

SWEDISH HOUSE
OF FINANCE



NOBEL SYMPOSIA



Nobel Symposium “Money and Banking”

<https://www.houseoffinance.se/nobel-symposium>

May 26-28, 2018
Clarion Hotel Sign, Stockholm



RIKSBANKENS
JUBILEUMSFOND

THE SWEDISH FOUNDATION FOR
HUMANITIES AND SOCIAL SCIENCES

Money and Banking: Some DSGE Challenges

Nobel Symposium on “Money and Banking”

Harald Uhlig¹

¹University of Chicago
Department of Economics
huhlig@uchicago.edu

Stockholm, May 27th, 2018

Outline

- 1 Challenges
- 2 Asset prices and Yield Spreads
- 3 Financial Frictions
- 4 Inflation
- 5 Neo-Fisherian features of New Keynesian models
- 6 Conclusions

Outline

- 1 Challenges
- 2 Asset prices and Yield Spreads
- 3 Financial Frictions
- 4 Inflation
- 5 Neo-Fisherian features of New Keynesian models
- 6 Conclusions

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

- 1 Challenges
- 2 Asset prices and Yield Spreads**
- 3 Financial Frictions
- 4 Inflation
- 5 Neo-Fisherian features of New Keynesian models
- 6 Conclusions

The skeleton in the closet

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

$$\log(c_{t+1}) = \phi s_t + \epsilon_{t+1}$$

$$\log(R_{t+1}) = \xi s_t + \nu_{t+1}$$

- 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:

$$\hat{V}_t = (1 - \beta) \hat{c}_t + \beta \hat{\mathcal{R}}_t$$

$$\hat{\mathcal{R}}_t = E_t [\hat{V}_{t+1}]$$

$$\hat{M}_{t+1} = \hat{c}_t - \hat{c}_{t+1} + (\eta - 1) (\hat{V}_{t+1} - \hat{\mathcal{R}}_t)$$

- Note:

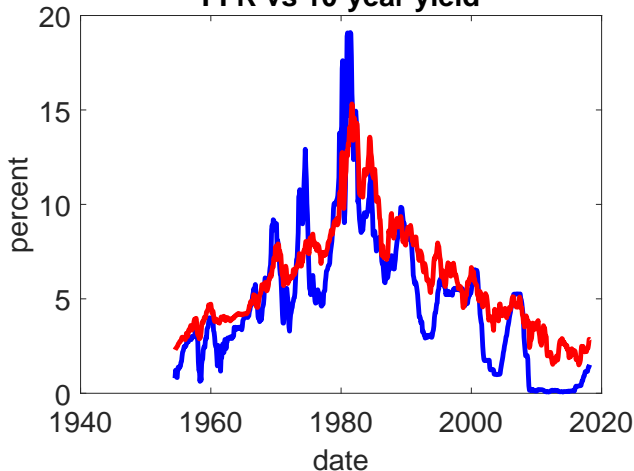
$$E_t[\hat{M}_{t+1}] = \hat{c}_t - E_t[\hat{c}_{t+1}]$$

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

FFR vs 10-year yield



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.

Outline

- 1 Challenges
- 2 Asset prices and Yield Spreads
- 3 Financial Frictions**
- 4 Inflation
- 5 Neo-Fisherian features of New Keynesian models
- 6 Conclusions

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 idiosyncratic 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” ...

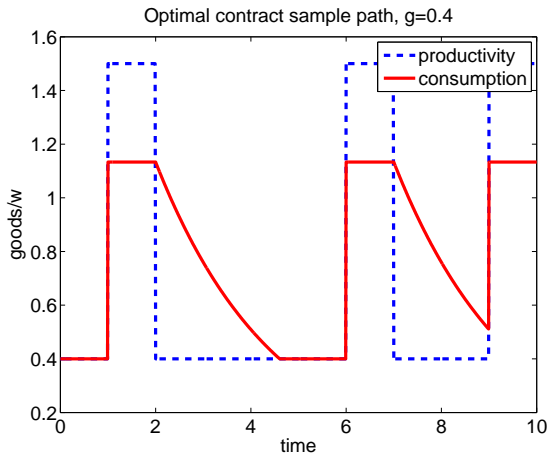
The Chicken Paper Conundrum

- 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).

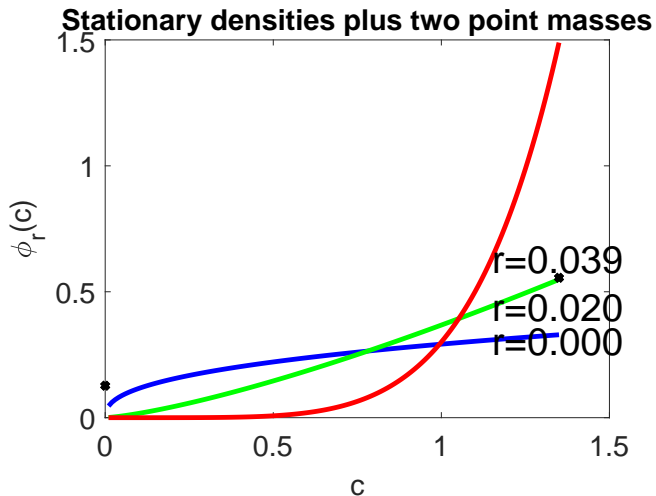
Example: Krüger-Uhlig (2018)

- 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: $\xi dt = P(\zeta \rightarrow 0)$, $\nu dt = P(0 \rightarrow \zeta)$.
 - ▶ 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 $\rho > r$.

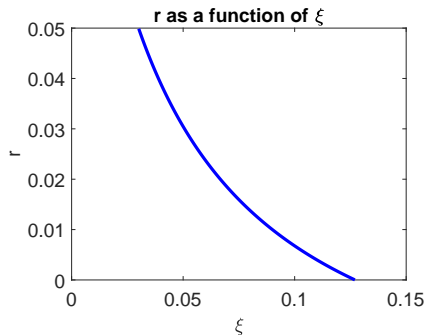
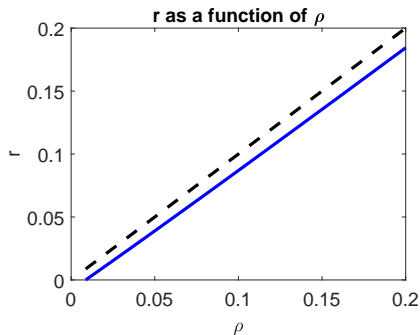


Stationary Consumption Distribution for three r 's



Results

Closed form solution for everything!



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

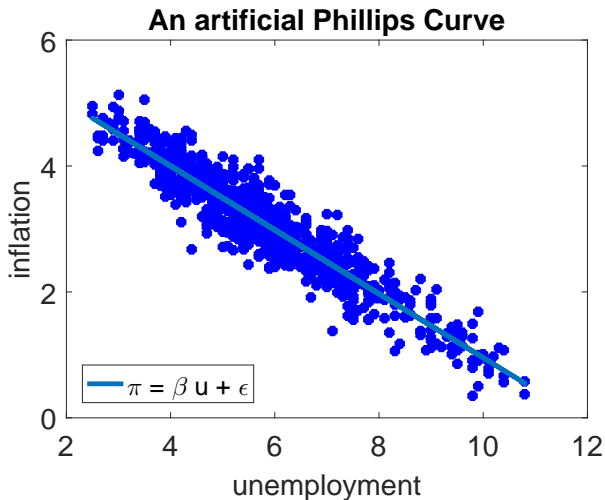
Financial frictions: bottom line

- 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

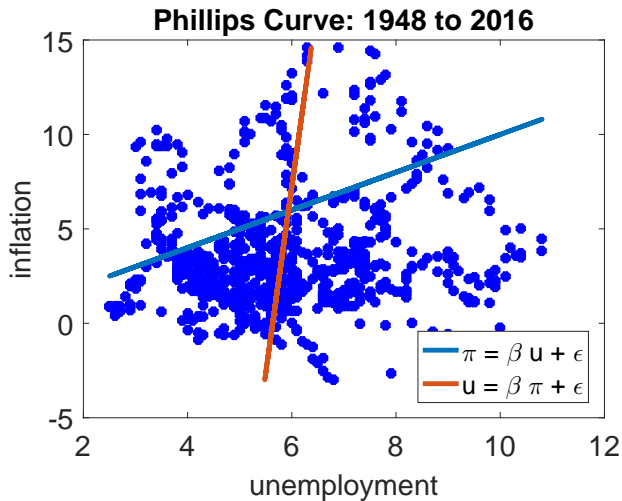
- 1 Challenges
- 2 Asset prices and Yield Spreads
- 3 Financial Frictions
- 4 Inflation**
- 5 Neo-Fisherian features of New Keynesian models
- 6 Conclusions

Classic Phillips Curve: textbook.

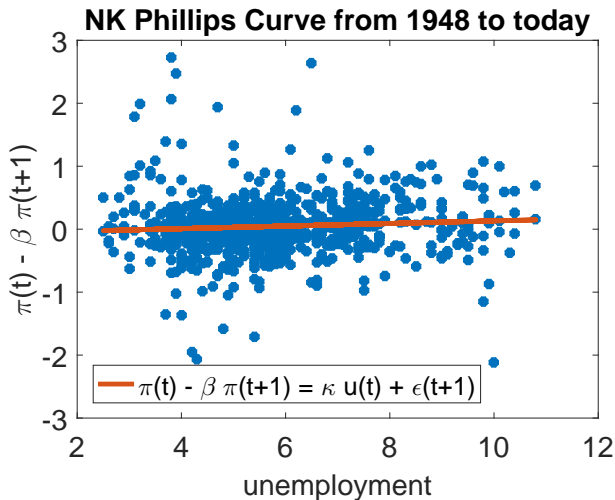


per generating $\pi_t = 6 - 0.5u_t + \epsilon$, $\epsilon \sim \mathcal{N}(0, 0.3^2)$

Classic Phillips Curve: data.



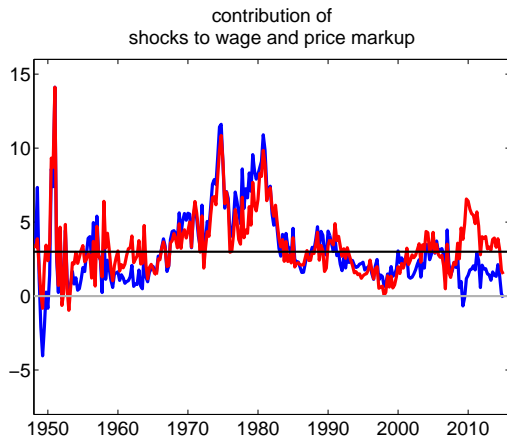
Phillips Curve: NK version.



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

- 1 Challenges
- 2 Asset prices and Yield Spreads
- 3 Financial Frictions
- 4 Inflation
- 5 Neo-Fisherian features of New Keynesian models**
- 6 Conclusions

The three equation NK model

$$\text{IS: } x_t = E_t[x_{t+1}] - \frac{1}{\sigma} (i_t - E_t[\pi_{t+1}] - r_t^n)$$

$$\text{Phillips: } \pi_t = \beta E_t[\pi_{t+1}] + \kappa x_t$$

$$\text{Taylor: } i_t = \rho + \phi \pi_t + \xi x_t + \nu_t$$

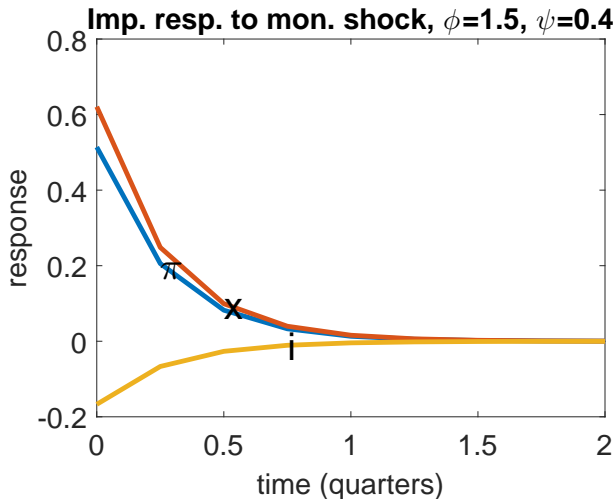
$$\text{Persistence: } \nu_t = \psi \nu_{t-1} + \epsilon_t$$

Parameters:

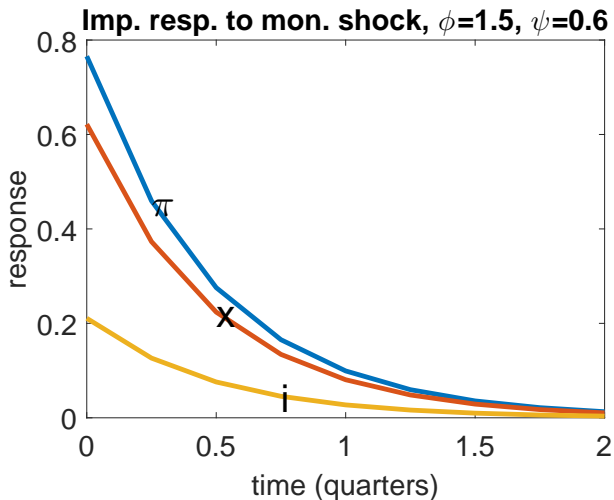
- $\beta = 0.99, \kappa = 0.5, \sigma = 1.$
- $\rho = 0, r_t^n \equiv 0$ (for impulse response).
- $\xi = 0.1$ (Note: $\xi = 0.5$ might be nice ... but gives even weirder results).
- $\phi = 1.5.$
- $\psi = 0.4$ or $\psi = 0.6.$

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.

Outline

- 1 Challenges
- 2 Asset prices and Yield Spreads
- 3 Financial Frictions
- 4 Inflation
- 5 Neo-Fisherian features of New Keynesian models
- 6 Conclusions**

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:
 - ▶ **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.