The Term Structure of Monetary Policy News

Midwest Macro, 16 May 2025

Jonathan J. Adams [1] Philip Barrett [2]

[1]Federal Reserve Bank of Kansas City

[2]International Monetary Fund

Introduction

Motivation

- What are the effects of monetary policy? Recent work has developed carefully-identified *empirical* monetary policy shocks (EMPS) to answer this question.

Motivation

- What are the effects of monetary policy? Recent work has developed carefully-identified *empirical* monetary policy shocks (EMPS) to answer this question.
- ... but what are these EMPS? Are they short-term interest rate surprises? News about future policy?

Motivation

- What are the effects of monetary policy? Recent work has developed carefully-identified *empirical* monetary policy shocks (EMPS) to answer this question.
- ... but what are these EMPS? Are they short-term interest rate surprises? News about future policy?
- EMPS can be high dimensional objects: information about policy rates at many future horizons.

Motivation

- What are the effects of monetary policy? Recent work has developed carefully-identified *empirical* monetary policy shocks (EMPS) to answer this question.
- ... but what are these EMPS? Are they short-term interest rate surprises? News about future policy?
- EMPS can be high dimensional objects: information about policy rates at many future horizons.
- Understanding this structure is *essential* for interpretation.

This Paper

- A framework to decompose an EMPS: the Term Structure of Monetary Policy News.

This Paper

- A framework to decompose an EMPS: the Term Structure of Monetary Policy News.
- Develop an estimator for the term structure of any EMPS, using macro instruments and aggregate time series.

This Paper

- A framework to decompose an EMPS: the Term Structure of Monetary Policy News.
- Develop an estimator for the term structure of any EMPS, using macro instruments and aggregate time series.
- Evaluate a variety of EMPS from the literature, decomposing their dependence on surprises, short, medium, and long-term forward guidance.

This Paper

- A framework to decompose an EMPS: the Term Structure of Monetary Policy News.
- Develop an estimator for the term structure of any EMPS, using macro instruments and aggregate time series.
- Evaluate a variety of EMPS from the literature, decomposing their dependence on surprises, short, medium, and long-term forward guidance.
- Killer app: using term structures of many EMPS, we can construct a *synthetic* MPS with any desired term structure

This Paper

- A framework to decompose an EMPS: the Term Structure of Monetary Policy News.
- Develop an estimator for the term structure of any EMPS, using macro instruments and aggregate time series.
- Evaluate a variety of EMPS from the literature, decomposing their dependence on surprises, short, medium, and long-term forward guidance.
- Killer app: using term structures of many EMPS, we can construct a *synthetic* MPS with any desired term structure
- We use synthetic MPS to study effects of true policy surprises and news

Motivating Example

- A simple New Keynesian model:

New Keynesian Phillips curve:	$\pi_t = \beta \mathbb{E}[\pi_{t+1}] + \kappa y_t$
Euler equation:	$i_t = \mathbb{E}_t[\gamma(y_{t+1} - y_t) + \pi_{t+1}]$
Taylor rule:	$i_t = \phi_y y_t + \phi_\pi \pi_t + \nu_t$
Policy news:	$\nu_t = \nu_{0,t} + \nu_{1,t-1} + \nu_{2,t-2} + ...$

Motivating Example

- A simple New Keynesian model:

New Keynesian Phillips curve:	$\pi_t = \beta \mathbb{E}[\pi_{t+1}] + \kappa y_t$
Euler equation:	$i_t = \mathbb{E}_t[\gamma(y_{t+1} - y_t) + \pi_{t+1}]$
Taylor rule:	$i_t = \phi_y y_t + \phi_\pi \pi_t + \nu_t$
Policy news:	$\nu_t = \nu_{0,t} + \nu_{1,t-1} + \nu_{2,t-2} + ...$

- Policy residual ν_t is partially anticipated; $\nu_{h,t-h}$ is h-period ahead news at time $t - h$.

Motivating Example

- A simple New Keynesian model:

New Keynesian Phillips curve:	$\pi_t = \beta \mathbb{E}[\pi_{t+1}] + \kappa y_t$
Euler equation:	$i_t = \mathbb{E}_t[\gamma(y_{t+1} - y_t) + \pi_{t+1}]$
Taylor rule:	$i_t = \phi_y y_t + \phi_\pi \pi_t + \nu_t$
Policy news:	$\nu_t = \nu_{0,t} + \nu_{1,t-1} + \nu_{2,t-2} + ...$

- Policy residual ν_t is partially anticipated; $\nu_{h,t-h}$ is h-period ahead news at time $t - h$.
- An EMPS is some combination of surprise/news shocks

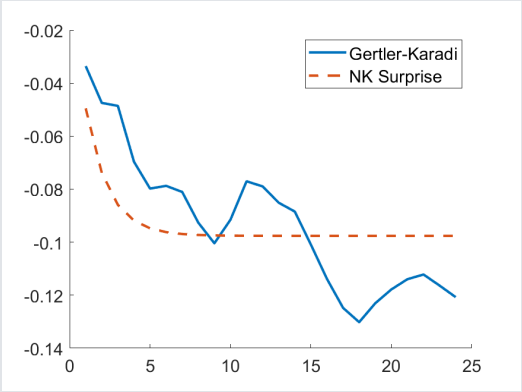
Motivating Example

- A simple New Keynesian model:

New Keynesian Phillips curve:	$\pi_t = \beta \mathbb{E}[\pi_{t+1}] + \kappa y_t$
Euler equation:	$i_t = \mathbb{E}_t[\gamma(y_{t+1} - y_t) + \pi_{t+1}]$
Taylor rule:	$i_t = \phi_y y_t + \phi_\pi \pi_t + \nu_t$
Policy news:	$\nu_t = \nu_{0,t} + \nu_{1,t-1} + \nu_{2,t-2} + ...$

- Policy residual ν_t is partially anticipated; $\nu_{h,t-h}$ is h-period ahead news at time $t - h$.
- An EMPS is some combination of surprise/news shocks
- Each news shock has a unique IRF: *any* EMPS IRF can be rationalized by this model!

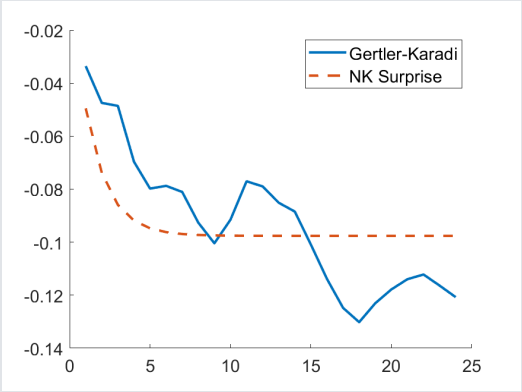
Do EMPS Look Like the NK Model?



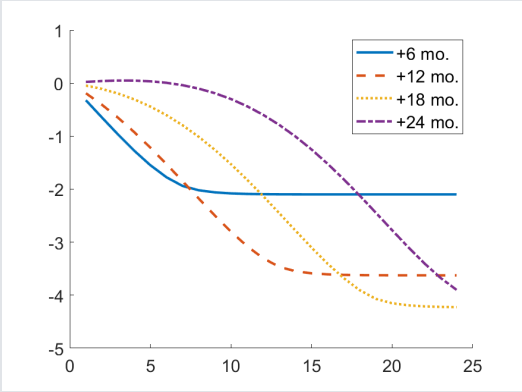
(a) EMPS vs. NK Surprise Shock **(b)**

Figure 1: CPI Responses to Monetary Shocks

Do EMPS Look Like the NK Model?



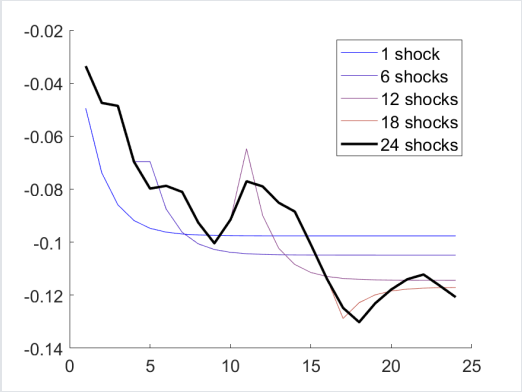
(a) EMPS vs. NK Surprise Shock



(b) NK News Shocks

Figure 1: CPI Responses to Monetary Shocks

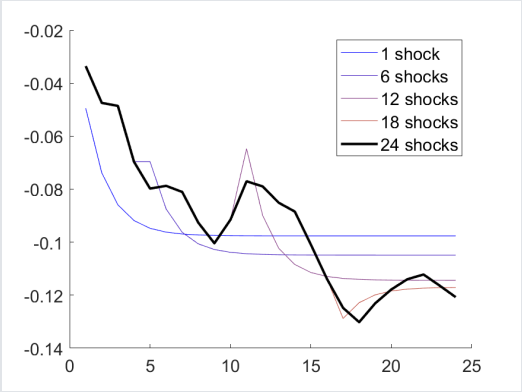
... Yes, for Some Term Structure of News



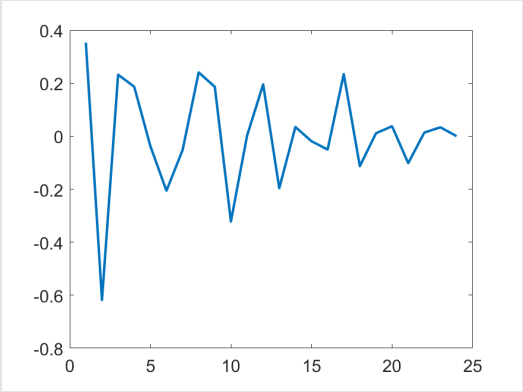
(a) MPS Approximations **(b)**

Figure 2: Rationalizing Gertler-Karadi with a Combination of News Shocks

... Yes, for Some Term Structure of News



(a) MPS Approximations



(b) Rationalizing Term Structure

Figure 2: Rationalizing Gertler-Karadi with a Combination of News Shocks

Theoretical Framework

General Framework: Monetary Policy

- Monetary policy is given by a Taylor-type rule (y_t is the policy instrument):

$$y_t = x_t\phi + r_t \tag{1}$$

- The residual r_t may be autocorrelated:

$$r_t = \sum_{\ell=1}^{L} \rho_{r,\ell} r_{t-\ell} + \nu_t \tag{2}$$

- The monetary policy *innovation* ν_t is a linear combination of i.i.d. news shocks:

$$\nu_t = \nu_{0,t} + \nu_{1,t-1} + \nu_{2,t-2} + ... + \nu_{H_\nu,t-H_\nu} \tag{3}$$

General Framework: Monetary Policy Shocks

- EMPS contain some information about policy news at many horizons. EMPS w_t^j of type j is:

$$w_t^j = \sum_{h=0}^{H_w} \beta_h^j \nu_{h,t} + \xi_t^j \tag{4}$$

- ξ_t^j is iid orth. to $\nu_{h,t}$ (measurement error, CBI, etc.)

General Framework: Term Structure of Monetary Policy News

- The term stucture of EMPS j is the effect of the EMPS w_t^j on expectations of the MPI over many horizons:

$$\gamma_h^j \equiv \frac{d\mathbb{E}[\nu_{t+h}|w_t^j]}{dw_t^j}$$

- Given DGP (4), the term structure of EMPS can be written:

$$\nu_t = \sum_{h=0}^{H_w} \gamma_h^j w_{t-h}^j + u_t \tag{5}$$

with residual u_t

Empirical Strategy

Estimation Strategy

- Would like to regress $\nu_t = \sum_{h=0}^{H_w} \gamma_h^j w_{t-h}^j + u_t$, but ν_t is unobserved

Estimation Strategy

- Would like to regress $\nu_t = \sum_{h=0}^{H_w} \gamma_h^j w_{t-h}^j + u_t$, but ν_t is unobserved
- Problems: policy rule is unknown and endogenous, policy residual is autocorrelated

Estimation Strategy

- Would like to regress $\nu_t = \sum_{h=0}^{H_w} \gamma_h^j w_{t-h}^j + u_t$, but ν_t is unobserved
- Problems: policy rule is unknown and endogenous, policy residual is autocorrelated
- 4-stage procedure:

Estimation Strategy

- Would like to regress $\nu_t = \sum_{h=0}^{H_w} \gamma_h^j w_{t-h}^j + u_t$, but ν_t is unobserved
- Problems: policy rule is unknown and endogenous, policy residual is autocorrelated
- 4-stage procedure:
  - 1./2. Use macro IVs to estimate policy rule $y_t = x_t\phi + r_t$ by 2SLS (a la Barnichon-Mesters)

Estimation Strategy

- Would like to regress $\nu_t = \sum_{h=0}^{H_w} \gamma_h^j w_{t-h}^j + u_t$, but ν_t is unobserved
- Problems: policy rule is unknown and endogenous, policy residual is autocorrelated
- 4-stage procedure:
  - 1./2. Use macro IVs to estimate policy rule $y_t = x_t\phi + r_t$ by 2SLS (a la Barnichon-Mesters)
  - 3. Whiten the policy residuals r_t to find the policy innovations ν_t

Estimation Strategy

- Would like to regress $\nu_t = \sum_{h=0}^{H_w} \gamma_h^j w_{t-h}^j + u_t$, but ν_t is unobserved
- Problems: policy rule is unknown and endogenous, policy residual is autocorrelated
- 4-stage procedure:
  - 1./2. Use macro IVs to estimate policy rule $y_t = x_t\phi + r_t$ by 2SLS (a la Barnichon-Mesters)
  - 3. Whiten the policy residuals r_t to find the policy innovations ν_t
  - 4. Regress innovations on lags of EMPS to estimate the γ_h^j term structure coefficients

Estimation Strategy: One Step

- The 4-stage procedure can be estimated in one step:

$$\hat{\gamma} = (W'W)^{-1}W'M_{\mathbf{X}}(I - X(X'P_ZX)^{-1}X'P_Z)y$$

where P_Z and $M_{\mathbf{X}}$ are projection matrices that depend on instruments Z and macro variables X.

Estimation Strategy: One Step

- The 4-stage procedure can be estimated in one step:

$$\hat{\gamma} = (W'W)^{-1}W'M_{\mathbf{X}}(I - X(X'P_ZX)^{-1}X'P_Z)y$$

  where P_Z and $M_{\mathbf{X}}$ are projection matrices that depend on instruments Z and macro variables X.
- $\hat{\gamma}$ consistently estimates the term structure if Z are valid instruments (exclusion: orthogonal to ν_t)

Estimation Strategy: One Step

- The 4-stage procedure can be estimated in one step:

$$\hat{\gamma} = (W'W)^{-1}W'M_{\mathbf{X}}(I - X(X'P_ZX)^{-1}X'P_Z)y$$

  where P_Z and $M_{\mathbf{X}}$ are projection matrices that depend on instruments Z and macro variables X.
- $\hat{\gamma}$ consistently estimates the term structure if Z are valid instruments (exclusion: orthogonal to ν_t)
- This representation is useful because it has analytical standard errors:

$$Var\left(\hat{\gamma}|W, X, Z\right) = (W'W)^{-1}W'M_{\mathbf{X}}...$$
$$\times \left(I - X(X'P_ZX)^{-1}X'P_Z\right)\Omega\left(I - X(X'P_ZX)^{-1}X'P_Z\right)'M_{\mathbf{X}}W(W'W)^{-1}$$

Estimation Strategy: Smoothing Variant

- The fourth stage is a local projection: unbiased but high variance. Can improve with limited bias-variance tradeoff.

Estimation Strategy: Smoothing Variant

- The fourth stage is a local projection: unbiased but high variance. Can improve with limited bias-variance tradeoff.
- We apply *smooth local projections* (Barnichon and Brownlees 2019) to estimate the term structure.

Estimation Strategy: Smoothing Variant

- The fourth stage is a local projection: unbiased but high variance. Can improve with limited bias-variance tradeoff.
- We apply *smooth local projections* (Barnichon and Brownlees 2019) to estimate the term structure.
- Tractable: can be estimated by ridge regression with appropriate penalty matrix $\lambda \mathbf{P}_B$, and has analytical standard errors.

Estimation Strategy: Smoothing Variant

- The fourth stage is a local projection: unbiased but high variance. Can improve with limited bias-variance tradeoff.
- We apply *smooth local projections* (Barnichon and Brownlees 2019) to estimate the term structure.
- Tractable: can be estimated by ridge regression with appropriate penalty matrix $\lambda \mathbf{P}_B$, and has analytical standard errors.
- Estimator becomes

$$\hat{\gamma}^j = (W'W + \lambda \mathbf{P}_B)^{-1} W' M_{\mathbf{X}} (I - X(X'P_Z X)^{-1} X'P_Z) y$$

Estimation Strategy: Smoothing Variant

- The fourth stage is a local projection: unbiased but high variance. Can improve with limited bias-variance tradeoff.
- We apply *smooth local projections* (Barnichon and Brownlees 2019) to estimate the term structure.
- Tractable: can be estimated by ridge regression with appropriate penalty matrix $\lambda \mathbf{P}_B$, and has analytical standard errors.
- Estimator becomes

$$\hat{\gamma}^j = (W'W + \lambda \mathbf{P}_B)^{-1} W' M_{\mathbf{X}} (I - X(X'P_Z X)^{-1} X'P_Z) y$$

- Smoothed LP will be especially useful when we construct synthetic MPS

Data

- Monetary policy shocks from the literature
- Non-monetary macro shocks to use as instruments
- Standard macro time series for estimating the policy rule (inflation and output gap) and evaluating effects

Monetary Policy Shocks

Shock Source	Method	Notes	Range
Gertler and Karadi (2015)	HFI	30 min. window around FOMC decisions	1990:M1-2007:M12
Jarociński and Karadi (2020)	HFI	2 shocks: pure monetary and Fed information	1990:M1-2016:M12
Miranda-Agrippino and Ricco (2021)	HFI	Orthogonalized w.r.t. Greenbook forecasts	1991:M1-2009:M12
Bauer and Swanson (2023)	HFI	Includes Fed minutes and speeches	1988:M2-2023:M12
Swanson (2023)	HFI	Decomposed into 3 types of EMPS	1988:M2-2023:M12
Jarociński (2024)	HFI	Decomposed into 4 types of EMPS	1990:M2-2024:M9
Romer and Romer (2004),	Narrative	Orthogonalized w.r.t. Greenbook forecasts	1983:M1-2007:M12
Aruoba and Drechsel (2024)	Narrative	Natural language processing of Fed docs	1982:M10-2008:M10

Non-monetary Structural Shock Instruments

Shock Source	Method	Notes	Range
Government Spending Shocks			
Romer and Romer (2016)	Narrative	Social Security expansions	1951:M1-1991:M12
Fieldhouse et al. (2018)	Narrative	Government housing purchases	1952:M11-2014:M12
Oil Shocks			
Känzig (2021)	HFI	Oil supply news	1975:M1-2023:M6
Baumeister and Hamilton (2019)	SVAR	Oil supply, consumption/inventory demand	1975:M2-2024:M3
Other Shocks			
Kim et al. (2022)	External	ACI severe weather shocks	1964:M4-2019:M5
Adams and Barrett (2024)	SVAR	Shocks to inflation expectations	1979:M1-2024:M5

Estimation Results: Taylor Rule

- Baseline:
  - 12-month PCE inflation coeff.: 1.55
  - Monthly (filtered) real GDP coeff.: 0.75
  - r_t residual autocorr.: 0.95
- Robustness:
  - Inflation coefficient very robust across specifications, including inflation measure, lag selection, time periods, different IVs (but not inclusion of infl. expectations)
  - Real activity coefficient very sensitive to measure used
  - OLS not robust at all!
- We do expect coefficients to change depending on which variables appear in rule. Key question: are the implied term structures robust? (Mostly yes)

Estimation Results: Summarizing the Term Structures

- How should we quantify the term structures?
- R_k^2 statistic captures the proportion of ν_t variation that is explained by a shock at horizon k is

$$R_k^2 \equiv \frac{Var(\nu_t | w_{t-k}^j)}{Var(\nu_t | \{w_{t-h}^j\}_{h=0}^{H_w})} = \frac{(\gamma_k^j)^2}{\sum_{h=0}^{H_w} (\gamma_h^j)^2}$$

- Also report entire vectors Term Structure Plots

Shock	$R^2_{0:1}$	$R^2_{2:6}$	$R^2_{7:12}$	$R^2_{13:24}$
Swanson FFR	0.01	0.40	0.47	0.13
Bauer-Swanson	0.04	0.45	0.32	0.18
Jarocinksi FFR	0.06	0.27	0.61	0.06
Jarocinksi LSAP	0.08	0.08	0.36	0.48
Swanson FG	0.11	0.59	0.23	0.07
Jarocinski-Karadi MPS	0.20	0.51	0.21	0.08
Miranda-Agrippino-Ricco	0.21	0.46	0.21	0.13
Aruoba-Drechsel	0.23	0.52	0.04	0.21
Jarocinksi Info	0.24	0.26	0.31	0.19
Jarocinksi FG	0.26	0.48	0.11	0.15
Gertler-Karadi	0.30	0.53	0.11	0.07
Swanson LSAP	0.41	0.50	0.02	0.07
Romer-Romer MPS	0.49	0.37	0.11	0.04

Table 1: Decomposition of Term Structure by Horizon

Synthetic Monetary Policy Shocks

Synthetic Monetary Policy Shocks: Method

- We can combine EMPS to create a *synthetic* MPS with a desired term structure!

Synthetic Monetary Policy Shocks: Method

- We can combine EMPS to create a *synthetic* MPS with a desired term structure!

- **Proposition:** For a linear combination of MPS $w_t^c = \lambda_a w_t^a + \lambda_b w_t^b$, the resulting term structure of monetary policy news $\vec{\gamma}^c$ is proportional to the linear combination of term structures:

$$\vec{\gamma}^c \propto \lambda_a \vec{\gamma}^a + \lambda_b \vec{\gamma}^b$$

Synthetic Monetary Policy Shocks: Method

- We can combine EMPS to create a *synthetic* MPS with a desired term structure!

- **Proposition:** For a linear combination of MPS $w_t^c = \lambda_a w_t^a + \lambda_b w_t^b$, the resulting term structure of monetary policy news $\vec{\gamma}^c$ is proportional to the linear combination of term structures:

$$\vec{\gamma}^c \propto \lambda_a \vec{\gamma}^a + \lambda_b \vec{\gamma}^b$$

- Valuable! Allows us to isolate the effects of specific components of monetary policy news, e.g. surprises or forward guidance.

Synthetic Monetary Policy Shocks: Application

- Construct 3 synthetic MPS:

Synthetic Monetary Policy Shocks: Application

- Construct 3 synthetic MPS:
  - Immediate: horizons $0 - 1$

Synthetic Monetary Policy Shocks: Application

- Construct 3 synthetic MPS:
  - Immediate: horizons $0 - 1$
  - Short-run: horizons $2 - 7$

Synthetic Monetary Policy Shocks: Application

- Construct 3 synthetic MPS:
  - Immediate: horizons $0-1$
  - Short-run: horizons $2-7$
  - Long-run: horizons $8-25$

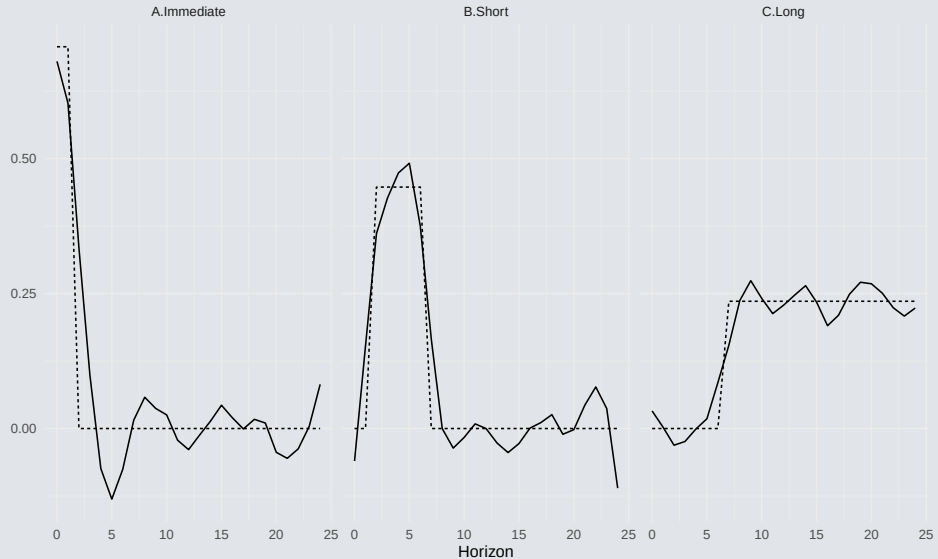
Synthetic Monetary Policy Shocks: Application

- Construct 3 synthetic MPS:
  - Immediate: horizons $0-1$
  - Short-run: horizons $2-7$
  - Long-run: horizons $8-25$
- Using 6 recent EMPS, we can accurately approximate these term structures.

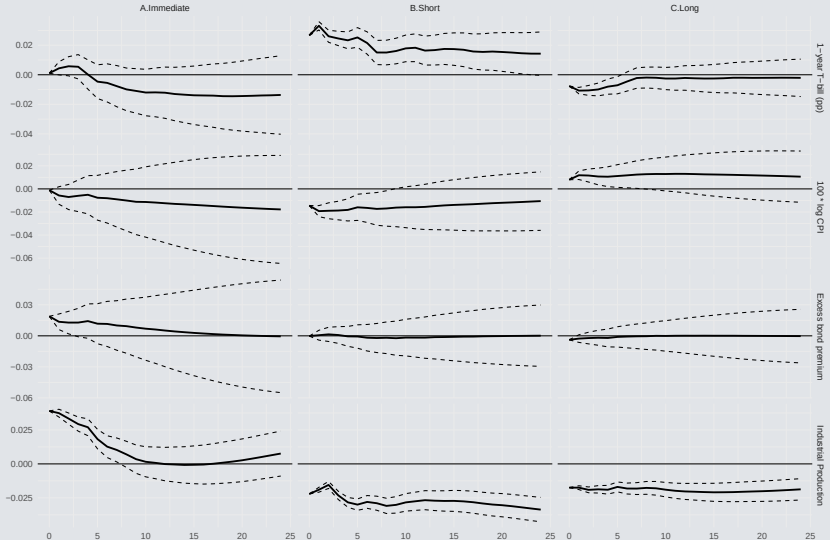
Synthetic Monetary Policy Shocks: Application

- Construct 3 synthetic MPS:
  - Immediate: horizons $0-1$
  - Short-run: horizons $2-7$
  - Long-run: horizons $8-25$
- Using 6 recent EMPS, we can accurately approximate these term structures.
- Then, estimate the macroeconomic effects using the standard Gertler-Karadi VAR

Synthetic Term Structures

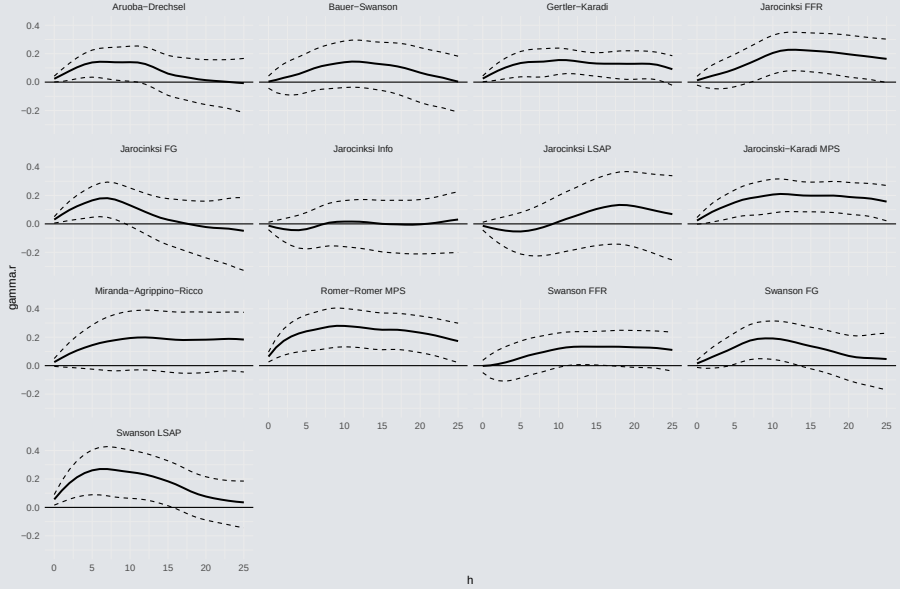


Macroeconomic Effects of Synthetic MPS

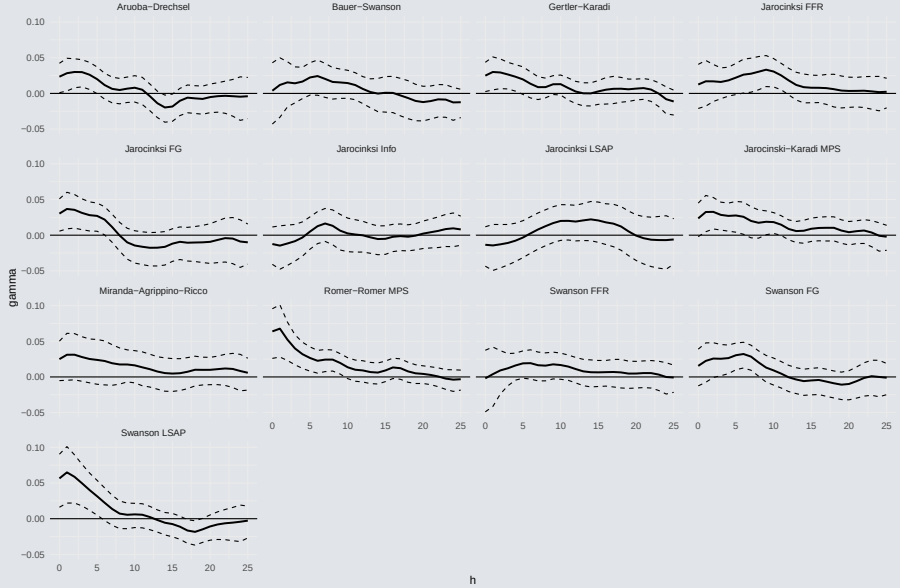


Conclusions

- Analyzing an EMPS in a model requires knowing its term structure of monetary policy news; we derived a method to estimate it.
- Can use good EMPS to construct synthetic MPS with desired term structures
- Textbook-looking EMPS are not so ordinary when broken down into immediate shocks, forward guidance
- Main conclusions robust to most alternative specifications (except ZLB inclusion)


Aruoba−Drechsel
Bauer−Swanson
Gertler−Karadi
Jarocinksi FFR
Jarocinksi FG
Jarocinksi Info
Jarocinksi LSAP
Jarocinski−Karadi MPS
Miranda−Agrippino−Ricco
Romer−Romer MPS
Swanson FFR
Swanson FG
Swanson LSAP
gamma.r
h
0.4
0.2
0.0
−0.2
0
5
10
15
20
25

Back


Aruoba−Drechsel
Bauer−Swanson
Gertler−Karadi
Jarocinksi FFR
Jarocinksi FG
Jarocinksi Info
Jarocinksi LSAP
Jarocinski−Karadi MPS
Miranda−Agrippino−Ricco
Romer−Romer MPS
Swanson FFR
Swanson FG
Swanson LSAP
gamma
h
0.10
0.05
0.00
−0.05
0
5
10
15
20
25

Back

References

Adams, Jonathan J. and Philip Barrett, "Shocks to inflation expectations," *Review of Economic Dynamics*, October 2024, *54*, 101234.

Aruoba, S. Borağan and Thomas Drechsel, "Identifying Monetary Policy Shocks: A Natural Language Approach," May 2024.

Bauer, Michael D. and Eric T. Swanson, "A Reassessment of Monetary Policy Surprises and High-Frequency Identification," *NBER Macroeconomics Annual*, May 2023, *37*, 87–155. Publisher: The University of Chicago Press.

Baumeister, Christiane and James D. Hamilton, "Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks," *American Economic Review*, May 2019, *109*