SYSTEMATIC MONETARY POLICY APPROACH TO TAYLOR RULE

Alexander Vlasov (avlasov@nes.ru)

New Economic School – 2024-06-20

Available at `https://github.com/avlsv/CheckingHank`

RESEARCH QUESTION

Monetary Policy Rule Counterfactuals

- McKay and Wolf (2023); Barnichon and Mesters (2023) use the identified shocks and impulse responses to them to minimize a loss function.

FOMC Preferences

- Hack, Istrefi, and Meier (2023) use Istrefi (2019) data on preferences of FOMC members and using the FOMC rotation mechanism they are able to construct an IV.

EMPIRICAL APPROACH

STATE-DEPENDENT LP MODEL

Based on method of Hack, Istrefi, and Meier (2023).

I assume that the monetary policy rule is

$$(r - r^*)_{t+h} = \phi_t^h \mathbb{E}\left[\pi_{t+1} \mid \mathcal{I}_t\right] + \psi_t^h \mathbb{E}\left[x_{t+1} \mid \mathcal{I}_t\right] + \varepsilon_t.$$

$\mathbb{E}_t \pi_{t+1}$ and $\mathbb{E}_t x_{t+1}$ are the expectations of monetary authority about inflation and output gap.

STATE-DEPENDENT LP MODEL [2]

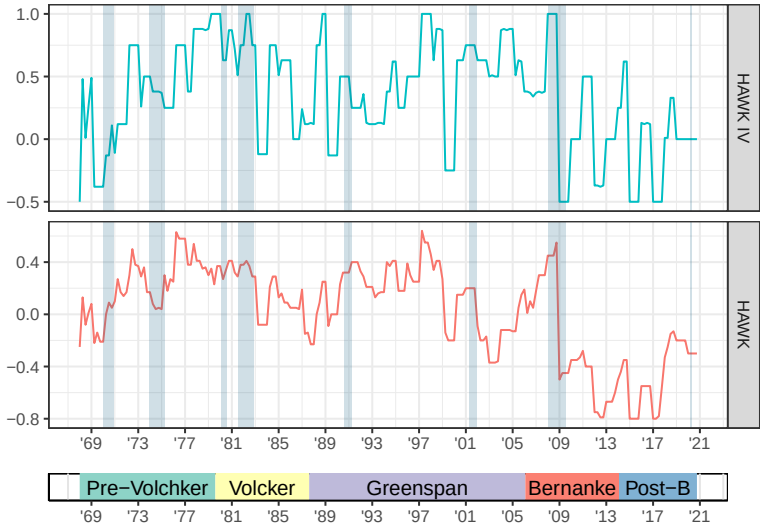
Then I estimate the following State-Dependent LP-IV.

$$
\begin{aligned}
(r - r^*)_{t+h} = \alpha^h + \beta_\pi^h \hat{\pi}_t + \gamma_\pi^h \hat{\pi}_t \left(Hawk_t - \overline{Hawk}\right) \\
\beta_u^h \hat{x}_t + \gamma_u^h \hat{x}_t \left(Hawk_t - \overline{Hawk}\right) \\
+ \delta^h \left(Hawk_t - \overline{Hawk}\right) + \zeta^h Z + e_{t+h}^h,
\end{aligned}
$$

where

- $Hawk_t$ is the Hack, Istrefi, and Meier (2023) index of FOMC hawkishness based on Istrefi (2019) estimate of preferences of each FOMC member.
- $\hat{\pi}_t$ is the FOMC (Tealbook) projection of future inflation.
- $\hat{x}_t$ is the FOMC (Tealbook) projection of future output gap.

HAWK and HAWK IV indexes from Hack, Istrefi, and Meier (2023)



SHORT AND LONG MODELS

- Contemporaneous Tealbook projections of CPI inflation and GDP gap are available starting from 1979 Q4 and 1987 Q3, respectively.
- Tealbook projections are available up to 2018 Q4 due to the publication lag.
- That leaves only 126 quarters (122 obs accounting for 4 quarter-lags) and 18 parameters.

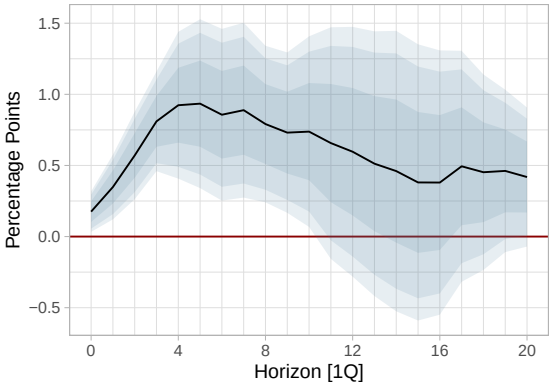
In order to increase the number of observation, I introduce Long model that uses Tealbook projections of Deflator inflation and unemployment gap $(u - u^*)$.

	Tealbook Projected ...	
Model	Inflation	Output Gap
Short	CPI Inflation	GDP Gap
Long	Deflator Inflation	Unemployment Gap

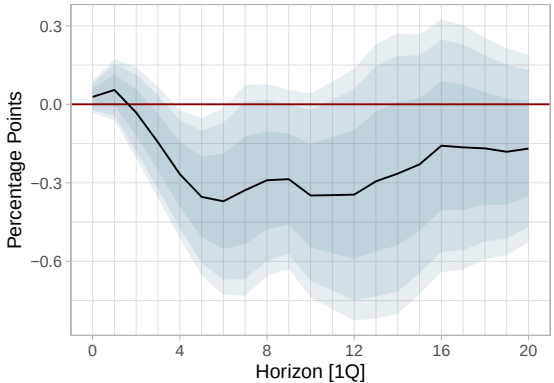
IRFS

SHORT MODEL. $r - r^*$ RESPONSE TO PROJECTED CPI INFLATION

(a) Average Resp. to Projected CPI Inflation



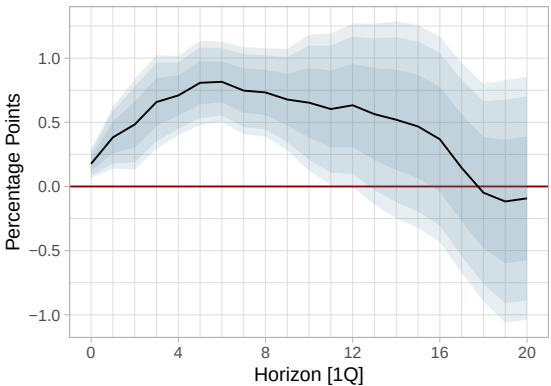
(b) Differential Resp. to Projected CPI Inflation



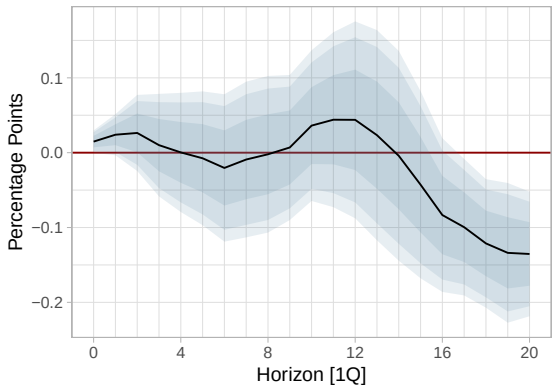
Notes: This figure reports the responses of the $(r - r^*)_t$ to an increase in the Tealbook CPI inflation projection and GDP gap projection of 1 p.p. The subfigure 1a reports the response of $(r - r^*)_t$ to projected CPI inflation for the $HAWK$ index equal to the sample average; 1b is the addition to the response in case there are 2 (out of 12 in total) additional consistent hawks in the FOMC. The shaded areas correspond to 68%, 90% and 95% confidence intervals calculated with Andrews (1991) HAC estimator.

SHORT MODEL. $r - r^*$ RESPONSE TO PROJECTED GDP GAP

(a) Average Response to Projected GDP Gap



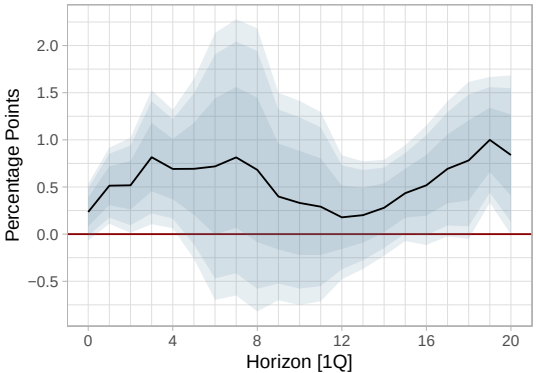
(b) Differential Response to Projected GDP Gap



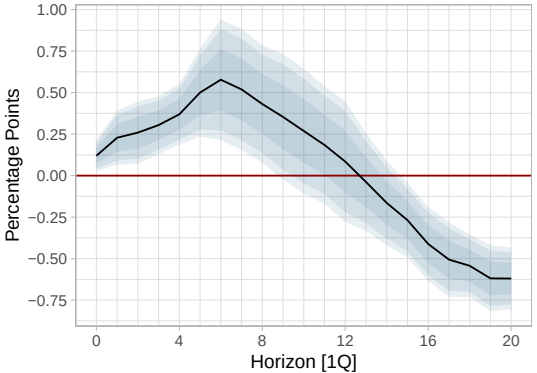
Notes: This figure reports the responses of the $(r - r^*)_t$ to an increase in the Tealbook GDP gap projection of 1 p.p. The subfigure 2a reports the response of $(r - r^*)_t$ to projected output gap increase for the $Hawk$ index equal to the sample average; 2b is the addition to the previous response in case there are 2 (out of 12 in total) additional consistent hawks in the FOMC. The shaded areas correspond to 68%, 90% and 95% confidence intervals calculated with Andrews (1991) HAC estimator.

LONG MODEL. $r - r^*$ RESPONSE TO PROJECTED DEFLATOR INFLATION

(a) Average Response to Deflator Inflation



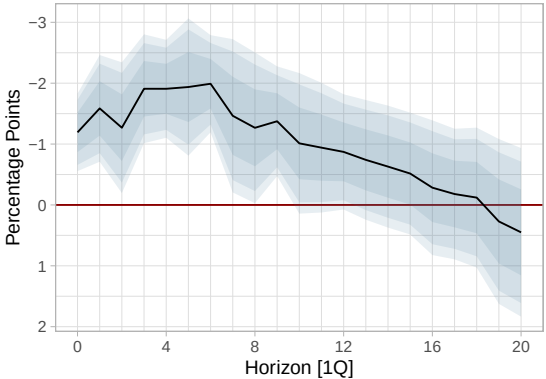
(b) Differential Response to Deflator Inflation



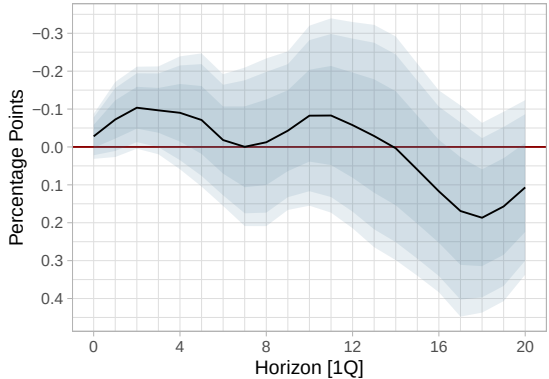
Notes: This figure reports the responses of the $(r - r^*)_t$ to an increase in the Tealbook GDP gap projection of 1 p.p. The subfigure 3a reports the response of $(r - r^*)_t$ to projected deflator inflation increase of 1 p.p. for the $Hawk$ index equal to the sample average; 3b is the addition to the previous response in case there are 2 (out of 12 in total) additional consistent hawks in the FOMC. The shaded areas correspond to 68%, 90% and 95% confidence intervals calculated with Andrews (1991) HAC estimator.

LONG MODEL. $r - r^*$ RESPONSE TO PROJECTED UNEMPLOYMENT GAP

(a) Average Response to Unemployment Gap



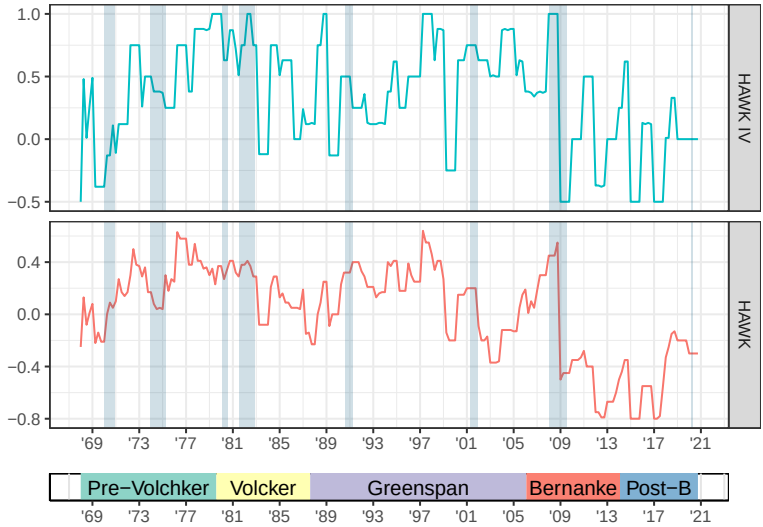
(b) Differential Response to Unemployment Gap



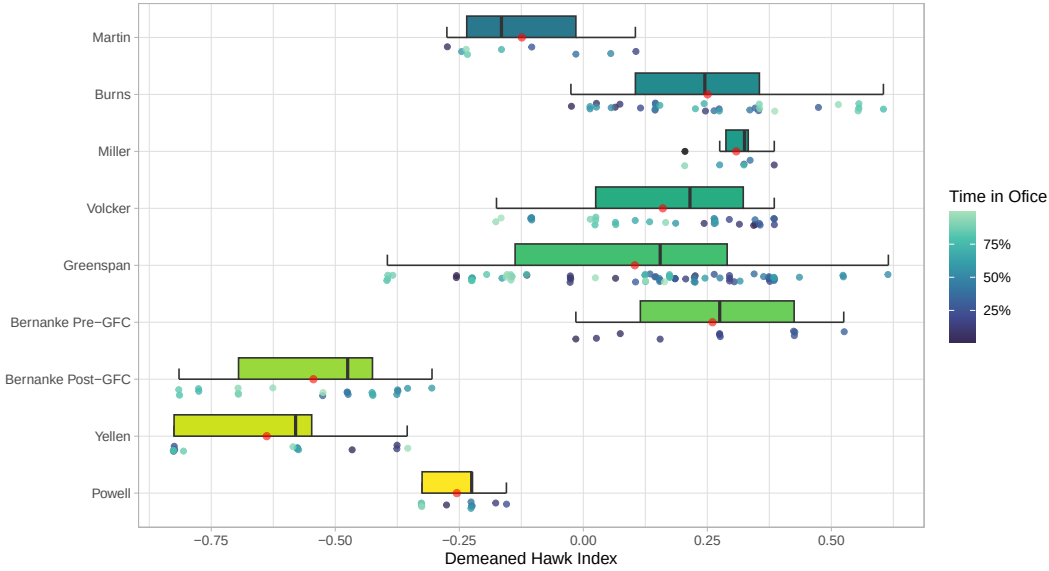
Notes: This figure reports the responses of the $(r - r^*)_t$ to an increase in the Tealbook GDP gap projection of 1 p.p. The subfigure 4a reports the response of $(r - r^*)_t$ to projected output gap increase for the $Hawk$ index equal to the sample average; 4b is the addition to the previous response in case there are 2 (out of 12 in total) additional consistent hawks in the FOMC. The shaded areas correspond to 68%, 90% and 95% confidence intervals calculated with Andrews (1991) HAC estimator.

COMBINED IRF

HAWK and HAWK IV indexes from Hack, Istrefi, and Meier (2023)



HAWK INDEX DISECTED BY FED CHAIR

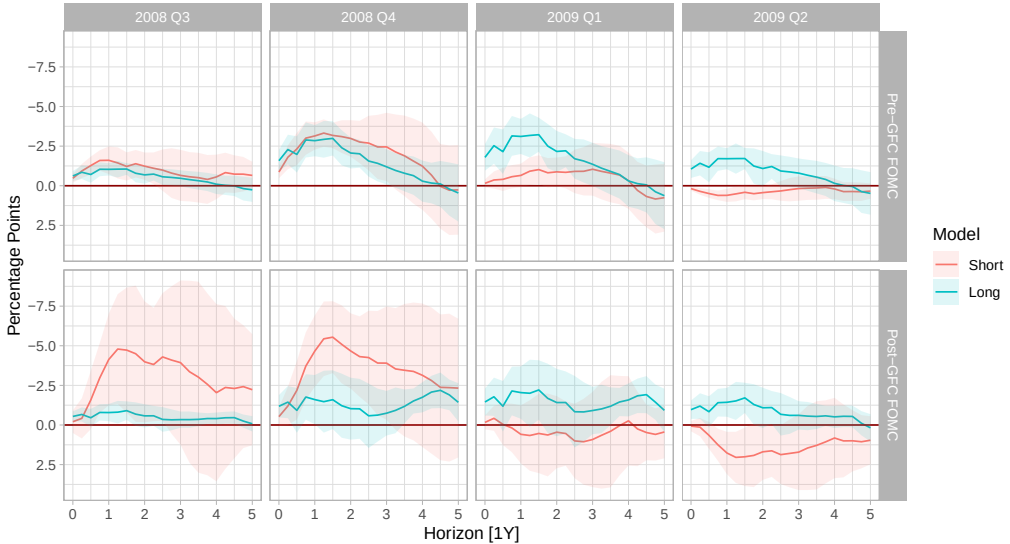


SHOCKS AND HAWK

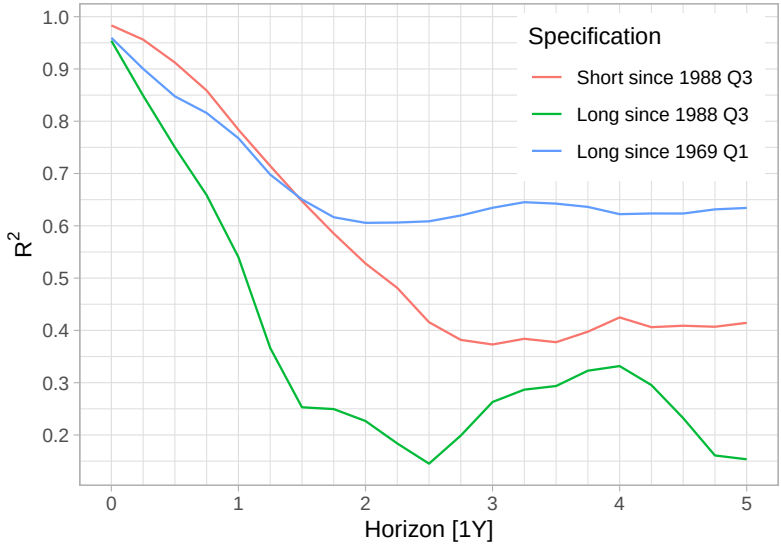
Shocks

		Δ CPI inflation	Δ GDP gap	Δ Deflator inflation	Δ Unemployment gap
1	2008 Q3	−2.40	0.05	−0.05	0.49
2	2008 Q4	−1.45	−3.03	−0.57	1.14
3	2009 Q1	1.18	−2.05	−0.40	1.36
4	2009 Q2	1.10	−0.21	0.03	0.87

IRFS TO GFC

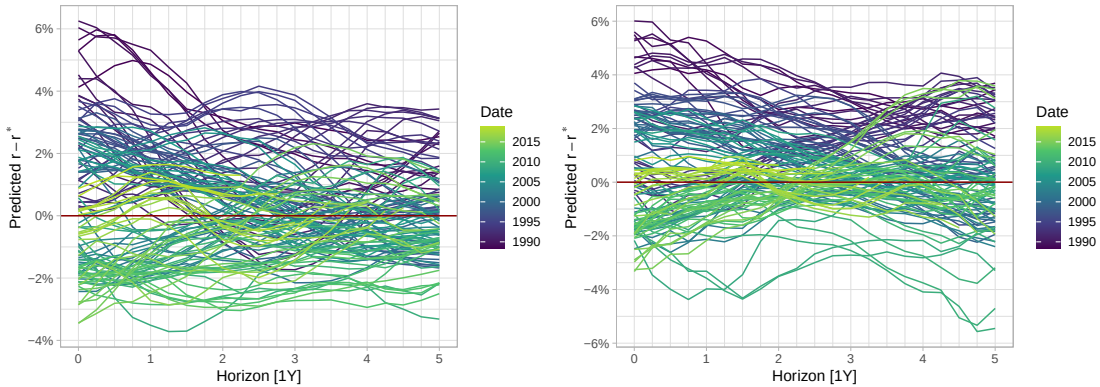

2008 Q3
2008 Q4
2009 Q1
2009 Q2
Pre−GFC FOMC
Post−GFC FOMC
Percentage Points
−7.5
−5.0
−2.5
0.0
2.5
0
1
2
3
4
5
Horizon [1Y]
Model
Short
Long

IN-SAMPLE PREDICTIVE ABILITY



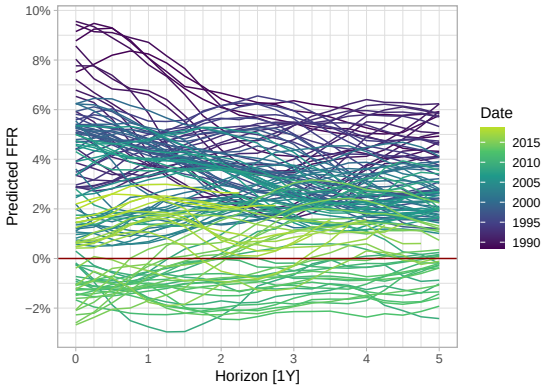
ESTIMATES OF LIQUIDITY PREMIA

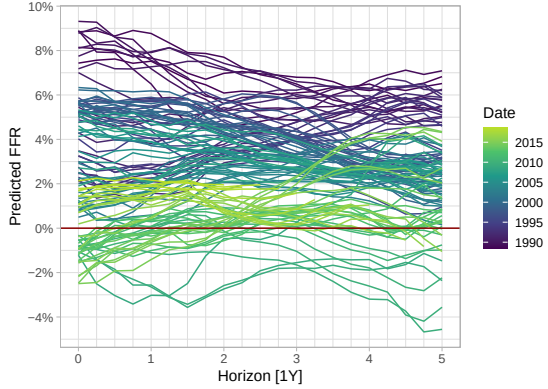
IN-SAMPLE PREDICTED $r - r^*$ PATHS



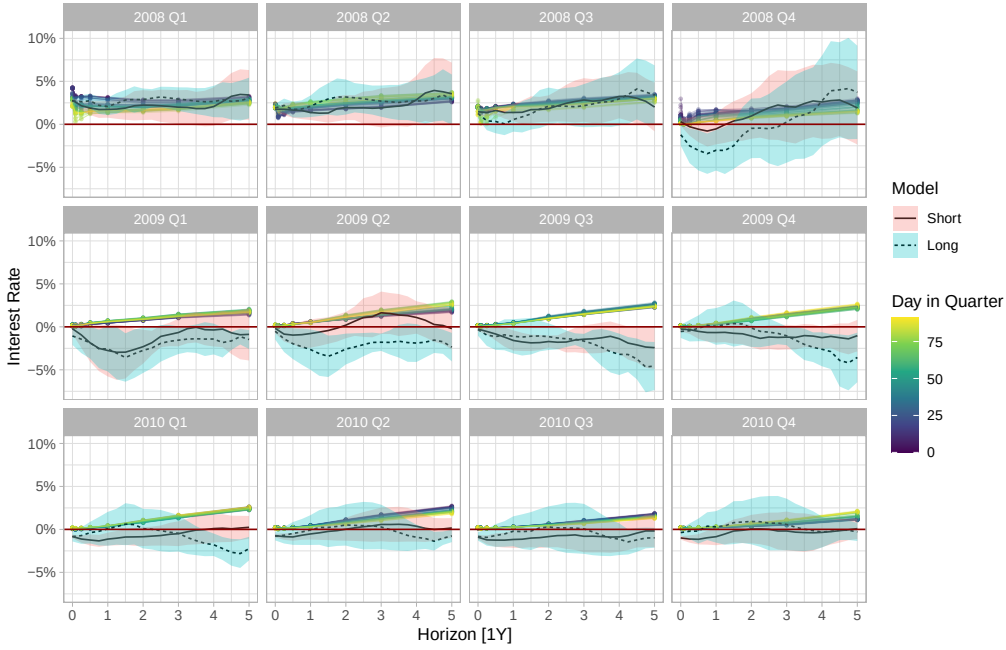
Notes: This figure shows the predictions of $r - r^*$ paths in each state calculated by short and long models.

IN-SAMPLE PREDICTED FFR PATHS

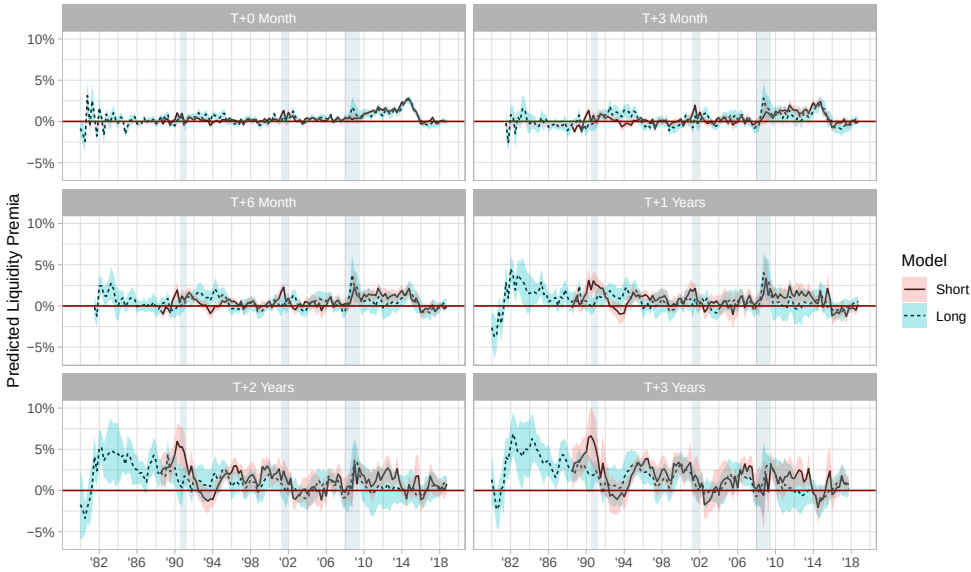




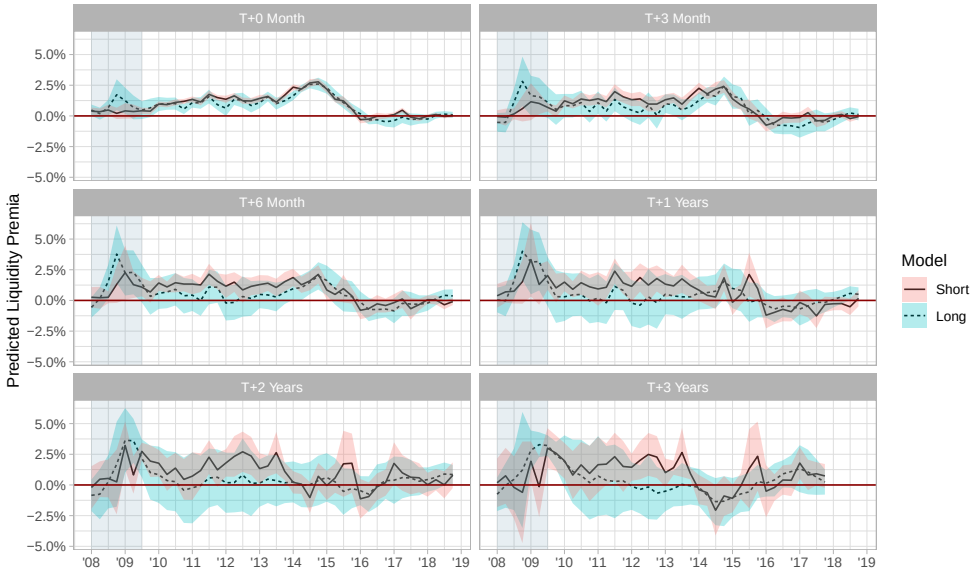
Notes: This figure shows the predictions of r paths in each state calculated by short and long models.


2008 Q1
2008 Q2
2008 Q3
2008 Q4
2009 Q1
2009 Q2
2009 Q3
2009 Q4
2010 Q1
2010 Q2
2010 Q3
2010 Q4
10%
5%
0%
−5%
Interest Rate
0
1
2
3
4
5
Horizon [1Y]
Model
Short
Long
Day in Quarter
75
50
25
0

ESTIMATES OF LIQUIDITY PREMIA



ESTIMATES OF LIQUIDITY PREMIA ZOOMMED TO 2008-2019



SIZE-PERSISTENCE ESTIMATIONS

Outcomes of Kaplan, Moll, and Violante (2018) model

Kaplan, Moll, and Violante (2018) Tradeoffs in HANK model:

1. **Size-Persistence Tradeoff:** Cumulative elasticity of aggregate consumption declines with the increase of persistence of monetary policy path in a nonlinear manner.
2. **Inflation-Output Tradeoff:** the same Taylor rule shocks lead to the increased effects in Inflation-Output tradeoff.

SIZE-PERSISTENCE IN RANK

Rate path:

$$r_t = \rho + \underbrace{\exp(-\eta\, t)}_{\textit{Persistence}}(r_0 - \rho).$$

NK consumption policy

$$C_0 = \bar{C} \exp\left(-\frac{1}{\gamma}\int_0^\infty (r_s - \rho)\ ds\right).$$

Size:

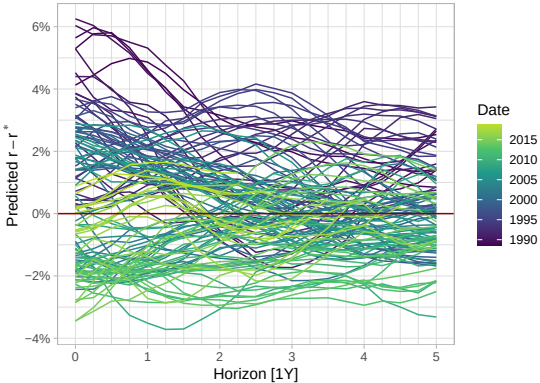
$$R_0 = \int_0^\infty (r_s - \rho)\ ds,$$

No Size-Persistence tradeoff in RANK:

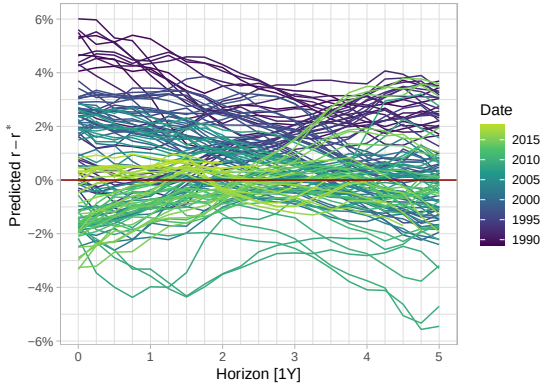
$$\frac{-d\log C_0}{dR_0} = \frac{1}{\gamma}.$$

PREDICTED $r - r^*$ PATHS

(a) Short Model



(b) Long Model



Notes: This figure shows the predictions of $r - r^*$ paths in each state calculated by short and long models.

ESTIMATION OF SIZE AND PERSISTENCE

Size in Kaplan, Moll, and Violante (2018) is

$$Size_t = \frac{1}{H}\sum_{h=0}^{H} \widehat{(r - r^*)}_{t+h}$$

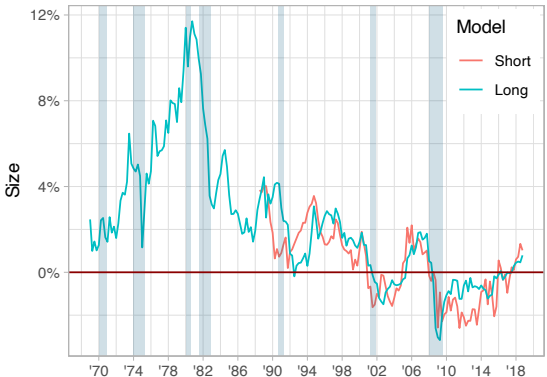
$$\widehat{(r - r^*)}_{t+h} = \exp(\mu_t h)\widehat{(r - r^*)}_t \exp(\varepsilon_t)$$

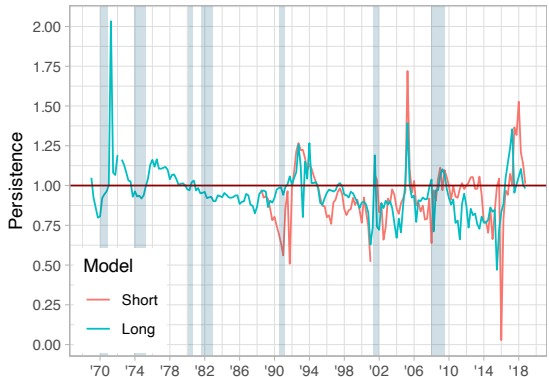
This can be rewritten as

$$\log\left(\frac{\widehat{(r - r^*)}_{t+h}}{\widehat{(r - r^*)}_t}\right) = \mu_t h + \varepsilon_{th},$$

and estimated with OLS. Persistence is then $Persistence = \exp(\hat{\mu}_t)$.

ESTIMATES OF SIZE OVER TIME

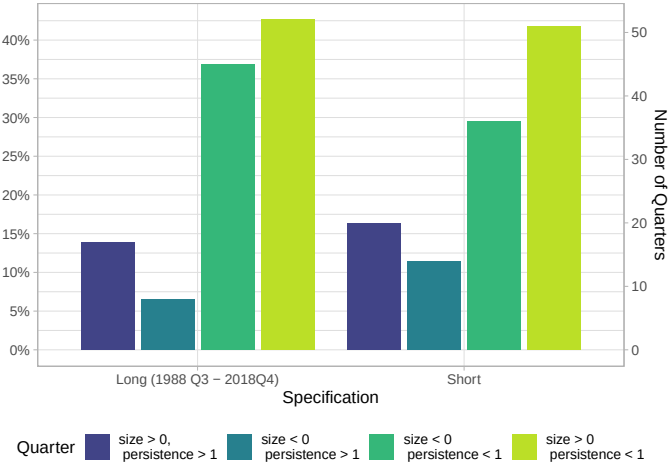




Notes: This figure presents the size and persistence, calculated as mean and the first autocorrelation of impulse-response function in each state, constructed as described in section 1 on page 28, over time.

SIZE-PERSISTENCE ESTIMATES

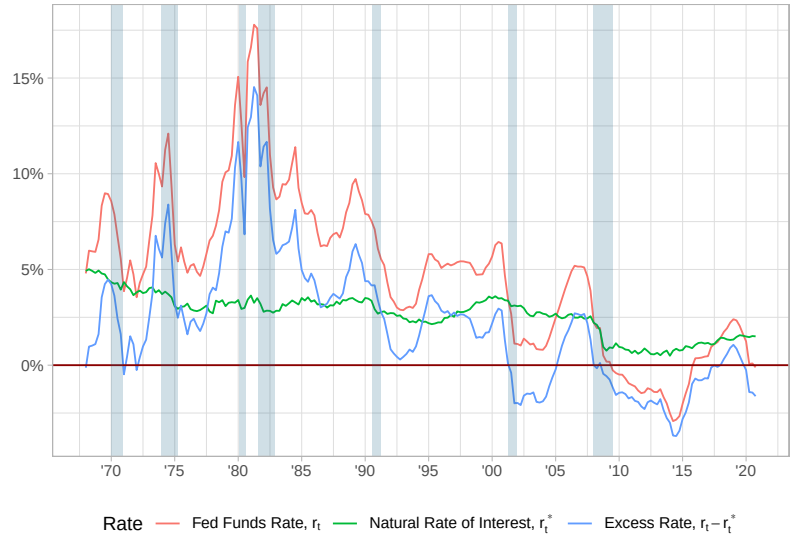
QUARTERS


40%
35%
30%
25%
20%
15%
10%
5%
0%
50
40
30
20
10
0
Number of Quarters
Long (1988 Q3 – 2018Q4)
Short
Specification
Quarter
size > 0, persistence > 1
size < 0 persistence > 1
size < 0 persistence < 1
size > 0 persistence < 1

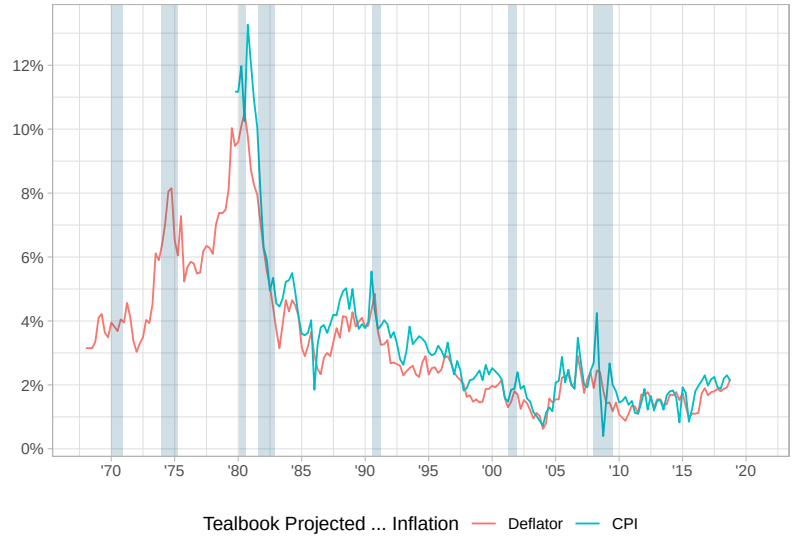
DATA

- Projections of FED inflation (deflator, and CPI), GDP gap, unemployment and NAIRU are from Tealbook (average of 1 and 2 quarter quarters ahead following Coibion and Gorodnichenko (2011) and averaging of FOMC meetings per quarter).
- HAWK index from Hack, Istrefi, and Meier (2023).
- Natural rate of interest by Holston, Laubach, and Williams (2017); Holston, Laubach, and Williams (2023).
- Short-term rate (r) is Fed Funds Rate and Wu and Xia (2016) shadow rate.

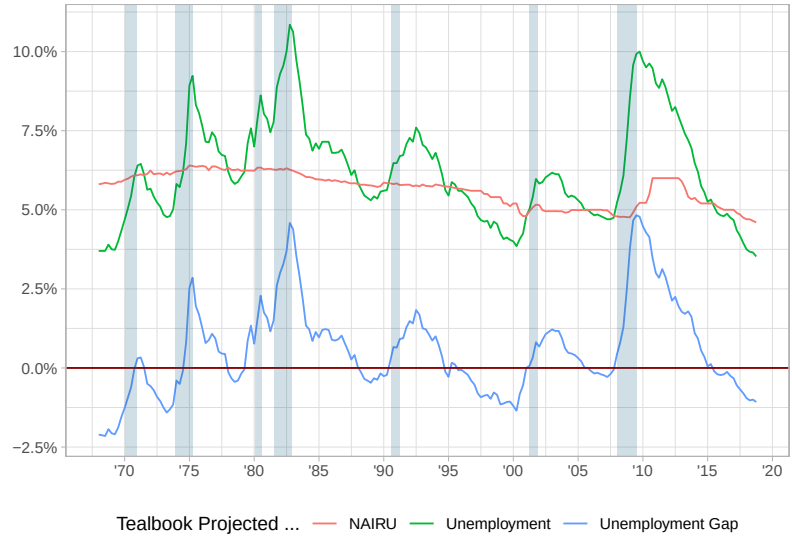
RATES


15%
10%
5%
0%
'70
'75
'80
'85
'90
'95
'00
'05
'10
'15
'20
Rate
Fed Funds Rate, r_t
Natural Rate of Interest, r_t^*
Excess Rate, $r_t - r_t^*$

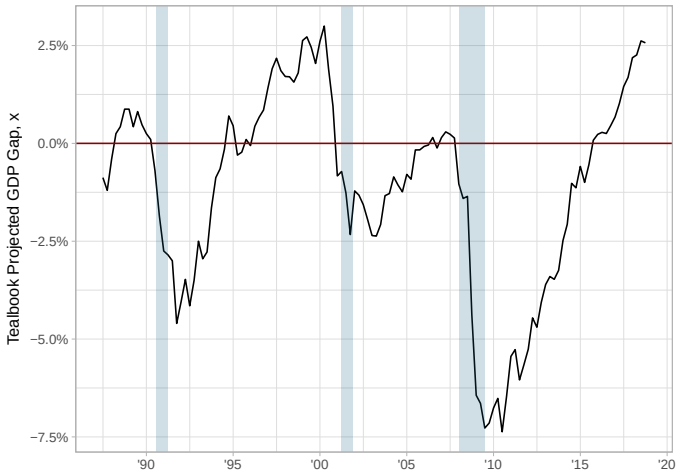
TEALBOOK INFLATION PROJECTIONS



TEALBOOK UNEMPLOYMENT PROJECTIONS



TEALBOOK OUTPUT GAP PROJECTIONS



REFERENCES [1]

- Andrews, Donald W K (May 1991). “Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimation”. In: *Econometrica* 59(3), pp. 817–858. URL: http://www.jstor.org/stable/2938229.
- Barnichon, Regis and Geert Mesters (Nov. 2023). “A Sufficient Statistics Approach for Macro Policy”. In: *American Economic Review* 113(11), pp. 2809–45. DOI: 10.1257/aer.20220581. URL: https://www.aeaweb.org/articles?id=10.1257/aer.20220581.
- Coibion, Olivier and Yuriy Gorodnichenko (2011). “Monetary Policy, Trend Inflation, and the Great Moderation: An Alternative Interpretation”. In: *The American Economic Review* 101(1), pp. 341–370. ISSN: 00028282. URL: http://www.jstor.org/stable/41038791 (visited on 01/12/2024).
- Hack, Lukas, Klodiana Istrefi, and Matthias Meier (Oct. 2023). *Identification of systematic monetary policy*. Working Paper Series 2851. European Central Bank. URL: https://ideas.repec.org/p/ecb/ecbwps/20232851.html.

REFERENCES [2]

- Holston, Kathryn, Thomas Laubach, and John C. Williams (2017). "Measuring the natural rate of interest: International trends and determinants". In: *Journal of International Economics* 108. 39th Annual NBER International Seminar on Macroeconomics, S59–S75. ISSN: 0022-1996. DOI: https://doi.org/10.1016/j.jinteco.2017.01.004. URL: https://www.sciencedirect.com/science/article/pii/S0022199617300065.
- Holston, Kathryn, Thomas Laubach, and John C. Williams (2023). *Measuring the Natural Rate of Interest after COVID-19*. Staff Reports 1063. Federal Reserve Bank of New York.
- Istrefi, Klodiana (2019). *In Fed Watchers' Eyes: Hawks, Doves and Monetary Policy*. Working papers 725. Banque de France. URL: https://ideas.repec.org/p/bfr/banfra/725.html.
- Kaplan, Greg, Benjamin Moll, and Giovanni L. Violante (Mar. 2018). "Monetary Policy According to HANK". In: *American Economic Review* 108(3), pp. 697–743. DOI: 10.1257/aer.20160042. URL: https://www.aeaweb.org/articles?id=10.1257/aer.20160042.

REFERENCES [3]


McKay, Alisdair and Christian K. Wolf (2023). “What Can Time-Series Regressions Tell Us About Policy Counterfactuals?” In: *Econometrica* 91(5), pp. 1695–1725. DOI: https://doi.org/10.3982/ECTA21045. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.3982/ECTA21045. URL: https://onlinelibrary.wiley.com/doi/abs/10.3982/ECTA21045.


Wu, Jing Cynthia and Fan Dora Xia (2016). “Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound”. In: *Journal of Money, Credit and Banking* 48(2-3), pp. 253–291. DOI: https://doi.org/10.1111/jmcb.12300. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/jmcb.12300. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/jmcb.12300.