

# Inequality and Macroeconomics: Facts and Theories

## Lecture 4. Neokeynesian macro models of inequality: a tractable example

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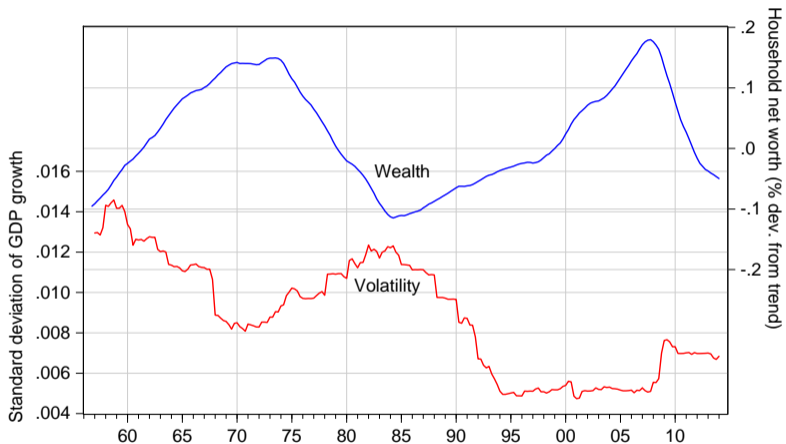
# Overview

- ▷ Objective: highlight powerful interaction between individual risk and macro outcomes
- ▷ Context: simple NK model with a tractable modelling of unemployment risk

# Sunspot-driven fluctuations

- ▷ Rise in expected unemployment
  - consumers reduce demand
  - firms reduce hiring
  - higher unemployment
- ▷ For a wave of self-fulfilling pessimism to get started need **high sensitivity of demand** to expected unemployment
- ▷ High wealth:
  - demand less sensitive to expectations (weak precautionary motive)
  - no sunspot-driven fluctuations
- ▷ Low wealth:
  - demand more sensitive to expectations (strong precautionary motive)
  - sunspot-driven fluctuations

# Wealth & GDP Volatility



Note: Standard deviations of GDP growth are computed over 40-quarter rolling windows. Observations for net worth are averages over the same windows.

# Outline

- ① A **tractable model** of confidence driven recessions
- ② **Micro** evidence on the link between wealth and precautionary motive

# Simple dynamic monetary model

Key ingredients:

- ① **Imperfect unemployment insurance** => precautionary motive for households => **expected unemployment affects demand**
- ② **Fixed nominal wage** => **demand affects unemployment**
- ③ **Central bank** can offset weak demand by cutting nominal rate, except at **ZLB**

# Agents

- ▷ Mass 1 of identical firms
- ▷ Mass 1 of identical households
  - ▷ Each household contains mass 1 of potential workers
- ▷ Monetary authority

## Representative firm

Perfectly competitive, produces consumption good using indivisible labor

$$y_t = n_t^\alpha$$

where  $n$  is mass of workers hired and  $\alpha < 1$  (decreasing returns)

Static profit maximization:

$$\pi_t = \max_{n_t \geq 0} \{p_t y_t - w_t n_t\}$$

where  $p_t$  is price of cons. relative to money,  $w_t$  grows at constant rate  $\gamma_w$

FOC:

$$\frac{w_t}{p_t} = \alpha n_t^{\alpha-1}$$

In equilibrium,

$$u_t = 1 - n_t$$

and thus

$$u_t = 1 - \left( \frac{\alpha p_t}{w_t} \right)^{\frac{1}{1-\alpha}}$$



# Households

- ▷ Infinitely-lived, enjoy two goods:
    - ① consumption, produced by firms
    - ② housing, aggregate endowment equal to 1
  - ▷ Can save in housing and in govt. bonds (zero net supply)
  - ▷ Unemployment risk + imperfect unemployment insurance within period
- => **tractable model of precautionary motive**

## Timing:

- ▷ All household members look for jobs
- ▷ If labor demand less than supply ( $n_t < 1$ ) jobs randomly rationed
- ▷ Within period, employed cannot transfer wages to unemployed family members
- ▷ => unemployed rely on savings to finance consumption
  - ▷ bonds are perfectly liquid
  - ▷ can only tap fraction  $\psi$  of home equity
- ▷ At end of period, household regroups, pools resources, decides on savings for next period

## Household solves

$$\max_{\{c_t^w, c_t^u, h_t, b_t\}} E \sum_{t=0}^{\infty} \left( \frac{1}{1 + \rho} \right)^t \{(1 - u_t) \log c_t^w + u_t \log c_t^u + \phi \log h_{t-1}\}$$

s.t. budget constraints

$$p_t c_t^u \leq \psi p_t^h h_{t-1} + b_{t-1}$$

$$p_t c_t^w \leq \psi p_t^h h_{t-1} + b_{t-1} + w_t$$

$$(1 - u_t) p_t c_t^w + u_t p_t c_t^u + p_t^h (h_t - h_{t-1}) + \frac{1}{1 + i_t} b_t \leq (1 - u_t) w_t + \pi_t + b_{t-1}$$

# FOCs

## Bonds

$$\frac{1}{c_t^w} \frac{1}{1+i_t} = \frac{1}{1+\rho} E_t \left[ \frac{p_t}{p_{t+1}} \left( \frac{(1-u_{t+1})}{c_{t+1}^w} + \frac{u_{t+1}}{c_{t+1}^u} \right) \right]$$

Extra real dollar tomorrow worth  $\frac{1}{c_{t+1}^w}$  to employed,  $\frac{1}{c_{t+1}^u}$  to unemployed

## Housing

$$\frac{p_t^h}{p_t c_t^w} = \frac{1}{1+\rho} E_t \left[ \frac{p_{t+1}^h}{p_{t+1}} \left( \frac{(1-u_{t+1})\psi}{c_{t+1}^w} + \frac{u_{t+1}\psi}{c_{t+1}^u} \right) + \frac{\phi}{h_t} \right]$$

Real dollar's worth of housing worth  $\psi$  to unemployed

# Monetary authority

- ▷ Sets nominal rate  $i_t$
- ▷ Follows rule of form

$$i_t = i^{CB}(u_t) = \max \{ (1 + \gamma_w)(1 + \rho - \kappa u_t) - 1, 0 \}$$

- ▷  $\kappa$  controls how aggressively central bank cuts rates when unemployment goes up
- ▷ Will consider passive ( $\kappa$  small) and aggressive ( $\kappa$  large) policies
- ▷ By changing  $i$  CB can affect current demand and output through standard IS effect

# Equilibrium

An equilibrium is a probability distribution over  $\{u_t, n_t, y_t, \pi_t, c_t^w, c_t^u, h_t, b_t\}$  and  $\{i_t, p_t, p_t^h, w_t\}$  that satisfies, at each date  $t$

- 1 Household and firm optimality
- 2 The policy rule  $i_t = i^{CB}(u_t)$
- 3 Market Clearing:

$$(1 - u_t) c_t^w + u_t c_t^u = y_t$$

$$h_t = 1$$

$$b_t = 0$$

# Steady States

- ▶ Real variables and interest rate are constant, prices grow at rate  $\gamma_w$
- ▶ There is always a full employment steady state in which

$$\begin{aligned}u &= 0, \\y &= 1, \\1 + i &= (1 + \rho)(1 + \gamma_w), \\ \frac{p^h}{p} &= \frac{\phi}{\rho}.\end{aligned}$$

- ▶ This is the efficient allocation
- ▶ Whether other steady states exist depends on level of household liquid wealth, and monetary policy aggressivity

# Steady State Asset Prices

- ▶ Put aside for a moment the monetary rule
- ▶ For any possible steady state unemployment rate  $u$ , what do optimization and market clearing imply for real house prices and the equilibrium interest rate?
- ▶ Answer depends on parameters that determine household liquid wealth:  $\psi, \phi, \rho$



# Perfect Risk Sharing Steady States

- ▷ If  $\psi(\frac{\phi}{\rho}) > 1$  (liquidity value of housing is high) then risk sharing is perfect in any steady state:

$$1 + i = (1 + \rho)(1 + \gamma_w)$$
$$\frac{p^h}{p} = \frac{\phi}{\rho}(1 - u)^\alpha$$

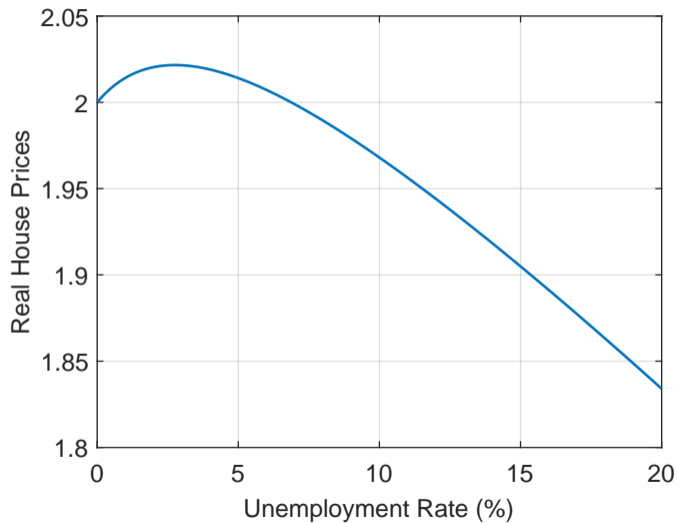
# Imperfect Risk Sharing Steady States

- ▶ If  $\psi(\frac{\phi}{\rho}) < 1$  then risk sharing is imperfect in any steady state
- ▶ Real house prices are given by

$$\frac{p^h}{p} = \underbrace{\frac{\phi}{\rho}(1-u)^\alpha}_{\text{fundamental component}} \times \underbrace{\frac{u + \phi}{\psi \frac{\phi}{\rho} u + \left(1 + \left(\psi \frac{\phi}{\rho} - 1\right) u\right) \phi}}_{\text{liquidity component}}$$

- ▶ Liquidity component  $> 1$

## Real House Prices and Unemployment



## Imperfect Risk Sharing Steady States

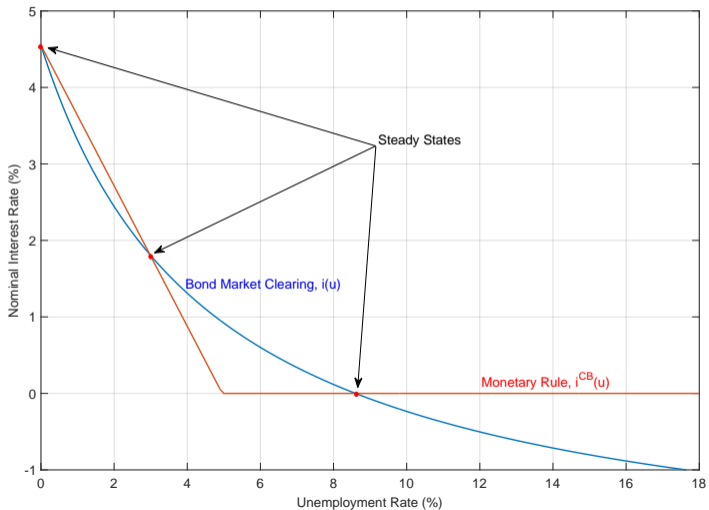
- ▶ If  $\psi(\frac{\phi}{\rho}) < 1$  then household optimality and market clearing imply

$$i = i(u) = (1 + \rho)(1 + \gamma_w) \left( \frac{u + \phi}{u \left(1 + \frac{\rho}{\psi} - \phi\right) + \phi} \right) - 1$$

- ▶  $i(u)$  derived from FOC for bonds, imposing market clearing and steady state house price expression
- ▶  $1 + i(0) = (1 + \rho)(1 + \gamma_w)$
- ▶  $i(u)$  is a decreasing and convex function of  $u$
- ▶ The higher the unemployment the higher the risk, the more households want to save and the lower eq. interest rate has to be to clear bond markets

# Steady States

A steady state is a pair  $(i, u)$  satisfying  $i = i(u)$  and  $i = i^{CB}(u)$



# Characterizing Equilibria

▷ Different sorts of equilibria are possible depending on:

- 1 Level of liquid wealth, which determines how fast  $i(u)$  declines with  $u$
- 2 Monetary policy, which determines how fast  $i^{CB}(u)$  declines with  $u$

▷ **High liquid wealth:**  $\psi > \frac{\rho}{(1+\rho)(1+\gamma_w)(1+\phi)-1}$

▷ High liquid wealth  $\Rightarrow i(u) > 0$  for all  $u$

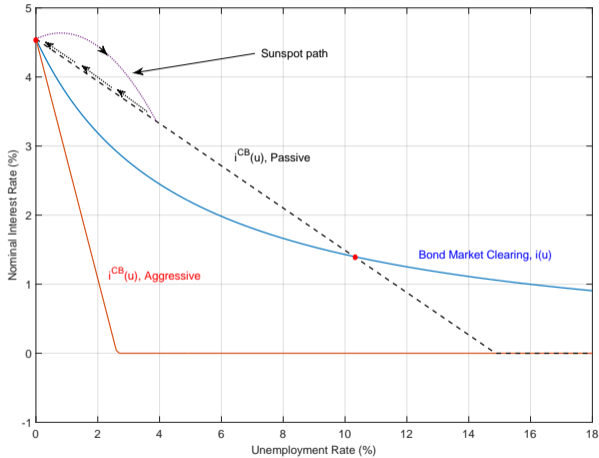
▷ **Aggressive monetary rule:**  $\kappa > (1 + \rho) \left( \frac{1 - \frac{\psi\phi}{\rho}}{\frac{\psi\phi}{\rho}} \right)$

▷ Aggressive rule  $\Rightarrow i^{CB}(u)$  falls faster than  $i(u)$  at  $u = 0$

# Dynamics Around Full Employment

- ▷ **Definition:** A steady state is **locally stable** (unstable) if there do (not) exist perfect foresight paths that converge to it
- ▷ **Result:** If monetary **policy is passive** (aggressive) then the full employment steady state is **locally stable** (unstable)
- ▷ **Implication:** An aggressive policy rules out temporary confidence-driven fluctuations
- ▷ **Intuition:** Aggressive Fed promises to cut rate more than required to support demand  $\Rightarrow$  temporary recession not possible

# Policy Aggressiveness and Local Stability

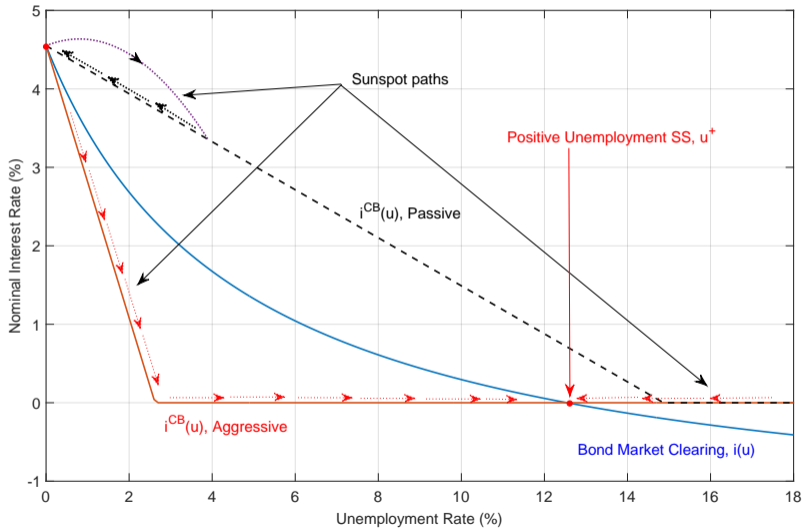




# High Liquidity

- ▷ **Result:** If liquid wealth is high and policy is aggressive, full employment is only equilibrium
- ▷ **Intuition:** High liquid wealth => weak precautionary motive =>  $i > 0$  in any steady state
- ▷ => Aggressive central bank can promise low enough policy rate to rule out positive unemployment steady states
- ▷ Aggressive CB can also rule out temporary recessions
- ▷ **Implication:** Central bank in high liquid wealth environment should be aggressive

# Low Liquidity Case



## Low Liquidity

- ▷ **Result:** Under an aggressive policy, a new steady state emerges with  $u > 0$  and  $i = 0$
- ▷ **Intuition:** Low liquid wealth => poor insurance within household
- ▷ If households expect persistent unemployment, strong precautionary motive and weak demand
- ▷ => A depressed-demand stagnation ZLB steady state emerges
- ▷ **Result:** The depressed steady state is locally stable
- ▷ **Intuition:** At the ZLB the CB is not responding aggressively enough to fluctuations in unemployment

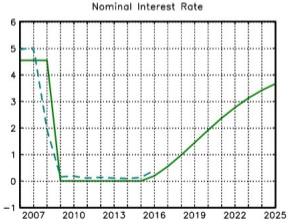
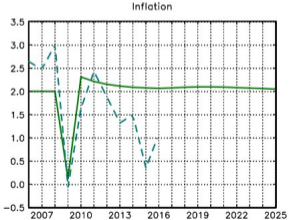
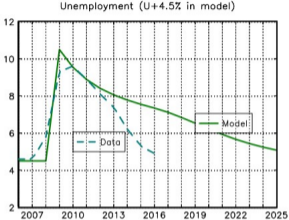
# Policy Dilemma With Low Liquid Wealth

- ▶ **Low wealth opens the door to rich macroeconomic volatility**
- ▶ **No simple policy fix:** bad outcomes possible whether central bank passive or aggressive
  - ▶ Aggressive central bank: Confidence shocks can lead to stagnation steady state
  - ▶ Passive central bank: Confidence shocks can lead to temporary recessions
- ▶ **Unemployment insurance can be an effective policy:**
  - ▶ Weakens impact of expected unemployment on precautionary motive
  - ▶ Can eliminate stagnation steady state

# Interpreting the Great Recession

- ▶ Decline in  $\phi$  reduced  $p^h$  pushing economy into low liquid wealth region
- ▶ Not inherently recessionary but creates vulnerability to a confidence shock
- ▶ Collective loss of confidence (collapse of Lehman?) triggered sunspot shock taking us to  $u > 0$
- ▶ Gradual recovery in which demand stimulus from expected growth balanced by strong precautionary motive plus rising rates
- ▶ Fed could have tried more aggressive policy, but could not have ruled out a permanent slump

# Great Recession: model and data



## Micro Evidence for the Mechanism

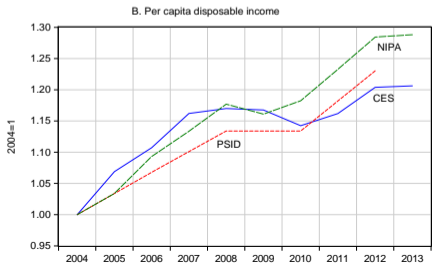
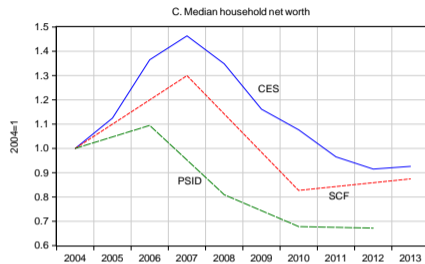
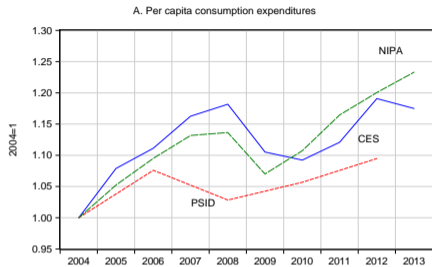
- ▷ **Key mechanism:** Elasticity of expenditures wrt unemployment risk is larger when wealth is low (for precautionary motives)
- ▷ **Natural test:** Did wealth-poor households reduce expenditures more than rich households as unemployment risk rose during the Great Recession?

## Micro Survey Data

- ▶ Use both the CEX (higher frequency) and the PSID (longer panel)
- ▶ Focus on households of working age
- ▶ Divide sample by household wealth (net financial wealth plus home equity) relative to avg. expenditure
- ▶ Compare panel change in saving to income ratio for the high v/s low wealth groups
- ▶ Do we see larger rise in saving rates for the low wealth group at the start of the recession?



# Surveys versus NIPA

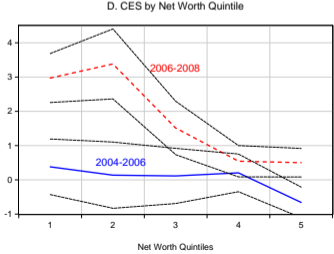
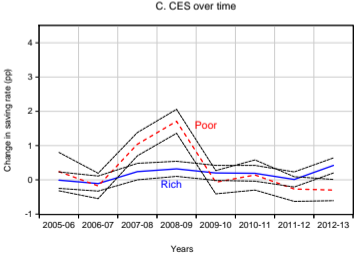
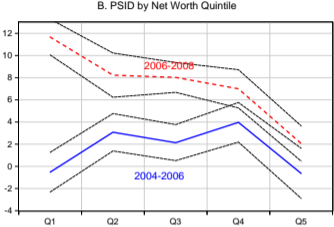
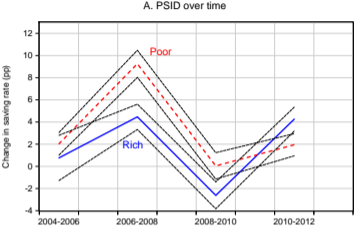


# Characteristics of Rich versus Poor

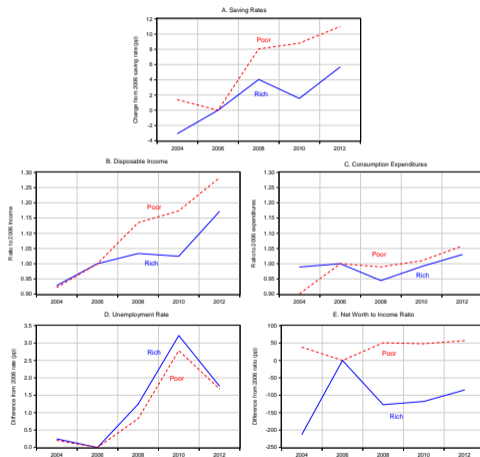
	PSID		CES	
	Poor	Rich	Poor	Rich
Sample size	3446	2523	1915	1960
Mean age of head	37.9 (0.21)	47.1 (0.21)	40.2 (0.25)	46.4 (0.24)
Heads with college (%)	21.3 (0.86)	36.5 (1.1)	24.8 (1.1)	39.4 (1.2)
Mean household size	2.45 (0.04)	2.72 (0.03)	2.84 (0.04)	2.79 (0.04)
Mean household net worth (current \$)	11,931 (879)	619,831 (49,388)	11,967 (1,155)	338,535 (12,644)
Median household net worth	5,000 (476)	265,000 (6,602)	1,800 (294)	187,102 (4,893)
Per capita disposable income	15,028 (256)	28,475 (667)	18,739 (334)	30,184 (593)
Per capita consumption expenditure	9,831 (177)	13,101 (250)	9,185 (232)	10,858 (188)
Consumption rate (%)	65.8 (0.90)	46.0 (0.86)	49.0 (1.18)	36.0 (0.66)

Note: Bootstrapped standard errors are in parentheses.

# Wealth and Changes in Saving Rates



# Are Other Factors Driving This?



## Micro Evidence: summary

- ▶ During the Great Recession low wealth households reduced their consumption rates significantly more than rich households
- ▶ A large (about 1.3% of disposable income) fall in expenditures over the Great Recession can be attributed to increased precautionary motive from these households.

# Conclusions

- ▷ Model in which macroeconomic outcomes affected by individual risk and insurance possibilities
- ▷ Can evaluate effectiveness of policies geared toward stabilization of these fluctuations