traditional exogenous monetary policy shocks in the last 25 years

Ramey, 2016

"Monetary policy is being conducted more systematically, so true monetary policy shocks are now rare... While this is bad news for econometric identification, it is good news for economic policy."

- Arouba & Dreschel (2023) show how large textual approach capture even more of the variation in shocks

Facts

Facts reaction function surprises are consistent with

1. Surprises are larger when policy rates deviate from a traditional Taylor rule (Schmeling, Schrimpf, and Steffensen 2020)
2. Surprises are positively correlated with news that occurs prior to the FOMC announcement (Bauer and Swanson 2020)
3. Surprises are systematically negative in downturns
4. Surprises are predictable based on past macro data (Miranda-Agrippino 2016).
5. Surprises are serially correlated (Ramey 2016; Miranda-Agrippino and Ricco 2021)
6. Surprises are correlated with central banks' private forecasts (Cieslak 2018; Schmeling, Schrimpf, and Steffensen 2020).

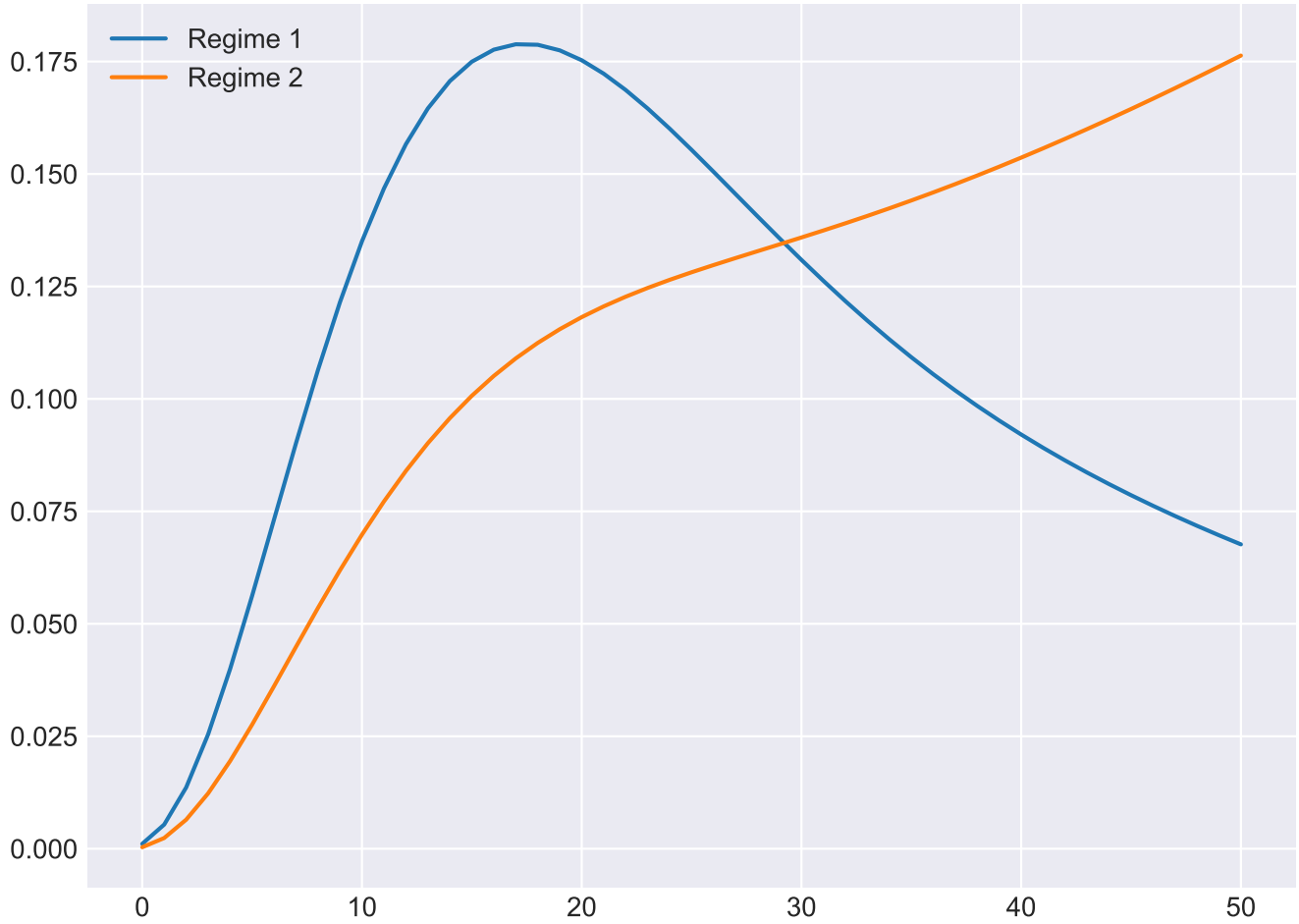
Reaction Function Shifts and Surprises

MS-DSGE Model [Details]

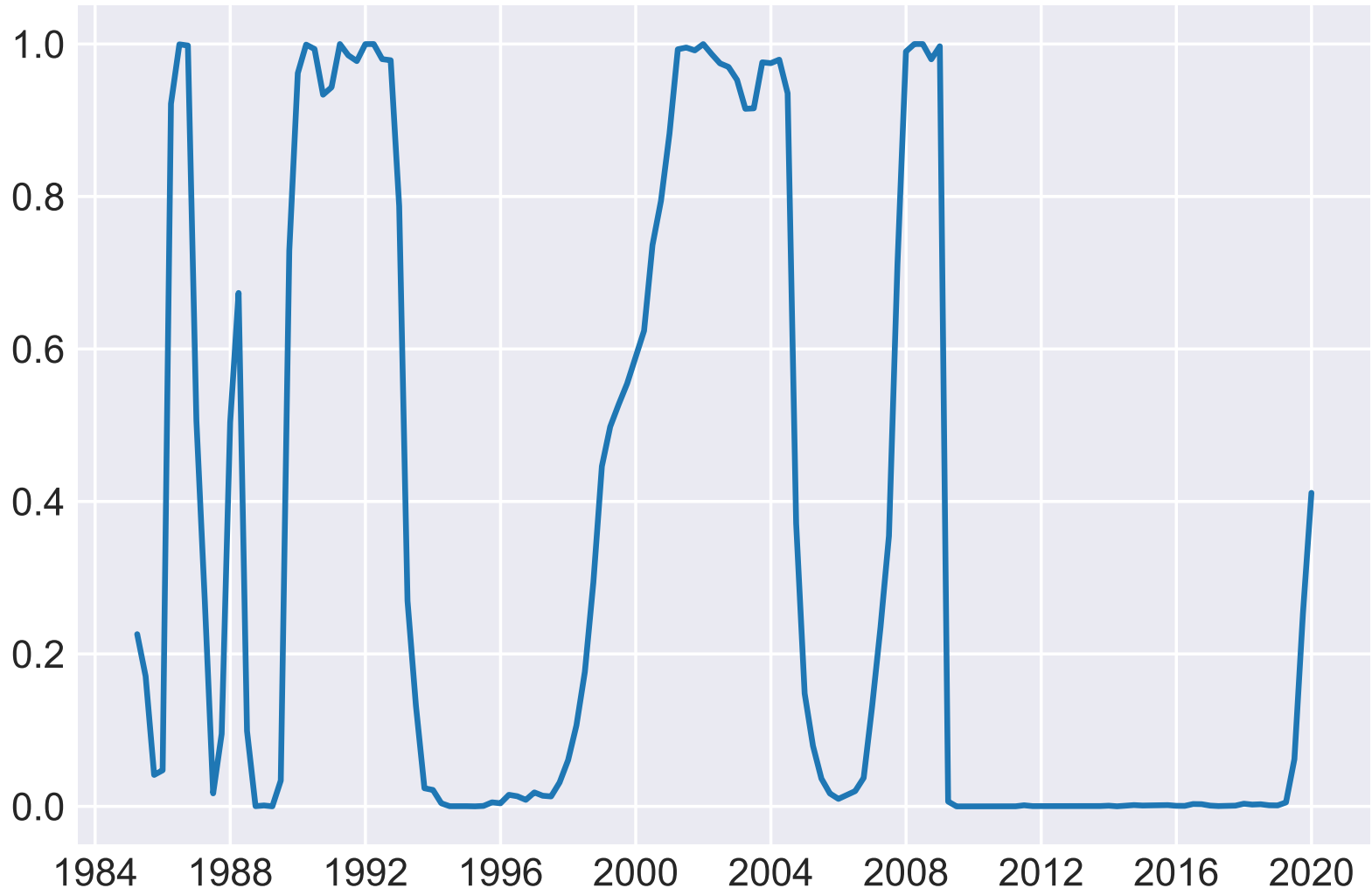
$$\pi_t = w_f^j \mathbb{E}\pi_{t+1} + (1 - w_f^j)\pi_{t-1} + \gamma_1 x + \sigma_s \epsilon_s$$
$$x_t = \beta_f \mathbb{E}x_{t+1} + (1 - \beta_f)(\beta_y x_{t-1} + (1 - \beta_y)x_{t-2}) - \beta_r(r - \mathbb{E}\pi_{t+1}) + \sigma_d \epsilon_d$$
$$r_t = (1 - \rho_1 - \rho_2)(\gamma_\pi^j \pi_t + \gamma_y^j x_t) + \rho_1 r_{t-1} + \rho_2 t_{t-2} + \sigma_r \epsilon_r$$

- Inflation as key driver is consistent with Cieslak et al (2023) on inflation uncertainty on the FOMC

Optimal responses of i_t to an inflation shock [Details]



Probability of being in Regime 2 [Details]



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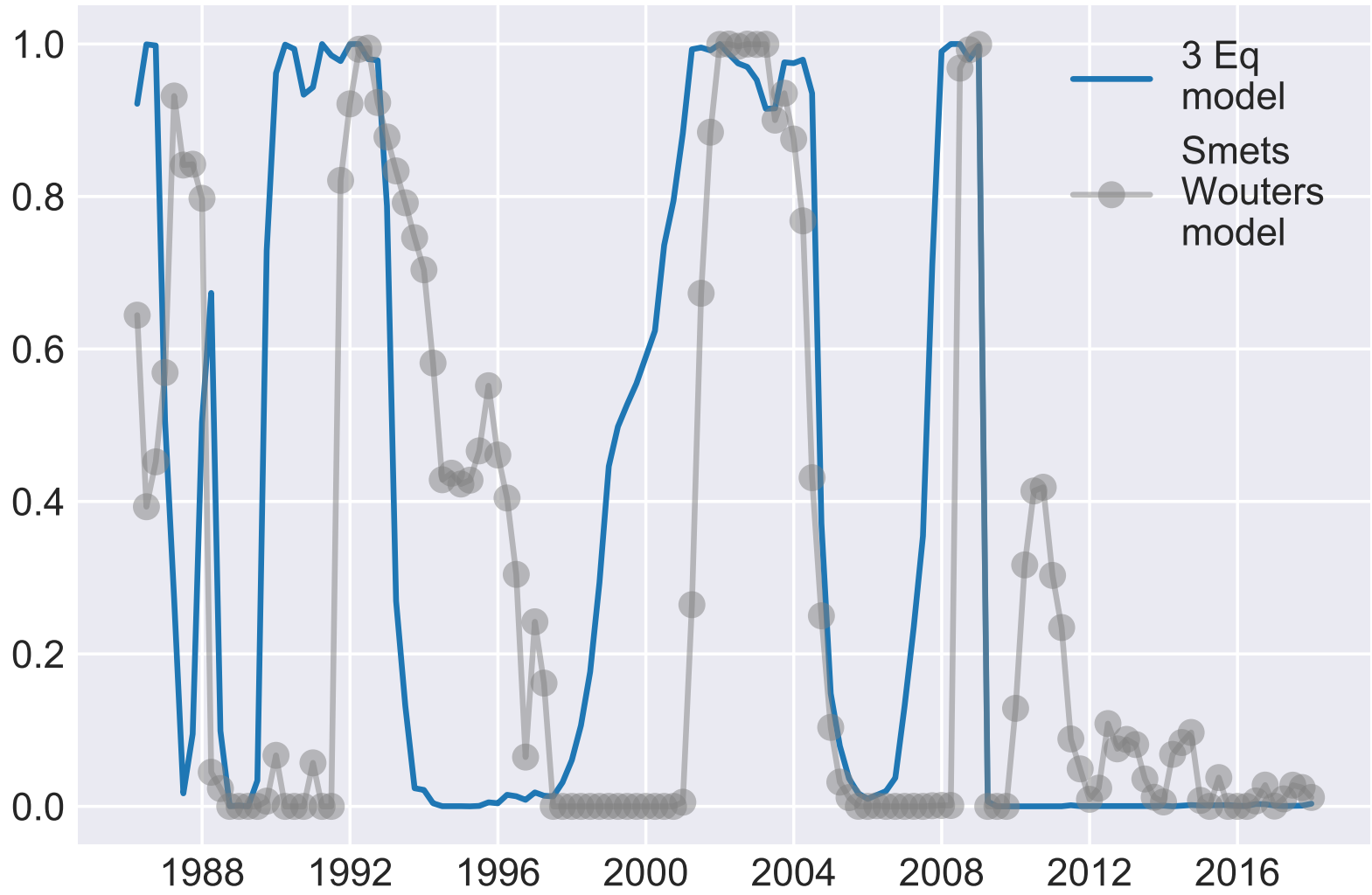
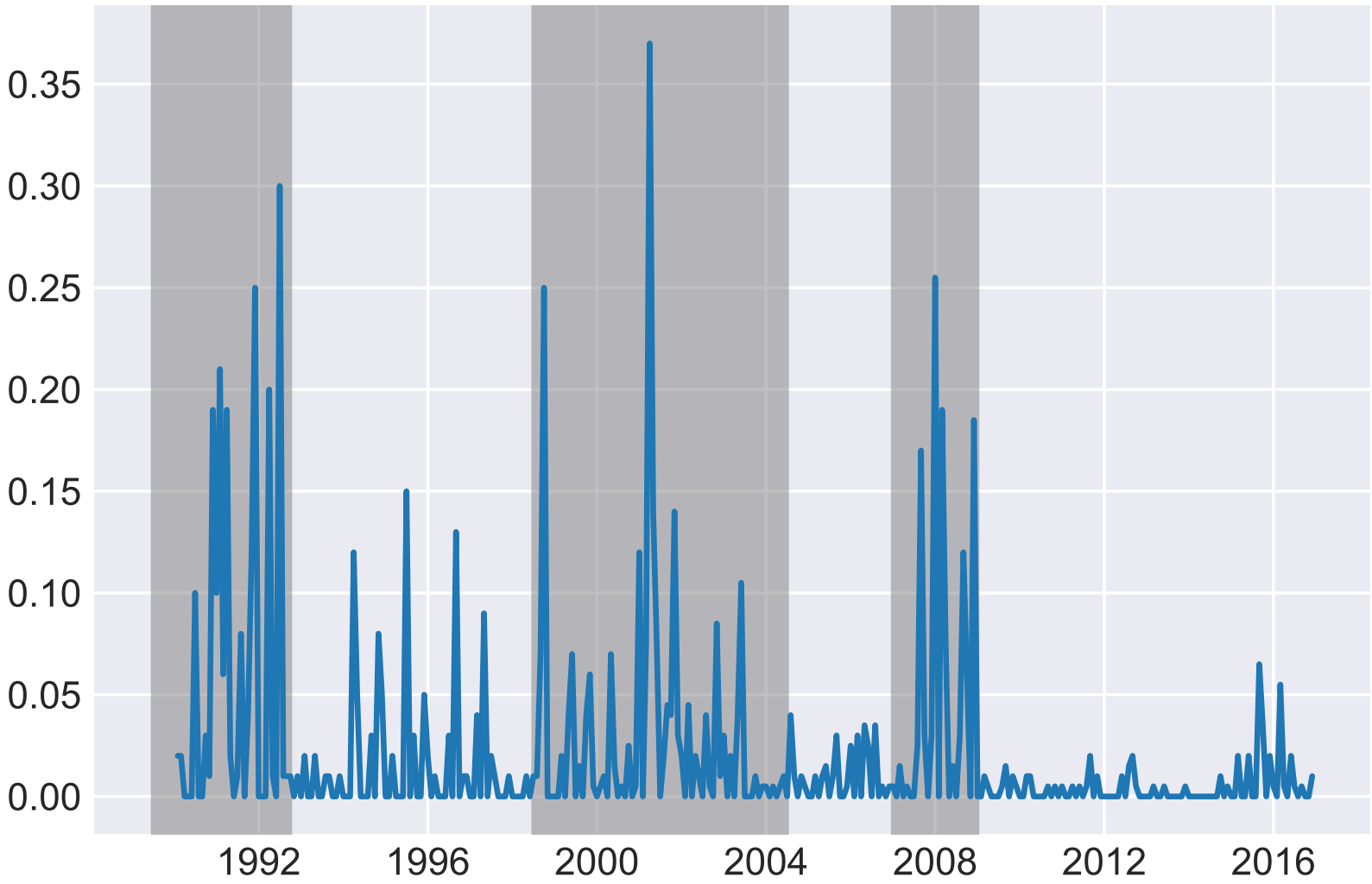
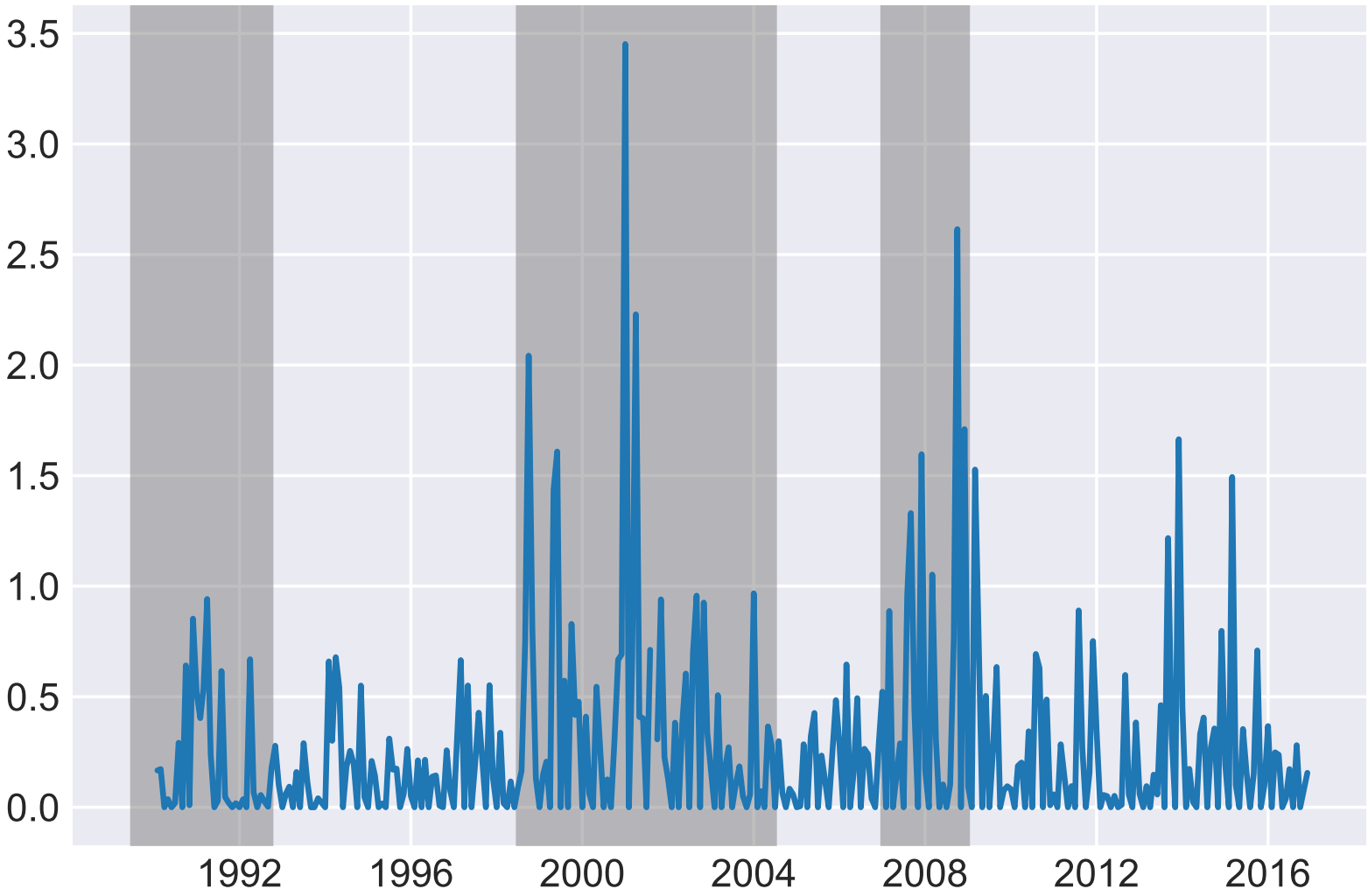


Absolute HF interest rate surprises [Details]

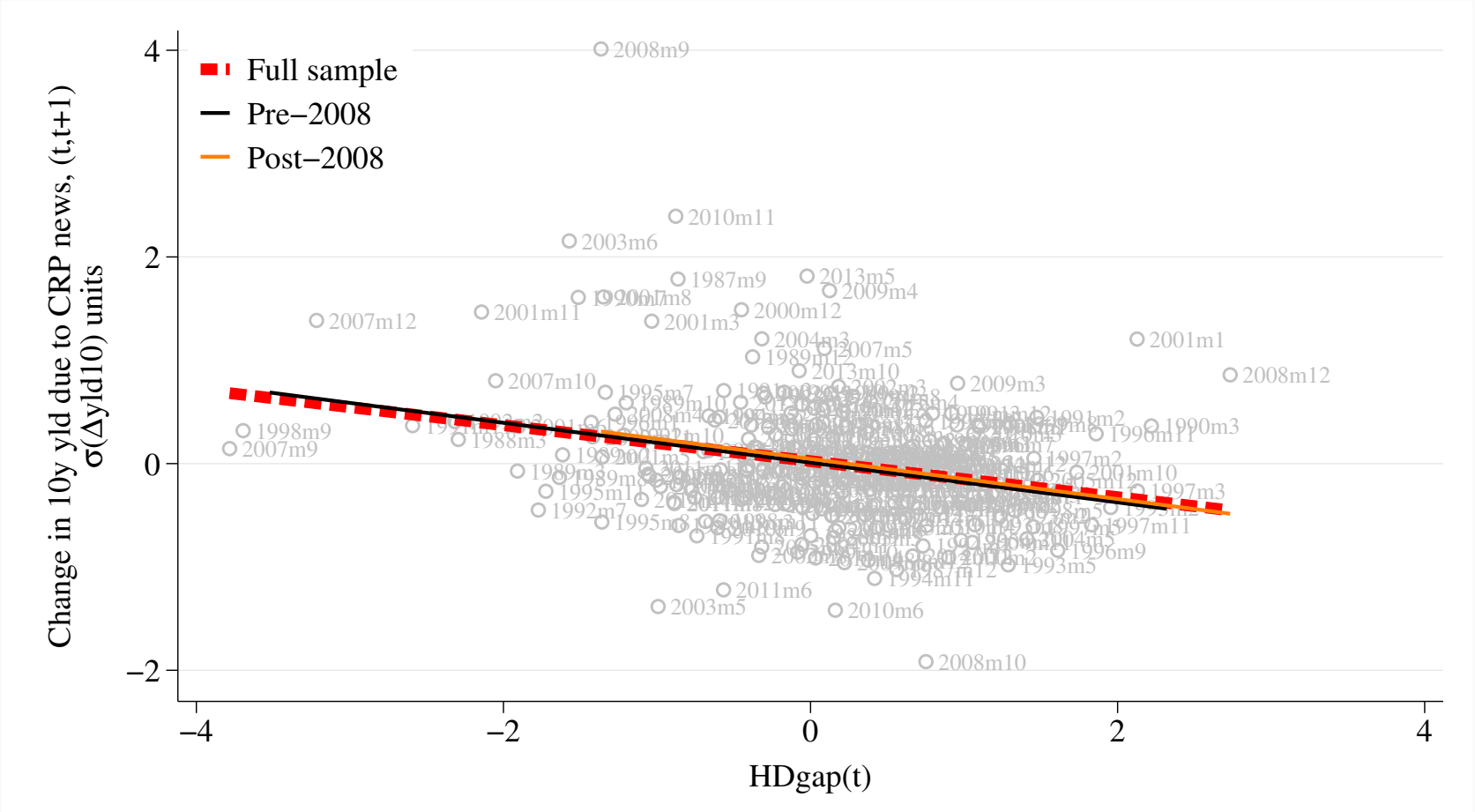


Absolute HF equity surprises ↶[Details]



Perceived Mistakes

Cieslak & McMahon, 2023



- Internal stance predicts intermeeting risk premium changes
- $\sim 17\%$ of intermeeting yield volatility per 1σ change in *HDgap*
- *Not* via short rate expectations

Why TP matters for Monetary Policy?

$$r_t^{10} = \mathbb{E}\left[\frac{\sum_{j=0}^{10} i_{t+j}^{cb}}{10}\right] + TP_t^{10} - \pi_t^{e,10}$$

Communications and mistakes:

1. If signal likely to make a dovish mistake, market worry drives up TP_t^{10}
   - tightens financial conditions: initially does some of the MP work
2. If market becomes convinced: $\mathbb{E}\left[\frac{\sum_{j=0}^{10} i_{t+j}^{cb}}{10}\right] \downarrow$ and $\pi_t^{e,10} \uparrow$
3. TP_t^{10} and $\pi_t^{e,10}$ volatility makes it harder to control real rate gaps with i_t^{cb}.

Perceived Mistakes

- The market can perceive mistakes (dropping ϵ_t)
  - *Ex-ante*:

$$\mathbb{E}[\, i_t \,] - i_t^M = \mathbb{E}[\, \psi_t X_t \,] - \psi_t^M X_t^M$$

  - *Ex-post*:

$$i_t - i_{t'}^M = \psi_t X_t - \psi_{t'}^M X_{t'}^M$$

- CB communication can affect market view of "correct":

$$\begin{aligned} i_{t'}^M - i_t^M &= \psi_{t'}^M X_{t'}^M - \psi_t^M X_t^M \\ &= \underbrace{n_t^\psi}_{\psi_{t'}^M - \psi_t^M} X_t^M + \psi_{t'}^M e_t^x \end{aligned}$$

- Last line requires that new information is believed: $X_{t'}^M = X_t^M + e_t^x$.

Evolution of Perceived Mistakes and Surprises

	Expected	Surprise
Disagree	“Expected Mistake”	“Surprising mistake”
Agree	“Expected correction”	“Corrective action”

Evolution of Perceived Mistakes and Surprises

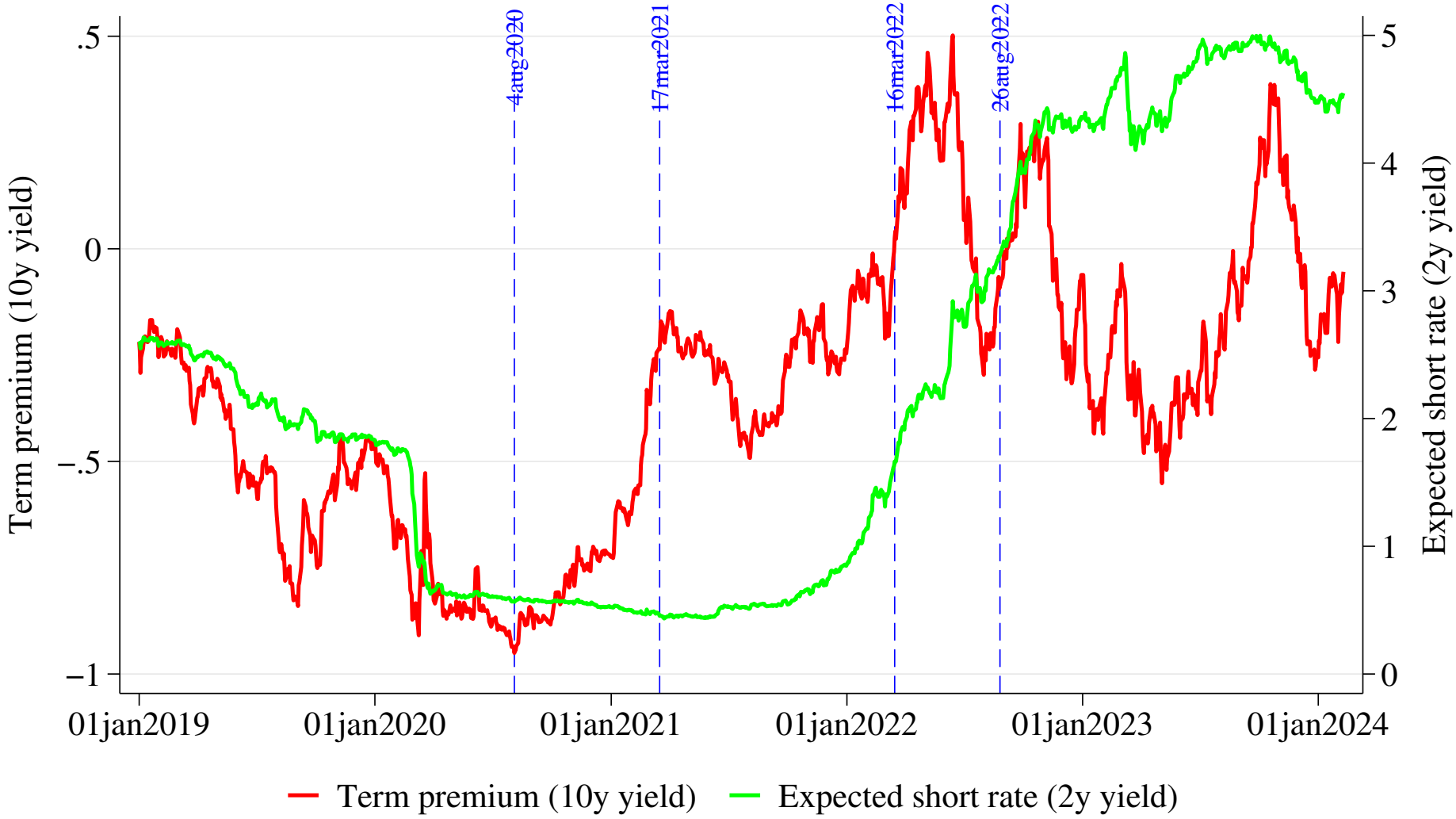
	Expected	Surprise
Disagree	"Expected Mistake"	"Surprising mistake"
Agree	"Expected correction"	"Corrective action"

Update on Perceived Mistake

$$
\begin{aligned}
\Omega_t &= i_t - i_{t'}^M - (\mathbb{E}[\, i_t \,] - i_t^M) \\
&= i_t - \mathbb{E}[\, i_t \,] - (i_{t'}^M - i_t^M) \\
&= \Delta_t - n_t^{\psi} X_t^M + \psi_{t'}^M e_t^x \\
&= e_t^{\psi} X_t + \psi_t e_t^X + e_t^{\psi} e_t^X + Cov(\psi_t, X_t) - n_t^{\psi} X_t^M + \psi_{t'}^M e_t^x \\
&\approx (e_t^{\psi} - n_t^{\psi}) X_t + Cov(\psi_t, X_t) \text{ if } e_t^x \approx 0
\end{aligned}
$$

- Today's perceived errors likely to feed into future surprises
- Macroeconomic news is likely to also affect perceived mistakes

The Post-Review Period

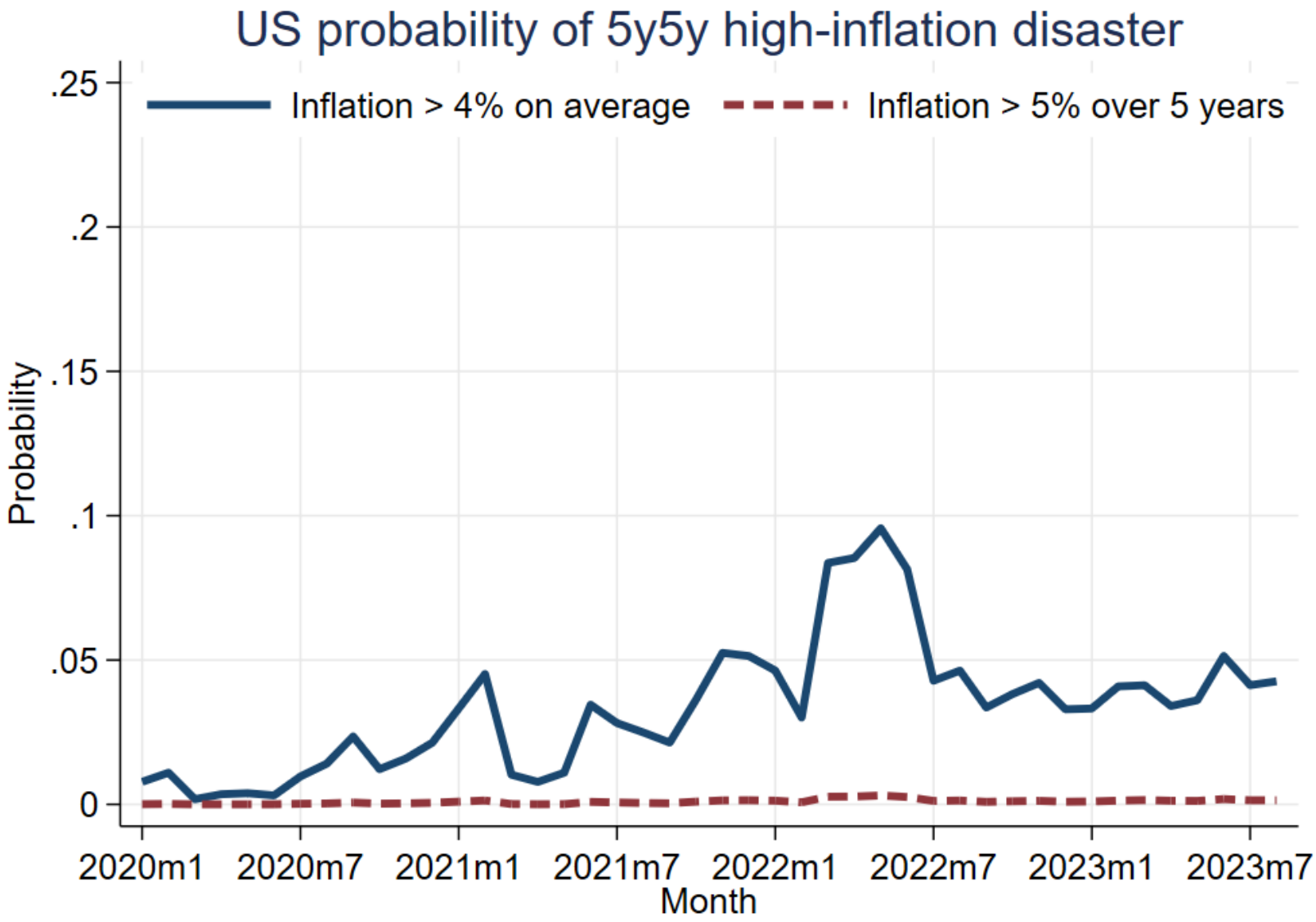


New Regime, New Confusion?

"But is the strategy truly "full make up" average inflation targeting? Not quite, we have said. It looks closer than we expected, but not quite there unless the Committee opts to define a "lookback period" (period over which the cumulative shortfall from 2% to be made up is to be calculated) and what "some time" means (over what period will the average inflation rate be measured). Nevertheless, we still get the thrust of the policy.

...in the macro projections, there is a cumulative undershoot of core inflation of one percentage point over 2020-2023 relative to the 2% objective. Frankly, we find it implausible that FOMC participants would be projecting the overshoot beyond 2023 to fully make up that one percentage point undershoot... To make up the remainder of the undershoot, you'd have to overshoot even longer, likely inconsistent with Powell's guidance that an overshoot wouldn't be for a "sustained period"."

Hilscher, Raviv & Reis (2023)



September 2022: Multidimensional Communication

"We changed our call after seeing the September SEP. We now think that the November hike will be 75 basis points (instead of 50), followed by two more 50-basis-point hikes (in December and February) and a final hike of 25 basis points in March to bring the funds rate to a peak level of 5-5.25%."

"The Fed hiked only 75 basis points, as expected... The FOMC did very little with the statement. And Powell kept it pretty simple in his press conference as well."

"Powell explicitly referred to his Jackson Hole messaging."

"With today's move, 'we've just moved into the very lowest level of what might be restrictive.' The FOMC doesn't know what level will be appropriate, but 'there's a ways to go'."

September 2022: Multidimensional Communication

"Most importantly, the dots moved up dramatically... the median dots were 25 basis points higher [in each year] than we anticipated. The market didn't rally when the statement and SEP were released, with the large upward move in the dots apparently preventing a dovish interpretation by the market."

"...when you consider not just the dots but the macro projections, the SEP doesn't strike us as particularly hawkish at all. We think more action is warranted, given those projections."

This Paper

Two Overarching Questions

1. Interested in the better understanding the effects of communication, how can we interpret monetary policy surprises in the face of time-varying reaction functions?
2. What can we learn about the effects of communication from perceived mistakes?

- Endogenous shifts in policy have important implications for how we model optimal policy and design communication
- We need to think about the role of perceived mistakes and policy credibility

END

Calibrated parameters [Back]

Parameter	Value	Reference
β_f	0.99	N/A
ρ_1	0.95	Svensson and Williams (2005)
ρ_2	-0.06	Svensson and Williams (2005)

Priors for estimated parameters [Back]

Parameter	Distribution	%90 bands
γ_1	Gamma	0.05, 0.1
σ_d	Weibull	0.05, 1
σ_s	Weibull	0.05, 1
σ_r	Weibull	0.05, 1
β_r	Gamma	0.005, 0.5
β_y	Normal	1.1, 1.2
w_f^1	Gamma	0.4, 0.7
w_f^2	Gamma	0.1, 0.3
$p_{1,2}$	Beta	0.1, 0.25
$p_{1,2}$	Beta	0.1, 0.25
γ_π^1	Gamma	0.5, 5.0
γ_π^2	Gamma	0.5, 5.0
γ_y^1	Gamma	0.05, 3.0
γ_y^2	Gamma	0.05, 3.0

Estimated Markov Switching parameters [Back]

Parameter	Regime 1: Posterior mode	Regime 2: Posterior mode
γ_π^j	2.7	1.1
	(0.35)	(0.65)
γ_y^j	0.15	0.37
	(0.03)	(0.10)
w_f^j	0.37	0.29
	(0.15)	(0.10)

Estimated fixed parameters [Back]

Parameter	Posterior mode
γ_1	0.001
	(0.001)
σ_d	2.86
	(0.21)
σ_s	0.09
	(0.014)
σ_r	0.07
	(0.02)
β_r	0.016
	(0.024)
β_y	1.15
	(0.036)
$p_{1,2}$	0.097
	(0.083)
$p_{2,1}$	0.15
	(0.12)

Optimal policy coefficients [Back]

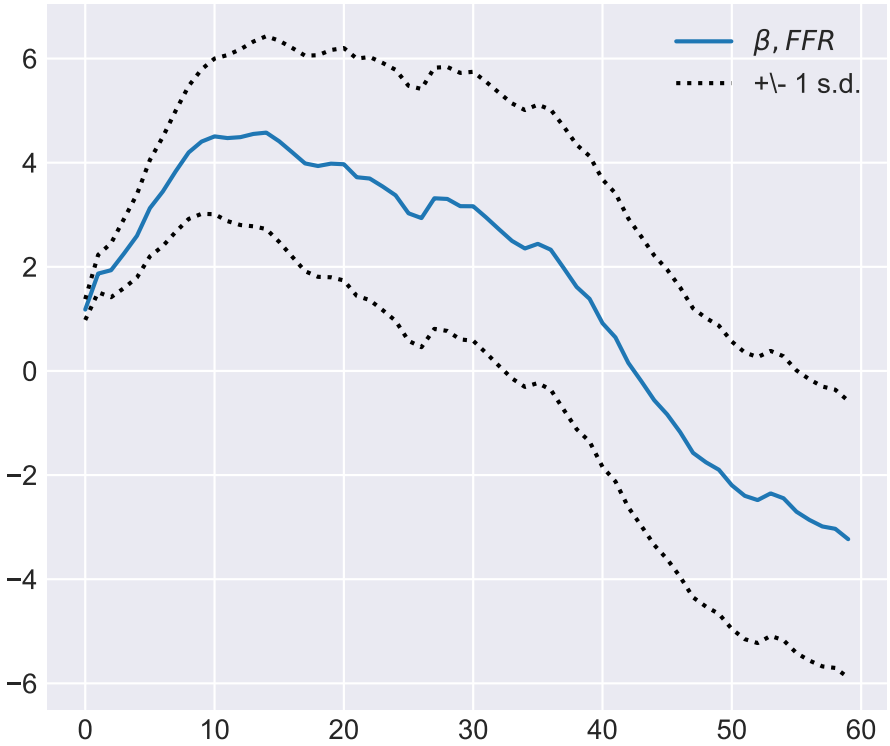
	π_{t-1}	x_{t-1}	x_{t-2}	i_{t-1}	$\epsilon_{s,t}$	$\epsilon_{d,t}$	$\lambda_{\pi,t-1}$	$\lambda_{x,t-1}$
Regime 1	0.0077	0.0002	-0.0000	0.8667	0.0011	0.7830	0.0001	0.1302
Regime 2	0.0026	0.0002	-0.0000	0.8667	0.0003	0.7830	0.0001	0.1302

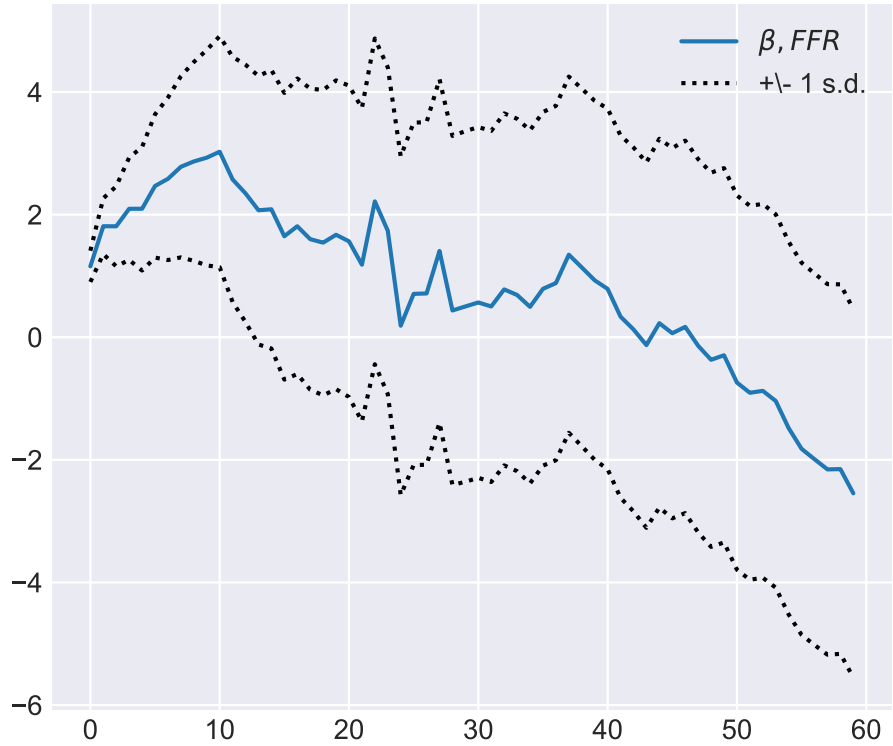
Empirical IRFs

- Existing uses of shocks mix shocks from Regime 1 and Regime 2
- Suspect Regime 2 surprises are actually reaction function innovations
- Use Jorda local projections
  - Use directly as independent variables (OLS)
  - Use as instruments (2SLS)

Empirical IRFs: OLS Unadjusted

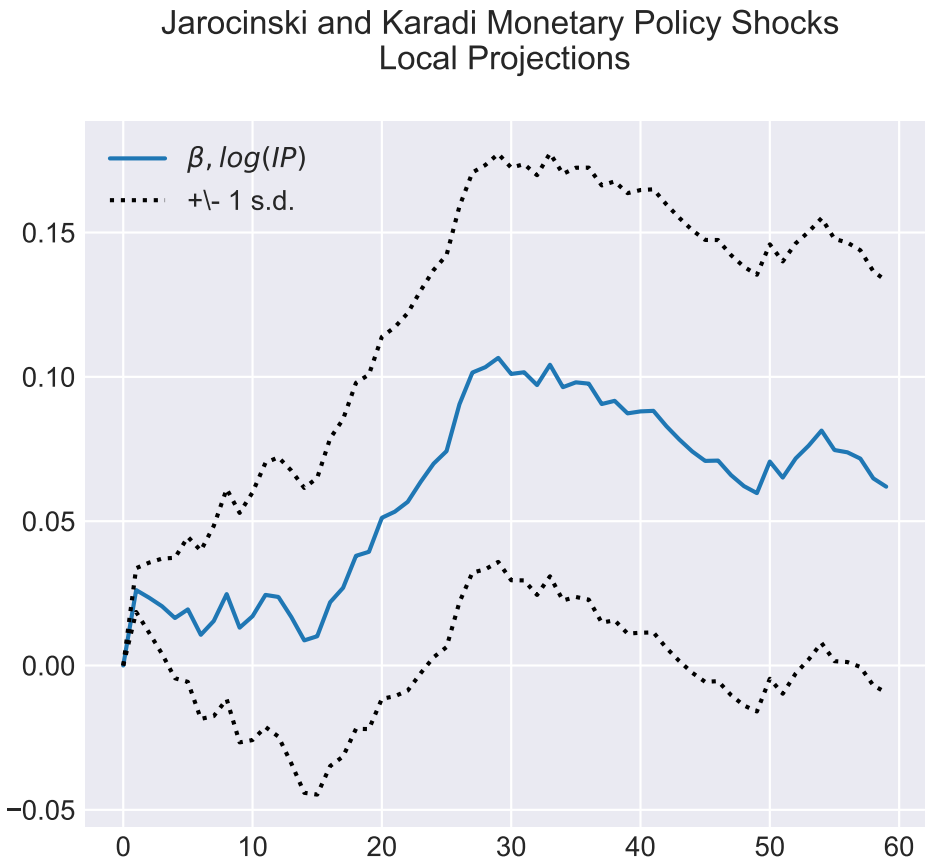
Effective FFR

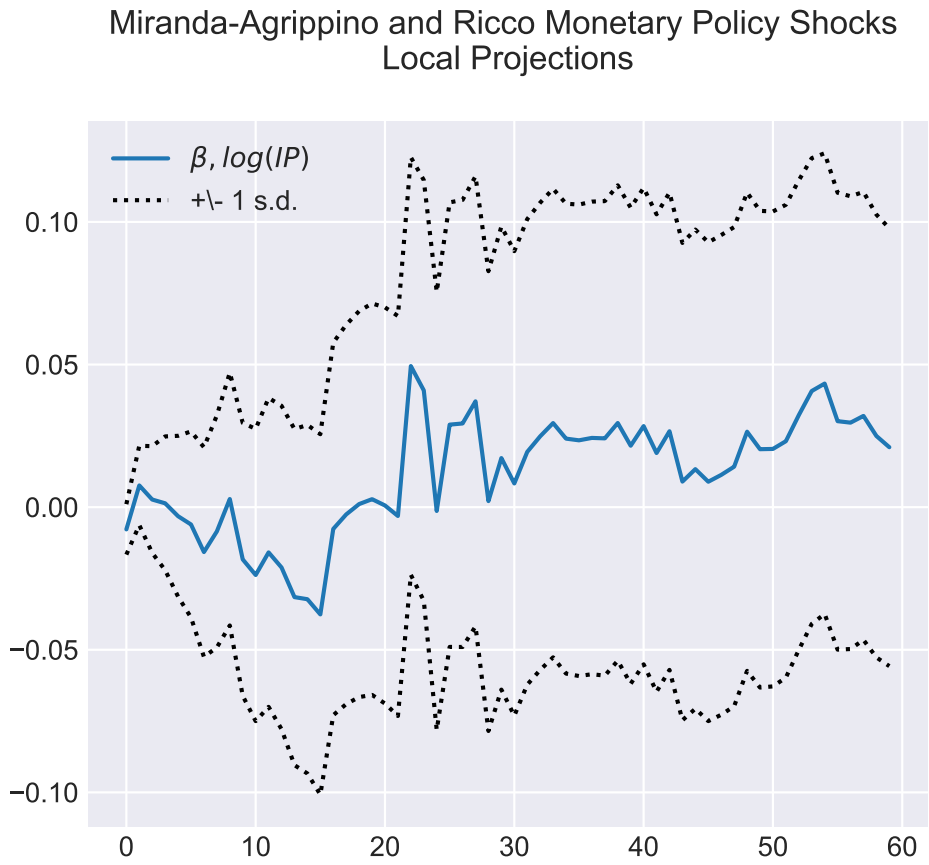




Empirical IRFs: OLS Unadjusted

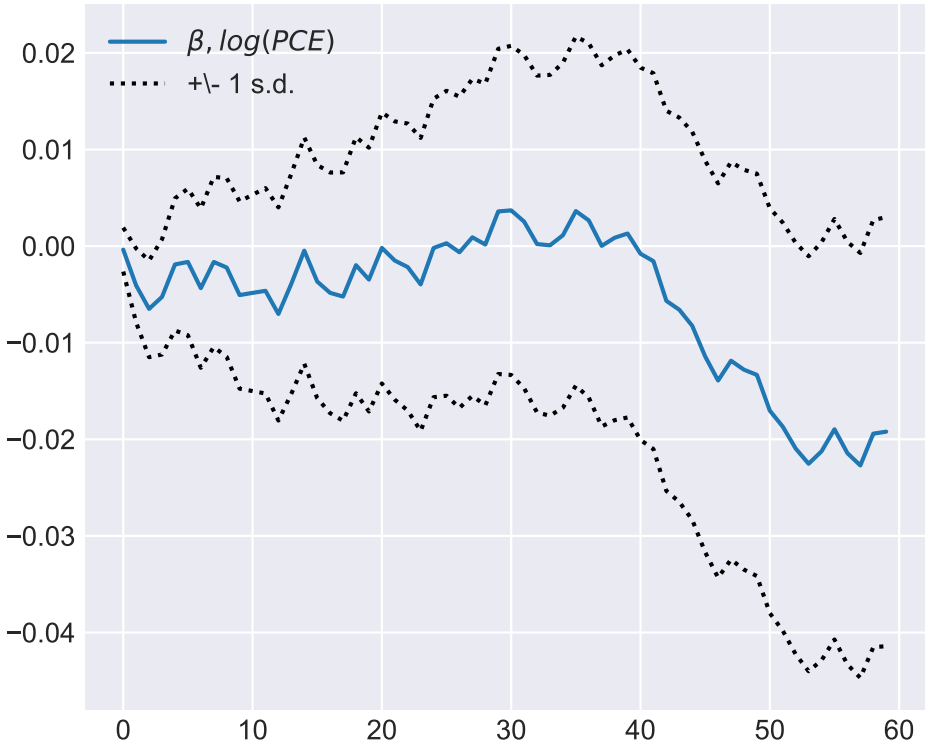
Industrial Production

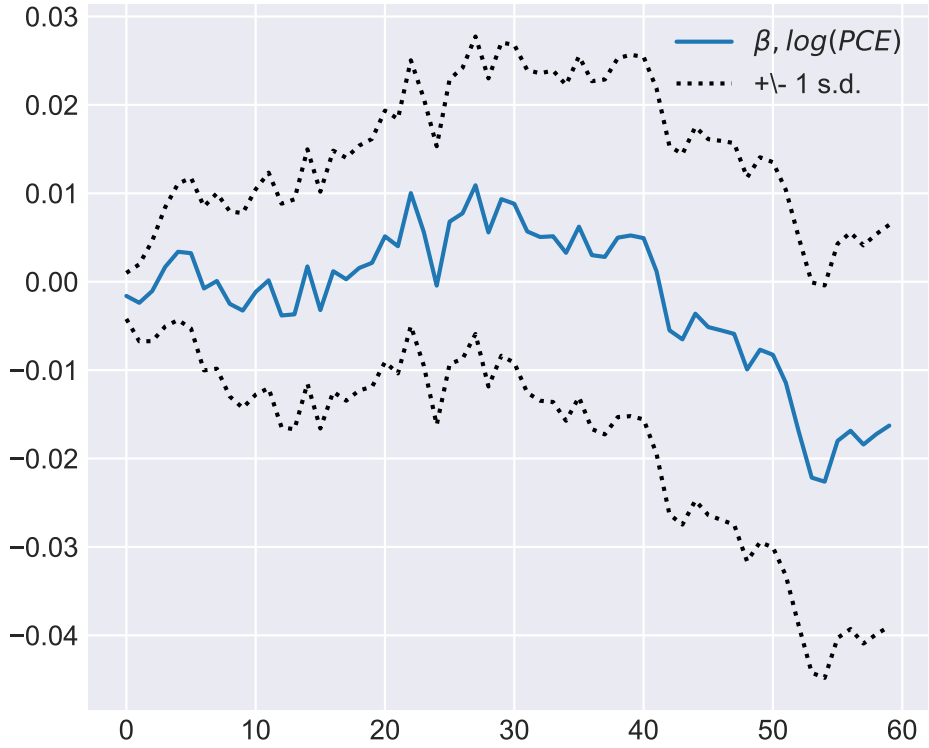




Empirical IRFs: OLS Unadjusted

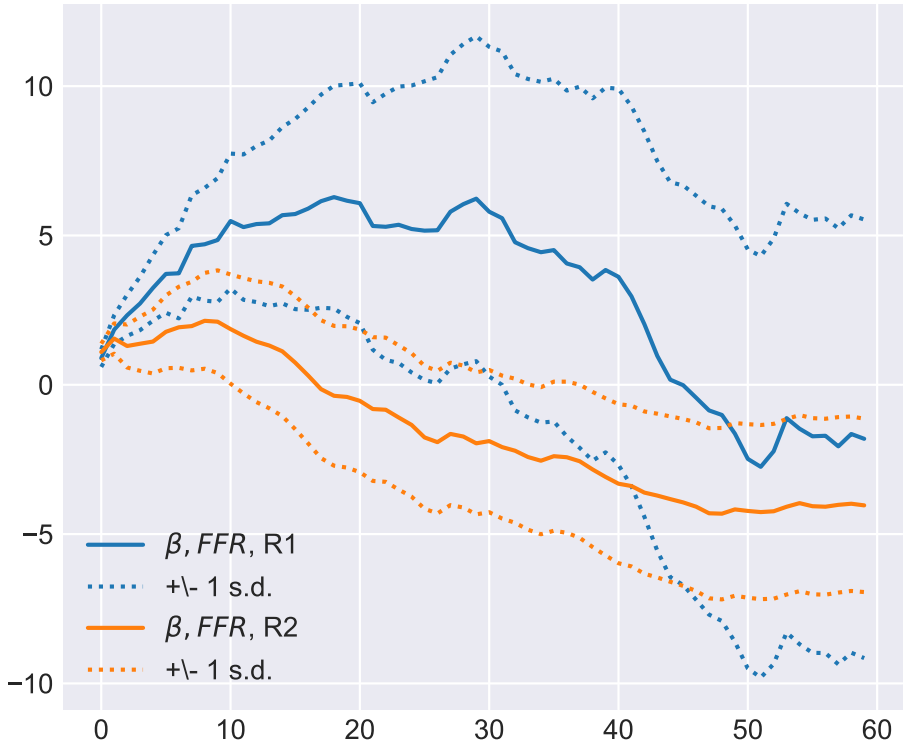
Inflation

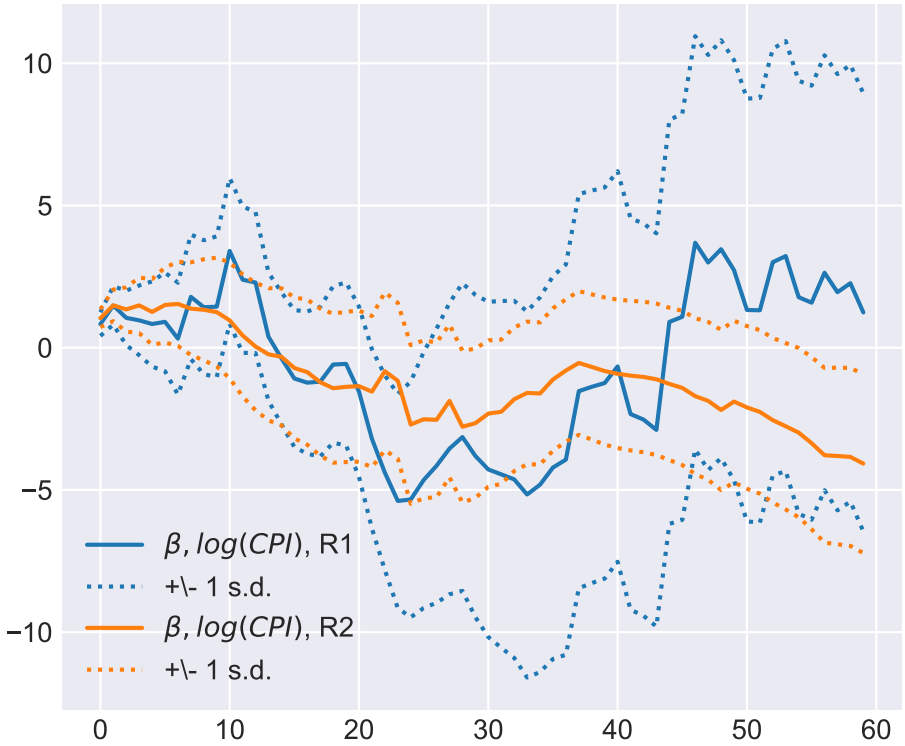




Empirical IRFs: OLS Regime Adjusted

Effective FFR

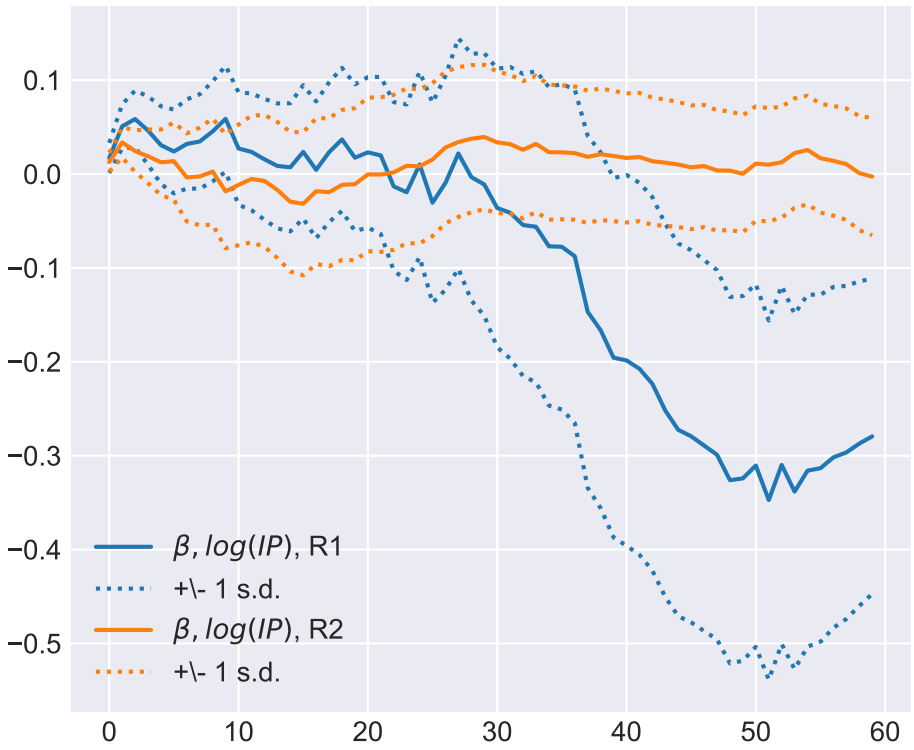




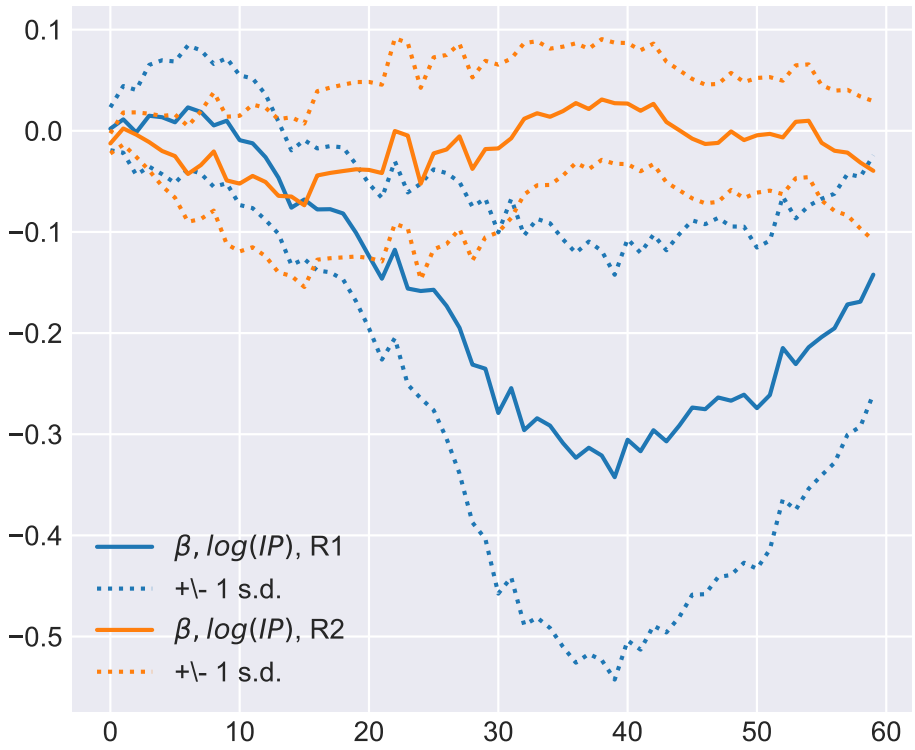
Empirical IRFs: OLS Regime Adjusted

Industrial Production

Jarocinski and Karadi Monetary Policy Shocks
Local Projections across regimes

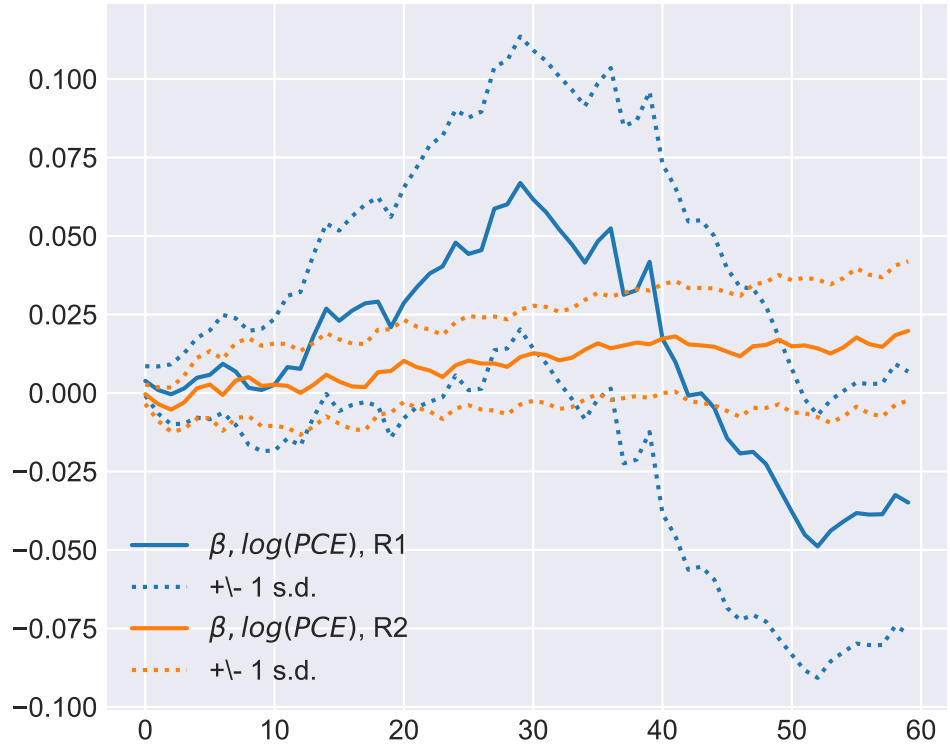


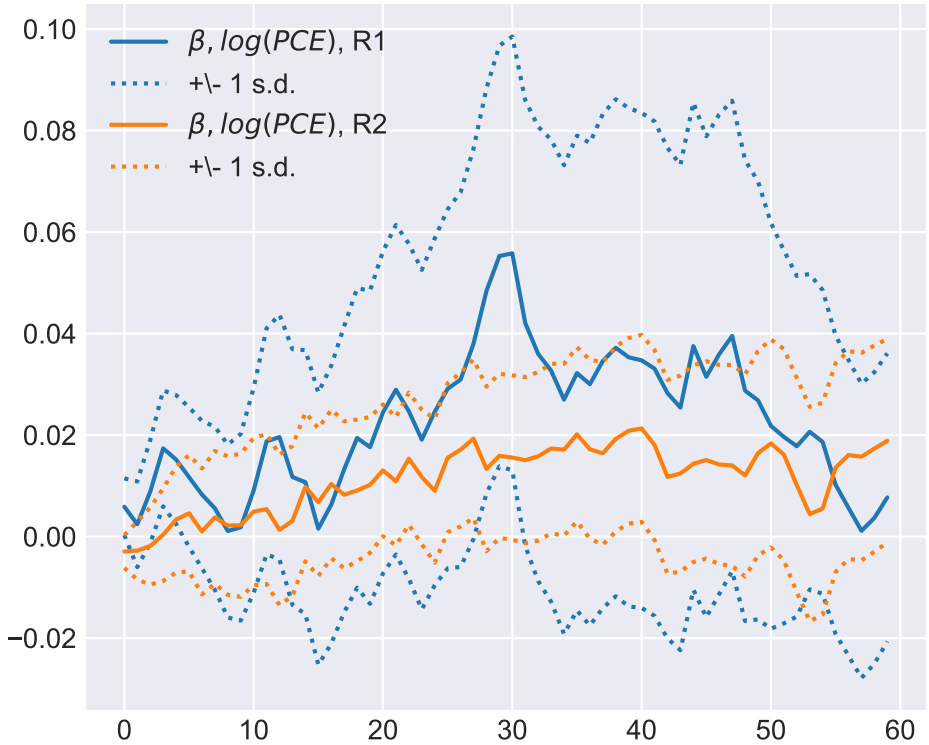
Miranda-Agrippino and Ricco Monetary Policy Shocks
Local Projections across regimes



Empirical IRFs: OLS Regime Adjusted

Inflation

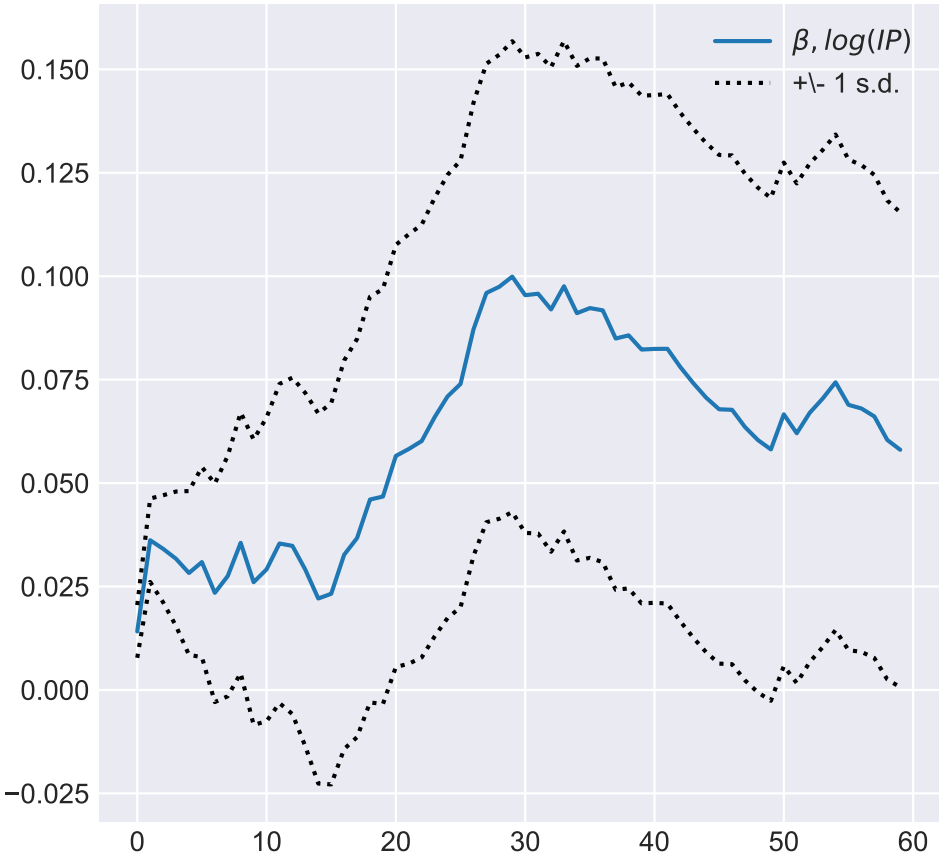




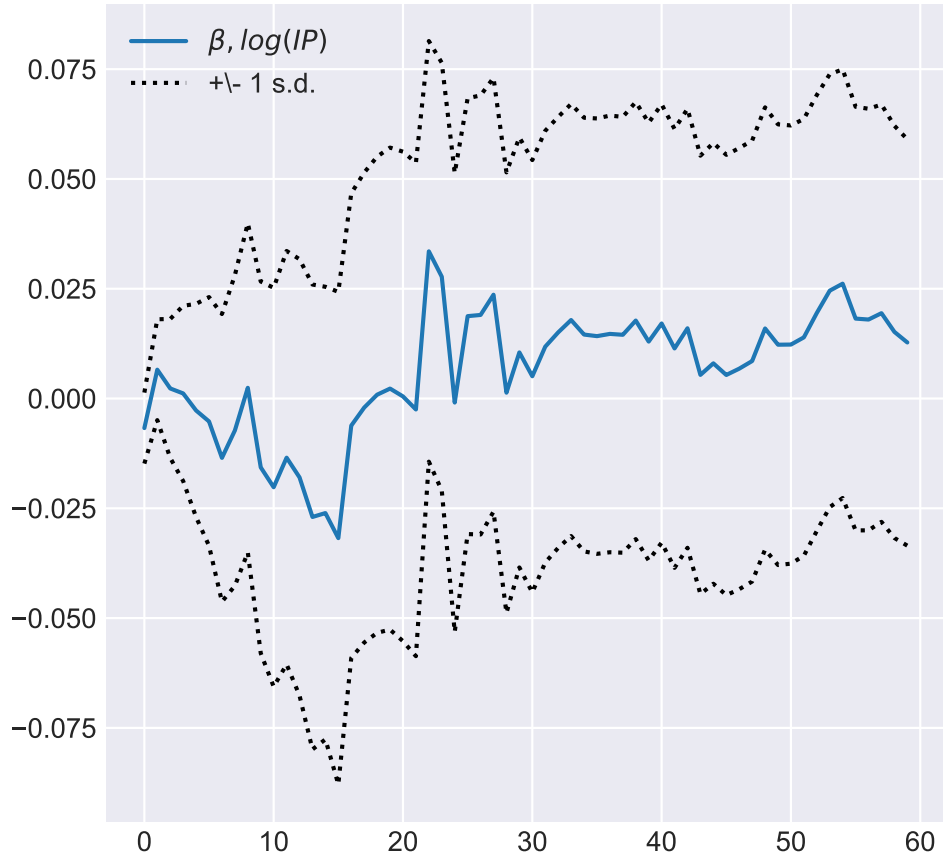
Empirical IRFs: 2SLS Unadjusted

Industrial Production

Jarocinski and Karadi Monetary Policy Shocks
Local Projections 2SLS

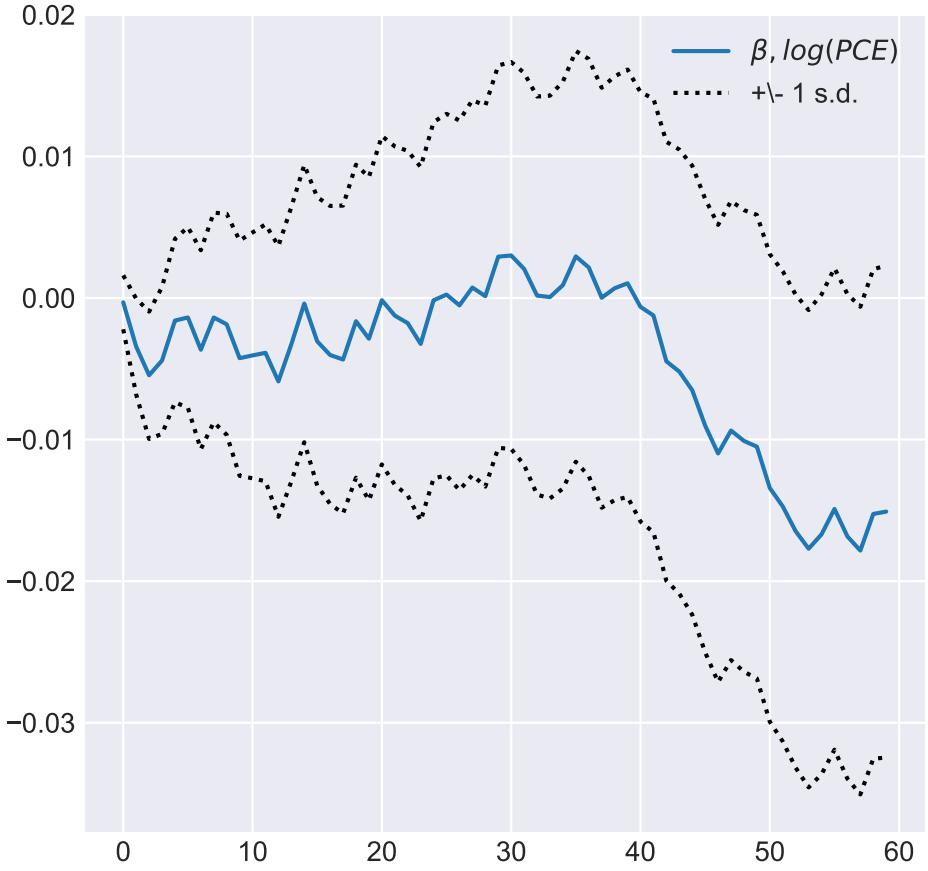


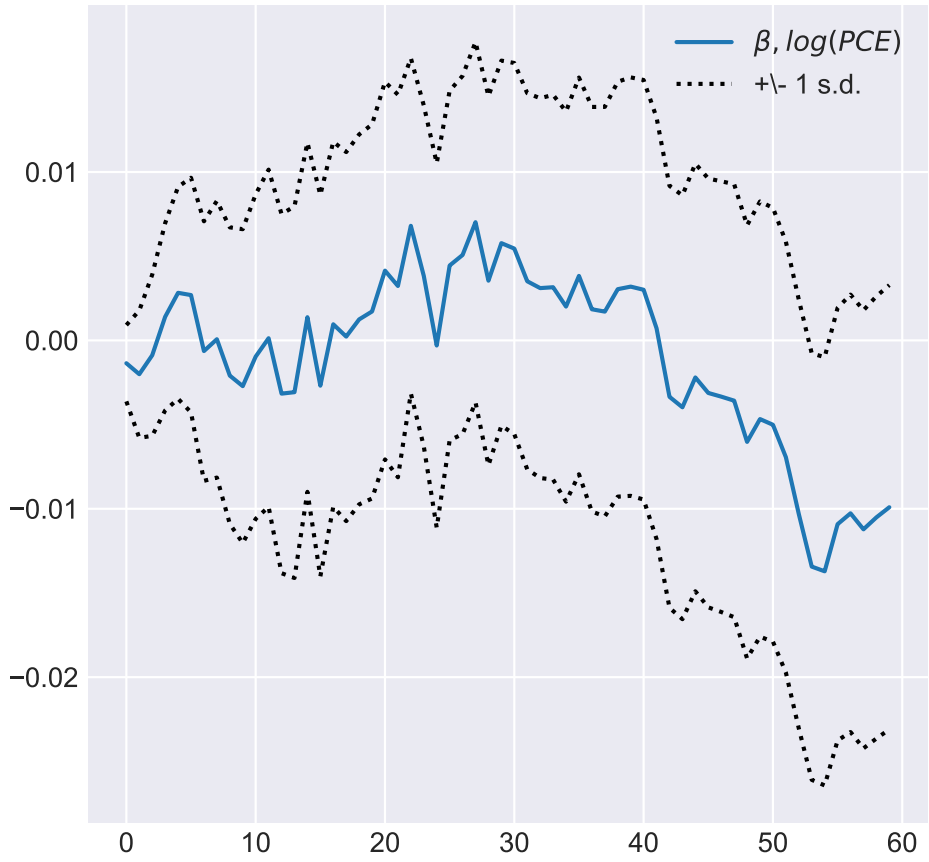
Miranda-Agrippino and Ricco Monetary Policy Shocks
Local Projections 2SLS



Empirical IRFs: 2SLS Unadjusted

Inflation

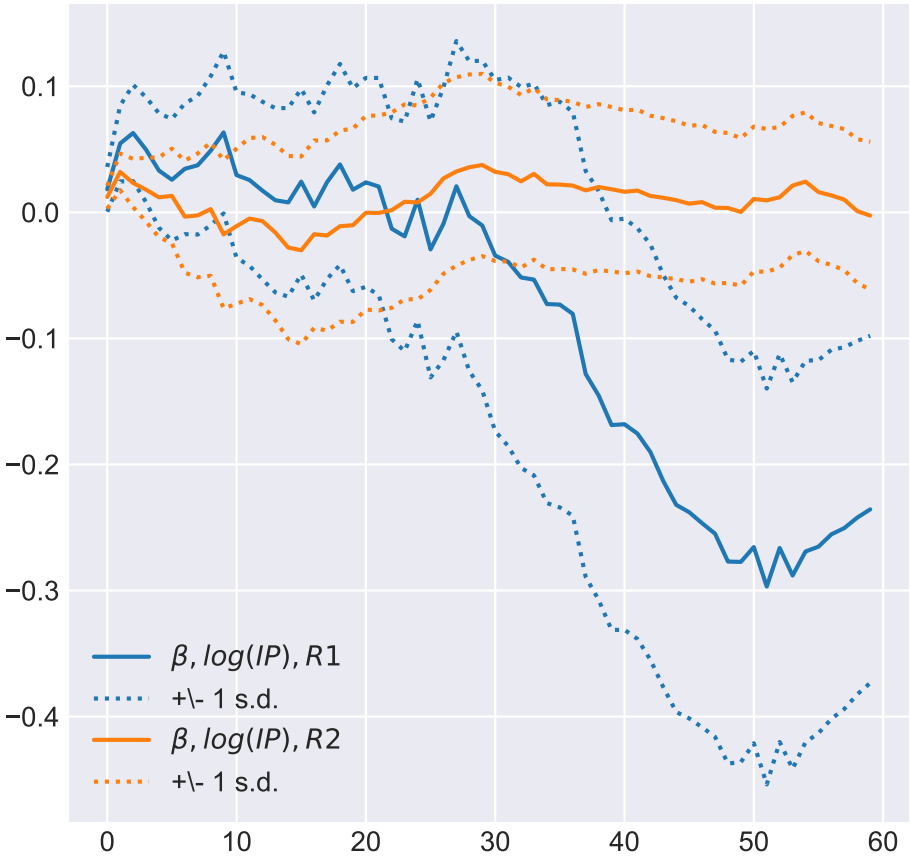




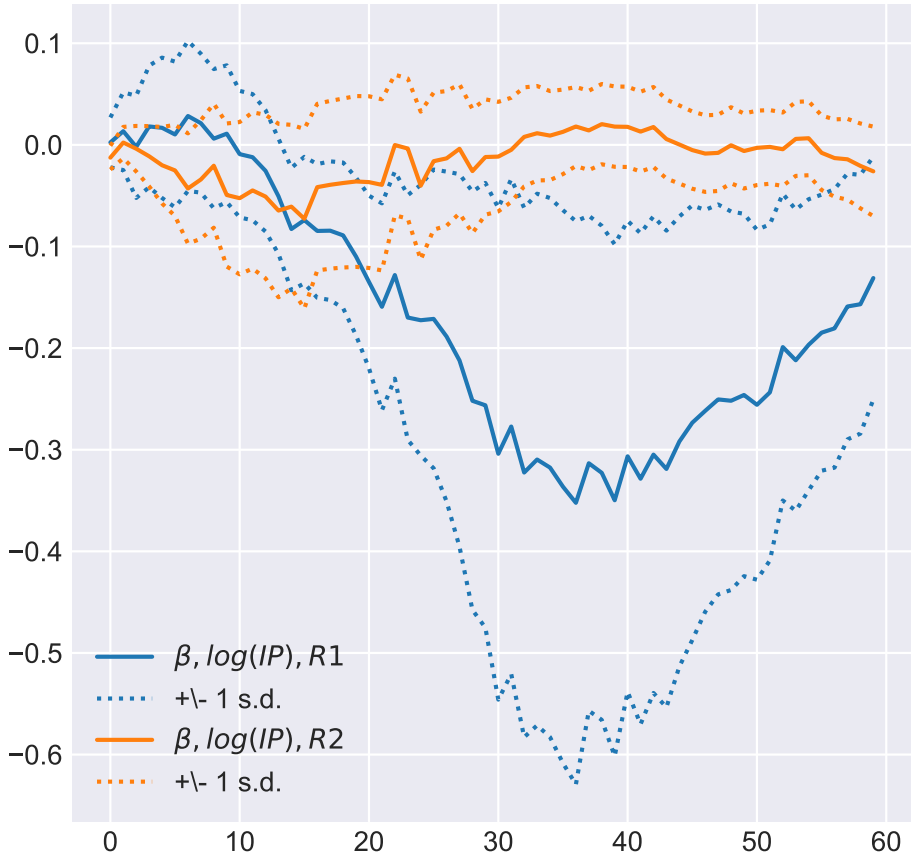
Empirical IRFs: 2SLS Regime Adjusted

Industrial Production

Jarocinski and Karadi Monetary Policy Shocks
Local Projections 2SLS across regimes

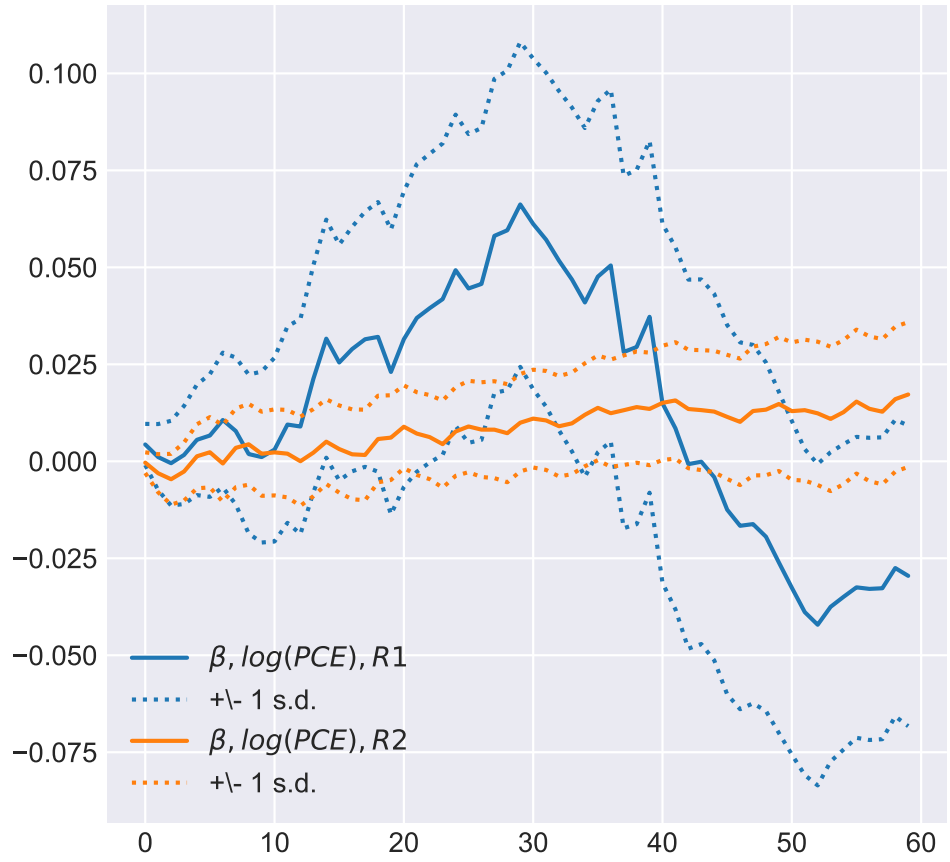


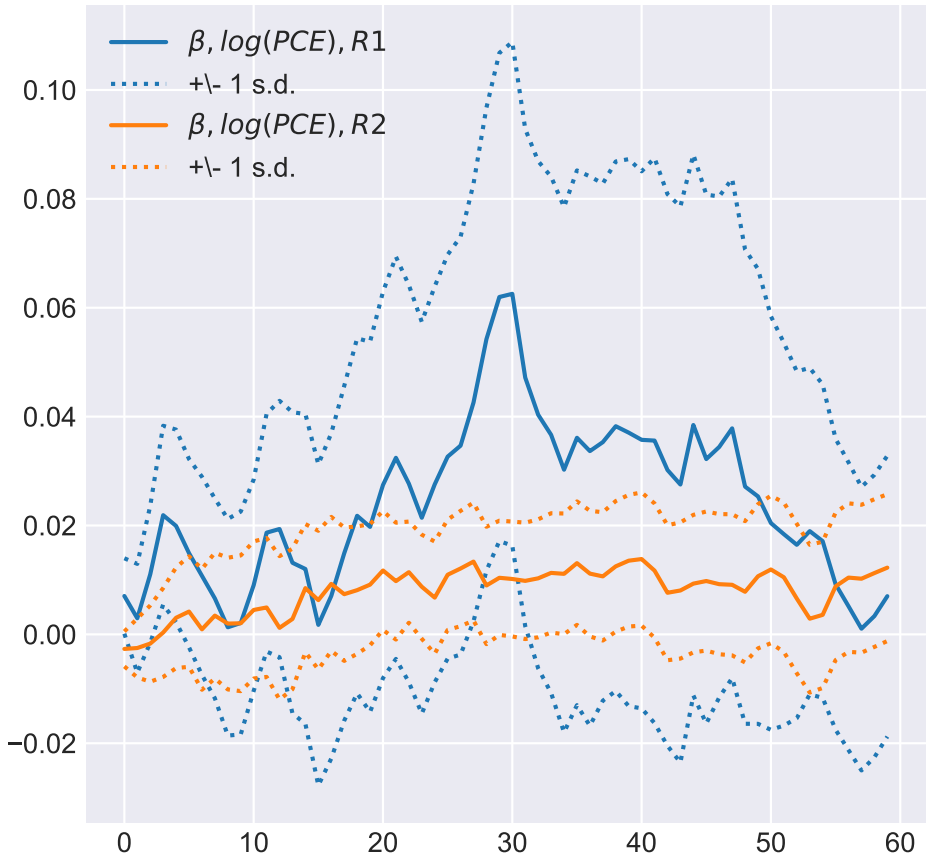
Miranda-Agrippino and Ricco Policy Shocks
Local Projections 2SLS across regimes



Empirical IRFs: 2SLS Regime Adjusted

Inflation





Decomposing forecast errors

- Decompose the reaction function forecast error (e_t^z):

$$e_t^z = \bar{e}^z + w_t^z + u_t^z(x_t)$$

  - a time-invariant mean $\bar{e}^z$
  - a time-varying zero mean rational forecast error w_t^z which captures random deviations from expected reaction
  - a time-varying forecast error related to the market's *systematic* misunderstanding of the central banks time-varying behaviour $u_t^z(x_t)$.

Facts 2 (news) and 3 (downturns)

Unsurprising that β_1 significant

For a given variable, y_t, run a regression:

$$\Delta_t = \beta_0 + \beta_1 y_t + v_t$$

- As Bauer and Swanson:
  - Keep the market expectation of ψ_t and x_t independent
  - Remove information effects from the analysis.
- Surprises can be written as:

$$\Delta_t = \underbrace{e_t^{\psi} x_t}_{\text{reaction function surprise}} + \underbrace{\epsilon_t}_{\text{monetary policy shock}} \tag{1}$$

Facts 2 (news) and 3 (downturns)

- Decompose the reaction function forecast error (e_t^{ψ}):

$$\Delta_t = (\bar{e} + w_t + u_t(x_t))\, x_t + \epsilon_t \tag{2}$$

  - a time-invariant mean $\bar{e}$
  - a time-varying zero mean rational forecast error w_t which captures random deviations from expected reaction
  - a time-varying forecast error related to the market's *systematic* misunderstanding of the switches in the central bank's reaction function $u_t(x_t)$.

Facts 2 (news) and 3 (downturns)

- Decompose the reaction function forecast error (e_t^{ψ}):

$$\Delta_t = (\bar{e} + w_t + u_t(x_t))\, x_t + \epsilon_t \tag{2}$$

  - a time-invariant mean $\bar{e}$
  - a time-varying zero mean rational forecast error w_t which captures random deviations from expected reaction
  - a time-varying forecast error related to the market's *systematic* misunderstanding of the switches in the central bank's reaction function $u_t(x_t)$.

- $u_t\,(x_t)$:
  - Cieslak (2018) - recession indicators as an important correlate
  - Schmeling et al (2020) - financial variables drive deviations from standard monetary policy responses
  - Cieslak et al (2022) - show that uncertainty leads to endogenous reaction function variation and deliberations explain surprises

Fact 4 (Predictable)

Unsurprising Fact 4

The covariance of the surprises and past data should be non-zero:

$$\begin{aligned} Cov\left(\Delta_t, x_{t-1}\right) &= Cov\left(\left(\bar{e} + w_t + u_t\right) x_t, x_{t-1}\right) \\ &= Cov\left(u_t x_t, x_{t-1}\right) \\ &\neq 0 \end{aligned}$$

- Holds if:
  - Persistence in the macro time series x_t
  - Persistence in market misunderstanding u_t
- E.g. If the market takes a while to learn about the extent of the Fed's concerns about the risks of rising inflation.

Fact 5 (Serial Correlation)

Unsurprising Fact 5

The autocovariance of surprises should be non-zero:

$$\begin{aligned} Cov\left(\Delta_t, \Delta_{t-1}\right) &= Cov\left(\left(\bar{e} + w_t + u_t\right) x_t + \epsilon_t, \left(\bar{e} + w_{t-1} + u_{t-1}\right) x_{t-1} + \epsilon_{t-1}\right) \\ &= Cov\left(u_t x_t, u_{t-1} x_{t-1}\right) \\ &\neq 0 \end{aligned}$$

- Requires persistence in the systematic misunderstanding of the parameter which causes reaction function changes, u_t, or the state of the economy, x_t, or their products.

Fact 6 (Private forecasters)

Unsurprising Fact 6

Let $F_{cb}(x_{t+1})$ be the CB's private forecast of x_{t+1}, the following covariance should be non-zero:

$$\begin{aligned} Cov(\Delta_t, F_{cb}(x_{t+1})) &= Cov((\bar{e} + w_t + u_t)x_t + \epsilon_t, F_{cb}(x_{t+1})) \\ &= Cov(u_t x_t, F_{cb}(x_{t+1})) \\ &\neq 0 \end{aligned}$$

- Is there covariance between the systematic reaction function change surprise, and the forecast?
- Yes: If the reaction function changes owing to the forecast state of the economy.