Financial Conditions Targeting

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Asset prices affect financial conditions and monetary policy

- Fed Chair Powell, October 2023, after the bond market rout:
  - "Financial conditions have tightened significantly in recent months..."
  - "Persistent changes in financial conditions can affect monetary policy"

Higher Bond Yields Likely to Extend Fed Rate Pause

Officials are signaling that a run-up in long-term interest rates might substitute for a further central bank rate hike

By Nick Timiraos Follow

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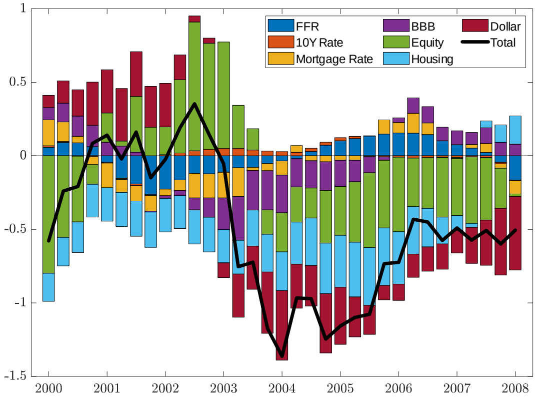
- **Financial Conditions Indices** aggregate asset prices' macro impact—they summarize whether "effective policy" is tight or loose
- FCIs are greatly influenced by **risky** asset prices such as stocks & FX

US FCI is driven by stocks, FX, house prices (and bonds)



- FCI-G by Ajello et al: FRB/US implied output effects of various ΔP
- 3-year lookback. Rates convention: Negative ~higher ΔP and output

Financial noise affects asset prices and macro fluctuations

- Risky asset prices are influenced by **financial noise**—non-fundamental demand and supply changes—due to **limits to arbitrage**
- Gabaix & Koijen (2021) show noisy flows affect the stock market
- We show their measure also affects FCI and macro fluctuations

How should monetary policy react to noise-driven fluctuations?

This paper: FCI targeting improves macro-stabilization

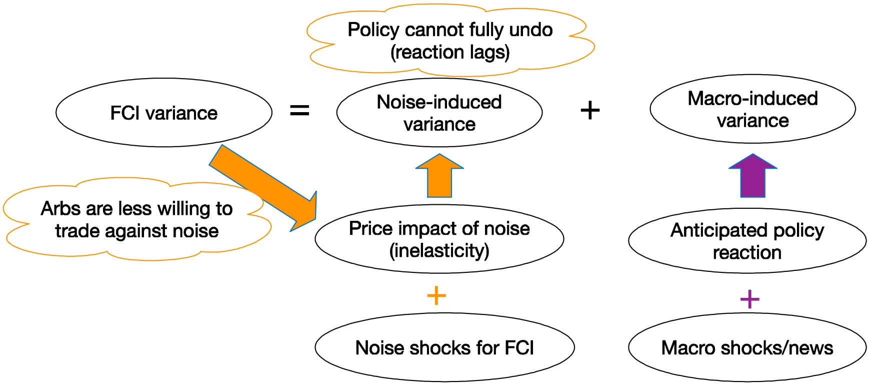
Received answer:

- Bernanke and Gertler (2001) use a standard NK model to conclude
  - Monetary policy should focus on expected output and inflation gaps
  - "...no significant additional benefit to responding to asset prices"

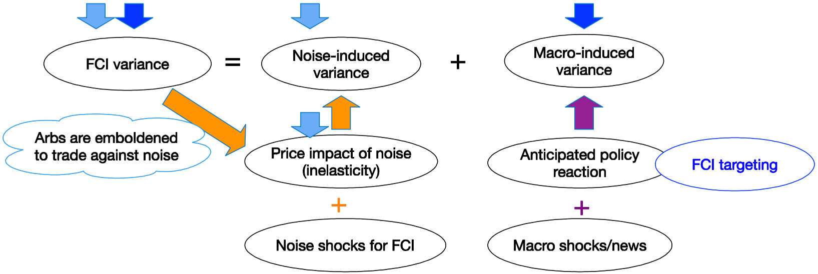
This paper:

- A macroeconomic model with financial noise and limits to arbitrage
- **FCI targeting:** (Soft) commitment to a pre-announced FCI target
- **Main theory result:** FCI targeting stabilizes FCI **& the output gap**
- **Policy counterfactuals for US**: Stabilizes output gaps

Mechanism: Volatility amplifies noise & induces feedback



FCI targeting reduces noise impact & reverses feedback



- Policy has costs—less flexibility to macro shocks—but stabilizes gaps
- Trades second order losses vs first order gains from noise reduction

Roadmap

1. Empirical evidence: Financial noise affects output gaps
2. A New Keynesian model with noise and limits to arbitrage
3. Financial conditions targeting
4. Policy counterfactuals with FCI targeting

Methodology: VAR with an instrument for financial noise

- Let Y_t denote a vector of macro variables including FCI. Suppose:

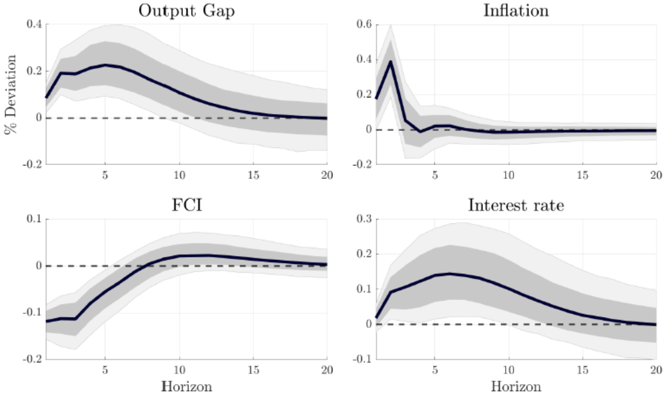
$$\underbrace{Y_t = \sum_{\ell=0}^{\infty} \Theta_\ell \varepsilon_{t-\ell}}_{\text{DGP}} \text{ and } \underbrace{Y_t = \sum_{\ell=1}^{L} A_\ell Y_{t-\ell} + u_t}_{\text{VAR}}$$

- Let $\varepsilon_{\mu,t}$ denote the noise shock. Suppose we have an instrument

$$\tilde{Z}_t^{\mu} = \alpha \varepsilon_t^{\mu} + v_t$$

- We use stock market flow shocks by Gabaix and Koijen (2021)
  - Δq_{it}: Change in equity held by sector i in FoF. Residualize $\Delta \tilde{q}_{it}$
  - Equity-share weight average $Z_{\mu,t} = \sum_{i=1}^{I} S_{i,t-1} \Delta \tilde{q}_{it}$. Residualize $\tilde{Z}_{\mu,t}$
- GK show $\tilde{Z}_{\mu,t}$ affects stock prices. How about FCI, output, inflation?

Financial noise shock affects financial conditions and gaps



Impulse response to a financial noise shock

Noise explains significant output gap variance

- Noise explains significant output gap variance (between 20%-50%)
- It drives especially the pre-GFC bust-boom cycle and some others

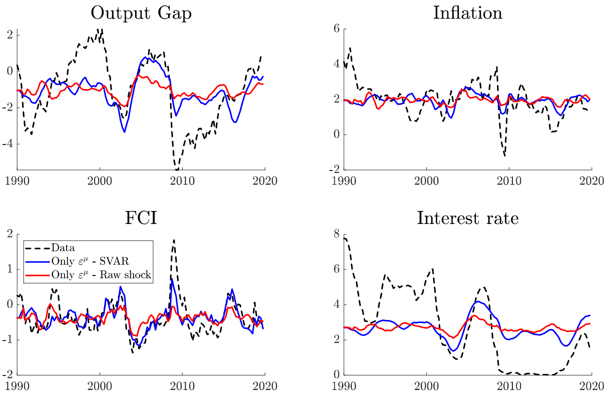


Figure: Historical decomposition: Set all shocks in VAR to zero but $\hat{\varepsilon}_{\mu,t}$

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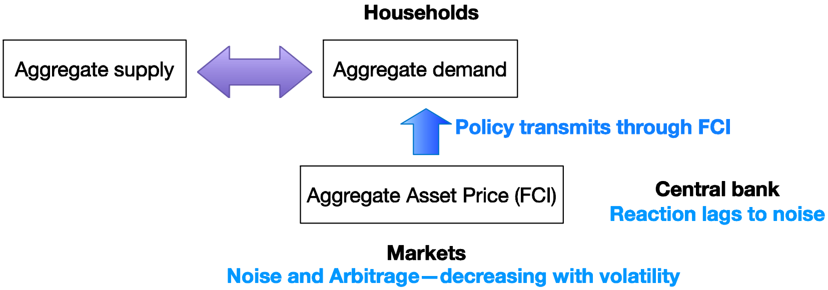
Key elements: Transmission via FCI and financial noise



Macro block: Financial conditions drive demand

- Potential output (log) is subject to persistent **supply shocks**

$$y_t^* = y_{t-1}^* + \varepsilon_{z,t}$$

- Output is driven by aggregate demand. For now, fully sticky prices
- Relatively standard assumptions imply **output-asset price relation:**

$$y_t = m + p_t + \delta_t$$

  - p_t is the log price of market portfolio (claim on αY_t): model's FCI
  - p_t affects demand via a wealth effect: model's FCI-output link
  - δ_t is an i.i.d. (more general in the paper) aggregate demand shock

Finance block: Noise and limits to arbitrage

- Assets:
  - Market portfolio (claim on αY_t) with endogenous log return r_t
  - Risk-free asset in zero net supply. Central Bank sets r_t^f
- Portfolio managers (delegated by households):
  - Inelastic/passive funds: $\omega_t^I = 1$
  - Noise traders (fraction η): $\omega_t^N = 1 + \frac{\mu_t}{\eta}$ where μ_t is **aggregate noise**:

$$\mu_t = \varphi_\mu \mu_{t-1} + \varepsilon_{\mu,t}$$

  - Arbitrageurs (fraction α) choose ω_t^A to maximize expected log wealth
- **Equilibrium**: Given return variance $\sigma^2 = \sigma^2_{t,r_{t+1}}$, the price satisfies:

$$p_t = \rho + \beta E_t\left[p_{t+1}\right] + (1-\beta)\, E_t\left[y_{t+1}\right] - \left(r_t^f + \frac{\sigma^2}{2}\right) + \frac{\sigma^2}{\alpha}\mu_t$$

Higher variance $\Longrightarrow$ Arbs require **higher premium to absorb noise**

Benchmark with perfect policy: Noise is absorbed by rates

Suppose CB sets r_t^f after observing all shocks (including $\varepsilon_{\mu,t}$) $\Longrightarrow$

$$
\begin{aligned}
p_t &= p_t^* \equiv y_t^* - m - \delta_t \\
y_t &= y_t^* \\
r_t^f &= \rho - \frac{1}{2}\sigma^2 + \delta_t + \frac{\sigma^2}{\alpha}\mu_t \\
& \text{where} \\
\sigma^2 &= \sigma_{macro}^2 = \sigma_z^2 + \beta^2\sigma_\delta^2
\end{aligned}
$$

Policy lags: Noise matters & volatility induces feedback

- Main assumption: **Reaction lags**. CB sets r_t^f **before** observing $\varepsilon_{\mu,t}$
- CB sets r_t^f to minimize $G_t = \underline{E}_t\left[\sum_{h=0}^{\infty} \beta^h \tilde{y}_{t+h}^2\right]$ with discretion $\Longrightarrow$

$$
\begin{aligned}
p_t &= p_t^* + \frac{\sigma^2}{\alpha}\varepsilon_{\mu,t} \\
y_t &= y_t^* + \frac{\sigma^2}{\alpha}\varepsilon_{\mu,t} \\
r_t^f &= \rho - \frac{1}{2}\sigma^2 + \delta_t + \frac{\sigma^2}{\alpha}\varphi_\mu \mu_{t-1} \\
&\quad \text{where} \\
\sigma^2 &= \underbrace{\sigma_{macro}^2}_{\sigma_z^2 + \beta^2\sigma_\delta^2} + \frac{\left(\sigma^2\right)^2}{\alpha^2}\sigma_\mu^2
\end{aligned}
$$

Volatility feedback: Higher $\sigma^2 \Longrightarrow$ Higher noise impact $\Longrightarrow$ Higher σ^2

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FCI targeting: Soft commitment to announced FCI-target

Suppose CB **operationally** minimizes

$$G_t^{FCI}\left(\overline{p}_t\right) = \min_{r_t^f, \overline{p}_{t+1}} \underline{E}_t\left[\tilde{y}_t^2 + \psi\left(p_t - \overline{p}_t\right)^2\right] + \beta \underline{E}_t\left[G_{t+1}^{FCI}\left(\overline{p}_{t+1}\right)\right]$$

- Announces an FCI target $\overline{p}_{t+1}$ one period in advance
- ψ captures the strength of FCI targeting/commitment
- We evaluate losses using *original* objective function $\underline{E}_t\left[\sum_{h=0}^{\infty} \beta^h \tilde{y}_{t+h}^2\right]$

FCI targeting reduces the impact of macro shocks on FCI

The Fed announces expected "pstar" $\overline{p}_{t+1} = \underline{E}_t \left[p^*_{t+1} \right]$ and implements

$$\begin{aligned} p_t &= \underline{E}_{t-1} \left[p^*_t \right] + \frac{1}{1+\psi} \left(\varepsilon_{z,t} - \varepsilon_{\delta,t} \right) + \frac{\sigma^2}{\alpha} \varepsilon_{\mu,t} \\ y_t &= y^*_t + \frac{\psi}{1+\psi} \left(\varepsilon_{\delta,t} - \varepsilon_{z,t} \right) + \frac{\sigma^2}{\alpha} \varepsilon_{\mu,t} \end{aligned}$$

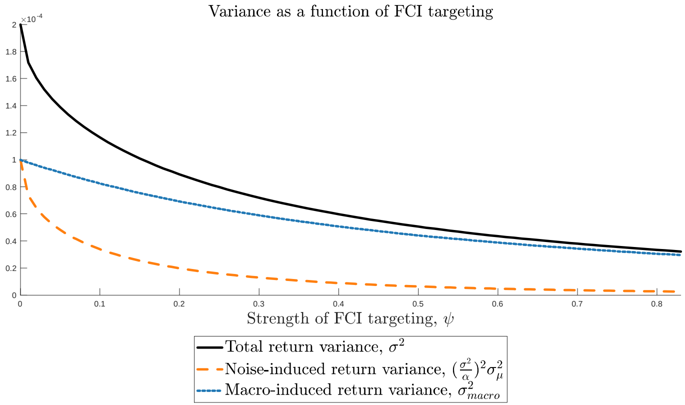
where

$$\sigma^2 = \underbrace{\sigma^2_{macro} \left(\psi \right)}_{\sigma^2_z \left(\frac{1}{1+\psi} \right)^2 + \ldots} + \frac{\left(\sigma^2 \right)^2}{\alpha^2} \sigma^2_\mu$$

FCI targeting reduces macro AND noise-induced volatility

Result: FCI targeting (greater ψ) reduces $\sigma^2_{macro}(\psi)$ and σ^2, $\frac{(\sigma^2)^2}{\alpha^2}\sigma^2_\mu$

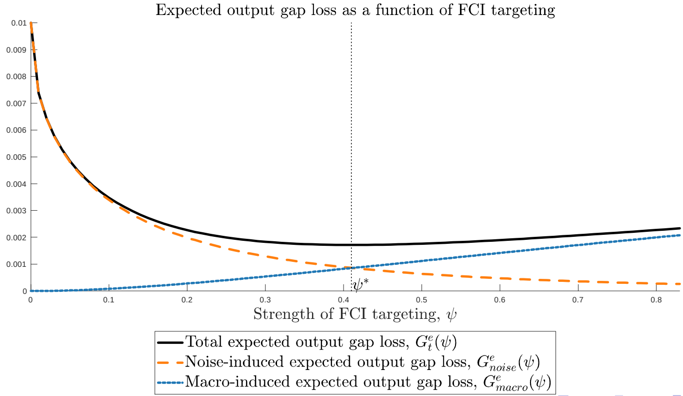
$$\sigma^2 = \sigma^2_{macro}(\psi) + \frac{(\sigma^2)^2}{\alpha^2}\sigma^2_\mu$$



FCI targeting stabilizes output gaps and macroeconomy

Result: Starting with $\psi = 0$, small increase in ψ reduces output gap loss

$$\underbrace{\tilde{y}_t}_{G^e = E\left[\sum_{h=0}^{\infty} \beta^h \tilde{y}_{t+h}^2\right]} = \underbrace{(\varepsilon_{\delta,t} - \varepsilon_{z,t}) \frac{\psi}{1+\psi}}_{G^e_{macro}} + \underbrace{\varepsilon_{\mu,t} \frac{\sigma^2}{\alpha}}_{G^e_{noise}}$$



FCI targeting: Other results

Does FCI targeting require large changes in policy rate to keep FCI stable?

- In our calibration, FCI targeting **reduces rate volatility** as by-product
- Since arbs absorb noise, burden on CB is reduced ($r_t^f = \ldots \frac{\sigma^2}{\alpha} \varphi_\mu \mu_{t-1}$)

details

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FCI targeting is like forward guidance about future FCI (commitment)

Could conventional rate forward guidance achieve similar benefits?

- FCI targeting **dominates FG:** greater vol reduction and smaller gaps
- FG reduces flexibility to react to post-guidance noise ($r_t^f = \ldots \varphi_\mu \mu_{t-1}$)

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FCI targeting is robust to extensions including inflation-output trade-off

model extensions

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Semi-structural policy counterfactuals: Setup

We extend policy counterfactual methods by McKay and Wolf (2023):

1. Start with a VAR estimated under the prevailing policy rule
2. Add **policy shock impulse responses to fit alternative rule** ex ante

Restrictions: **Linearity** + Policy works via current or expected rates

Our model features a nonlinearity: volatility reducing feedback. We add:

3. Scale noise shock IRF with $\frac{\tilde{\sigma}_r^2}{\sigma_r^2}$ where $\tilde{\sigma}_r^2$ is solved as in the model

▸ details

FCI targeting would mitigate the macro impact of noise

Consider policies that minimize an objective with one-period lag: details

$$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \left[\pi_t^2 + \tilde{y}_t^2 + \lambda_{\Delta i}(i_t - i_{t-1})^2 + \psi(\overline{FCI}_t - FCI_t))^2\right]$$

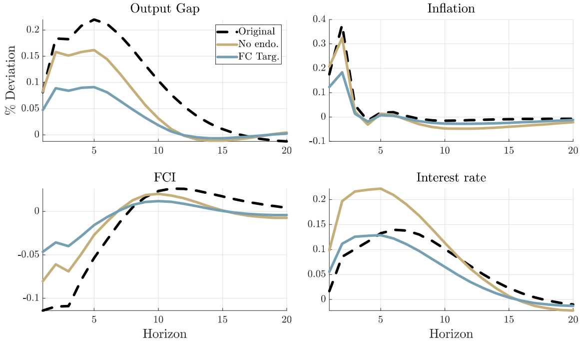
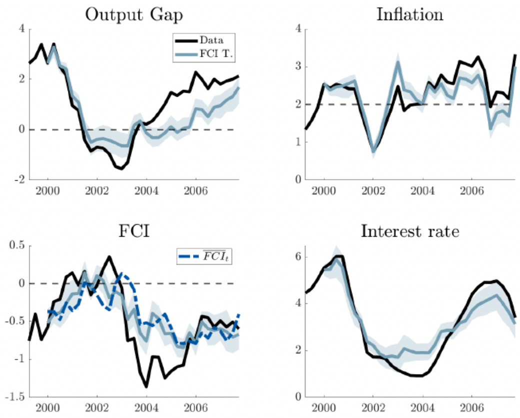


Figure: Counterfactual impulse response with optimal FCI targeting ψ^* (blue)

FCI targeting would stabilize gaps, especially pre-GFC

- FCI targeting stabilizes gaps relative to data & dual mandate $\psi = 0$
- Especially pre-GFC bust-boom cycle where noise was large. Case:



Conclusion: Noise and Financial conditions targeting

We present evidence that **financial noise shocks affect FCI & output**

We build a model with noise & arbitrage to analyze policy implications:

- FCI targeting: Announce (soft) FCI target & try to keep FCI at target
- FCI targeting reduces return volatility **and stabilizes output gaps**
  - Arbitrageurs help policy to undo the noise impact in real time
  - Some FCI targeting is always optimal
- FCI targeting can reduce rate volatility & dominates interest rate FG

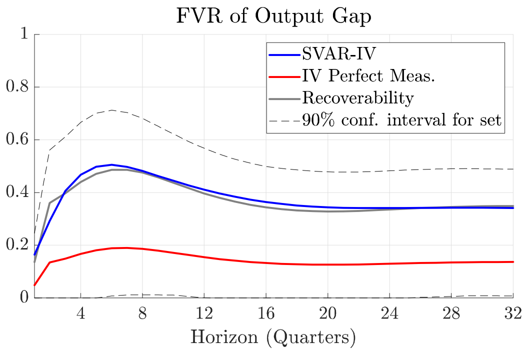
We extend semi-structural counterfactual methods to FCI targeting

- Policy IRF + Identified noise sufficient, despite nonlinearity (scaling)
- FCI targeting would have stabilized US gaps, especially pre-GFC

Literature

- **New Keynesian models with risk and asset prices**
  - Our earlier papers. Pflueger et al., Kekre and Lenel...
  - We analyze financial noise and its policy implications
- **Noise (supply/demand) and asset price fluctuations**
  - Large finance literature with theory and empirics. Recently revived
  - We analyze macro effects of noise and monetary policy implications
- **Change in Central Bank objectives** (Rogoff 1985; Woodford 2003)
  - We show commitment to lower volatility can be useful to absorb noise
- **FX targeting** with noise (Mussa puzzle, Jeanne&Rose, Itskhoki&Mukhin)
  - We apply similar mechanism for FCI—affects macro (not disconnect)
- **Macro effects of financial shocks:** Empirical literature post-GFC
  - We show financial noise shocks affect activity. Beyond crises
- **Policy Counterfactuals:** McKay&Wolf (2023), Caravello et al. (24)
  - We extend method to allow a nonlinearity: endogenous change in risk

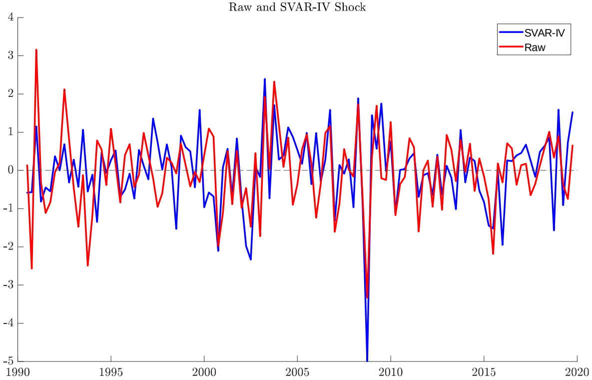
Noise explains significant output gap variance



We bound the Forecast Variance Ratios explained by noise shock:

- "Upper bound": SVAR-IV: Assume VAR is invertible so $\varepsilon_{\mu,t} = q' u_t$
- Lower bound: Assume GK is perfect measure $v_t = 0$ so $\tilde{Z}_{\mu,t} = \alpha \varepsilon_{\mu,t}$

Time series for GK shock and SVAR-identified shock



Macro block: Financial conditions drive demand

Two types of households

- Hand-to-mouth: Supply labor and spend (MPC=1). Unimportant
- **Households:** Own the aggregate asset (claim to capital's share αY_t) They have log utility and follow (almost) the rational consumption rule

$\Longrightarrow$ **Output-asset price relation** (driven by wealth effects+):

$$y_t = m + p_t + \delta_t$$

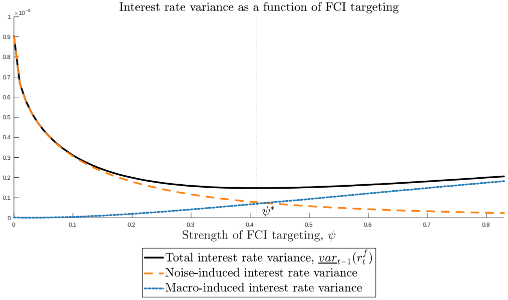
- p_t is the log price of the aggregate risky asset (model's FCI)
- δ_t is an aggregate demand shifter driven by demand shocks

FCI targeting may reduce interest rate volatility

- Does FCI targeting require large movements in policy rate?

$$r_t^f = \ldots + \underbrace{\frac{\psi}{1+\psi}\varepsilon_{z,t}}_{\text{more volatile}} + \underbrace{\left[1 - \beta\varphi_\delta - \frac{\psi}{1+\psi}\right]\varepsilon_{\delta,t}}_{\text{more volatile}} + \underbrace{\frac{\sigma^2}{\alpha}\varphi_\mu\varepsilon_{\mu,t-1}}_{\text{less volatile}}$$

- Persistent shocks $\varphi_\delta = \varphi_\mu = 0.95 \implies$ FCI targeting reduces rate vol
- $\varepsilon_{z,t}, \varepsilon_{\delta,t}$ does not require a large rate response but $\varepsilon_{\mu,t-1}$ does



Results are robust to allowing for inflation-output trade-off

FCI targeting with inflation and output trade-off

- We endogenize inflation via the NK Phillips Curve

$$\pi_t = \kappa \tilde{y}_t + \beta E_t \left[\pi_{t+1}\right] + u_t$$

  Adjust the central bank's **true** objective as $\sum_{h=0}^{\infty} \beta^h \left(\tilde{y}_{t+h}^2 + \zeta \pi_{t+h}^2\right)$
- Cost-push shocks u_t raise π_t and reduce $\tilde{y}_t, p_t$—more macro volatility
- FCI targeting still reduces volatility and **improves CB's objective**
- G_{macro}^e *is non-zero but minimized, so its increase is still second-order*

Results are robust to assuming reaction lags to all shocks

Policy reaction lags to all current shocks $\varepsilon_{\mu,t}, \varepsilon_{\delta,t}, \varepsilon_{z,t}$ (not just $\varepsilon_{\mu,t}$)

- Markets still price **anticipated** policy reaction ($p_t = ... - \beta\varphi_\delta\varepsilon_{\delta,t}$)
- FCI targeting still reduces volatility ($p_t = ... \left(\frac{1}{1+\psi} - (1-\beta)\right)\varphi_\delta\varepsilon_{\delta,t}$)

FCI targeting dominates interest rate forward guidance

- FCI targeting is like forward guidance about future FCI (commitment)
- Could conventional rate forward guidance achieve similar benefits?

$$G_t^{FG}\left(\overline{r}_t^f\right) = \min_{r_t^f, \overline{r}_{t+1}^f} \underline{E}_t \left[(y_t - y_t^*) + \psi \left(r_t - \overline{r}_t^f \right)^2 \right] + \beta \underline{E}_t \left[G_{t+1}^{FG}\left(\overline{r}_{t+1}^f\right)\right]$$

- Solution (for special case with $\varepsilon_{z,t} = 0$ and $\varphi_\delta = 0$)

$$r_t^f = \ldots + \frac{\varepsilon_{\delta,t}}{1+\psi} + \frac{\sigma^2}{\alpha}\left(\varphi_\mu^2 \mu_{t-1} + \frac{1}{1+\psi}\varphi_\mu \varepsilon_{\mu,t-1}\right)$$

- Rates underreact to *recent noise shocks* $\varepsilon_{\mu,t-1}$ (in addition to $\varepsilon_{\mu,t}$)
- This increases price and output impact of recent *and current* noise
- Compared to FCI, larger gaps & lower vol-reduction (might *raise* vol)

Semi-structural policy counterfactuals: Setup

- We extend policy counterfactual methods by McKay and Wolf (2023)
- Assume data is from $Y_t = \sum_{\ell=0}^{\infty} \Theta_\ell \varepsilon_{t-\ell}$ with structural shocks $\varepsilon_{t-\ell}$
- Impulse responses Θ_ℓ solve structural equations and a policy equation

$$\underbrace{\mathcal{A}_z \boldsymbol{z}}_{\text{policy instrument}} + \underbrace{\mathcal{A}_x \boldsymbol{x}}_{\text{response to macro-finance variables}} + \underbrace{\mathcal{A}_v v_0}_{\text{policy shocks}} = \boldsymbol{0}$$

- We have access to a Wold representation of the data (through VARs)

$$Y_t = \sum_{\ell=0}^{\infty} \Psi_\ell u_{t-\ell} \text{ where } u_t = P\varepsilon_t \text{ for unknown } P$$

- Want counterfactuals (variances, historical episodes) if policy followed

$$\tilde{\mathcal{A}}_z \boldsymbol{z} + \tilde{\mathcal{A}}_x \boldsymbol{x} + \tilde{\mathcal{A}}_v v_0 = \boldsymbol{0}$$

MW: Policy shock response implies counterfactuals

Suppose structural equations take the general form:

$$\begin{aligned} \mathcal{H}_x \boldsymbol{x} + \mathcal{H}_z \boldsymbol{z} + \mathcal{H}_\varepsilon \varepsilon_0 &= \mathbf{0} & \text{(Macro)} \\ \mathcal{A}_z \boldsymbol{z} + \mathcal{A}_x \boldsymbol{x} + \mathcal{A}_v v_0 &= \mathbf{0} & \text{(Policy)} \end{aligned}$$

Restrictions: **Linearity** + Policy affects structure **only via instrument $\boldsymbol{z}$**

MW: With invertibility, Wold rep+Policy IRF sufficient for counterfactuals

Our model does not fit since noise shocks enter the system **nonlinearly**

$$p_0 = ... + \frac{\sigma_r^2}{\alpha} \mu_0$$

We generalize MW to allow for noise shocks

$$\begin{aligned} \mathcal{F}_x \boldsymbol{x} + \mathcal{F}_z \boldsymbol{z} + \mathcal{F}_\mu(\sigma_r^2 \varepsilon_{\mu,0}) &= \mathbf{0} && \text{(Finance)} \\ \mathcal{H}_x \boldsymbol{x} + \mathcal{H}_z \boldsymbol{z} + \mathcal{H}_\varepsilon \varepsilon_0 &= \mathbf{0} && \text{(Macro)} \\ \mathcal{A}_z \boldsymbol{z} + \mathcal{A}_x \boldsymbol{x} + \mathcal{A}_v v_0 &= \mathbf{0} && \text{(Policy)} \end{aligned}$$

Restriction: σ_r^2 only affects transmission of $\varepsilon_{\mu,0}$ & does so proportionally

Result: Under invertibility, Wold rep + Policy IRFs + identified noise shocks $\{\varepsilon_{\mu,t}\}$ are sufficient for counterfactuals

S1. Use MW to obtain counterfactuals, including IRF to noise shock $\hat{\Theta}_{\ell,\mu}$

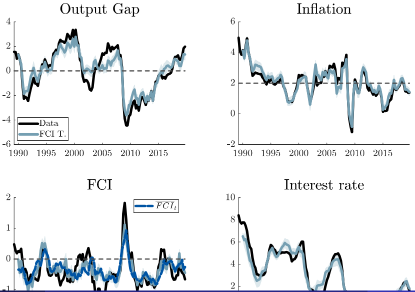
S2. Scale it by variance $\tilde{\Theta}_{\ell,\mu} = \hat{\Theta}_{\ell,\mu} \frac{\tilde{\sigma}_r^2}{\sigma_r^2}$ where $\tilde{\sigma}_r^2$ is solved as in the model

FCI targeting would mitigate the macro impact of noise

Consider policies that minimize an objective with one-period lag:

$$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \left[\pi_t^2 + \tilde{y}_t^2 + \lambda_{\Delta i}(i_t - i_{t-1}) + \psi(\overline{FCI}_t - FCI_t))^2\right]$$

- Benchmark (Flexible Dual Mandate): $\psi = 0$. Used in Fed's Tealbook
  - Set $\lambda_{\Delta i}$ to match the observed interest rate variance with FDM
- Compare with ψ^* that minimizes $\mathcal{L}$ excluding the FCI term
  - Set $\overline{FCI}_t$ to minimize optimal $\mathcal{L}$ subject to timing constraints



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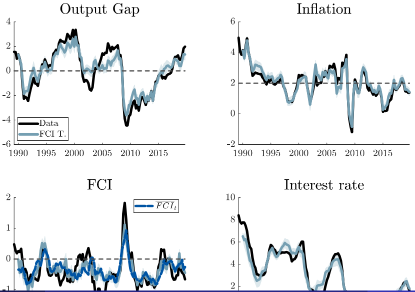
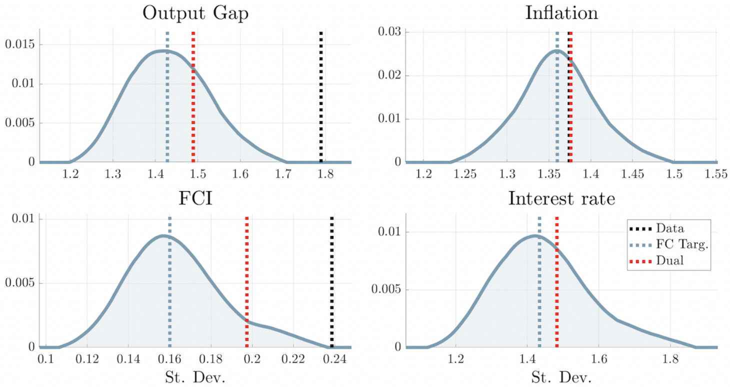


FCI-augmented dual mandate would have stabilized gaps

- Flexible Dual Mandate $\psi = 0$ (red). Optimal **FCI targeting** ψ^* (blue)



FCI-augmented Taylor rules would have stabilized gaps

- Consider augmented Taylor rules of the form:

$$i_t = \rho_i i_{t-1} + (1-\rho_i)(\phi_\pi \pi_t + \phi_y \tilde{y}_t + \psi(\overline{FCI}_t - FCI_t))$$

- Benchmark Taylor $\psi = 0$ (red). **FCI-augmented Taylor** $\psi > 0$ (blue)