

WEALTH AND VOLATILITY

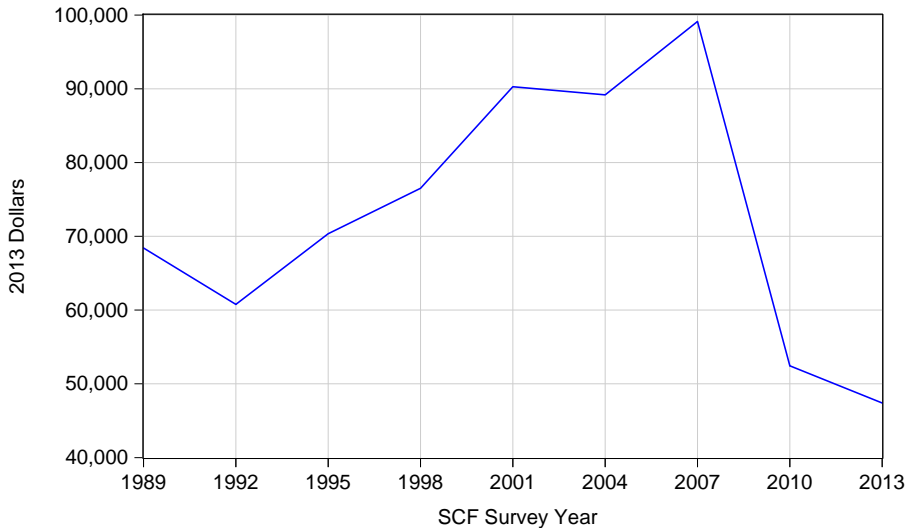
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Minneapolis Fed

Federal Reserve Board, March 7, 2018

Sources of Business Cycles

- Great Recession brought back old idea: business cycles driven by **self-fulfilling waves of optimism/pessimism**
- What makes such waves more likely?
- Our idea: extent to which these waves can generate fluctuations depends on the **level of household wealth**
- **Large and widespread** decline in asset prices which occurred prior to the crisis left many economies **fragile and susceptible to a confidence-driven recession**

Median Real Household Net Worth (from SCF)

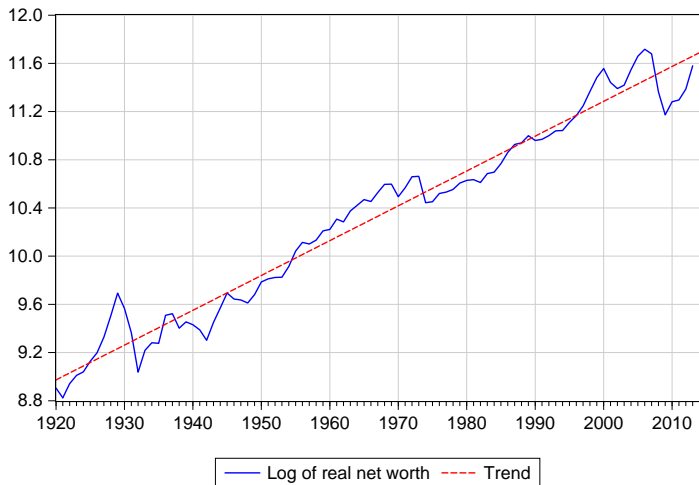


Note: Sample includes households with heads between ages 22 and 60.

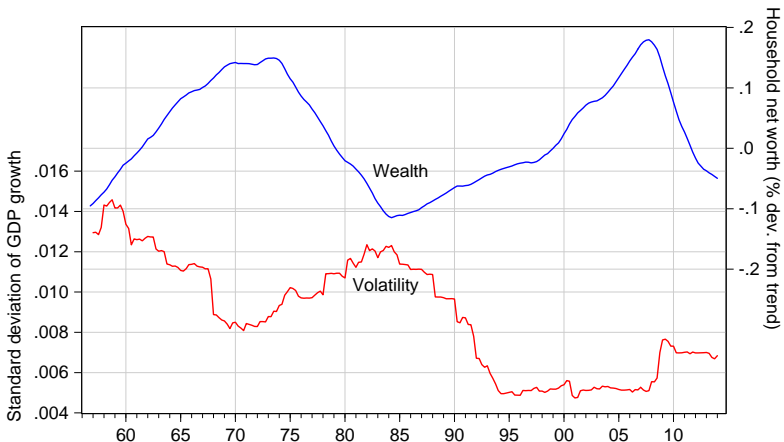
Sunspot-driven fluctuations

- 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

Household net worth in US in the long run



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

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

s.t. budget constraints

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

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

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 ψ to unemployed

Monetary authority

- Sets nominal rate i_t
- Follows rule of form

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

- 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 $\{i_t, p_t, p_t^h, w_t\}$ 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 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 in any steady state:

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

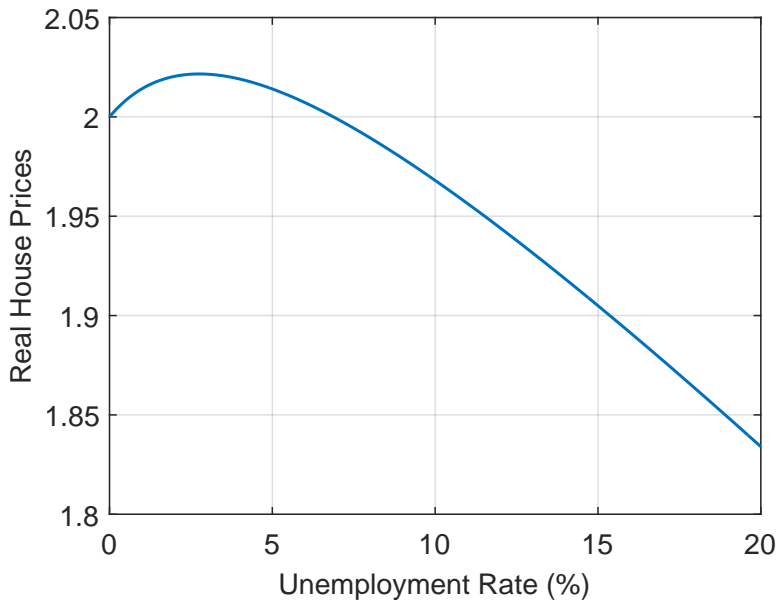
Imperfect Risk Sharing Steady States

- 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

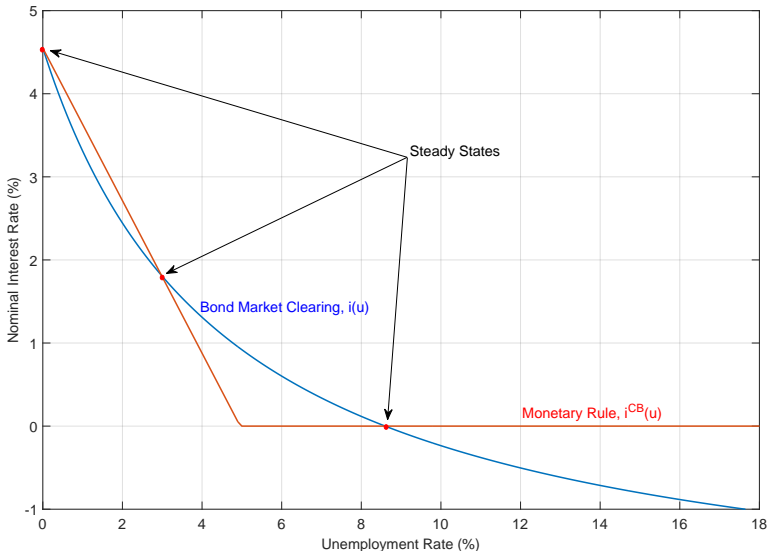
- If $\psi(\frac{\phi}{\rho}) < 1$ then household optimality and market clearing imply

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

- $i(u)$ 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

Steady States

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



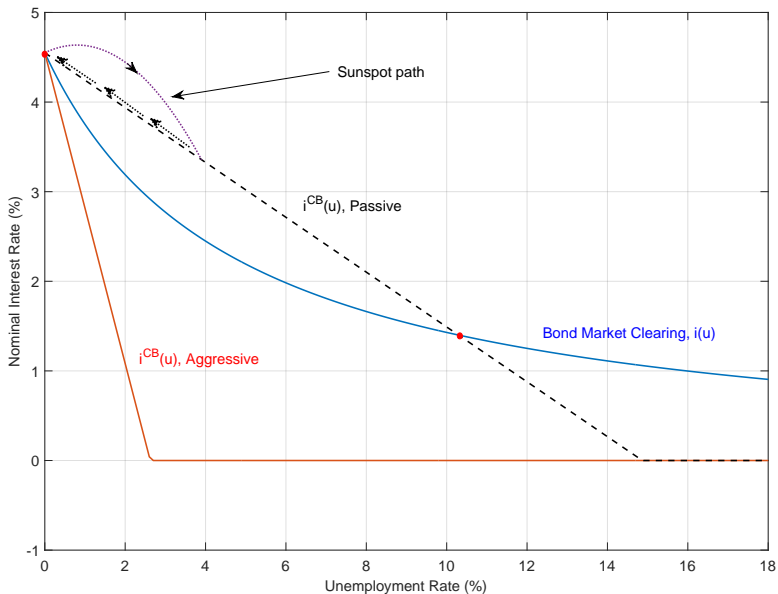
Characterizing Equilibria

- 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

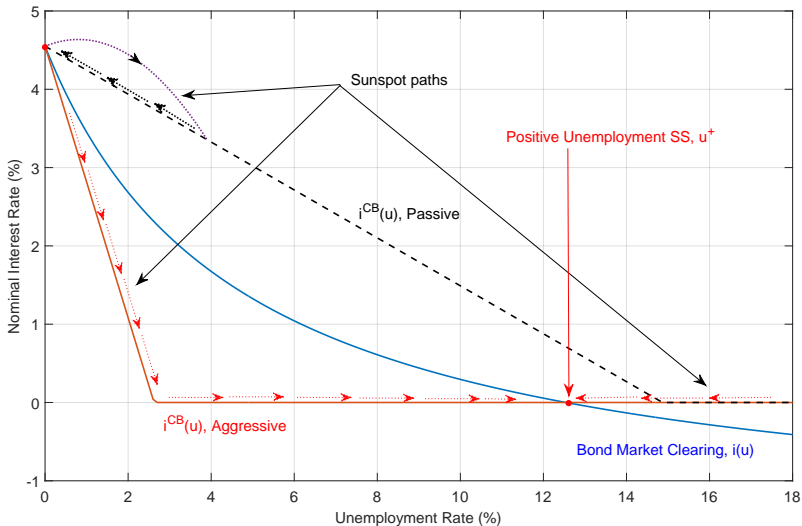
Policy Aggressivity and Local Stability



High Liquidity

- **Result:** If liquid wealth is high and policy is aggressive, full employment is only equilibrium
- **Intuition:** High liquid wealth \Rightarrow weak precautionary motive $\Rightarrow i > 0$ in any steady state
- \Rightarrow 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



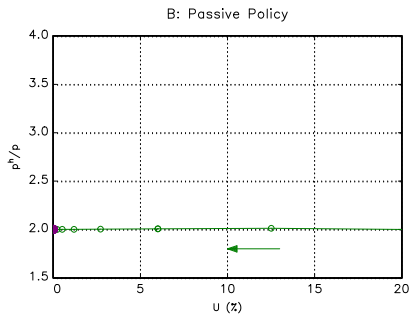
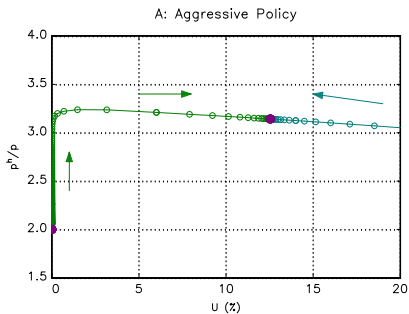
Low Liquidity

- **Result:** Under an aggressive policy, a new steady state emerges with $u > 0$ and $i = 0$
- **Intuition:** Low liquid wealth \Rightarrow poor insurance within household
- If households expect persistent unemployment, strong precautionary motive and weak demand
- \Rightarrow 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

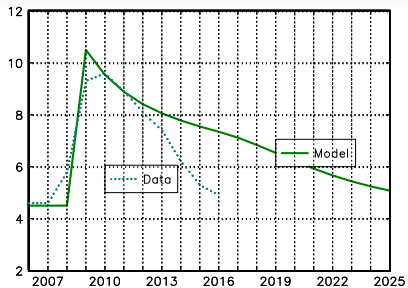
Figure: Global Dynamics with Low Liquid Wealth



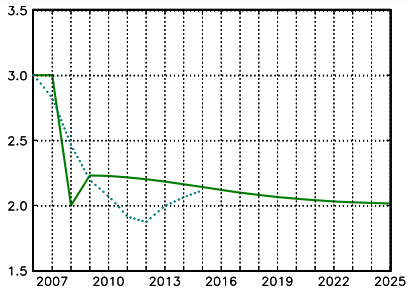
Great Recession Calibration

- $IES = 1/3 \Rightarrow CRRA = 3 \Rightarrow$ strong precautionary motive
- $\rho = 0.025 \Rightarrow$ real interest rate at full employment is 2.5%
- $\gamma_w = 0.02 \Rightarrow$ steady state inflation is 2.0%
- $\phi = 0.075 \rightarrow \phi = 0.05$ in 2008
 - \Rightarrow full employment house value to consumption declines from 3 to 2
 - Shifts economy from high liquid wealth to low liquid wealth regime
- $\kappa = 1.5 \Rightarrow$ midpoint of Taylor 1993 and 1999 coefficients
- $\psi = 0.33 \Rightarrow c^u/c^w = 0.76$ when recession hits
 - Given κ , need $\psi < 0.37$ for policy to be passive
 - \Rightarrow can construct sunspot shock to generate 6% jump in unemployment rate in 2009

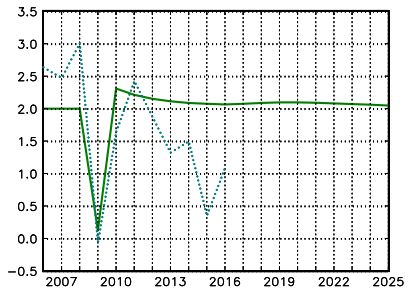
Unemployment (U+4.5% in model)



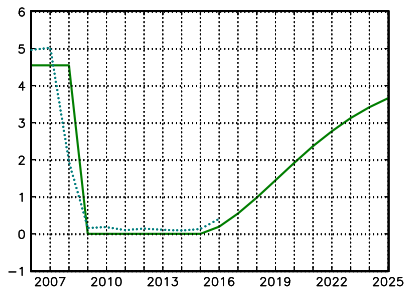
Real House Price



Inflation



Nominal Interest Rate



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

Other Models of the Lower Bound

Contrast with existing ZLB models, of which there are two types

1. Exogenous change in preferences to $\beta > 1$ drives temporary decline in real rate (e.g., Eggertsson & Woodford, 2003)
 - Shock hard to interpret
 - Shock has to be temporary
 - We don't need any exogenous shocks
2. Flip to nominal wage and price deflation (e.g., Benhabib, Schmitt-Grohe & Uribe, 2001, 2002)
 - Deflationary steady state has $\pi = -\rho$
 - **But ZLB experience in US involved low r , not $\pi < 0$**

Micro Evidence for the Mechanism

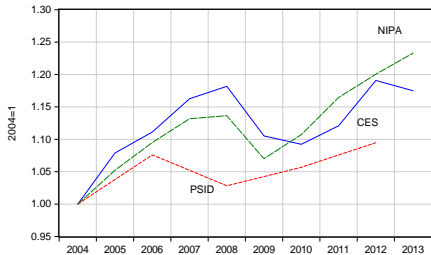
- **Key mechanism:** Elasticity of expenditures wrt unemployment risk is larger when wealth is low (for precautionary motives)
- **Natural test:** Did wealth-poor households reduce expenditures more than rich households as unemployment risk rose during the Great Recession?

Micro Survey Data

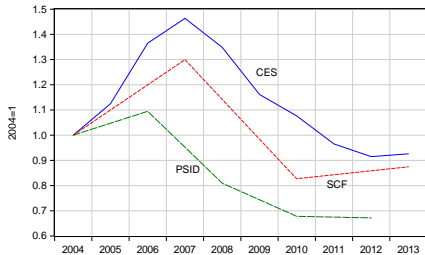
- Use both the CEX (higher frequency) and the PSID (longer panel)
- Focus on households of working age
- Divide sample by household wealth (net financial wealth plus home equity) relative to avg. expenditure
- Compare panel change in saving to income ratio for the high v/s low wealth groups
- Do we see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

Surveys versus NIPA

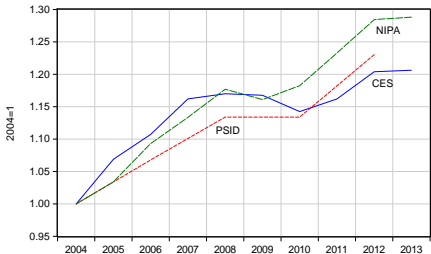
A. Per capita consumption expenditures



C. Median household net worth



B. Per capita disposable income



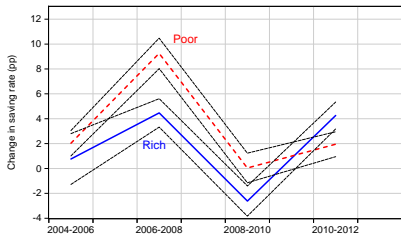
Characteristics of Rich versus Poor

	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)

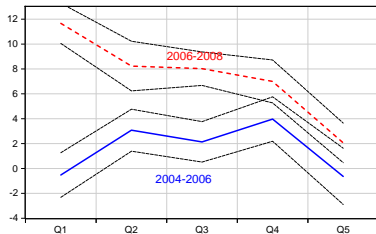
Note: Bootstrapped standard errors are in parentheses.

Wealth and Changes in Saving Rates

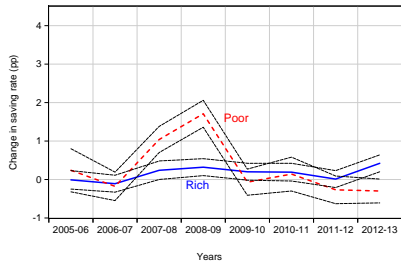
A. PSID over time



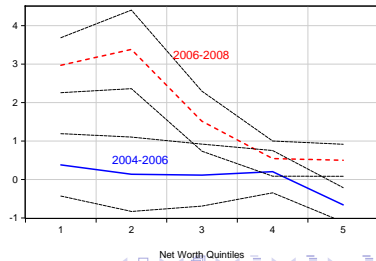
B. PSID by Net Worth Quintile



C. CES over time



D. CES by Net Worth Quintile

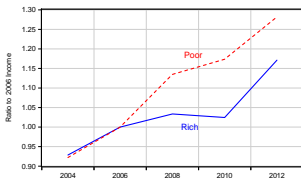


Are Other Factors Driving This?

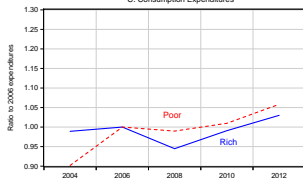
A. Saving Rates



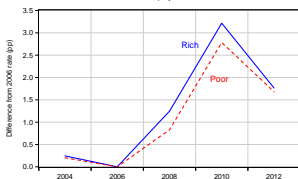
B. Disposable Income



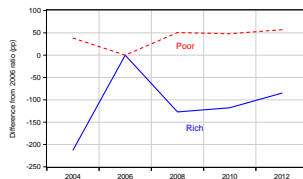
C. Consumption Expenditures



D. Unemployment Rate



E. Net Worth to Income Ratio



Conclusions

- Model in which macroeconomic stability threatened by low liquid wealth
- Great Recession: Decline in home values left economy vulnerable to wave of pessimism
- Macro evidence of a link between level of wealth and aggregate volatility
- Micro evidence that low wealth households increased saving most sharply
- Can evaluate effectiveness of policies geared toward stabilization of these fluctuations