

# Unemployment (Fears), Precautionary Savings, and Aggregate Demand

Wouter J. Den Haan (LSE/CEPR/CFM)

Pontus Rendahl (University of Cambridge/CEPR/CFM)

Markus Riegler (LSE/CFM)

November 4, 2015

# What we do

Show that the interaction between

- 1 One friction in **financial markets**: **incomplete risk sharing**
- 2 Two frictions in **labor markets**:
  - **sticky nominal wages**:  $dW/dP < 1$
  - **matching**

can

- give rise to "aggregate demand" like propagation from supply shocks
- lead to novel policy implication regarding unemployment insurance (UI)

# Interaction of two frictions key

- Complete risk sharing  $\implies$   
Sticky nominal wages **dampen** effect shocks
- Flexible nominal wages  $\implies$   
Incomplete risk sharing **dampens** effect shocks
- Both shocks **magnify** effect shocks

# Key components behind these results

- Aggregate risk
  - UI policy implications different without aggregate risk
- Asset price volatility
- Portfolio rebalancing towards liquid/unproductive asset during recession
- Nonlinearities induced by standard matching framework

# Four cases

- ① Complete markets and flexible wages
- ② Complete markets and sticky wages
- ③ Incomplete markets and flexible wages
- ④ **Benchmark:** Incomplete markets and sticky wages

## Case 1: flexible wages & complete markets

usual matching stuff:

- productivity  $\downarrow \implies$
- expected future productivity  $\downarrow \implies$
- job creation  $\downarrow \implies$
- employment rate  $\downarrow \implies$
- unemployment rate  $\uparrow \implies$
- expected duration unemployment  $\uparrow$

## Case 2: Sticky nominal wages & complete markets

- productivity  $\downarrow \implies$
- **Upward** pressure on prices  $\implies$ 
  - downward pressure on *real* wages  $\implies$
  - nominal wage rigidity **dampens** shocks!

## Case 3: Flexible nominal wages & incomplete markets

- productivity  $\downarrow \implies$
- investment in job creation  $\downarrow \implies$
- unemployment  $\uparrow \implies$
- idiosyncratic risk  $\uparrow \implies$
- precautionary savings  $\uparrow \implies$
- reduction in job creation is smaller  $\implies$
- incomplete markets **dampens** shocks



## Case 4: Sticky nominal wages & incomplete markets

- Incomplete markets: Precautionary savings  $\uparrow$  when unemp  $\uparrow \implies$
- precautionary demand for money  $\uparrow \implies$
- **downward** pressure on  $P \implies W/P \uparrow$  (sticky  $W$ )  $\implies$
- job creation investment  $\downarrow$  **by more not by less!**  $\implies$
- unemployment rate  $\uparrow \implies$
- precautionary savings  $\uparrow \implies$  etc.
- $\implies$  **deflationary spiral**

Risk for unemployed  $\implies$  procyclical  $W/P \implies$  volatile asset prices

# Main results

- ① Incomplete markets together with sticky wages amplify shocks, but on their own repress shocks
- ② Increase in unemployment insurance from 50% to 55%  $\implies$  **everybody** better off
  - not true in economy without aggregate risk

# Model: Key ingredients

- ➊ Heterogeneous households and incomplete markets
- ➋ Nominal wages do not respond 1-for-1 with  $P$
- ➌ Search frictions in the labor market
- ➍ # jobs = # firms = # shares

# Existing firms

- One-worker firms
- Profits are given by

$$D_t = P_t \exp(z_t) - W_t$$
$$W_t = \omega_0 \left(\frac{z_t}{\bar{z}}\right)^{\omega_z} \bar{z} \left(\frac{P_t}{\bar{P}}\right)^{\omega_p} \bar{P}$$

- Key parameter is  $\omega_p \leq 1$
- Active firms do not make decisions

# Individual households

- one-worker households
- employed workers earn nominal wage  $(1 - \tau_t) W_t$
- unemployed earn  $\mu (1 - \tau_t) W_t$  & search for jobs
- idiosyncratic risk
  - exogenous job loss probability,  $\delta$
  - lower chance of getting a job in a recession
- agents can save/invest in
  - unproductive asset: money,  $M_{i,t}$
  - productive asset: equity,  $q_{i,t} \geq 0$  (i.e., firm ownership/jobs)

## Individual households

$$\max \mathbb{E}_t \left[ \sum_{j=0}^{\infty} \beta^j \left( \left( \frac{c_{i,t+j}^{1-\gamma} - 1}{1-\gamma} \right) + \chi \frac{\left( \frac{M_{i,t+1+j}}{P_{t+j}} \right)^{1-\zeta} - 1}{1-\zeta} \right) \right]$$

with respect to

$$\begin{aligned} & P_t c_{i,t} + J_t (q_{i,t+1} - (1 - \delta) q_{i,t}) + M_{i,t+1} \\ & = \\ & (1 - \tau_t) W_t e_{i,t} + \mu (1 - \tau_t) W_t (1 - e_{i,t}) + D_t q_{i,t} + M_{i,t} \\ & \text{and} \\ & q_{i,t+1} \geq 0 \end{aligned}$$

# First-order conditions

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

$$c_{i,t}^{-\gamma} = \beta \mathbb{E}_t \left[ \frac{P_t}{P_{t+1}} c_{i,t+1}^{-\gamma} \right] + \chi \left( \frac{M_{i,t}}{P_t} \right)^{-\zeta}$$

- Marked departure from literature: Individual MRS is used in **both** Euler equations
- Inequality constraints ignored here

# Equity market equilibrium

$$\begin{aligned}
 \underbrace{h_t}_{\text{Equity creation}} &+ \int_{i \in \mathcal{A}_-} \underbrace{\left( (1 - \delta) q_i - q(e_i, q_i, M_i; s_t) \right)}_{\text{Equity sold}} dF_t(e_i, q_i, M_i) \\
 &= \int_{i \in \mathcal{A}_+} \underbrace{\left( q(e_i, q_i, M_i; s_t) - (1 - \delta) q_i \right)}_{\text{Equity bought}} dF_t(e_i, q_i, M_i),
 \end{aligned}$$

with

$$\mathcal{A}_- = \{i : q(e_i, q_i, M_i; s_t) - (1 - \delta)q_i \leq 0\},$$

$$\mathcal{A}_+ = \{i : q(e_i, q_i, M_i; s_t) - (1 - \delta)q_i \geq 0\},$$

*"go to equity supply derivation"*



# Employment

$$\begin{aligned}q_t &= \int_{i \in \mathcal{A}_+} q(e_i, q_i, M_i; s_t) dF_t(e_i, q_i, M_i) + \int_{i \in \mathcal{A}_-} q(e_i, q_i, M_i; s_t) dF_t(e_i, q_i, M_i) \\ &= (1 - \delta) q_{t-1} + h_t\end{aligned}$$

# Money market equilibrium

- Equilibrium

$$\begin{aligned}
 & \int_{i \in \mathcal{B}_-} \underbrace{(M_i - M(e_i, q_i, M_i; s_t))}_{\text{Money sold}} dF_t(e_i, q_i, M_i) \\
 &= \int_{i \in \mathcal{B}_+} \underbrace{(M(e_i, q_i, M_i; s_t) - M_i)}_{\text{Money bought}} dF_t(e_i, q_i, M_i),
 \end{aligned}$$

- Money supply,  $\bar{M}$ , is constant in the benchmark economy.

# Government

$$\tau_t q_t W_t = (1 - q_t) \mu (1 - \tau_t) W_t$$

$$\tau_t = \mu \frac{(1 - q_t)}{q_t + \mu (1 - q_t)}$$

# Calibration

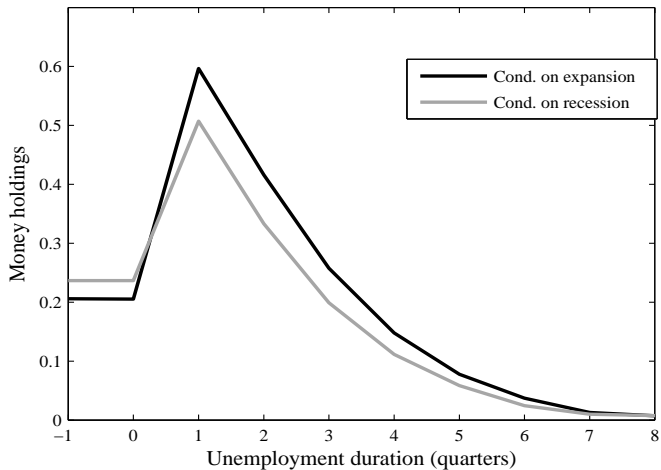
- $\omega_P$  : range of values

$$W_t = \omega_0 \left( \frac{z_t}{\bar{z}} \right)^{\omega_z} \bar{z} \left( \frac{P_t}{\bar{P}} \right)^{\omega_P} \bar{P}$$

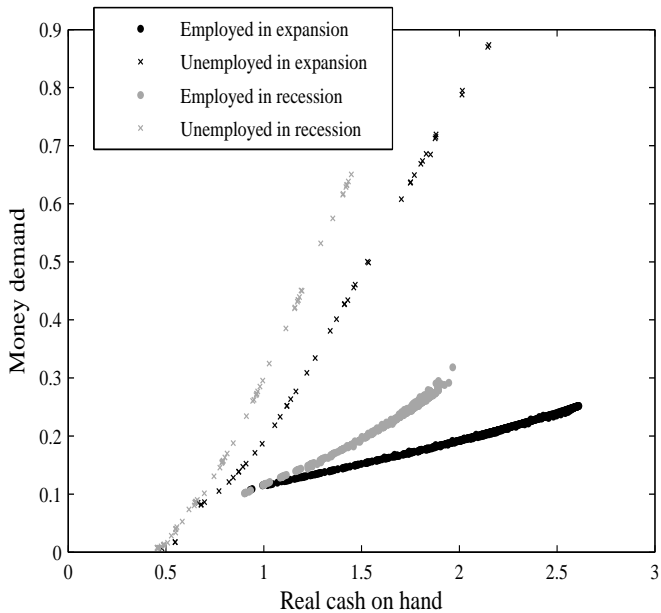
- One-year post-displacement consumption drop is 34% (Kolsrud, Landais, Nilsson, & Spinnewijn 2015; Sweden)
- Expected unemployment duration 3.57 quarters

# MODEL PROPERTIES

## Money holdings upon displacement



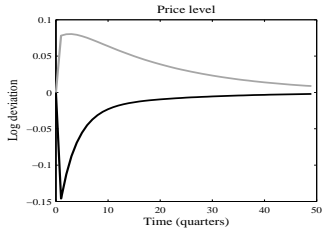
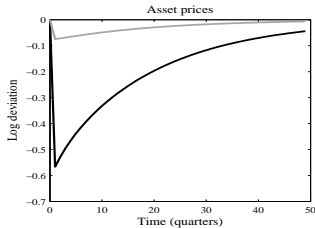
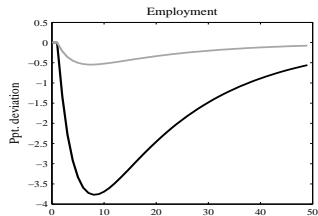
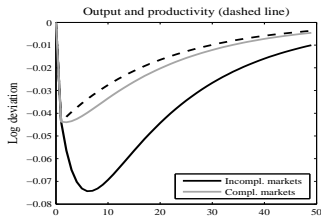
## Amount invested in liquid asset



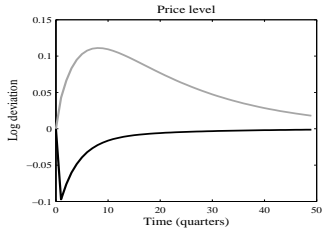
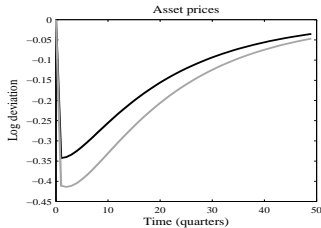
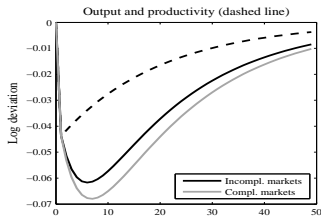
# BUSINESS CYCLES



# IRFs with sticky nominal wages



# IRFs with flexible nominal wages



# UNEMPLOYMENT INSURANCE

# Unemployment Insurance

## Two unemployment insurance (UI) experiments

- 1 Compare economies with different replacement rates
- 2 Unexpectedly increase replacement rate and take into account transition

## Two ways to deal with effect on wages

- 1 wage rule not affected
- 2 wage rule is adjusted to keep same implied Nash bargaining weights

# Unemployment insurance

## Mechanism emphasized in the literature

Replacement rate  $\uparrow \implies$

- 1 Agents better insured  $\implies$  savings  $\downarrow \implies$  employment  $\downarrow$
- 2 Through bargaining wage  $\uparrow \implies$  employment  $\downarrow$

**This also happens in our model too, but ...**

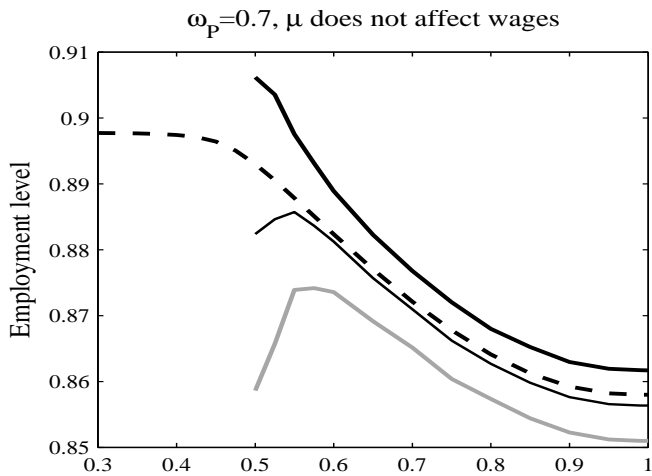
# Mean employment rate and higher UI

... there is a strong countervailing effect arising from aggregate uncertainty:

Replacement rate  $\uparrow \implies$

- 1 Asset prices less volatile  $\implies$  demand equity  $\uparrow \implies$  employment  $\uparrow$
- 2 Employment is concave in equity prices,  $J \implies \mathbb{E}[\text{employment}] \uparrow$  when  $\text{SID}[J] \downarrow$

## UI and employment



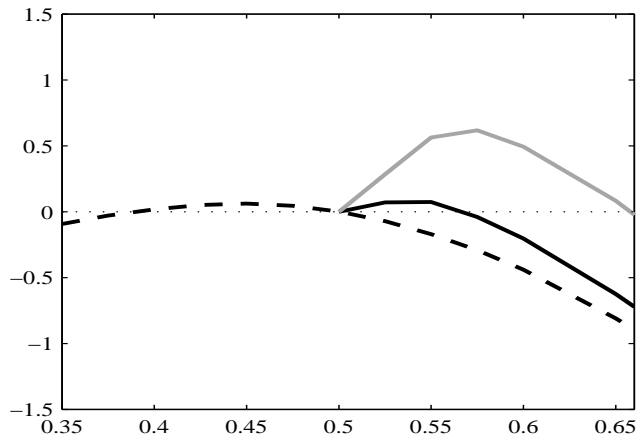
# Switch to alternative UI policy

- ➊ Replacement rate increases from 0.5 to 0.55
- ➋ Switch is unexpected
- ➌ Switch is permanent
- ➍ Agents take transition into account

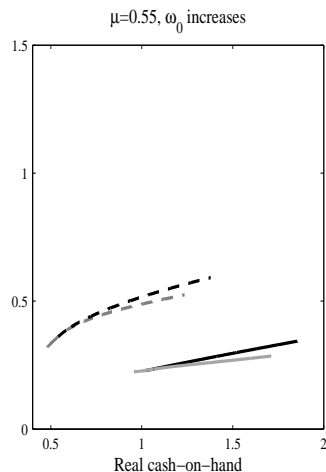
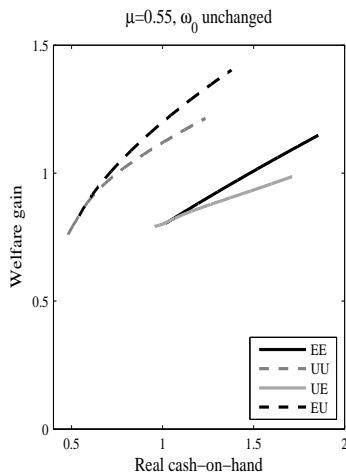


## Average welfare effect of change in UI

$\omega_p=0.7$ ,  $\mu$  affects wages



## Who likes/dislikes higher UI?



## Concluding comments

- With incomplete markets **and** sticky nominal wages, a decline in productivity sets off a self-reinforcing aggregate demand effect
- This happens despite the fact that both incomplete markets as well as sticky nominal wages – in isolation – repress propagation.
- One of the core components of this mechanism is the missing market for unemployment insurance.
- A rise in UI generosity can therefore increase average employment and raise welfare for all agents – even the asset-rich employed

# Creation of new jobs/firms/equity

- number of new firms created:

$$h_t = \psi v_t^\eta u_t^{1-\eta}$$

- vacancy yield:

$$\frac{h_t}{v_t} = \psi \left( \frac{v_t}{u_t} \right)^{\eta-1}$$

# Supply of new equity

- Matching function
- zero-profit condition

⇒

$$h_t = \psi \left( \frac{\psi J_t}{\kappa P_t} \right)^{\eta/(1-\eta)} u_t$$

# Creation of new jobs/firms/equity

- zero-profit condition  $\implies$  vacancies as a function of  $J_t/P_t$ :

$$\kappa = \psi \left( \frac{v_t}{u_t} \right)^{\eta-1} \frac{J_t}{P_t}$$

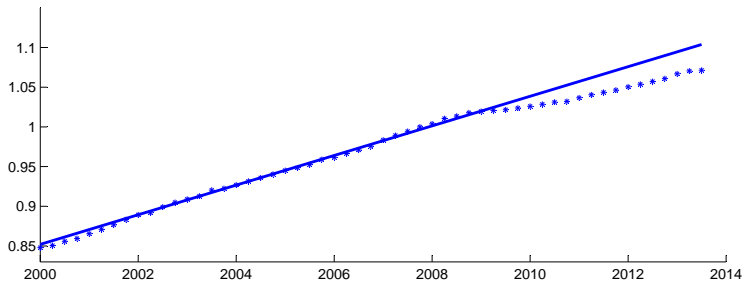
- supply of *new* equity (job/firm creation):

$$h_t = \psi \left( \frac{\psi J_t}{\kappa P_t} \right)^{\eta/(1-\eta)} u_t$$

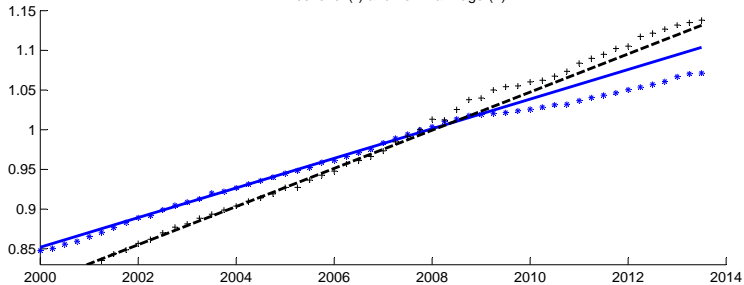
*"back to main"*

# Euro Area

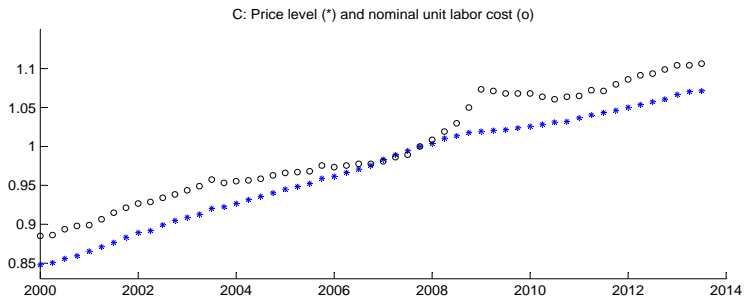
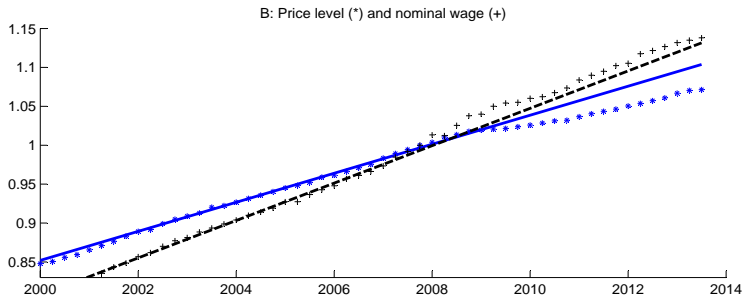
A: Price level (\*)



B: Price level (\*) and nominal wage (+)

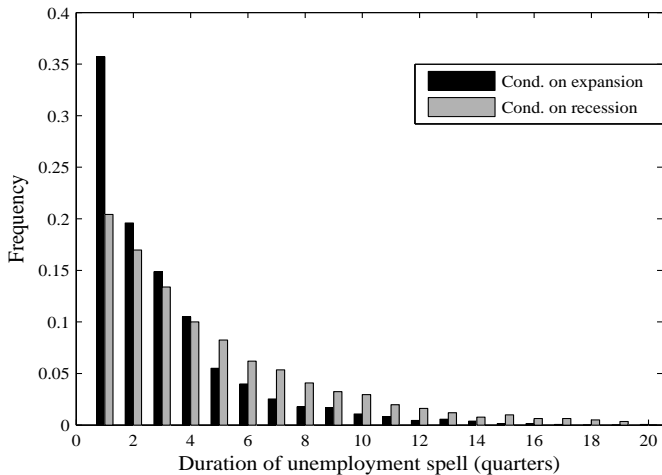


# Euro Area

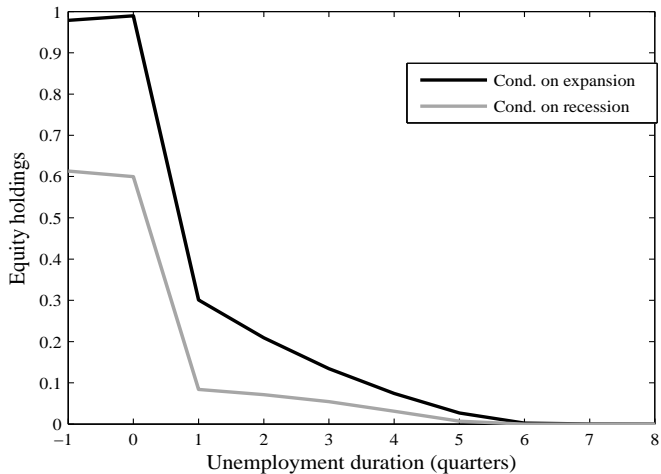




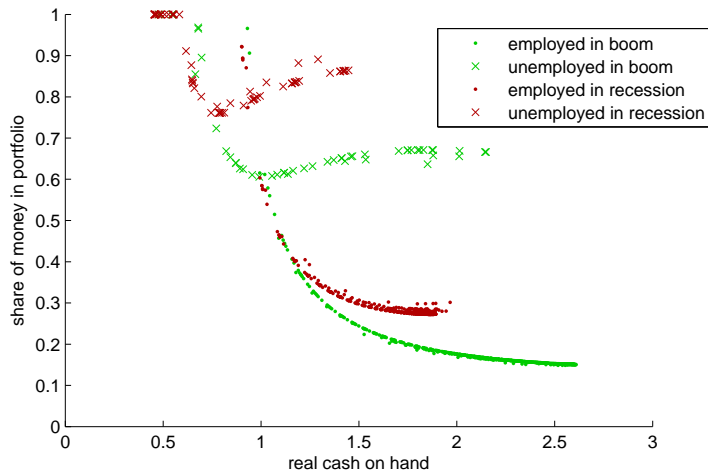
## Unemployment duration



## Equity holdings upon displacement



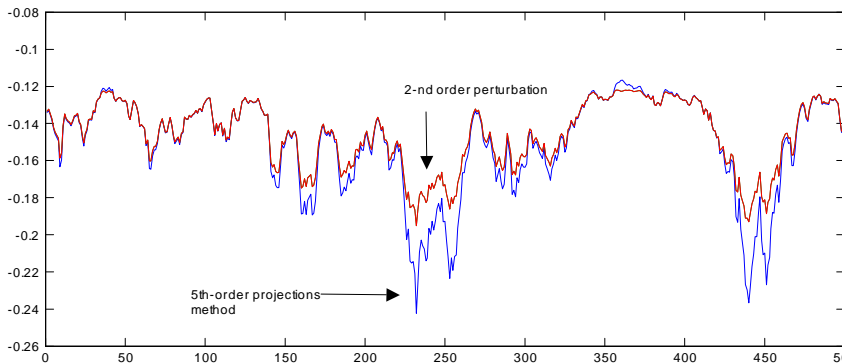
## Portfolio choice: fraction in liquid asset



# Technical challenges

- Even rep-agent version not trivial to solve accurately
  - non-linearity matching function matters
  - sufficiently volatile employment  $\implies$ 
    - volatile surplus
    - volatile equity prices
  - *"go to accuracy graph rep-agent model"*
- Adding moderate aggregate uncertainty to model is *not* a small change
  - substantial changes in means
  - volatile surplus and asset prices
  - multiplicity

# Log employment level



*"back to main"*

# Increase in UI & transition dynamics

- Increase in UI first period of recession
- No change in wage rule  $\implies$ 
  - equity less risky  $\implies$  average employment  $\uparrow$
  - less deflationary spiral  $\implies$  recession less deep  
 $\implies$  employment  $\uparrow$
- Change in wage rule  $\implies$ 
  - the same as above +
  - profits  $\downarrow \implies$  average employment  $\downarrow$

## Switch to higher level of unemployment benefits

