# Identifying Taylor Rules In Macro-Finance Models

David Backus, Mikhail Chernov,
and Stanley Zin

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# Identifying the Taylor rule

- Long-term goal
  - Integrate models of bond pricing and monetary policy
- Open question
  - Can we identify the monetary policy parameter(s)?
  - Can we distinguish systematic policy from shocks to it?

# Identifying the Taylor rule

- Common views
  - Macro: not identified
  - Finance: can't extract policy component from affine model
- What we do
  - Describe conditions for identification
  - Revisit earlier work on dynamic rational expectations models

# Outline

- Setup
- Two examples
- Rational expectations solutions and identification
- More complex models
- What if you don't see the state?

# Setup

- State

$$
\begin{aligned}
x_{t+1} &= A x_t + C w_{t+1} \\
V_x &= A V_x A^\top + C C^\top
\end{aligned}
$$

- Shocks

$$
s_{it} = d_i^\top x_t
$$

- Identification issue: we observe state $x$, but not shock $s_i$

## Cochrane's example

- Model

$$\begin{aligned} i_t &= r + E_t \pi_{t+1} && \text{(Fisher equation)} \\ i_t &= r + \tau \pi_t + s_t && \text{(Taylor rule)} \end{aligned}$$

- Expectational difference equation

$$E_t \pi_{t+1} = \tau \pi_t + s_t$$

- Solution: $\pi_t = b^\top x_t$ with $b^\top = -d^\top (\tau I - A)^{-1}$
- Identification problem: any $\tau$ works for some $d$

$$b^\top A = \tau b^\top + d^\top$$

# Affine example

- Model

$$\begin{aligned} m_{t+1}^{\$} &= -\lambda^\top\lambda - \delta x_t + \lambda^\top w_{t+1} && \text{(Pricing kernel)} \\ i_t &= -\log E_t m_{t+1}^{\$} \;=\; \delta^\top x_t && \text{(Euler equation)} \end{aligned}$$

- Expectational difference equation

$$E_t \pi_{t+1} \;=\; \tau \pi_t + s_t$$

- Is second equation a Taylor rule?

$$\delta \;=\; \tau b^\top + d^\top$$

# Questions

- Would an extra shock help?

$$\begin{aligned} i_t &= E_t \pi_{t+1} + s_{1t} && \text{(Fisher equation)} \\ i_t &= \tau \pi_t + s_{2t} && \text{(Taylor rule)} \end{aligned}$$

  - If shocks are independent, can use $s_{1t}$ as an instrument
- Would long rates help?
  - May span state, but we see state anyway