Lecture 4. Neo-keynesian macro models of inequality

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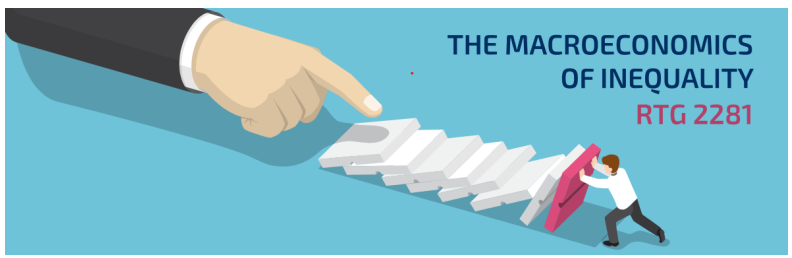


Bonn Summer School: The Macroeconomics of Inequality
June 2020

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

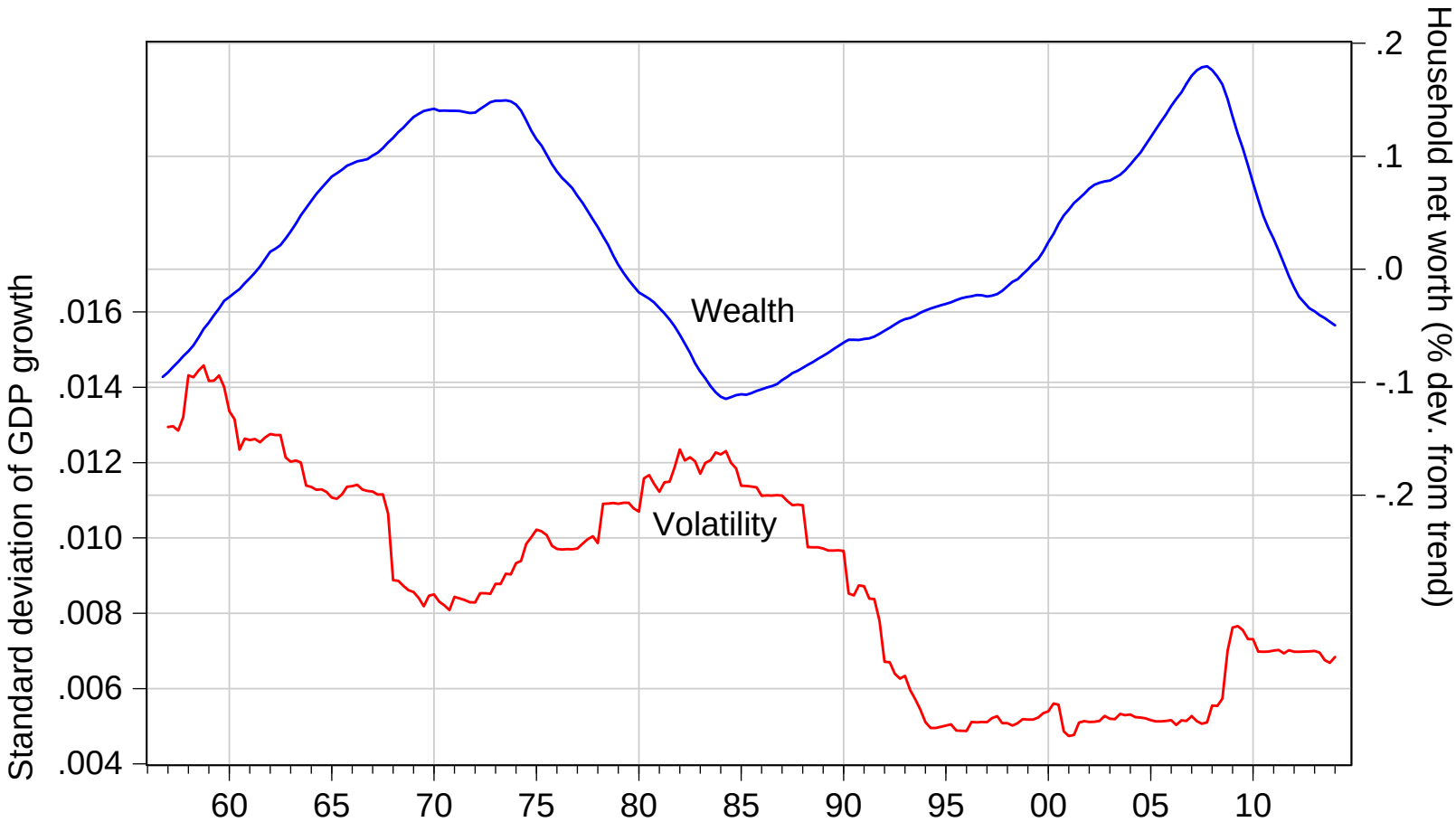
- Rise in expected unemployment
  $\rightarrow$ consumers reduce demand
  $\rightarrow$ firms reduce hiring
  $\rightarrow$ higher unemployment

- For a wave of self-fulfilling pessimism to get started need high sensitivity of demand to expected unemployment

- High wealth:
  $\rightarrow$ demand less sensitive to expectations (weak precautionary motive)
  $\rightarrow$ no sunspot-driven fluctuations

- Low wealth:
  $\rightarrow$ demand more sensitive to expectations (strong precautionary motive)
  $\rightarrow$ 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 γ_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 ψ of home equity
- At end of period, household regroups, pools resources, decides on savings for next period

Household solves

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

s.t. budget constraints

$$\begin{aligned} p_t c_t^u &\leq \psi p_t^h h_{t-1} + b_{t-1} \\ p_t c_t^w &\leq \psi p_t^h h_{t-1} + b_{t-1} + w_t \end{aligned}$$

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

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 ψ to unemployed

Monetary authority

- Sets nominal rate i_t
- Follows rule of form

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

- κ controls how aggressively central bank cuts rates when unemployment goes up
- Will consider passive (κ small) and aggressive (κ large) policies

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 $\left\{i_t, p_t, p_t^h, w_t\right\}$ 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 γ_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: ψ, ϕ, ρ

Perfect Risk Sharing Steady States

- If $\psi(\frac{\phi}{\rho}) > 1$ then risk sharing is perfect is any steady state:

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

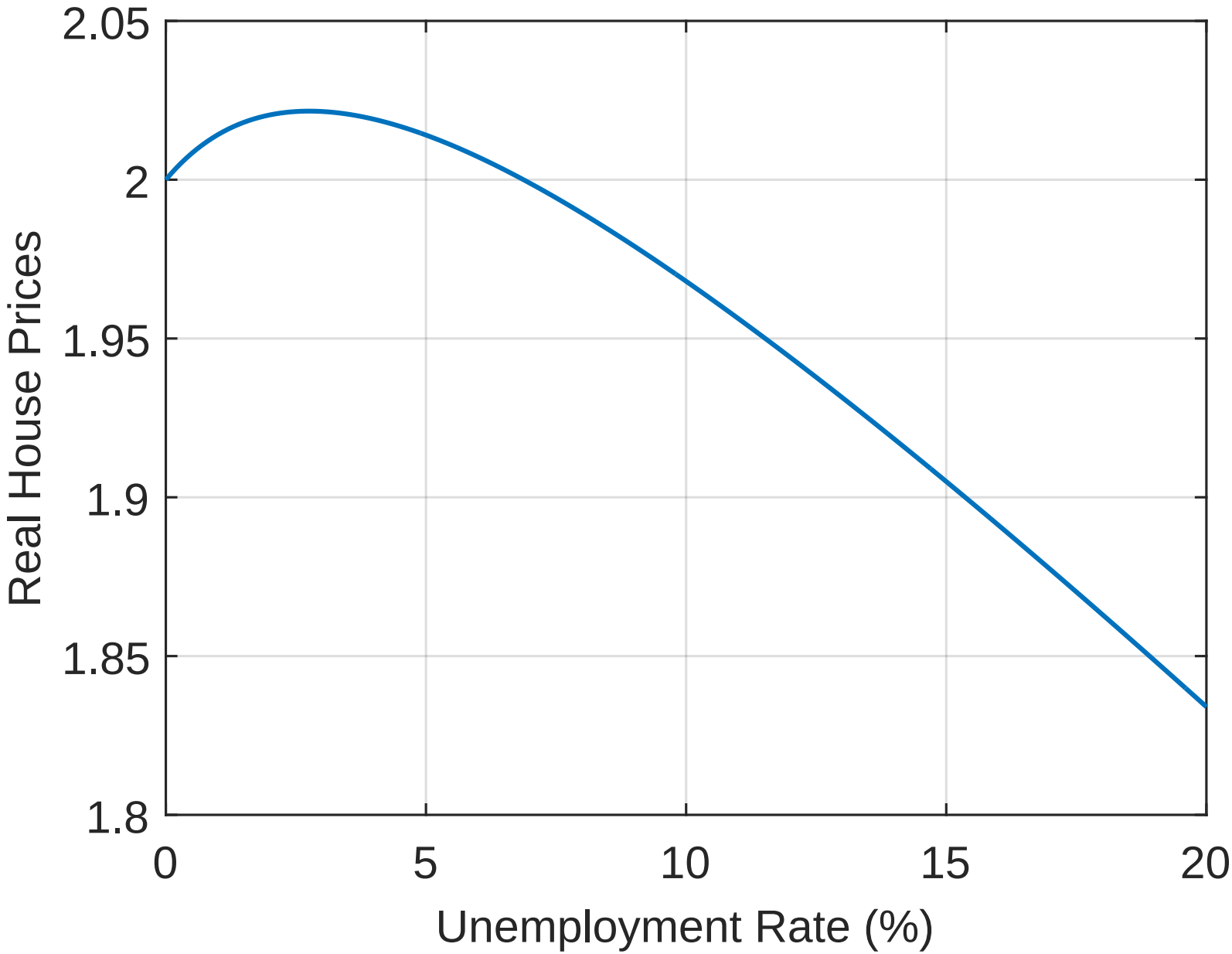
Imperfect Risk Sharing Steady States

- 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

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

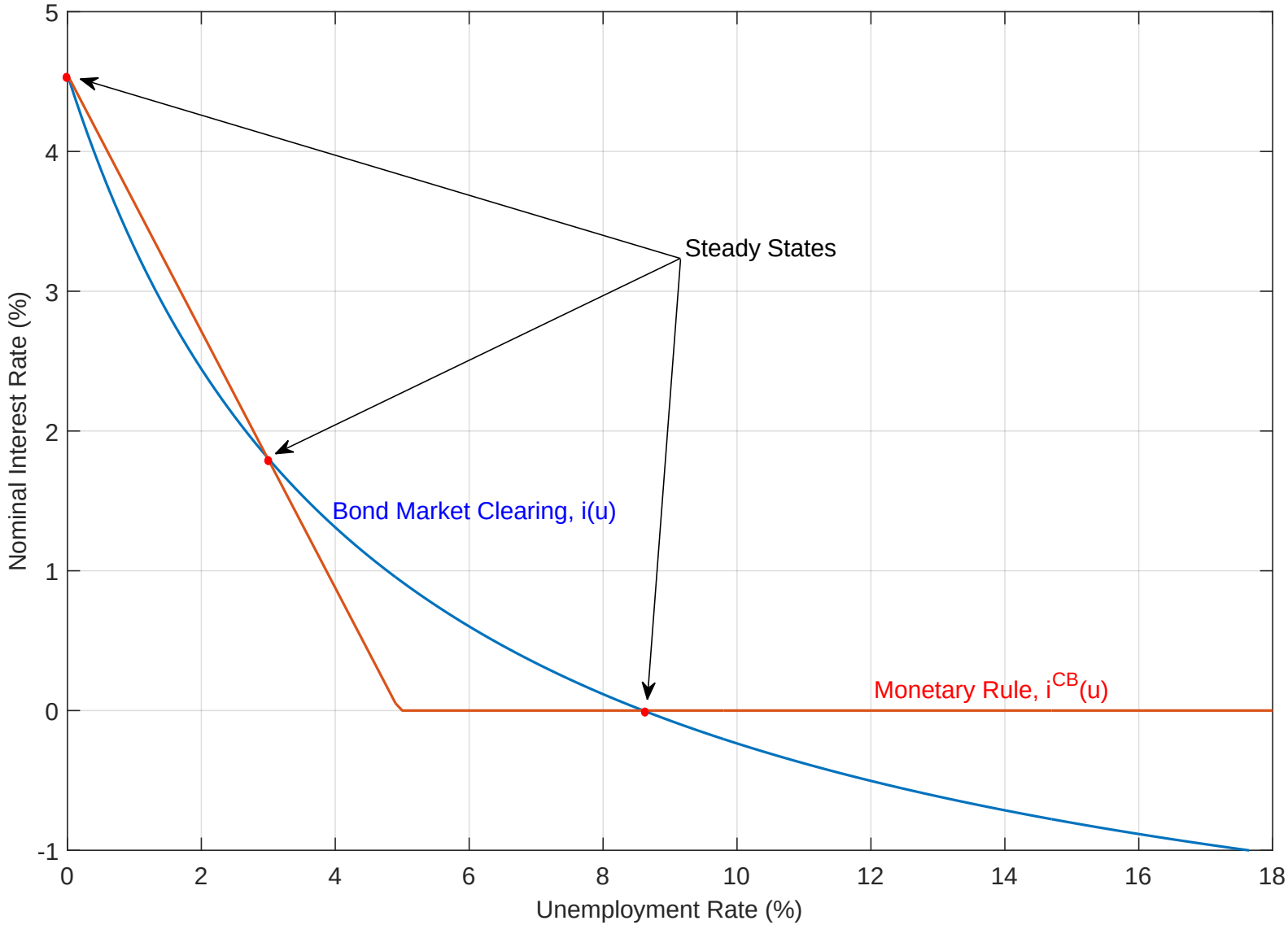
- $i(u)$ derived from FOC for bonds, imposing market clearing and steady state house price expression

- $1 + i(0) = (1+\rho)(1+\gamma_w)$

- $i(u)$ is a decreasing and convex function of u

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:

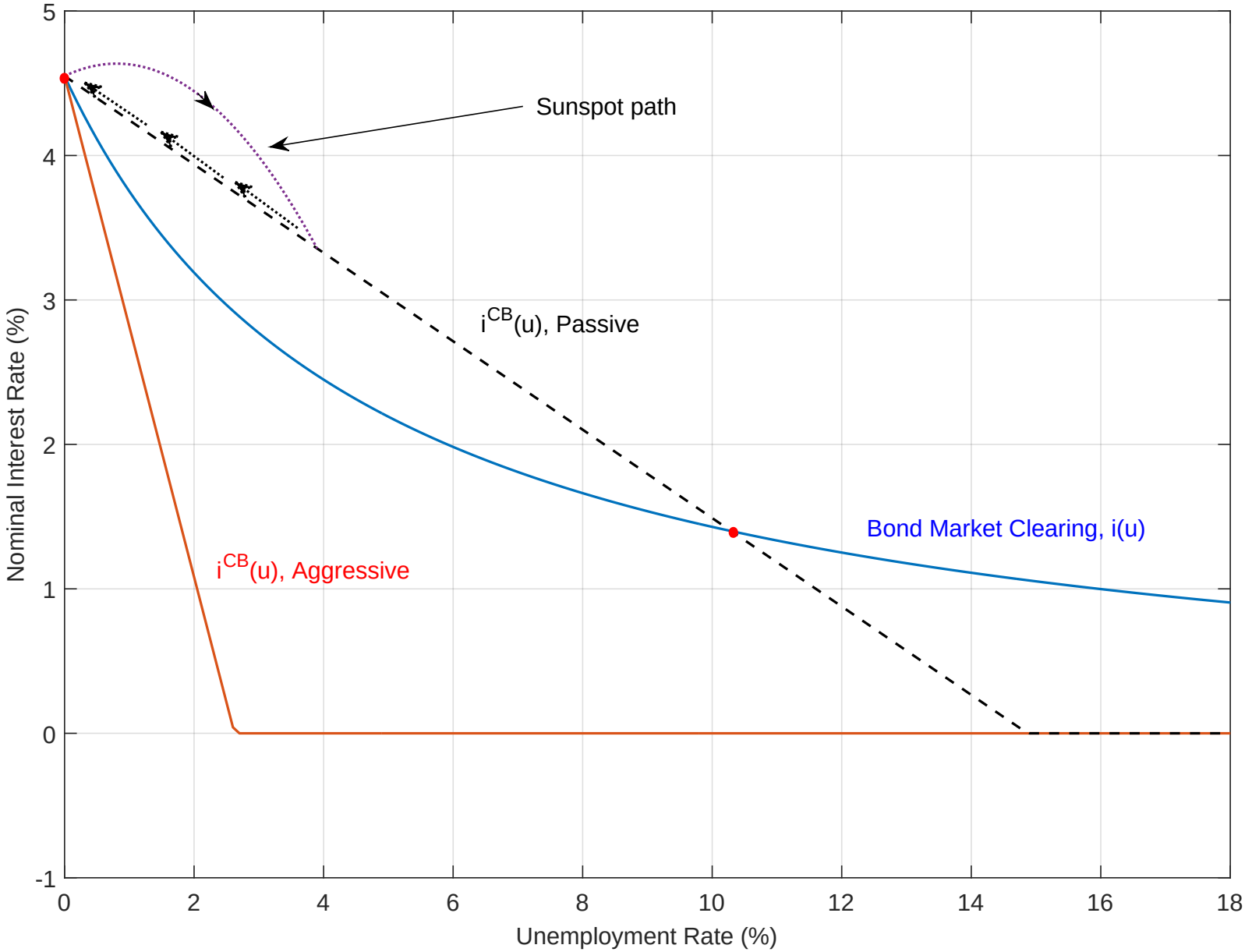
  1. Level of liquid wealth, which determines how fast $i(u)$ declines with u
  2. Monetary policy, which determines how fast $i^{CB}(u)$ declines with u

- 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

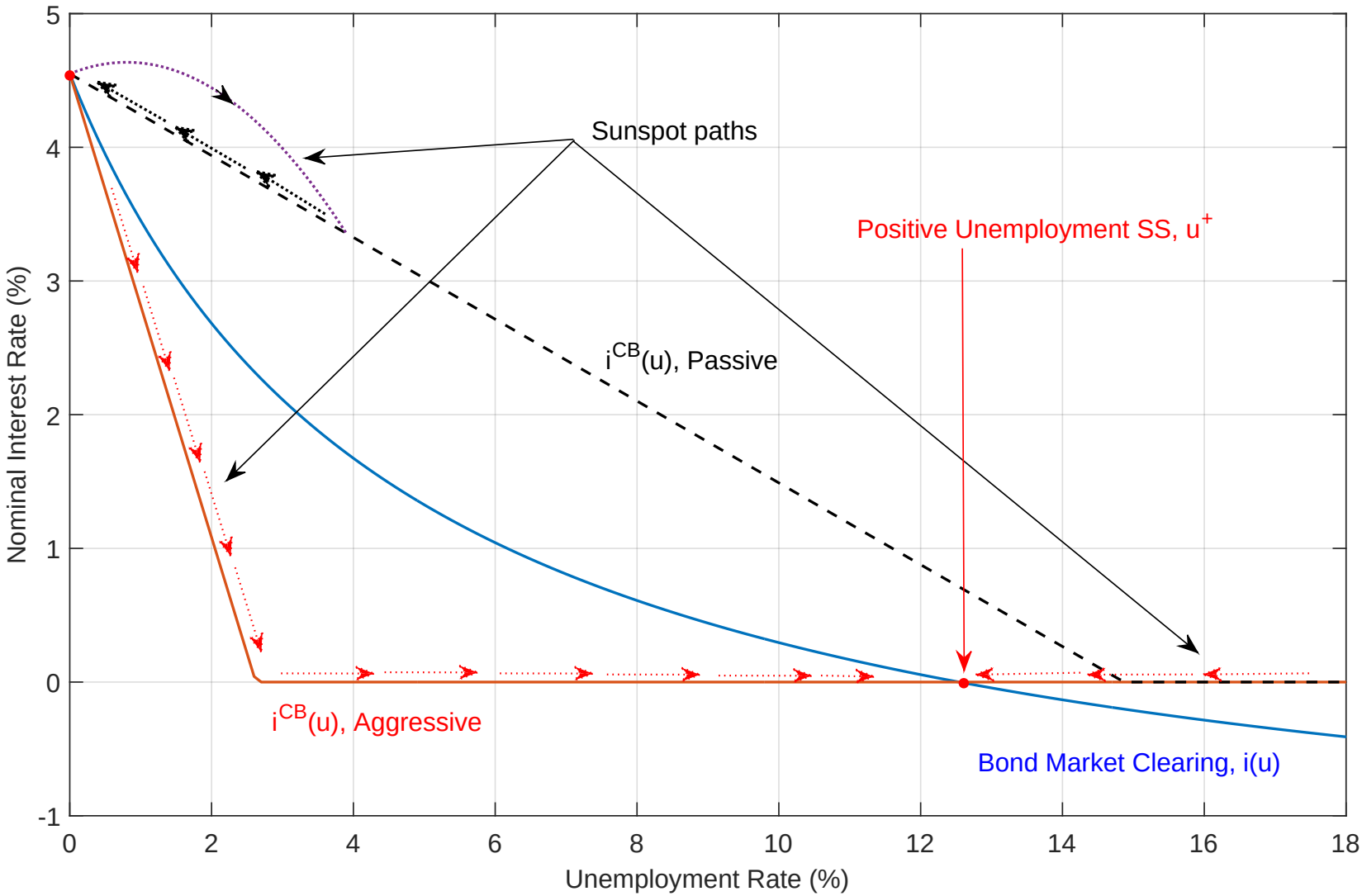
Policy Aggressivity and Local Stability



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 ϕ 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

Micro Evidence for the Mechanism

- Key mechanism: Elasticity of expenditures wrt unemployment risk is larger when wealth is low (for precautionary motives)

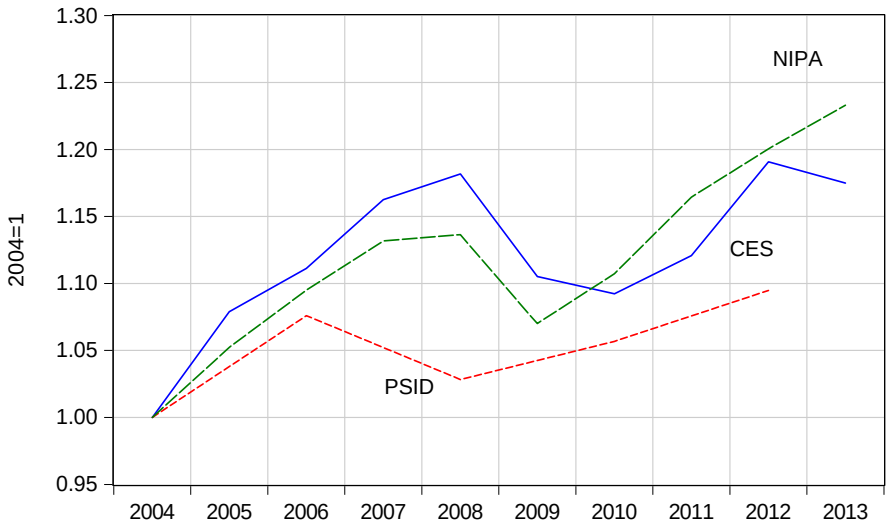
- Natural test: Did wealth-poor households reduce expenditures more than rich households as unemployment risk rose during the Great Recession?

Micro Survey Data

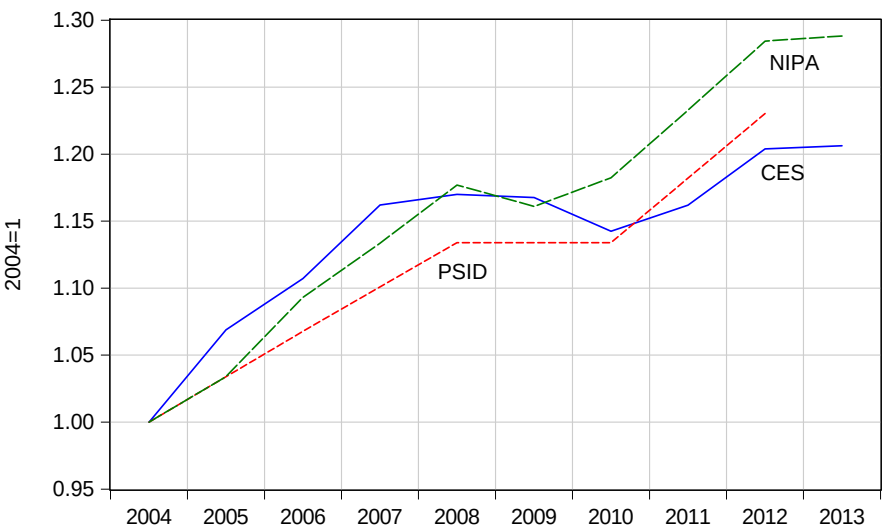
- Use both the CEX (higher frequency) and the PSID (longer panel)
- Focus on households of working age
- Divide sample by household wealth (net financial wealth plus home equity) relative to avg. expenditure
- Compare panel change in saving to income ratio for the high v/s low wealth groups
- Do we see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

Surveys versus NIPA

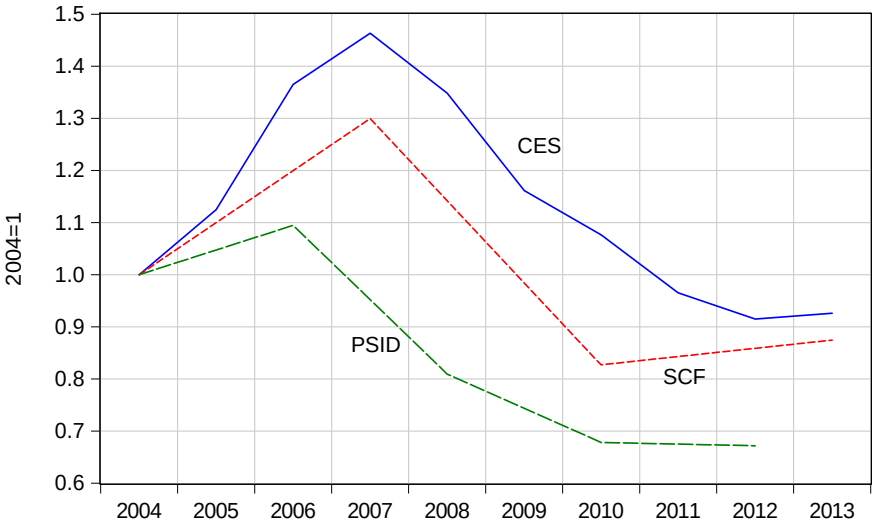
A. Per capita consumption expenditures



B. Per capita disposable income



C. Median household net worth

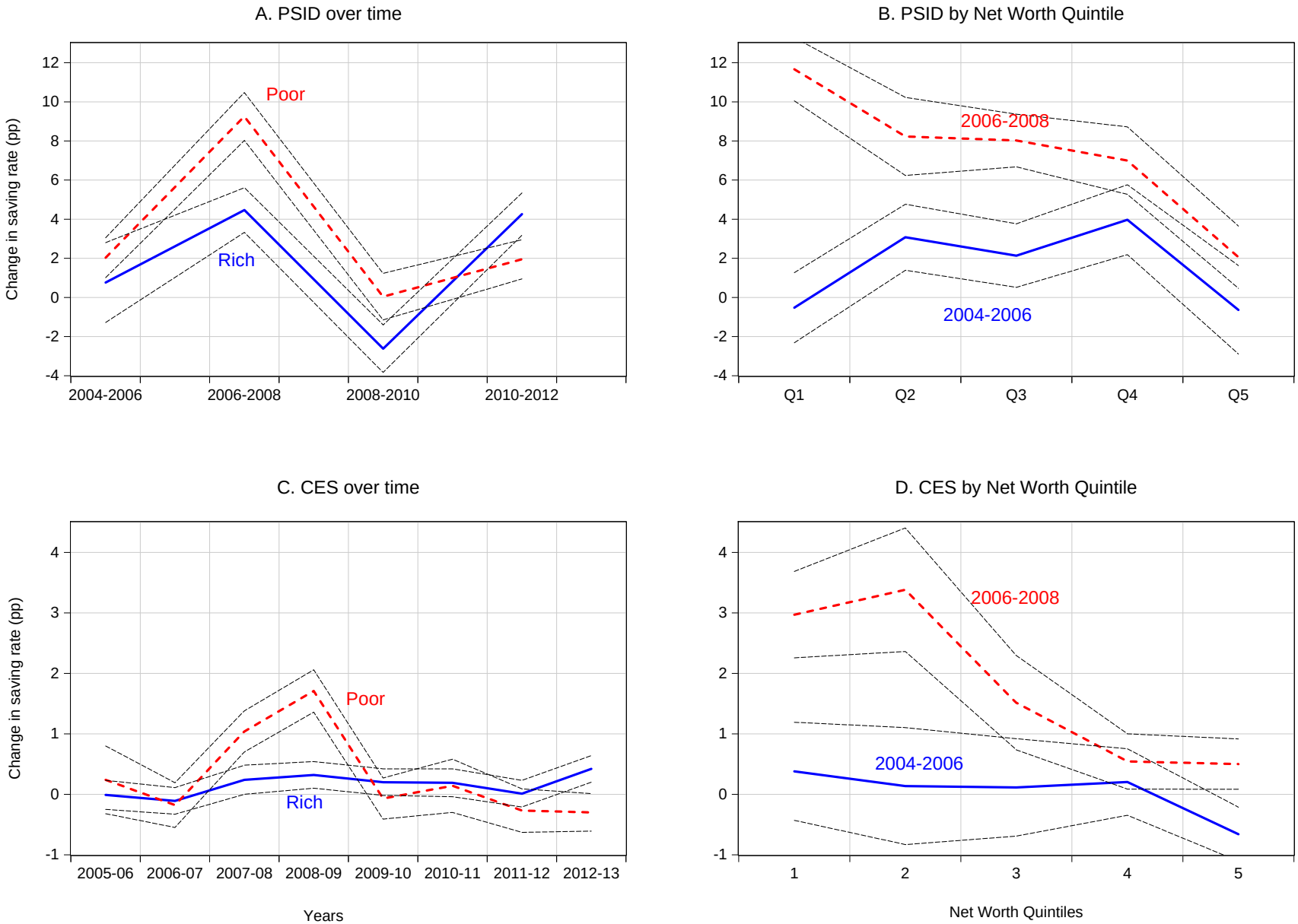


Characteristics of Rich versus Poor

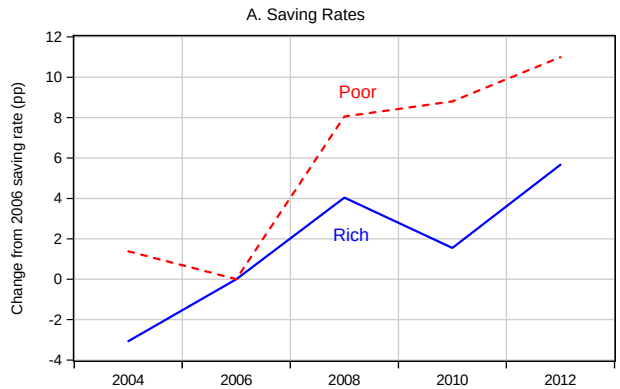
	PSID		CES	
	Poor	Rich	Poor	Rich
Sample size	3446	2523	1915	1960
Mean age of head	37.9	47.1	40.2	46.4
	(0.21)	(0.21)	(0.25)	(0.24)
Heads with college (%)	21.3	36.5	24.8	39.4
	(0.86)	(1.1)	(1.1)	(1.2)
Mean household size	2.45	2.72	2.84	2.79
	(0.04)	(0.03)	(0.04)	(0.04)
Mean household net worth (current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

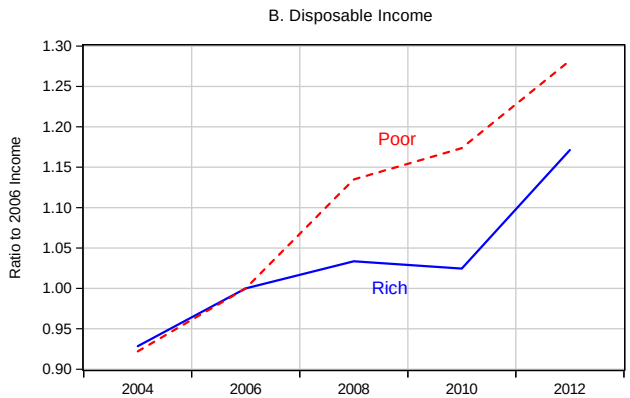
Note: Bootstrapped standard errors are in parentheses.

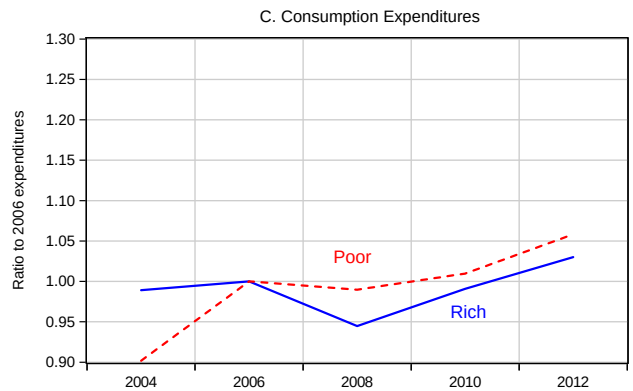
Wealth and Changes in Saving Rates

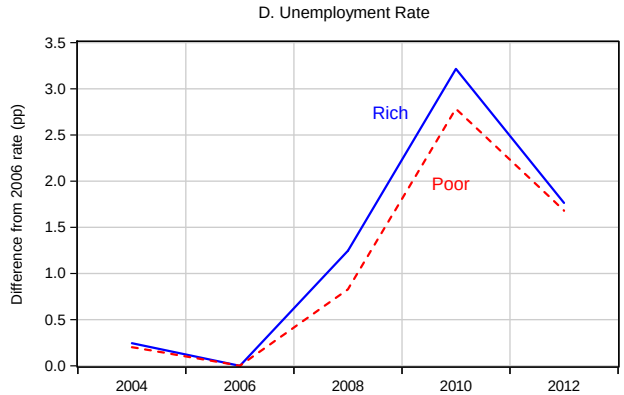


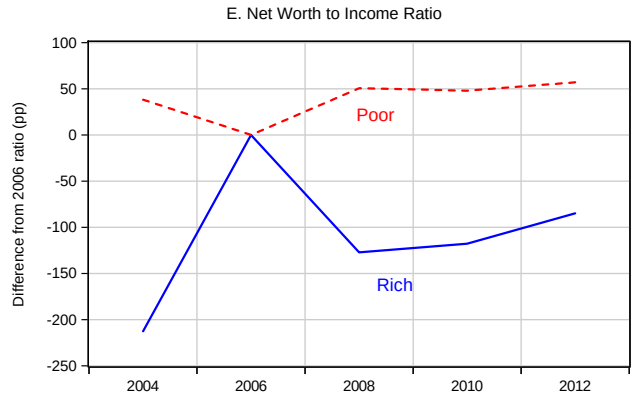
Are Other Factors Driving This?











Conclusions

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