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Money and Banking: Some DSGE Challenges

Nobel Symposium on “Money and Banking”

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Outline

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Main Theme

- Quantitative DSGE models were meant to rise to the Lucas challenge of constructing general equilibrium models with deep parameters. Now, workhorse models for monetary policy analysis.
- But:
  - **Asset prices and yield spreads.** Probably central for monetary policy. Typically ignored or trivialized in QDSGEs.
  - **Financial frictions**. Much progress has been made. But contracts are often not privately optimal. Perhaps they should be.
  - **Inflation.** Data: no Phillips-Curve tradeoff. QDSGE: don't account for inflation with monetary policy shocks.
  - **Neo-Fisherian features of New Keynesian models.** Substantial, but get swept under the rug.
- The glass is half full. Or half empty. Take your pick.

Outline

The skeleton in the closet

- E.g. log-linearized sol'n for cons c_t, return R_t return. s_t: state.

$$\begin{aligned}\log(c_{t+1}) &= \phi s_t + \epsilon_{t+1} \\ \log(R_{t+1}) &= \xi s_t + \nu_{t+1}\end{aligned}$$

- Assume log preferences. Asset pricing equation:

$$\begin{aligned}1 &= E_t\left[\beta\left(\frac{c_t}{c_{t+1}}\right)R_{t+1}\right] \\ &= \beta c_t e^{(\xi-\phi)s_t} E_t\left[e^{\nu_{t+1}-\epsilon_{t+1}}\right]\end{aligned}$$

- Suppose $\nu_{t+1} - \epsilon_{t+1} \sim \mathcal{N}(0, \sigma_t^2)$, conditional on t. Then,

$$E_t\left[e^{\nu_{t+1}-\epsilon_{t+1}}\right] = e^{\sigma_t^2/2}$$

- Suppose $\nu_{t+1} - \epsilon_{t+1} \sim t_{1000}(0, \sigma_t^2)$, conditional on t. Then,

$$E_t\left[e^{\nu_{t+1}-\epsilon_{t+1}}\right] = \infty$$

- Now what? It gets ignored. I will ignore it too.

Risk premia per Epstein-Zin

- Source: “Easy EZ for DSGE” (Uhlig, 2010).
- IES = 1. Risk av = η. Log-linearized:

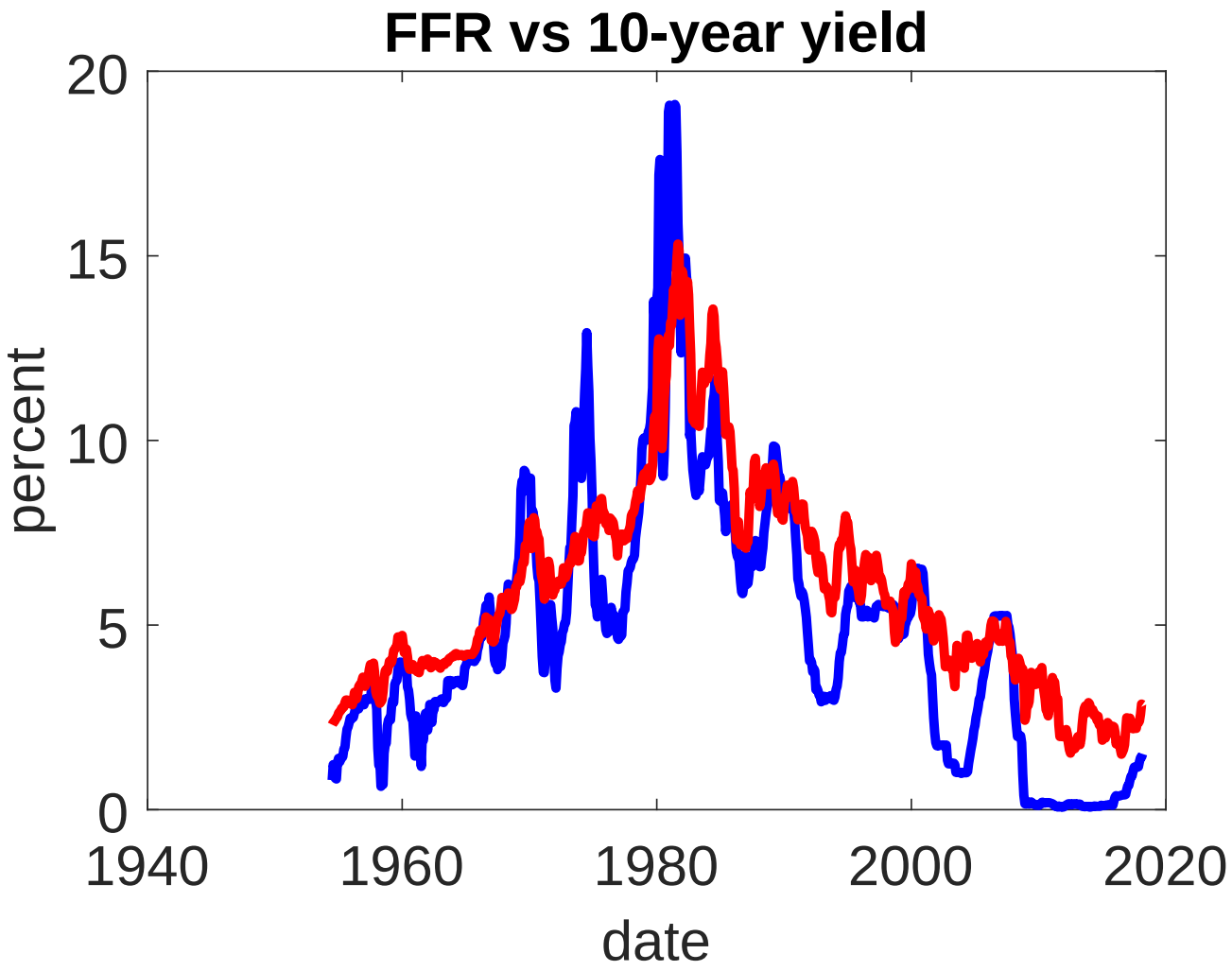
$$\begin{aligned}
\hat{V}_t &= (1-\beta)\,\hat{c}_t + \beta\hat{\mathcal{R}}_t \\
\hat{\mathcal{R}}_t &= E_t\left[\hat{\mathbf{V}}_{\mathbf{t+1}}\right] \\
\hat{M}_{t+1} &= \hat{c}_t - \hat{c}_{t+1} + (\eta-1)\left(\hat{\mathbf{V}}_{\mathbf{t+1}} - \hat{\mathcal{R}}_{\mathbf{t}}\right)
\end{aligned}$$

- Note:

$$E_t[\hat{M}_{t+1}] = \hat{c}_t - E_t[\hat{c}_{t+1}]$$

  Thus, EZ has no influence on macro-dynamics (up to first order).
- Dichotomy between “macro” and “asset pricing”. Too easy?
- If labor is part of utility, it **necessarily** shows up in asset pricing.

Yield Curves: FFR vs 10-year yields



Incorporating Yield Curves in DSGE models

- Long-term yields important for understanding the effects of monetary policy. Yet, either absent or treated insufficiently in QDSGE models (“expectations theory”).
- Some promising developments:
  - Piazzesi-Schneider (2007), “Equilibrium Yield Curves”.
  - Kliem-Meyer-Gohde (2018), “(Un)expected Monetary Policy Shocks and Term Premia”.

Asset prices and yield spreads: bottom line. Probably central for monetary policy. Typically ignored or trivialized in QDSGEs.

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Financial Frictions

- It is hard to think about the effects of monetary policy without thinking about pricing or financial frictions.
- Financial frictions, recent literature:
  - Agent heterogeneity and idiosynchratic shocks: HANK.
  - Financial intermediaries, banks: Gertler-Karadi-Kiyotaki or GKK.
- Increasingly used for policy guidance and welfare analysis.
- But then, contracts should be privately optimal.
- Otherwise: “chicken paper conundrum” ...

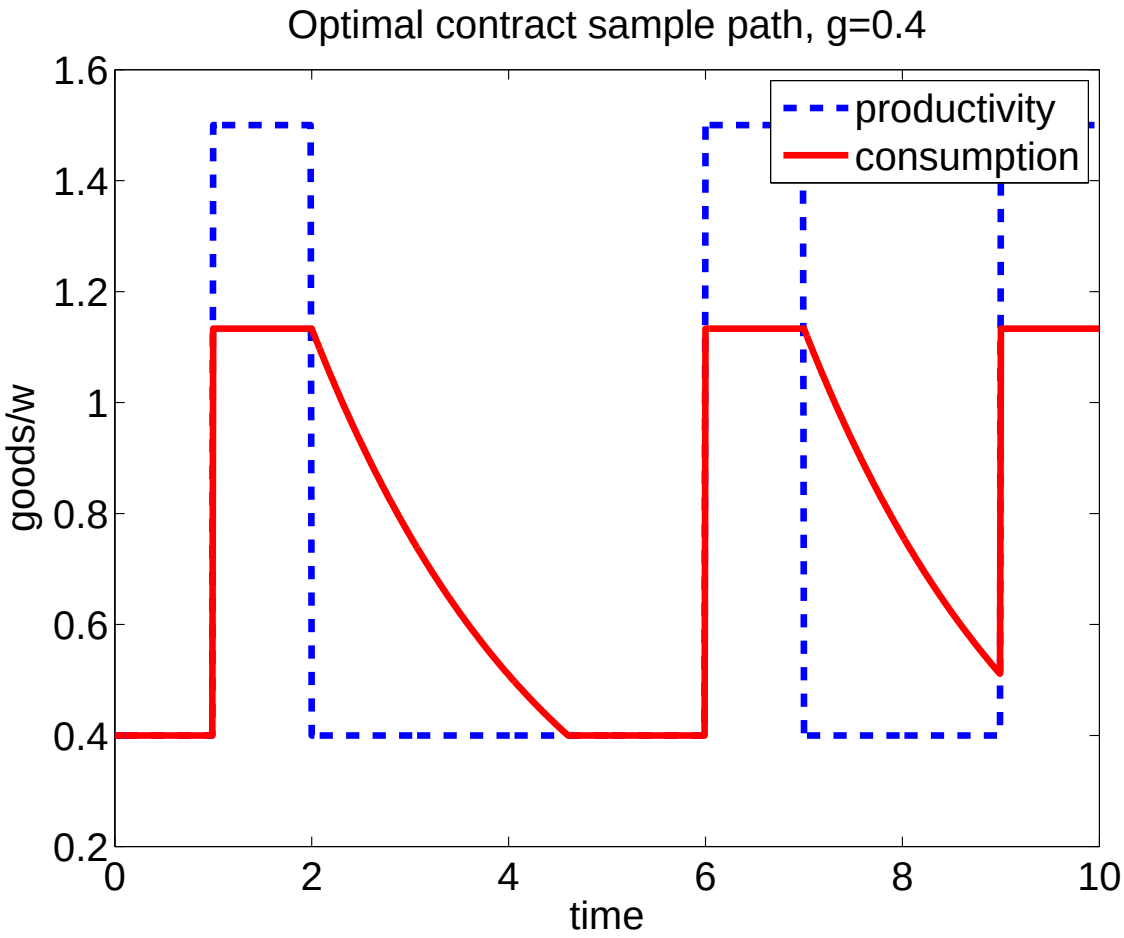
The Chicken Paper Conundrum

- The classic chicken paper (acc. to Ed Prescott):
  - Assumption 1: households enjoy consuming chicken.
  - Assumption 2: households cannot produce chicken.
  - Assumption 3: government can produce chicken.
  - Conclusion: government should produce chicken.
- For policy guidance, it is important to argue, **why** agents cannot address these frictions on their own.
- Example HANK: if income fluctuations are known, full insurance should be possible.
- Example GKK: if net worth might get destroyed, write insurance contracts.
- Needed: DSGE models with privately fully-optimal long-term contracts.
- Example: Krüger-Uhlig (2018).

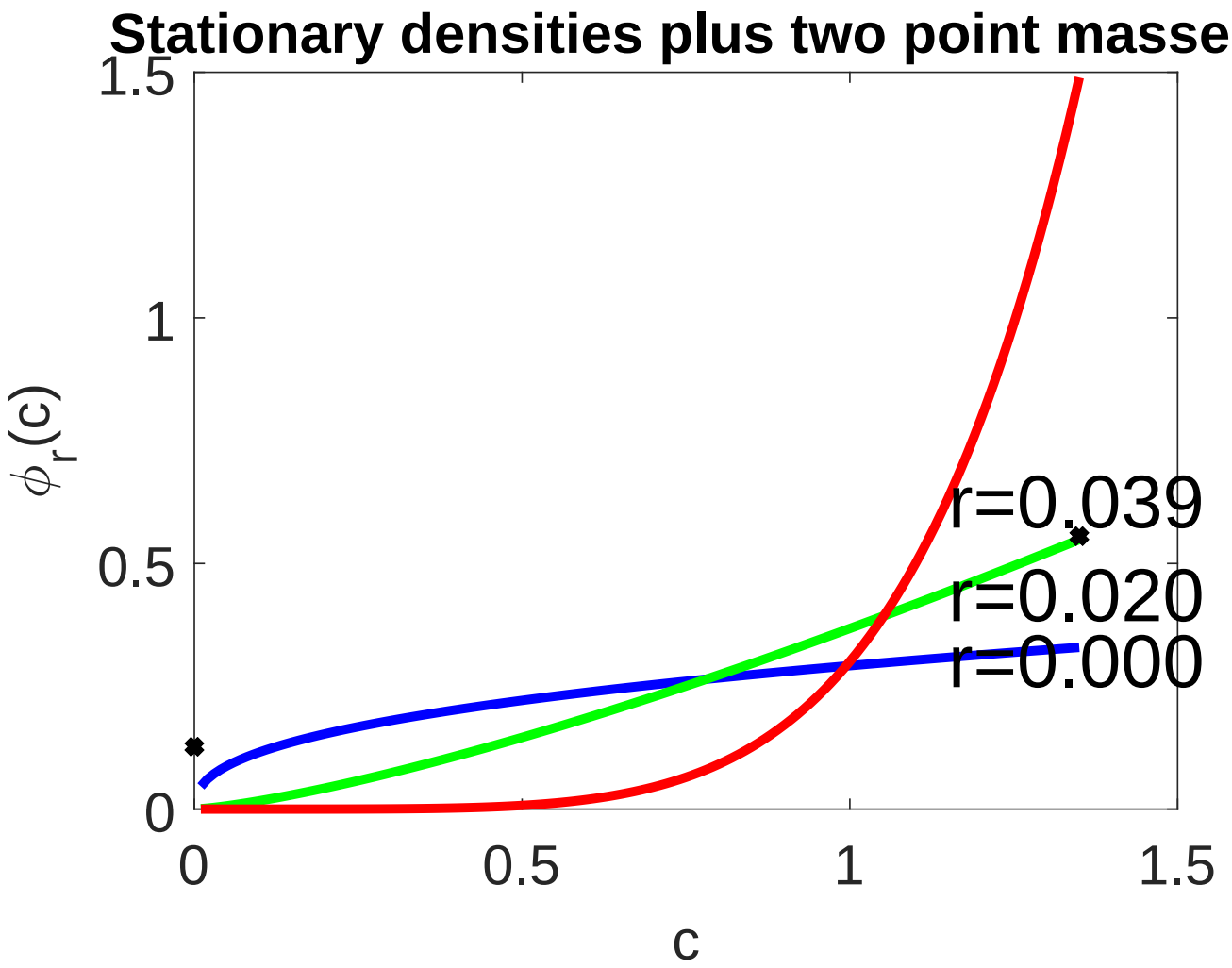
Example: Krüger-Uhlig (2018)

- Think: continuous-time Aiyagari model, ...
  - ... i.e.: agents are endowed with two-state Markov process of labor units, fluctuating between $\zeta > 0$ and 0.
  - Transition rates: $\xi\, dt = P(\zeta \to 0)$, $\nu\, dt = P(0 \to \zeta)$.
  - Aggregate production $Y = K^{\theta} L^{1-\theta}$. Cap. depr. rate δ.
  - Preferences: discount log-utility with ρ.
  - Equilibrium interest rate r.
- ... but: long-term insurance contracts, with one-sided commitment:
  - Competitive intermediaries, commit long-term.
  - Agents can walk anytime, sign up with the next one.
  - Full information, though no “credit history punishment”.
  - Contracts: payments from agent are front-loaded, payments from intermediary are backloaded.
  - Intermediaries invest payments from agent in capital.
- Steady state comparison only.

Optimal contract. Case $\rho > r$.

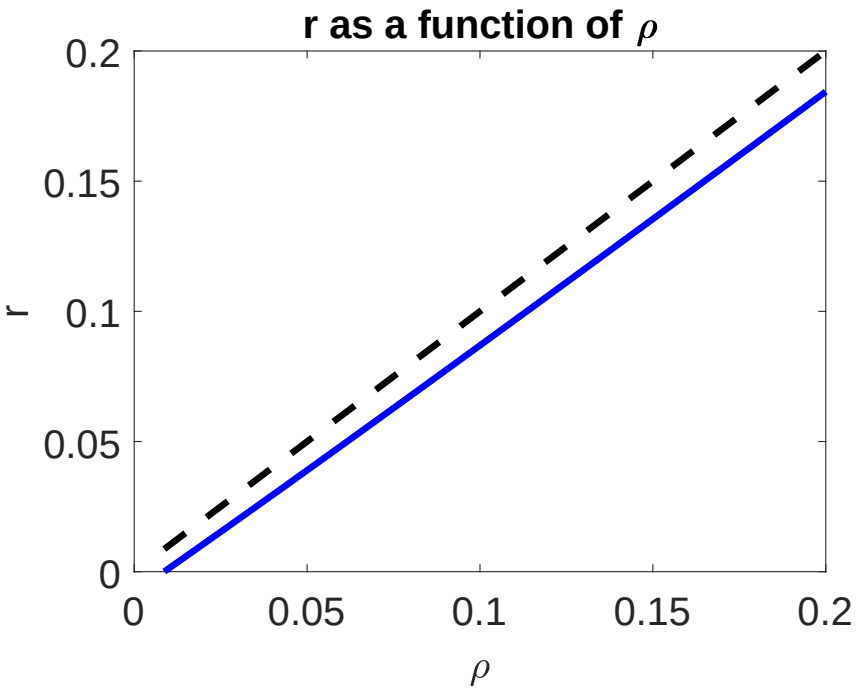


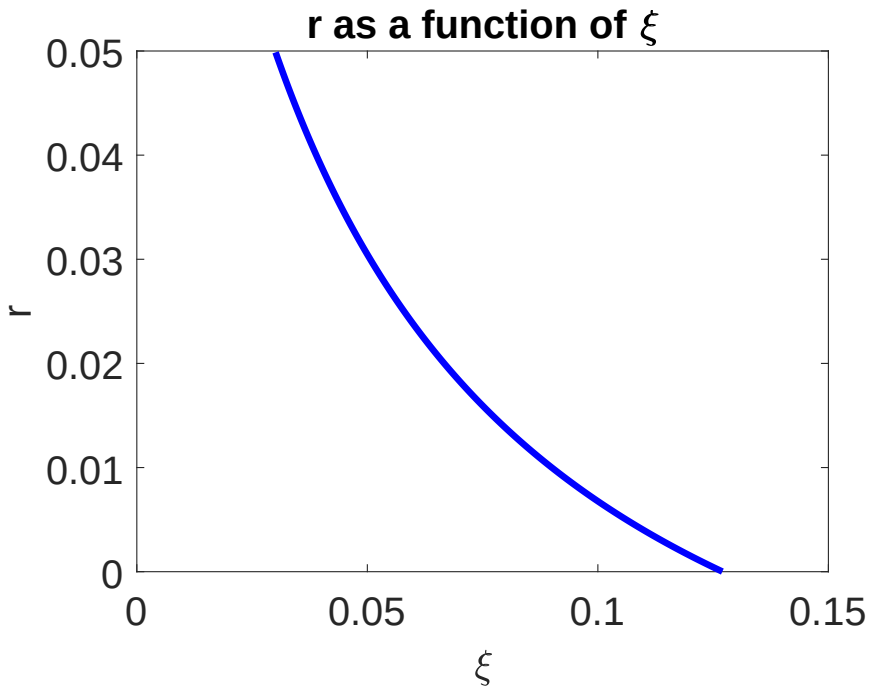
Stationary Consumption Distribution for three *r*'s



Results

Closed form solution for everything!





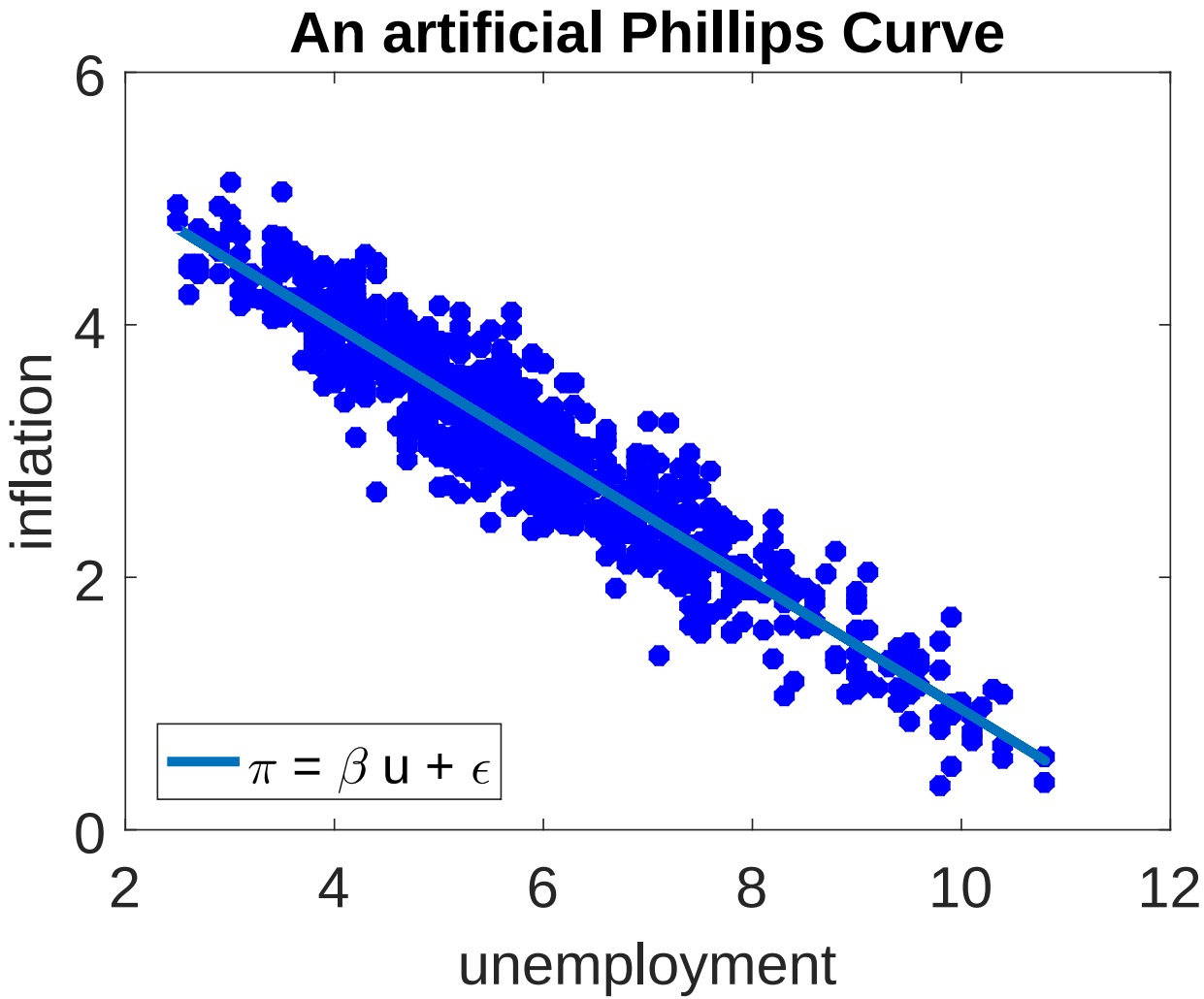
Recall: $\xi\, dt = P(\zeta \to 0)$

Financial frictions: bottom line

- Much progress has been made.
- But contracts are often not privately optimal.
- Perhaps they should be: chicken paper conundrum.
- Recent research shows they can be.

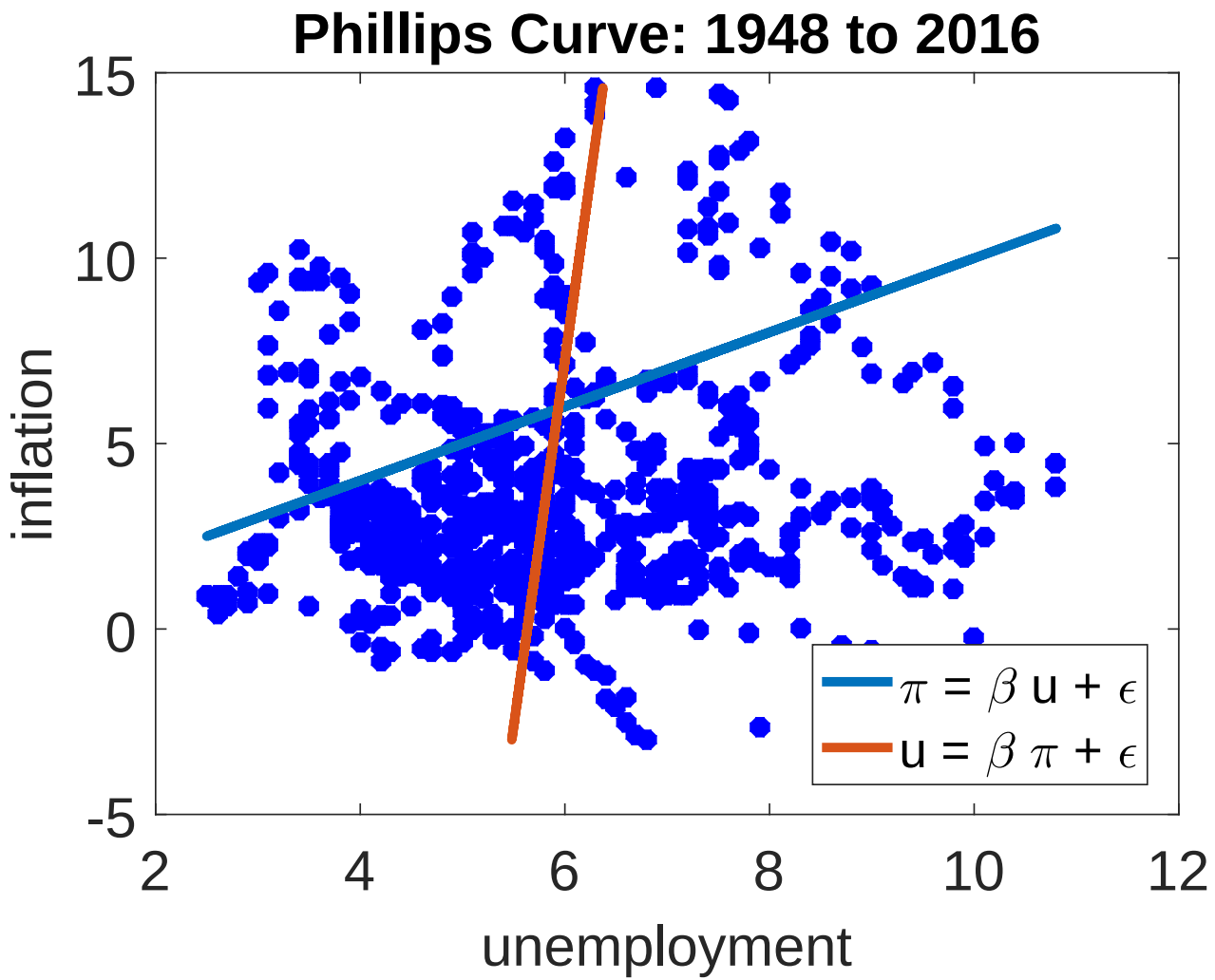
Outline

Classic Phillips Curve: textbook.

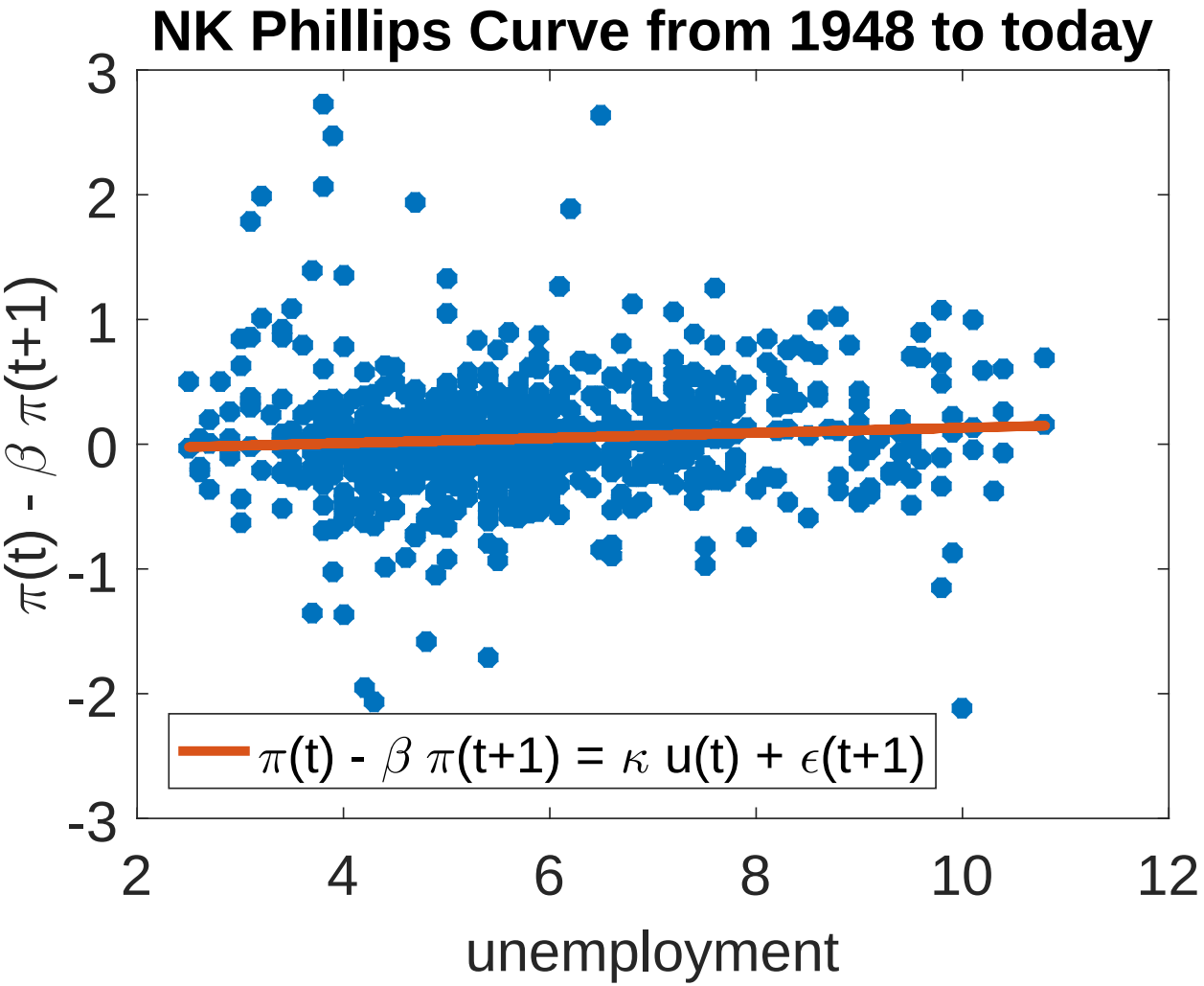


per generating $\pi_t = 6 - 0.5u_t + \epsilon,\ \epsilon \sim \mathcal{N}(0, 0.3^2)$

Classic Phillips Curve: data.



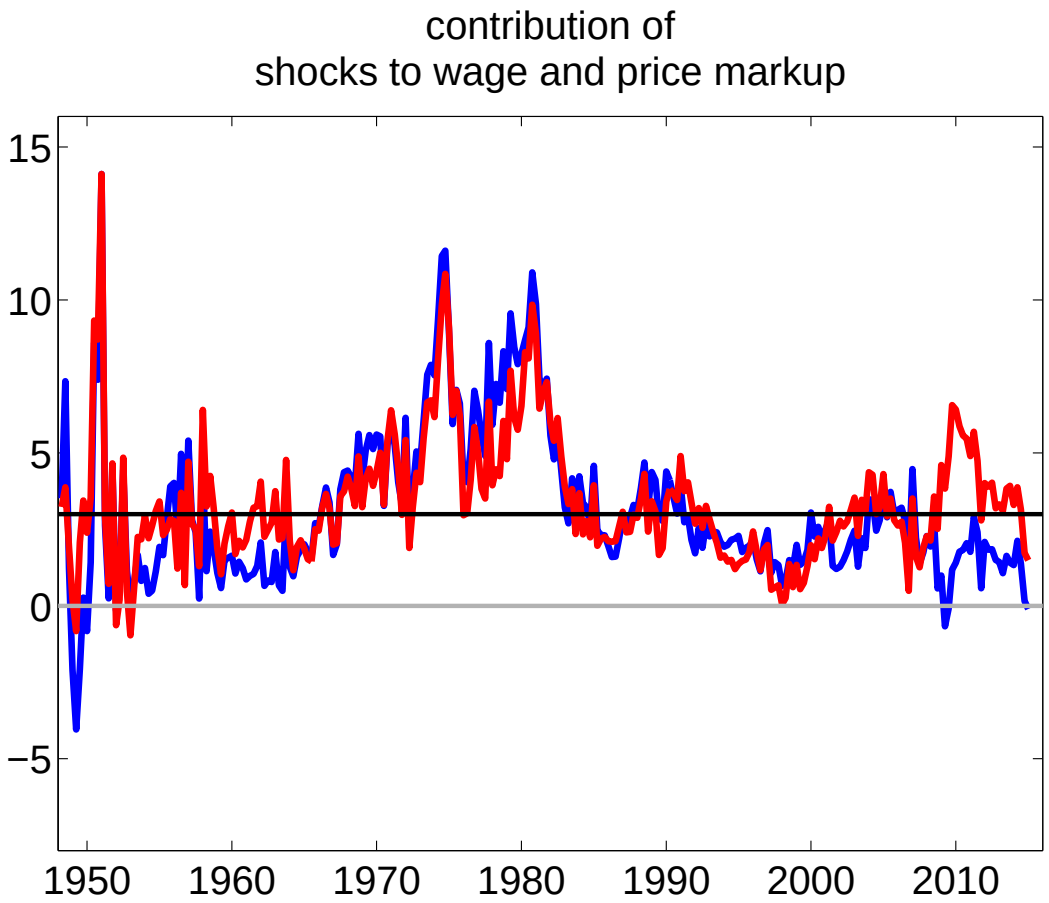
Phillips Curve: NK version.



NK: $\pi_t = \beta E_t[\pi_{t+1}] + \kappa x_t$. Rewrite: $\pi_t - \beta\pi_{t+1} = \kappa x_t + \epsilon_{t+1}$.
Use $x_t = -u_t$, $\beta = 0.99$.

Accounting for Inflation

Source: Fratto-Uhlig (2018). Approach: take pre-crisis Smets-Wouters (2007) model. Decompose inflation into the shocks driving it.



Variance decomp.	
Technology	3.90
Price Markup	**51.09**
Wage Markup	**27.04**
Preferences	7.65
Inv.Spec.Tech.	3.54
Gov't Exp	0.43
Monetary Policy	**6.33**

Inflation: bottom line

- Data: no Phillips-Curve tradeoff.
- QDSGE: don’t account for inflation with monetary policy shocks.
- The NK / Phillips-Curve-based NK QDSGE models may thus provide a poor guide for monetary policy.

Outline

The three equation NK model

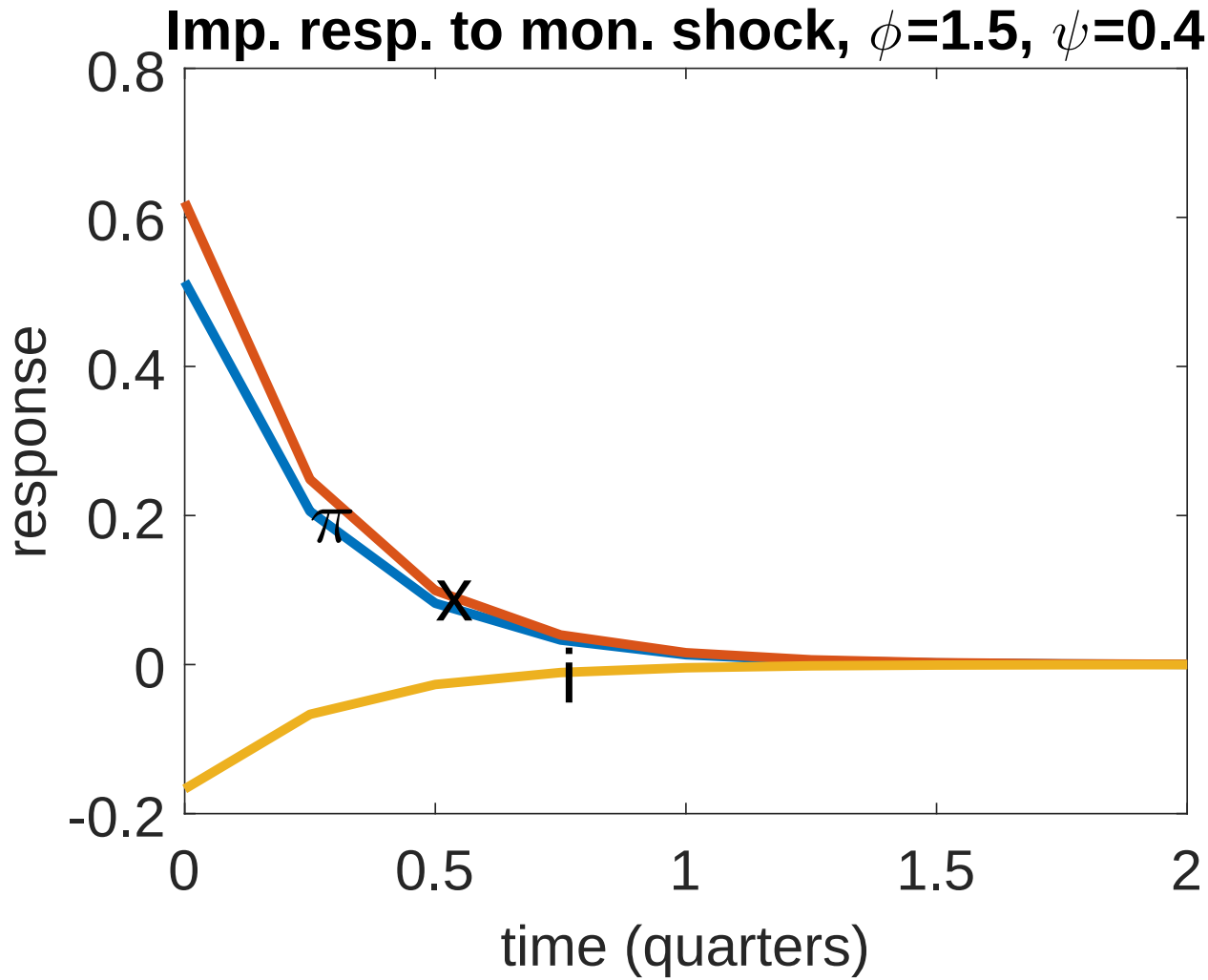
$$\begin{aligned}
\text{IS:} \quad x_t &= E_t[x_{t+1}] - \frac{1}{\sigma}\left(i_t - E_t[\pi_{t+1}] - r_t^n\right) \\
\text{Phillips:} \quad \pi_t &= \beta E_t[\pi_{t+1}] + \kappa x_t \\
\text{Taylor:} \quad i_t &= \rho + \phi\pi_t + \xi x_t + \nu_t \\
\text{Persistence:} \quad \nu_t &= \psi\nu_{t-1} + \epsilon_t
\end{aligned}$$

Parameters:

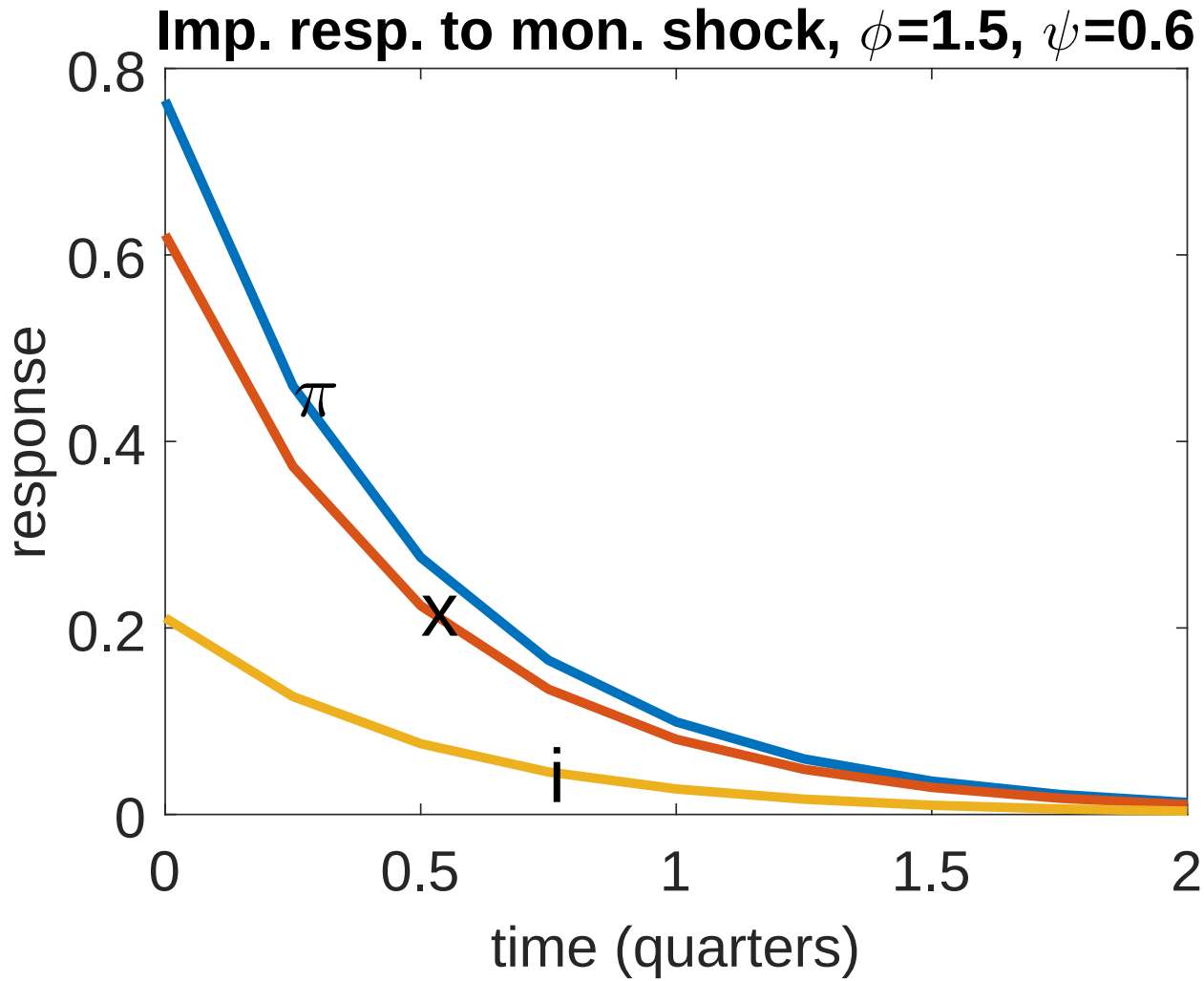
- $\beta = 0.99, \kappa = 0.5, \sigma = 1.$
- $\rho = 0$, $r_t^n \equiv 0$ (for impulse response).
- $\xi = 0.1$ (Note: $\xi = 0.5$ might be nice ... but gives even weirder results).
- $\phi = 1.5.$
- $\psi = 0.4$ or $\psi = 0.6.$

Let's check some impulse responses to $\epsilon_0 = -1.$

Impulse responses to $\epsilon_0 = -1$, if $\psi = 0.4$.



Impulse responses to $\epsilon_0 = -1$, if $\psi = 0.6$.



Neo-Fisherian features of New Keynesian models. Bottom line.

- Cochrane, Garin-Lester-Sims.
- Neo-Fisherian features are substantial, but get swept under the rug.
- A reliable guide for monetary policy? Perhaps not quite.

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Overall bottom line.

- Quantitative DSGE models were meant to rise to the Lucas challenge of constructing general equilibrium models with deep parameters. Now, workhorse models for monetary policy analysis.
- But:
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