Unemployment (Fears), Precautionary Savings, and Aggregate Demand

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Overview

- Heterogeneous agents:
  - influence of precautionary savings on employment
  - role of nominal wage rigidity
  - correctly discounting profits

Overview

1. Model
   - interaction between goods and labor market
   - precautionary savings *could* end up in productive investment
2. Model properties
   - fear of unemployment
     - *dampens* downturn when nominal wages are *not* sticky
     - *exacerbates* downturn when nominal wages are sticky

Model: Key ingredients

1. Search frictions in labor market
2. Heterogeneous agents and incomplete markets
3. (Some) nominal wage stickiness

Individual agent

unemployed and employed agents

- unemployed search for work
- employed get nominal wage W_t
- exogenous job loss probability, ρ_x
- agents can invest in
  - money, $M_{i,t}$
  - firm ownership (equity), $q_{i,t}$

Individual agent

$$\max \sum_t \beta^t \left[u\left(c_{i,t}\right) + v\left(\frac{M_{i,t}}{P_t}\right) \right]$$

Budget constraint:

$$P_t c_{i,t} + J_t q_{i,t} + M_{i,t}$$
$$=$$
$$e_{i,t} W_t + \left(1 - e_{i,t}\right) U_t + q_{i,t-1} \left(D_t + \left(1 - \rho_x\right) J_t\right) + M_{i,t-1}$$

$$q_{i,t} \geq 0$$

First-order conditions

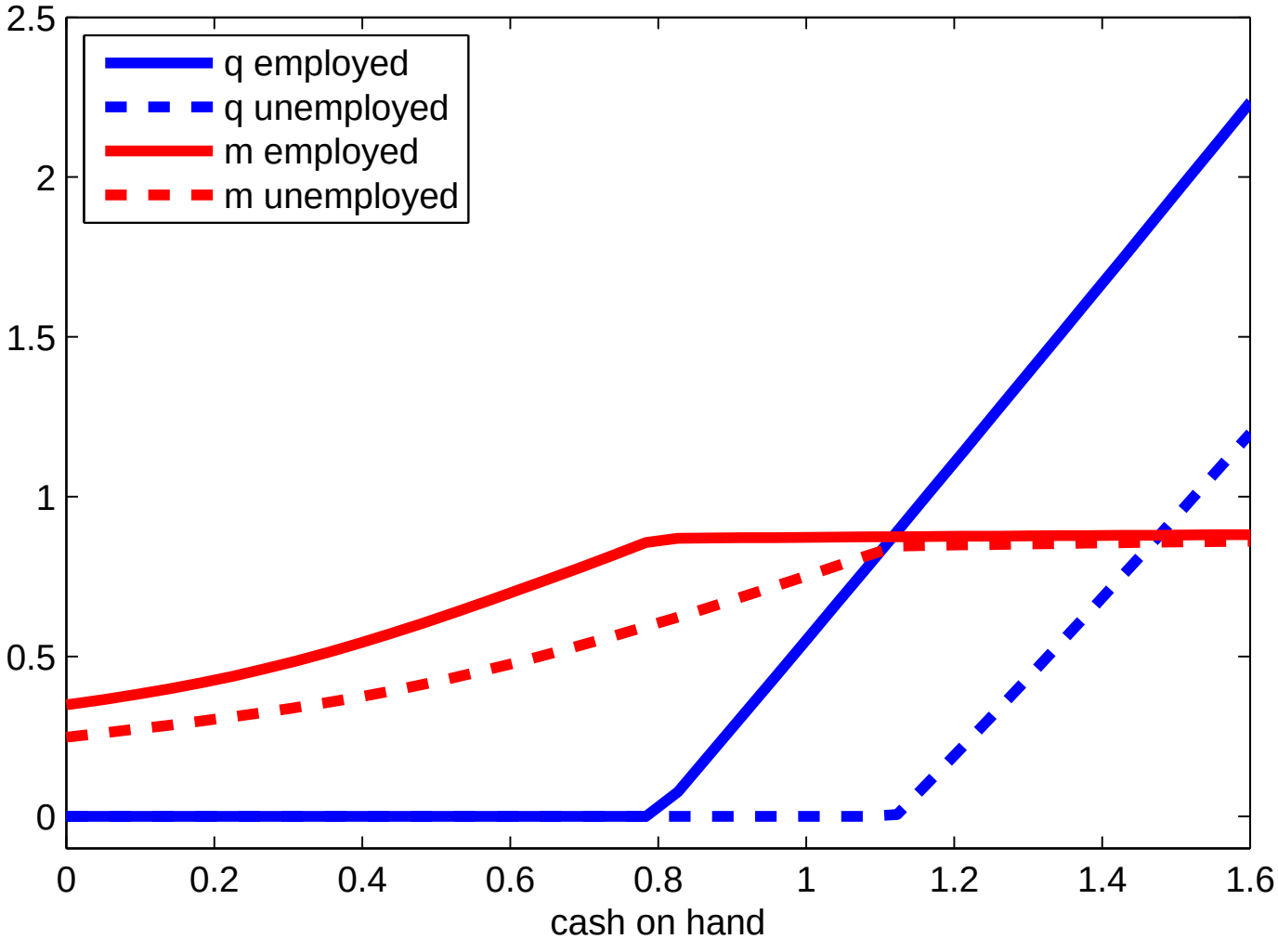
Money:

$$c_{i,t}^{-\nu} = \beta \mathsf{E}_t \left[\frac{P_t}{P_{t+1}} c_{i,t+1}^{-\nu} \right] + \zeta_0 \left(\frac{M_{i,t}}{P_t} \right)^{-\zeta_1}$$

Equity, if $q_{i,t} > 0$:

$$\frac{J_t}{P_t} = \beta \mathsf{E}_t \left[\left(\frac{c_{i,t+1}}{c_{i,t}} \right)^{-\nu} \left(\frac{D_{t+1}}{P_{t+1}} + (1 - \rho_x) \frac{J_{t+1}}{P_{t+1}} \right) \right]$$

Policy functions



Job/Firm creation

Standard free-entry condition:

$$
\begin{aligned}
P_t \psi &= \pi_{f,t} J_t \\
\pi_{f,t} &= \phi_o \left(\frac{v_t}{1 - n_{t-1}} \right)^{\phi_1 - 1} \\
n_t &= (1 - \rho_x)\, n_{t-1} + \phi_o v_t^{\phi_1} \left(1 - n_{t-1}\right)^{1 - \phi_1}
\end{aligned}
$$

Existing firm

$$D_t = P_t z_t - W_t$$

Wage setting

$$W_t = \omega_0 z_t^{\omega_1} P_t^{\omega_2}$$

- $\omega_1 < 1$: sticky real wages
- $\omega_2 < 1$: sticky nominal wages

Equilibrium

- demand for money = (constant) money supply
- demand for firm ownership = number of firms

Algorithm

Correctly dealing with firm value:

$$\frac{J_t}{P_t} \stackrel{?}{=} \mathsf{E}_t \left[MRS_{i,t+1} \left(\frac{D_{t+1}}{P_{t+1}} + (1-\rho_x) \frac{J_{t+1}}{P_{t+1}} \right) \right]$$

Which $MRS_{i,t+1}$ to use?

Firm value

$$\frac{J_t}{P_t} \stackrel{?}{=} \mathsf{E}_t \left[MRS_{i,t+1} \left(\frac{D_{t+1}}{P_{t+1}} + (1-\rho_x) \frac{J_{t+1}}{P_{t+1}} \right) \right]$$

Literature:

- representative agent: $MRS_{t+1} = \beta \left(c_{t+1}/c_t \right)^{-\nu}$
- heterogeneous agents:
  - Krusell, Mukoyama, Sahin (2010): two assets and two outcomes for aggregate state $\Longrightarrow$ use prices of the two Arrow-Debreu securities
  - dinky "solution": assume risk neutral firm manager, which is inconsistent with risk averse firm owners

This paper: Get $J(\cdot)$ by imposing equilibrium

Solving for firm value

$$J_t = J(s_t)$$

- solve for $J(s_t)$ by imposing equilibrium

$$\int_i q_{i,t} di = n_t$$

- LHS: demand for firm ownership from individual problem
- RHS: supply of firm ownership comes from free-entry condition

State variables

- Individual state variables
  - cash on hand: $q_{t-1}\left(D_t + (1-\rho_x)\, J_t\right) + M_{i,t-1}$
  - employment status
- Aggregate state variables
  - aggregate productivity
  - number of firms $=$ equity shares

Precautionary savings

How to get precautionary savings in a model?

- typically done through $\Delta\beta$
- this paper through Δunemployment

Typical precautionary savings story

Households want to save more

- $\Longrightarrow$ demand for consumption $\downarrow$ & prices do not adjust
- $\Longrightarrow$ demand for labor $\downarrow$, etc.

Where do savings end up?

- typically not allowed to end up in investment because
  - there is no physical investment
  - or incorrect discounting of firm profits

Precautionary savings in this paper

We do have something like the standard channel:

- unemployment $\uparrow \Longrightarrow$ demand for money $\uparrow$
- $\Longrightarrow P_t \downarrow \Longrightarrow$ real profits $\downarrow$ (because of sticky nominal wages)
- $\Longrightarrow$ firm/job creation $\downarrow$

    - but in this paper !!!

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  - precautionary savings could end up in productive investment since $MRS_{i,t} \uparrow$ when precautionary savings $\uparrow$

Precautionary savings and productive investment

- This paper: investment in firm/job creation *could* $\uparrow$ when precautionary savings $\uparrow$

Reasons why it *could* $\downarrow$:

- agents less willing to hold firm equity when profits $\downarrow$
- agents less willing to hold risky assets when unemployment $\uparrow$

Model properties

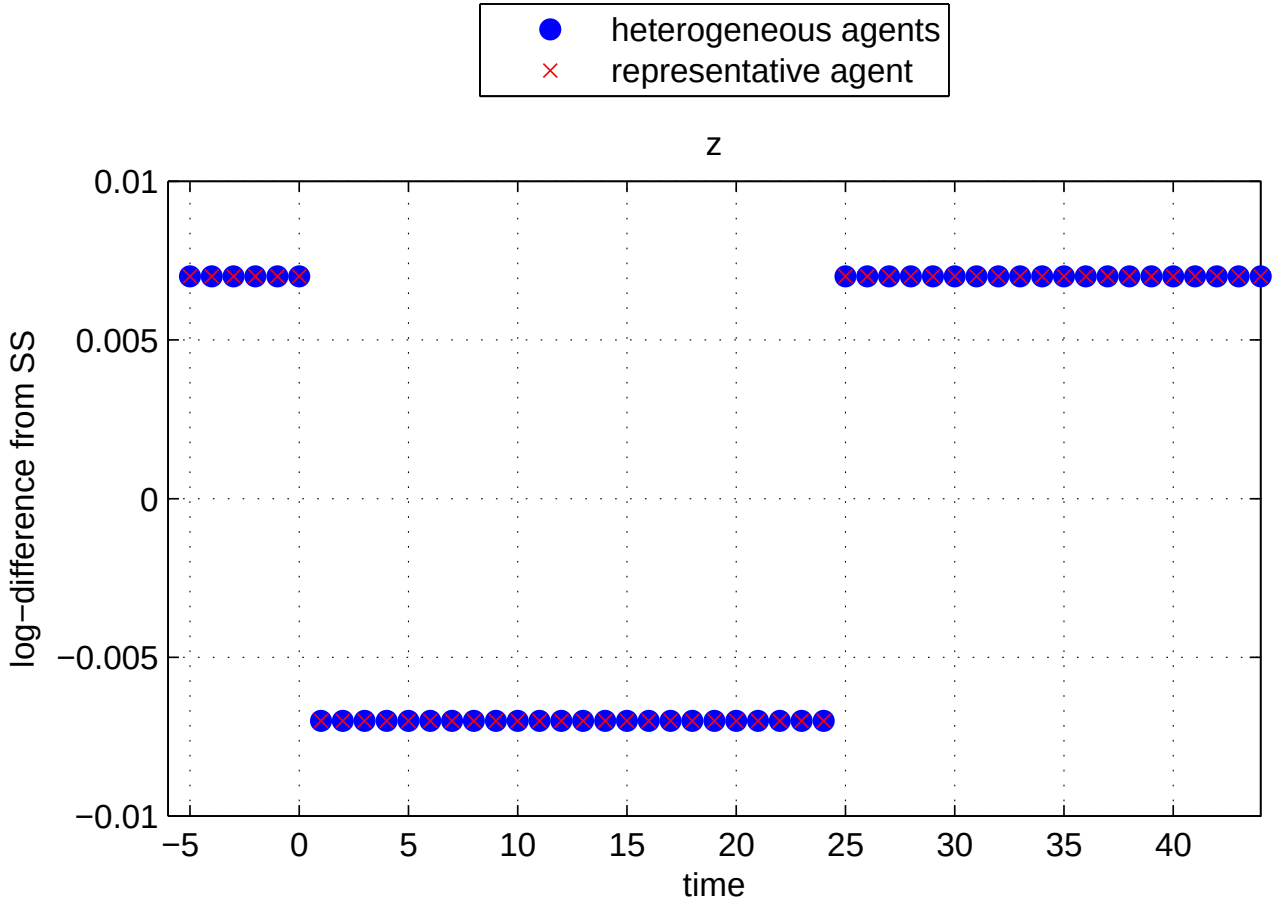
1. Model 1: no nominal wage stickiness
   $W_t = \omega_0 z_t^{0.3} P_t$
   precautionary savings **dampen** downturn

2. Model 2: with nominal wage stickiness
   $W_t = \omega_0 z_t^{0.3} P_t^{0.85}$
   precautionary savings **worsen** downturn

No nominal wage stickiness

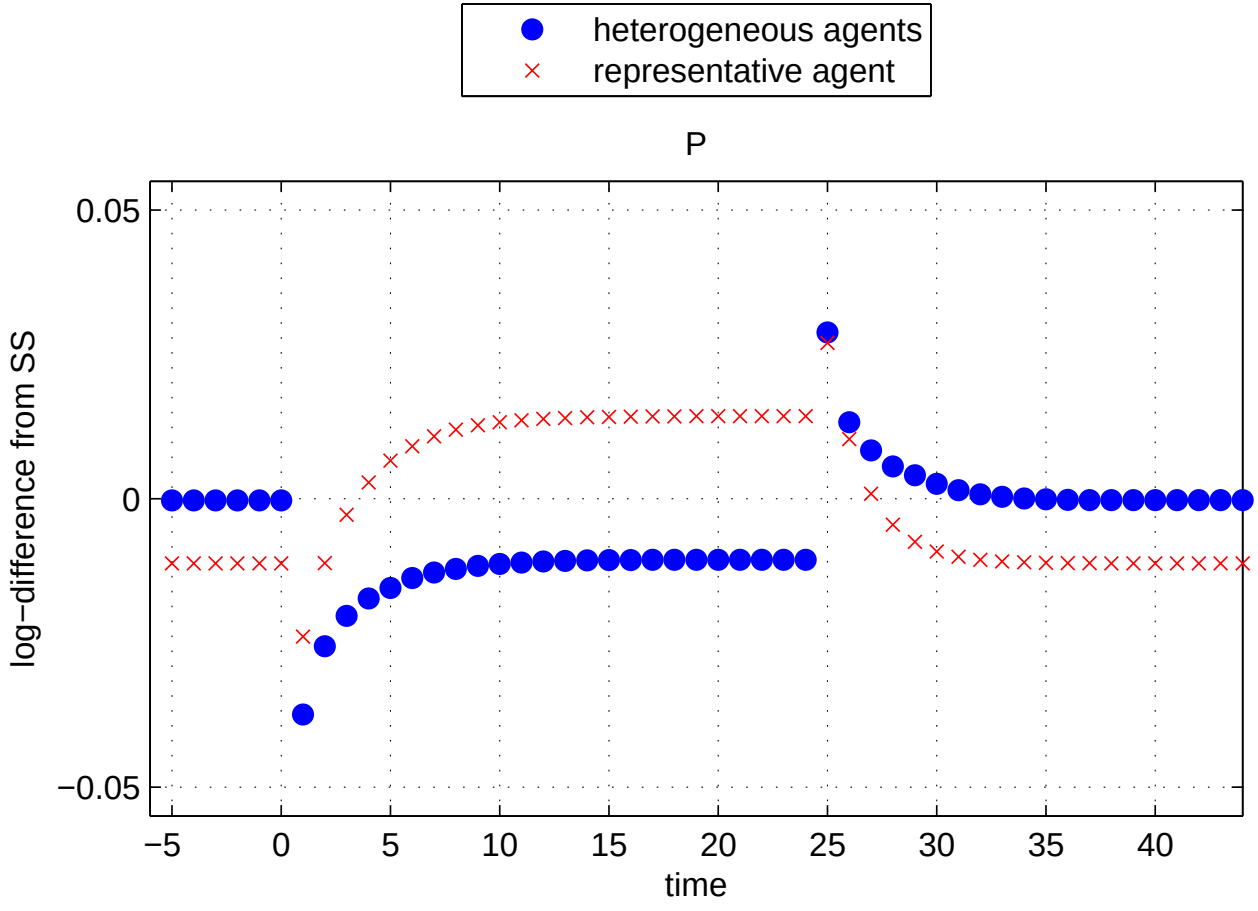
- productivity $\downarrow$
- $\Longrightarrow$ profits $\downarrow \Longrightarrow$ firm value $\downarrow \Longrightarrow$ unemployment $\uparrow$
- $\Longrightarrow$ precautionary savings $\uparrow$
  - $\Longrightarrow$ demand for firm ownership may $\uparrow \Longrightarrow$ unemployment $\downarrow$
  - $\Longrightarrow$ demand for money $\uparrow \Longrightarrow P \downarrow \not\Rightarrow \Delta$ profits since nominal wages adjust

No nominal wage stickiness



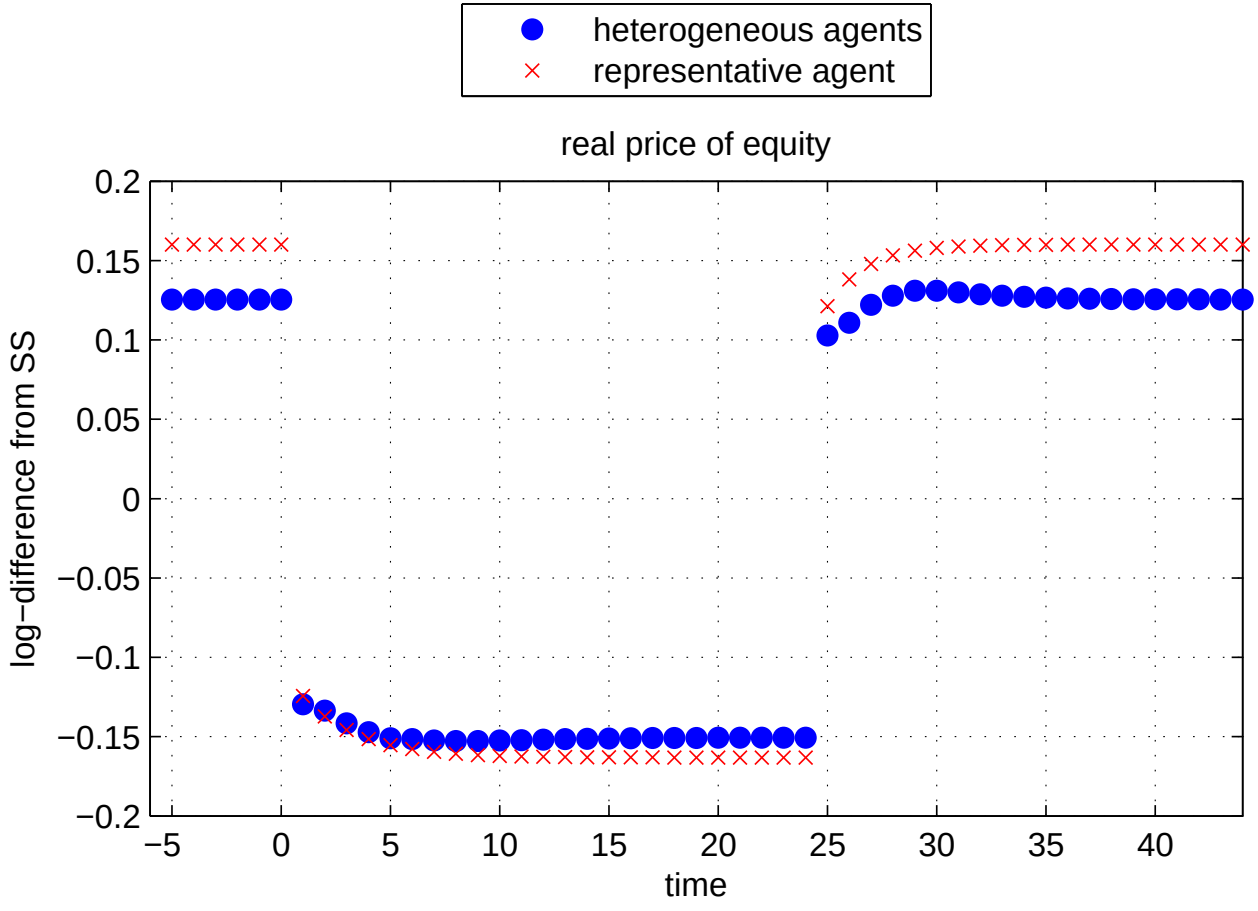
Productivity z

No nominal wage stickiness



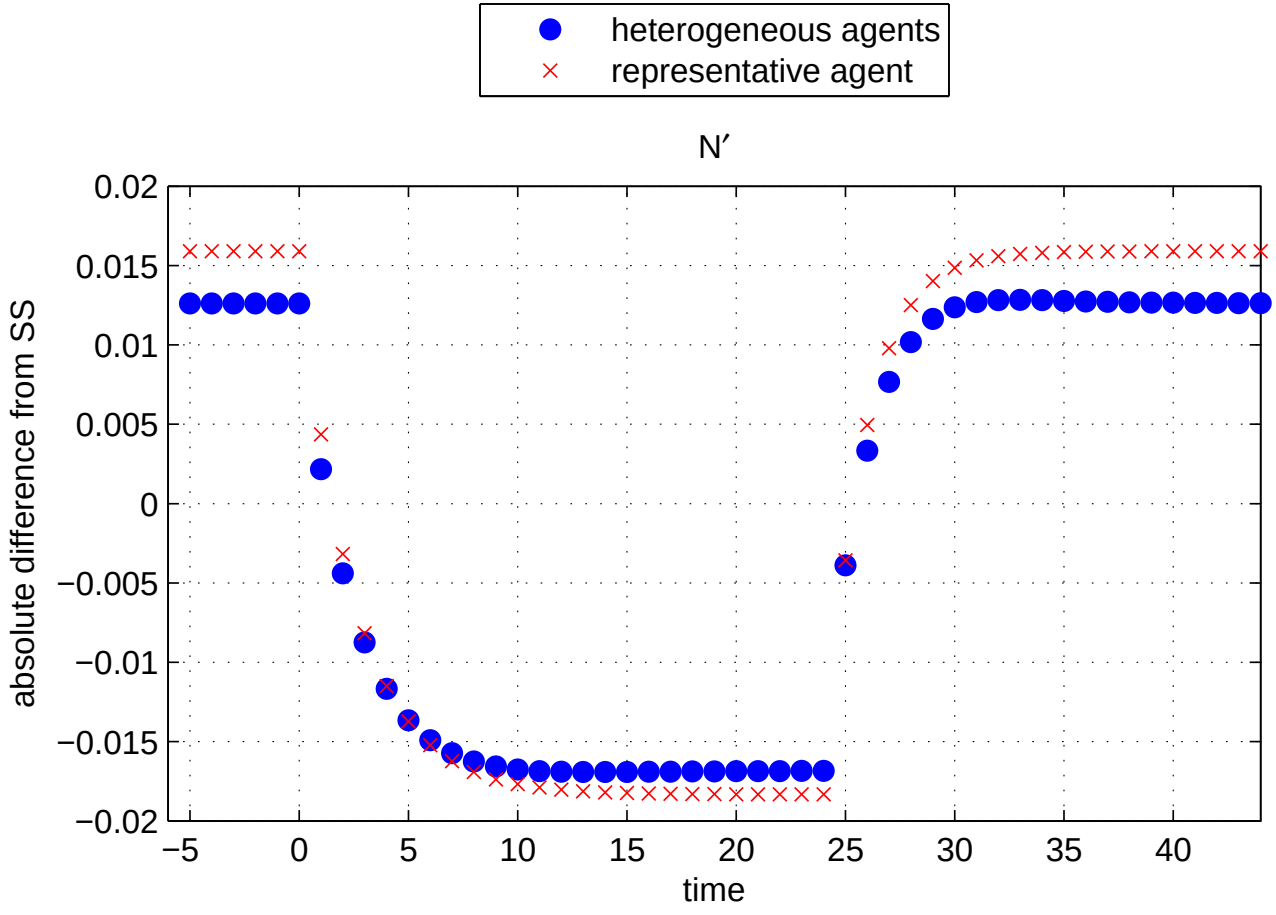
Precautionary demand for M makes price procyclical!

No nominal wage stickiness



Precautionary savings has small upward effect on firm value for low z

No nominal wage stickiness

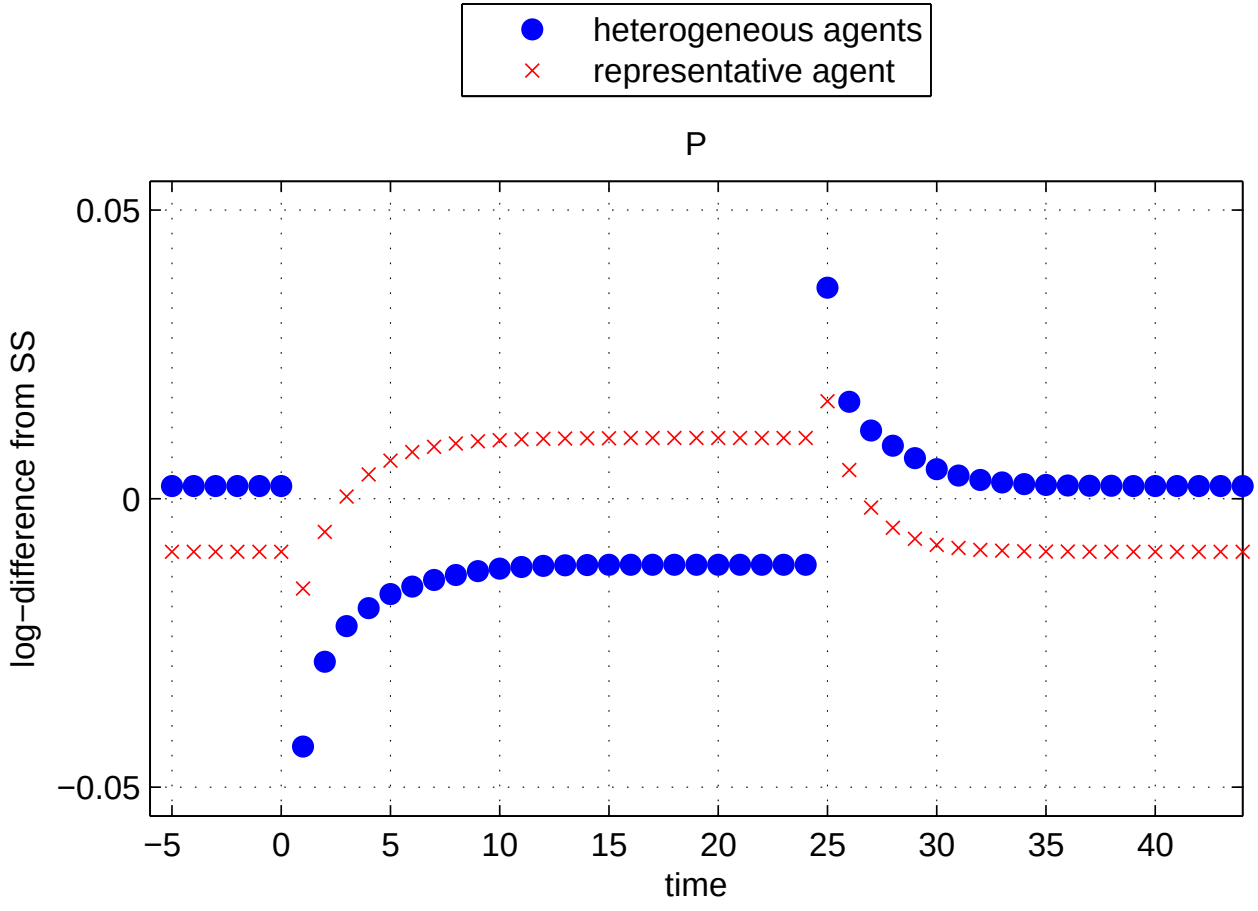


Precautionary savings has small upward effect on employment for low z

With nominal wage stickiness

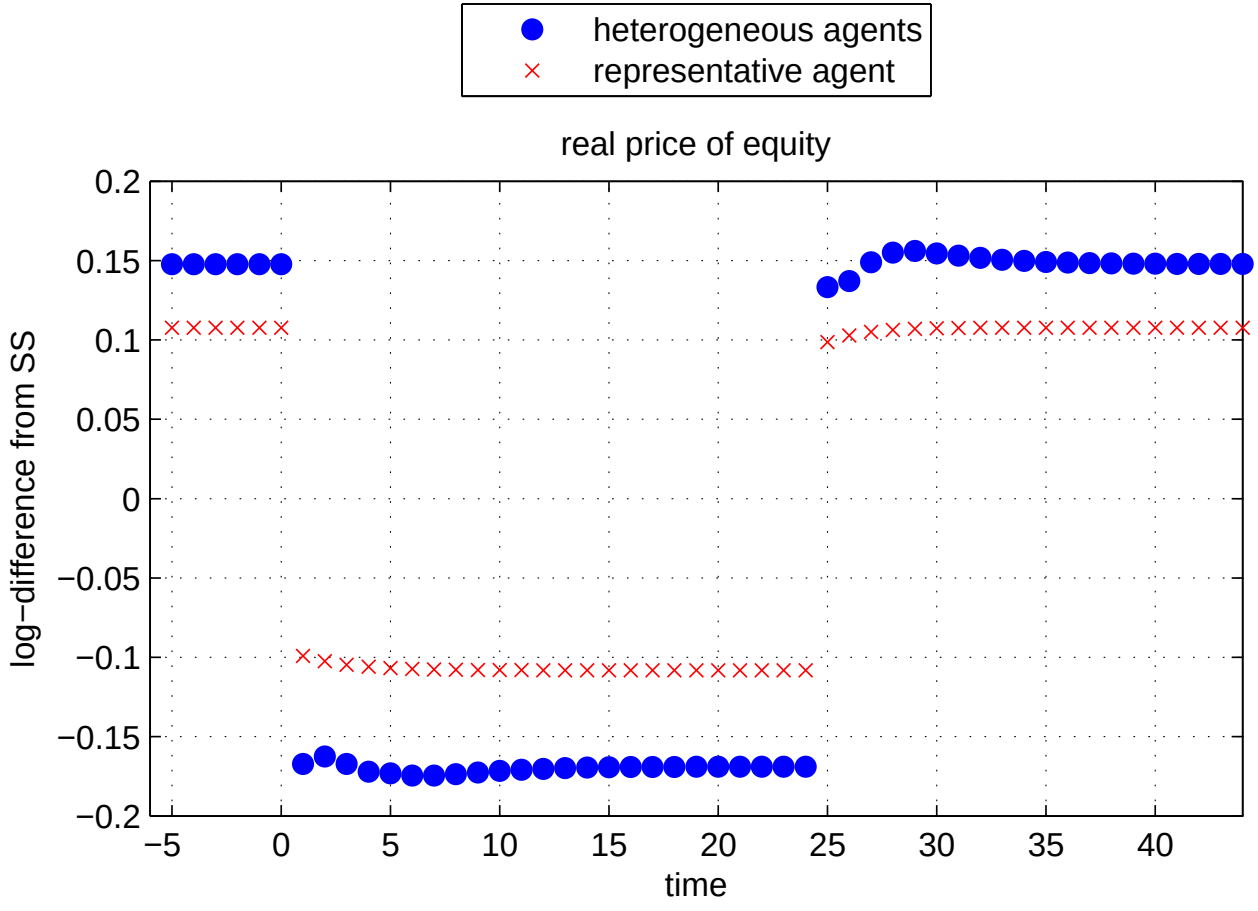
- productivity $\downarrow$
- $\Longrightarrow$ profits $\downarrow \Longrightarrow$ firm value $\downarrow \Longrightarrow$ unemployment $\uparrow$
- $\Longrightarrow$ precautionary savings $\uparrow$
  - $\Longrightarrow$ demand for firm ownership may $\uparrow \Longrightarrow$ unemployment $\downarrow$
  - $\Longrightarrow$ demand for money $\uparrow \Longrightarrow P \downarrow \Longrightarrow$ profits $\downarrow \Longrightarrow$ unemployment $\uparrow \Longrightarrow$ downward spiral

With nominal wage stickiness



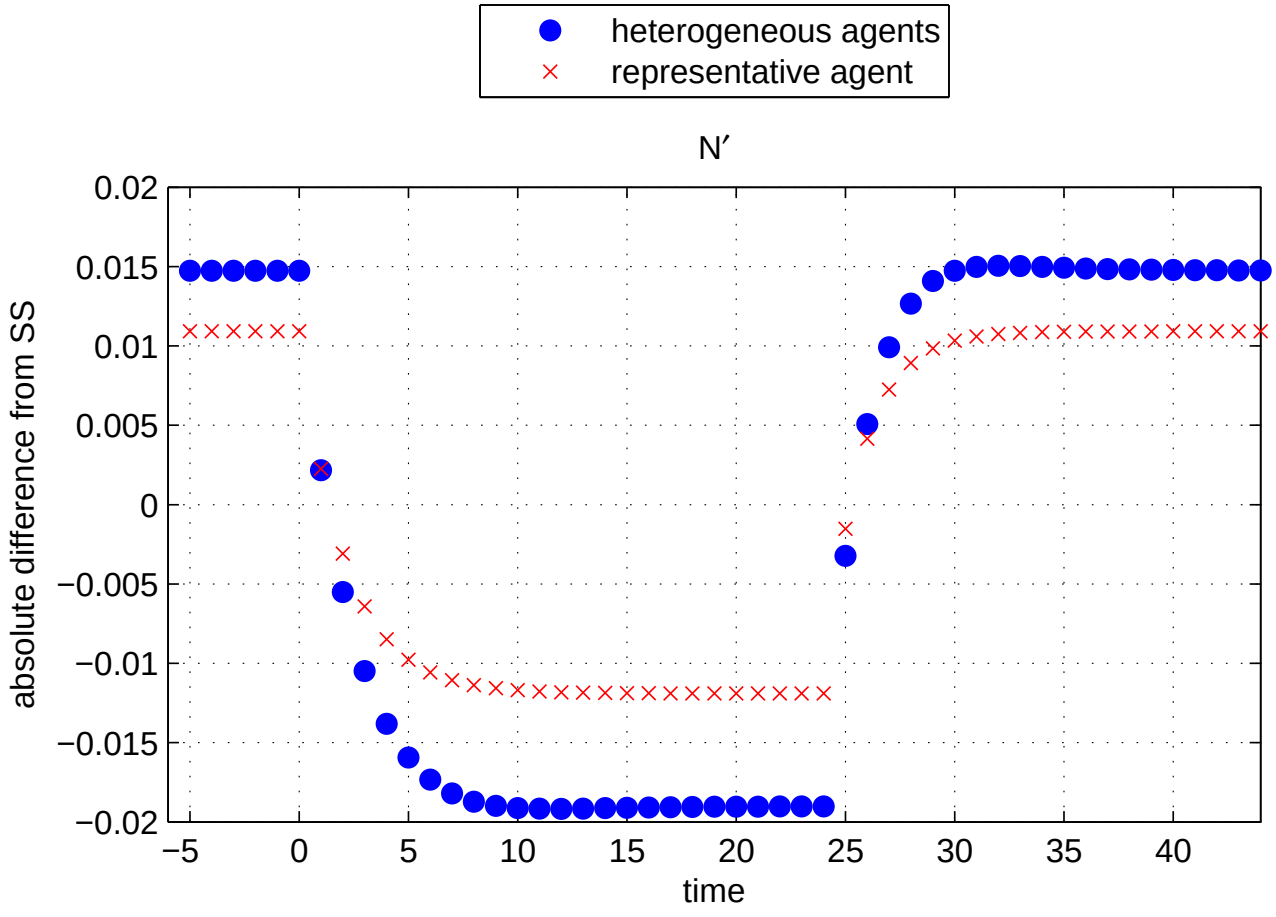
Precautionary demand for M makes price procyclical!

With nominal wage stickiness



Firm value strongly reduced in a downturn

With nominal wage stickiness



Employment strongly reduced in a downturn

Role of nominal wage stickiness

Change from boom to recession for
representative agent (red) vs heterogeneous agents (blue)

