WEALTH AND VOLATILITY

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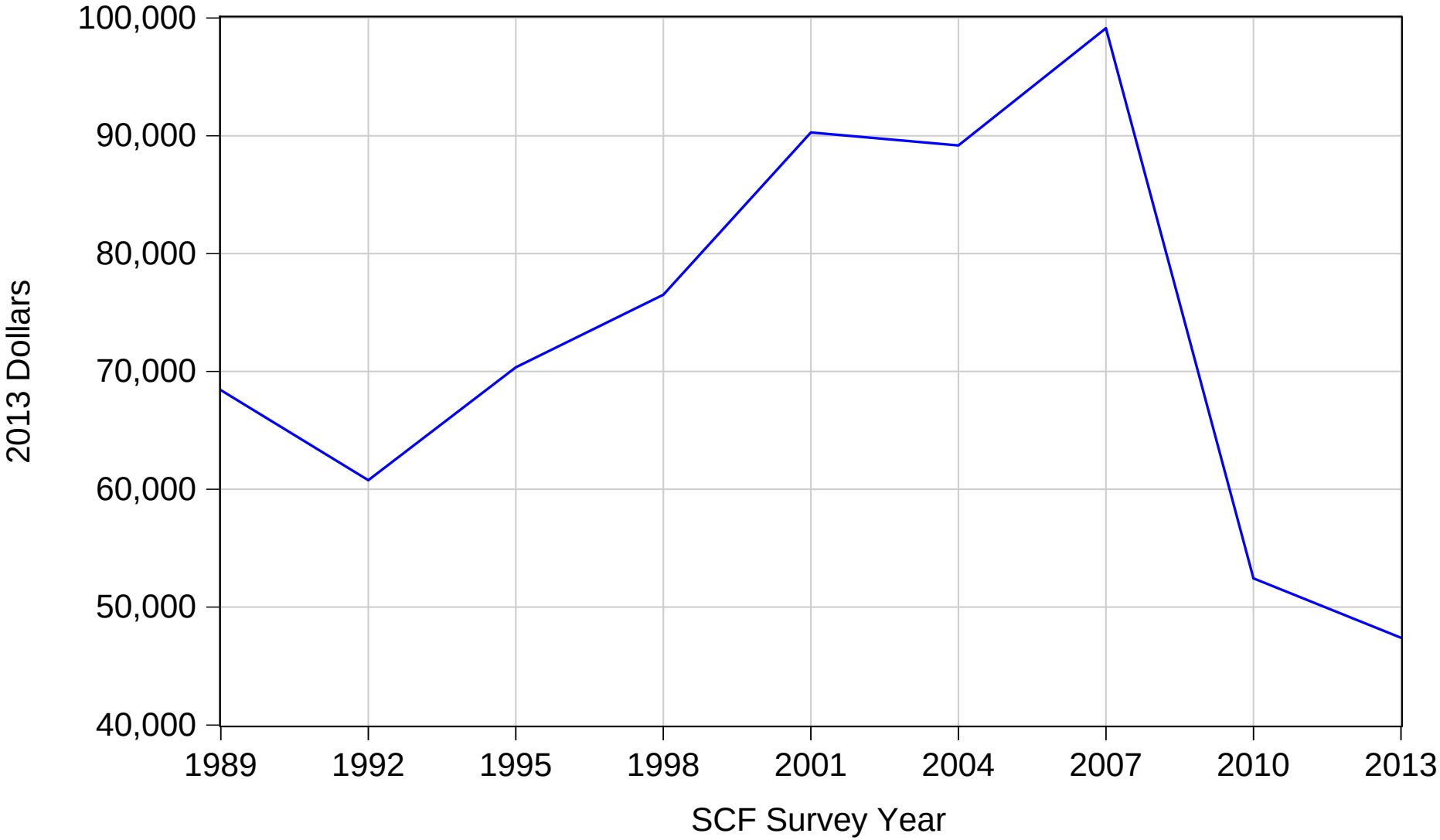
Sources of Business Cycles

- 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

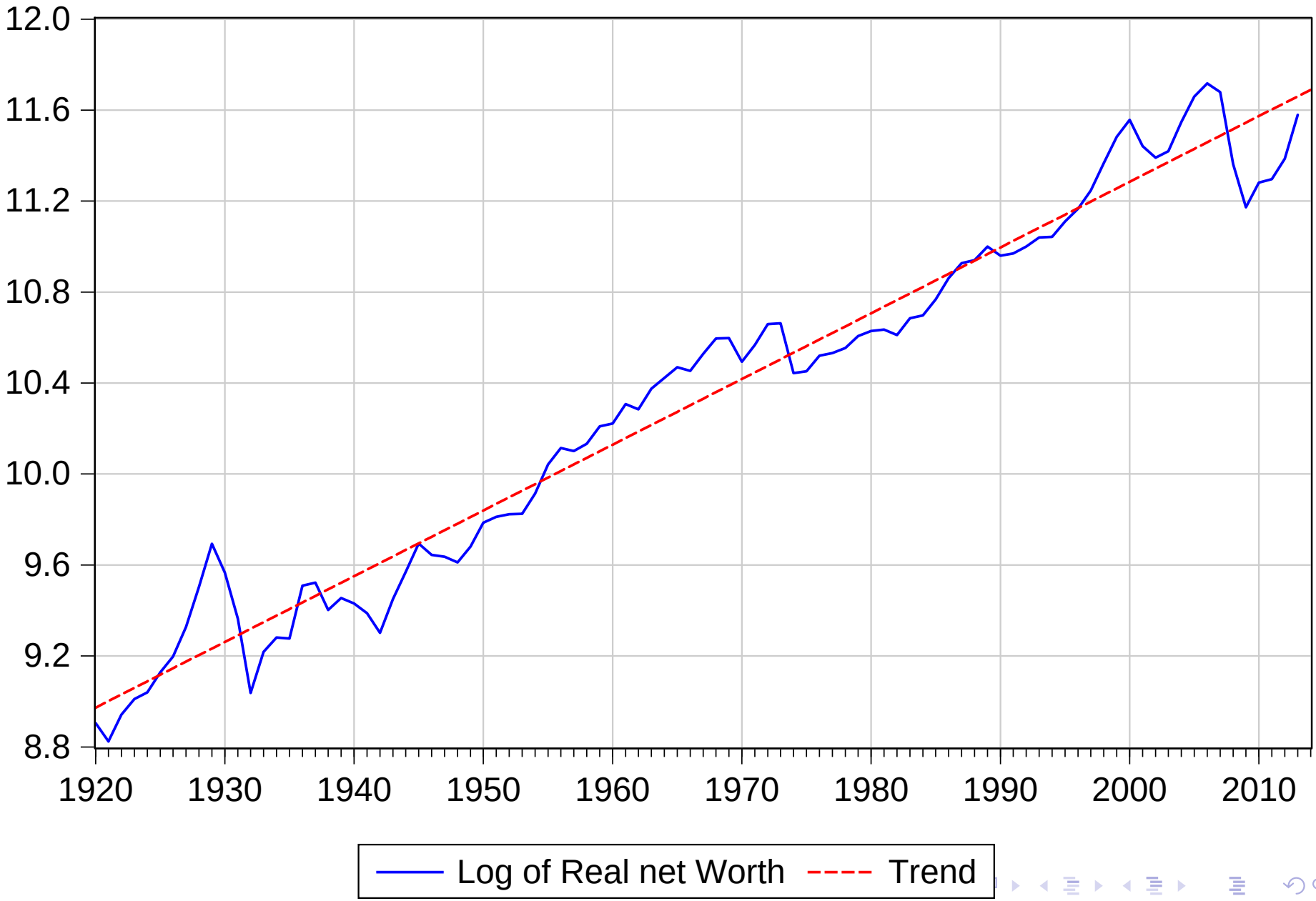
- Rise in expected unemployment
  $\rightarrow$ consumers reduce demand
  $\rightarrow$ firms reduce hiring
  $\rightarrow$ higher unemployment

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

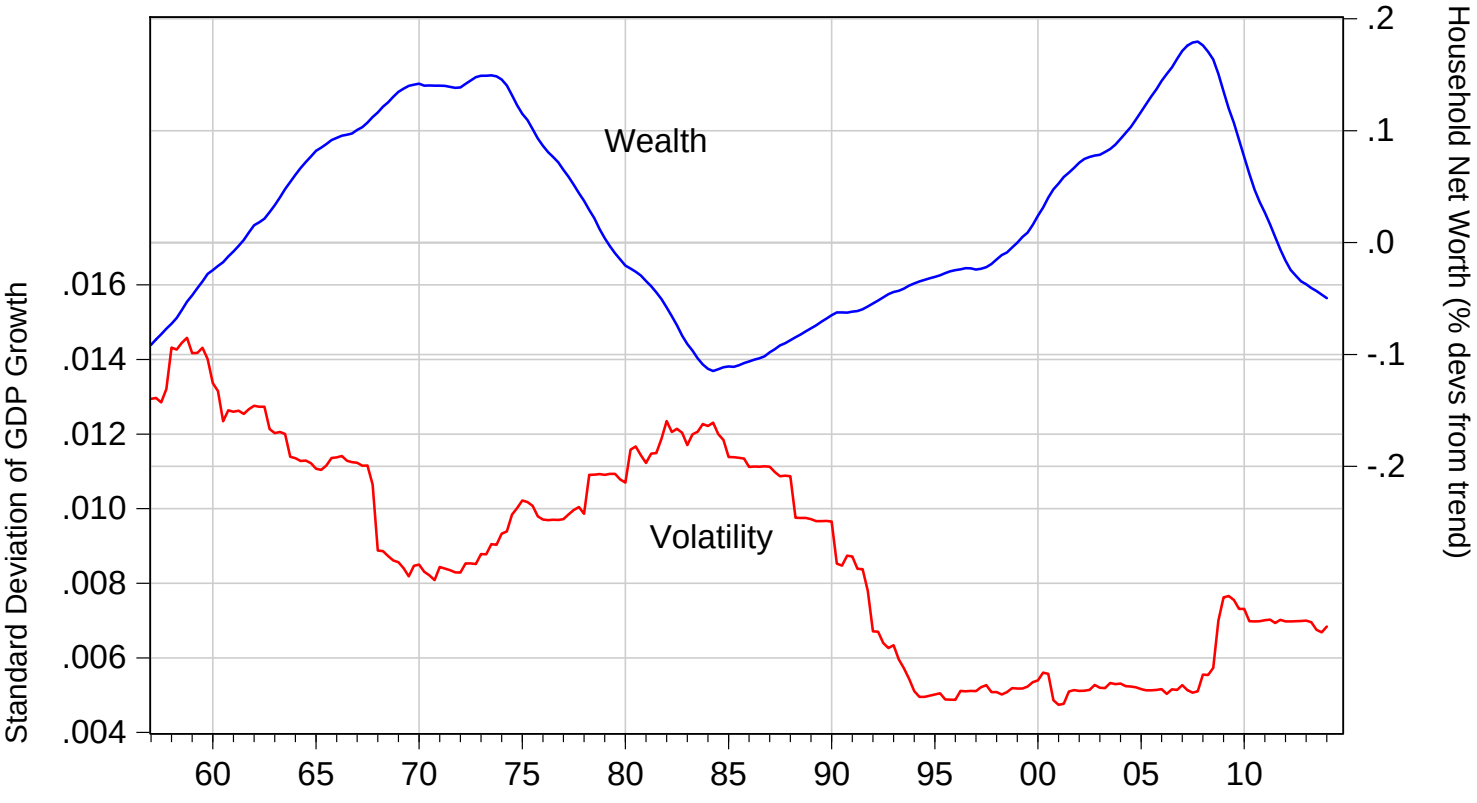
- High wealth:
  $\rightarrow$ demand less sensitive to expectations (weak precautionary motive)
  $\rightarrow$ no or small sunspot-driven fluctuations

- Low wealth:
  $\rightarrow$ demand more sensitive to expectations (strong precautionary motive)
  $\rightarrow$ sunspot-driven fluctuations

Household net worth in US in the long run



Wealth & GDP Volatility



Note: Standard deviation of GDP growth are computed over 40 quarters rolling windows. Observations for net worth are average over the same windows

Outline

1. A stylized 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

$$y_t = n_t^{\frac{1}{1+\sigma}}$$

where n is mass of workers hired and $\sigma > 1$ (decreasing returns)
Static profit maximization:

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

where p_t is price of cons. relative to money, w is fixed nominal wage
FOC:

$$\frac{w}{p_t} = \frac{n_t^{-\frac{\sigma}{1+\sigma}}}{1+\sigma}$$

In equilibrium,

$$u_t = 1 - n_t$$

which implies

$$p_t = (1+\sigma) w \, (1-u_t)^{\frac{\sigma}{1+\sigma}}$$

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

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

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

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

$$i_t = i(u_t) = \max\{\rho - \kappa u_t, 0\}$$

- Will consider passive (κ small) and aggressive (κ large) policies

Equilibrium

An equilibrium is a joint probability distribution over $\left\{u_t, p_t^h\right\}_{t=0}^{\infty}$ s.t. at each date:

1. Firm's FOC is satisfied, which pins down $p_t = p(u_t)$ for all t
2. Monetary authority follows rule $i_t = i(u_t)$ for all t
3. Households FOCs for bonds and money are satisfied at market-clearing quantities $h_t = 1$ and $b_t = 0$

Steady States

- Unemployment, prices, and interest rate are all constant
- There is always a full employment steady state in which

$$\begin{aligned} u &= 0 \\ i &= \rho \\ \frac{p^h}{p} &= \frac{\phi}{\rho} \end{aligned}$$

- This is the efficient allocation
- Existence of other steady states depends on size of liquid household wealth (ϕ,ψ) and monetary policy (κ)

High Liquidity Case

- Assume $\psi \frac{\phi}{\rho} < 1 =>$ imperfect insurance in any steady state
- If $\psi \frac{\phi}{\rho} \geq \frac{1-\psi}{1+\rho}$ and if κ is large enough, then
  1. $u = 0$ is unique steady state, and
  2. no sunspot shocks (confidence driven fluctuations) are possible

High Liquidity Intuition

- High liquid wealth => can insure consumption quite well within the household
- => $r > 0$ in any steady state (weak precautionary motive)
- Fixed w => $\pi = 0$ and $i = r$ in any steady state
- But if $i = r > 0$, then Fed can cut rates to steer economy away from unemployment
  - Reduce i => all agents will want to borrow and spend
  - => upward pressure on price of goods p_t
  - => reduction in real wage w/p_t
  - => unemployment declines
- Advice to Fed: be aggressive

Low Liquidity Case

- Suppose $\psi \frac{\phi}{\rho} < \frac{1-\psi}{1+\rho}$
  - If κ low, $u = 0$ is unique steady state, but sunspot shocks possible
  - If κ high, no sunspots around $u = 0$, but new steady state(s) with $u > 0$
- Takeaways:
  1. Low wealth opens the door to rich macroeconomic volatility
  2. No simple policy fix: bad outcomes possible whether Fed passive or aggressive

Low Liquidity: Two Steady States with Aggressive Fed

If $\psi\frac{\phi}{\rho} < \frac{1-\psi}{1+\rho}$ and κ is large then $\exists$ two steady states:

1. the one in which $u = 0$
2. a new one in which $i = 0$ and

$$u = u^{+} = \frac{\phi}{\frac{(1-\psi)}{\psi} - \frac{\phi}{\rho}}$$

$$\frac{p^h}{p} = \underbrace{\frac{\phi}{\rho}}_{\text{full employment pr.}} \times \underbrace{\left(1-u^{+}\right)^{\frac{1}{1+\sigma}}}_{\text{lower fundamental value}} \times \underbrace{\frac{1}{(1-\psi-\phi\psi)}}_{\text{greater liquidity value}}$$

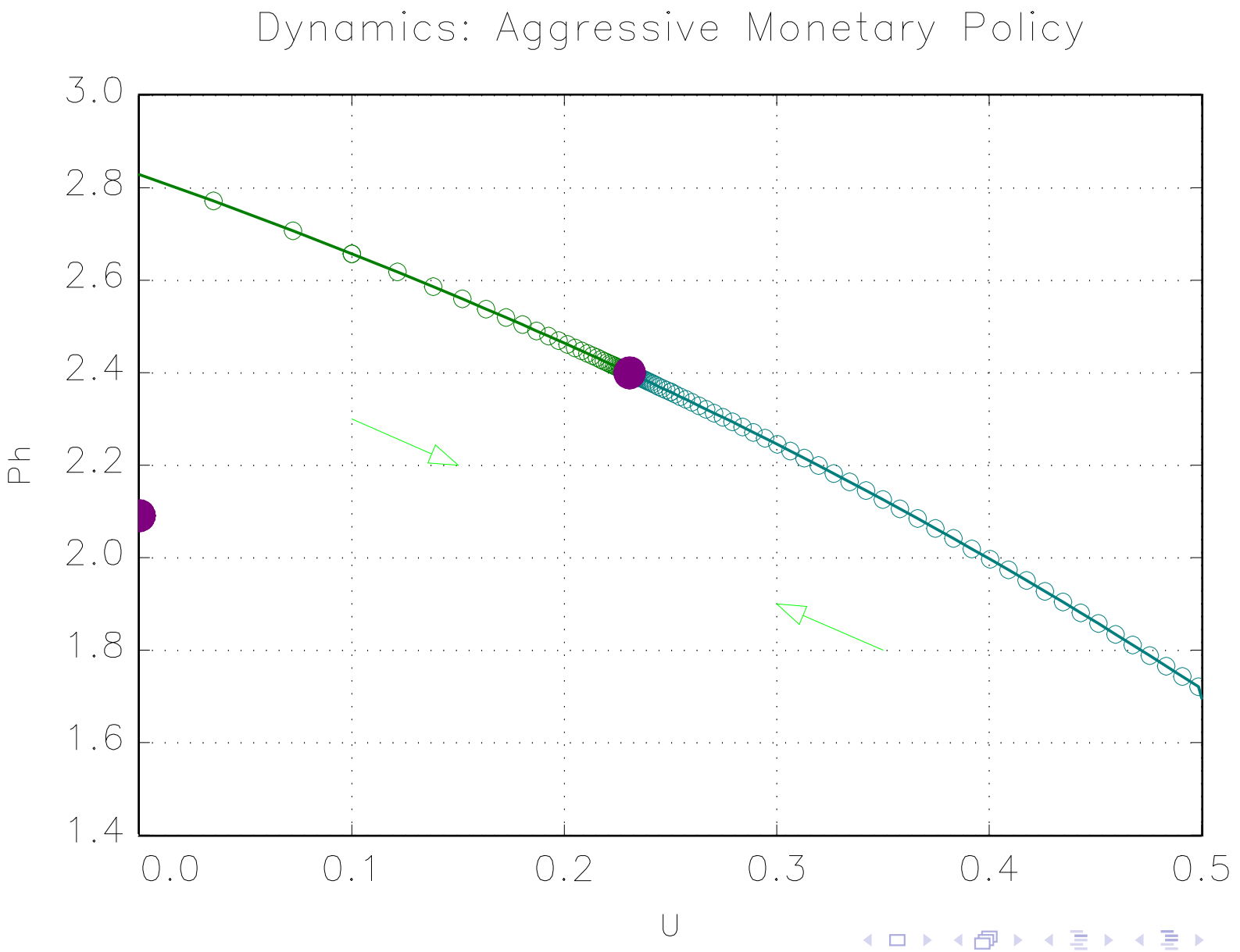
Low Liquidity: Intuition for $u > 0$ Steady State

- Low liquid wealth => poor insurance within household
- If households expect persistent unemployment, strong precautionary motive
- Aggressive Fed cuts i to $i = 0$
- But at $u = u^+$, precautionary motive strong enough to support $r = 0$!
- Unemployment exists because w/p_t too high
  - If Fed could push i_t negative, it could encourage borrowing, push up p_t, reduce w/p_t, and eliminate unemployment

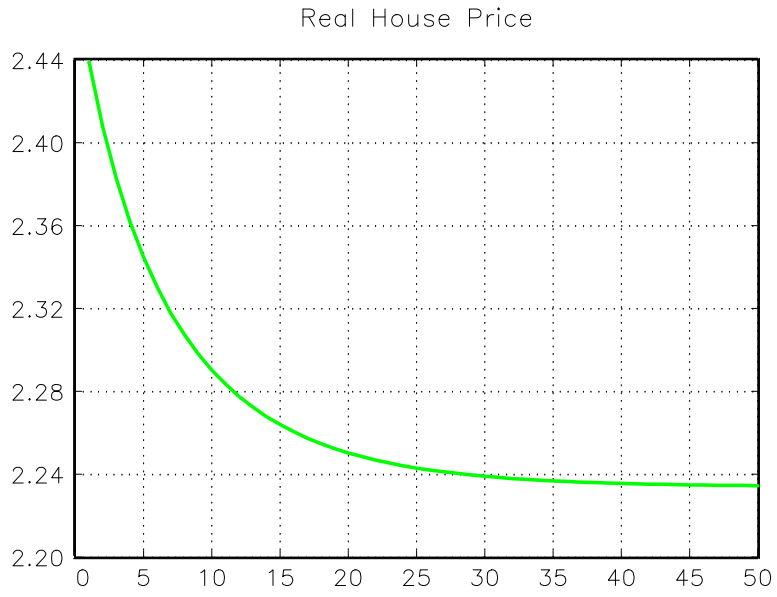
Low Liquidity Dynamics with Aggressive Fed

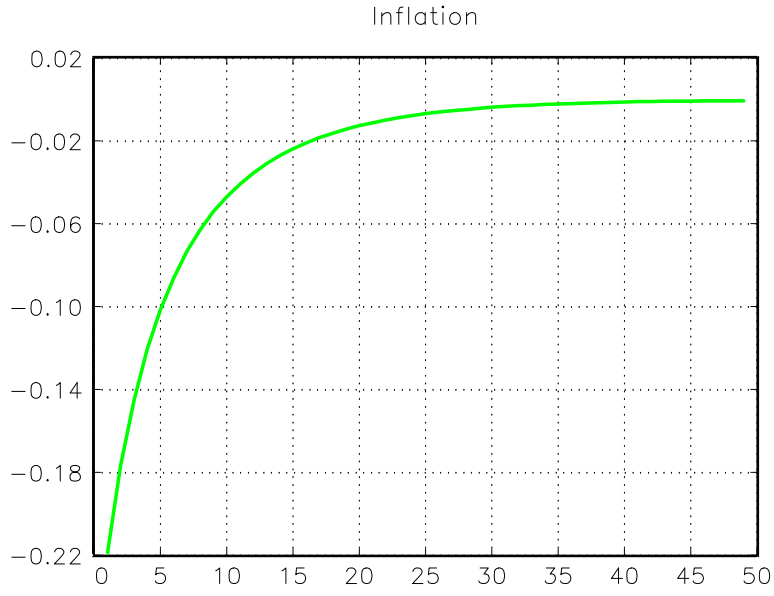
- Numerical example: $\beta = 0.95$, $w = 1$, $\sigma = 0.1$, $\phi = 0.1$, $\psi = 0.3$
- Implies $u^+ = 0.23$, $c^u/c^w = 0.81$ at $u = u^+$

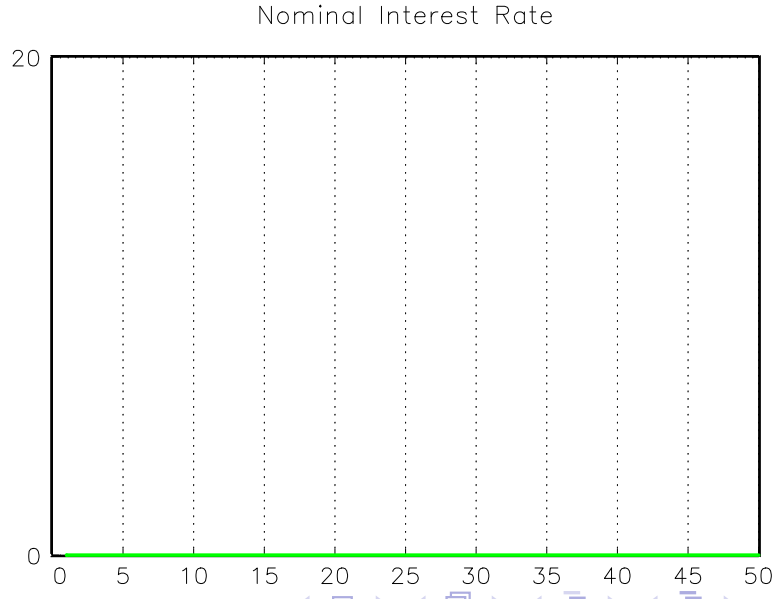
Phase diagram for aggressive Fed



Impulse response for shock going to u^+



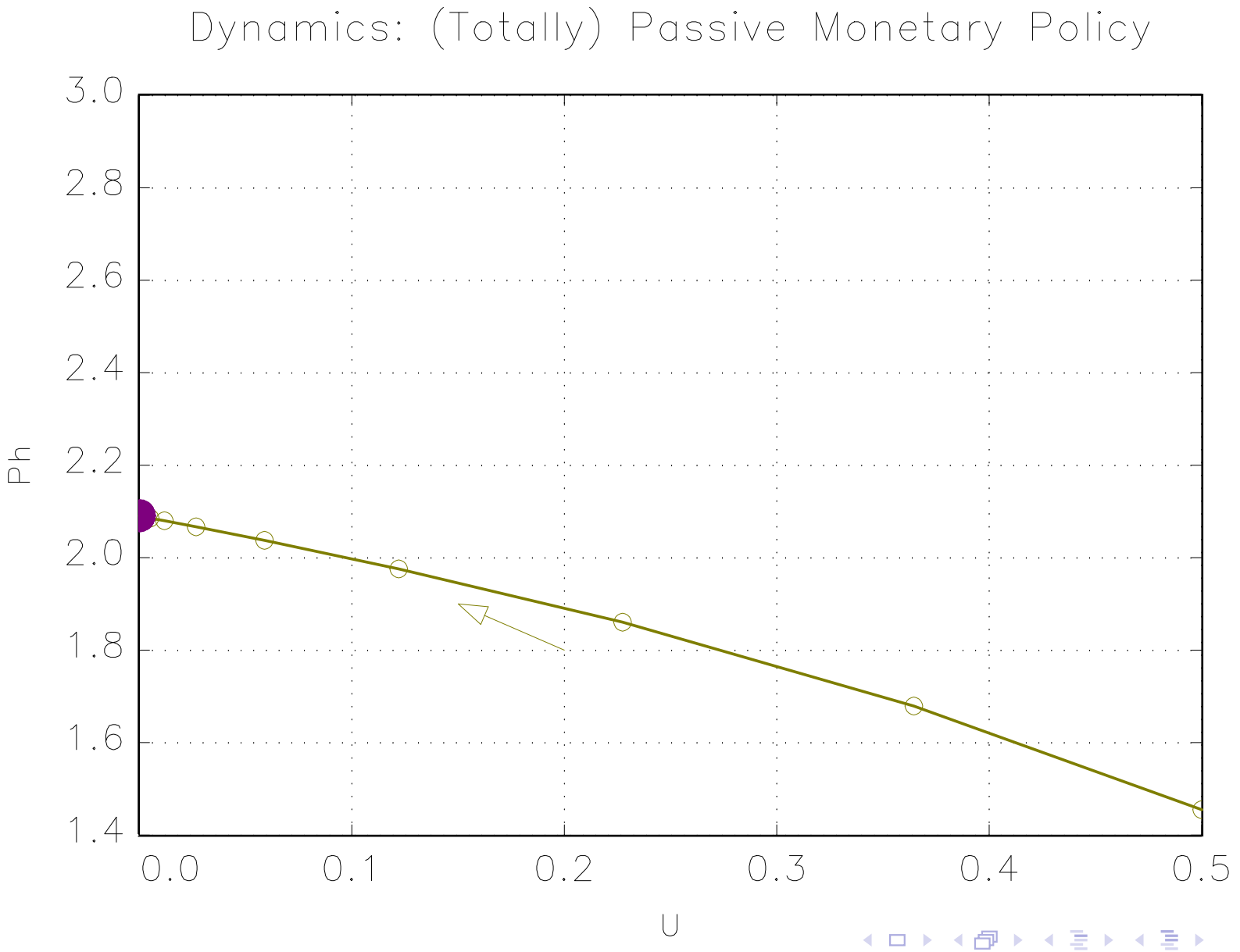




Low Liquidity: Does a Passive Fed Fix the Problem?

- Suppose Fed sets $\kappa = 0 => i_t = \rho$ (a la Schmitt-Grohe & Uribe)
- This rules out steady states with $u > 0$
  - with $u > 0$, precautionary motive implies $r = i < \rho$ which contradicts $i = \rho$
- But, another problem arises: if Fed is passive, $u = 0$ steady state becomes vulnerable to sunspots!

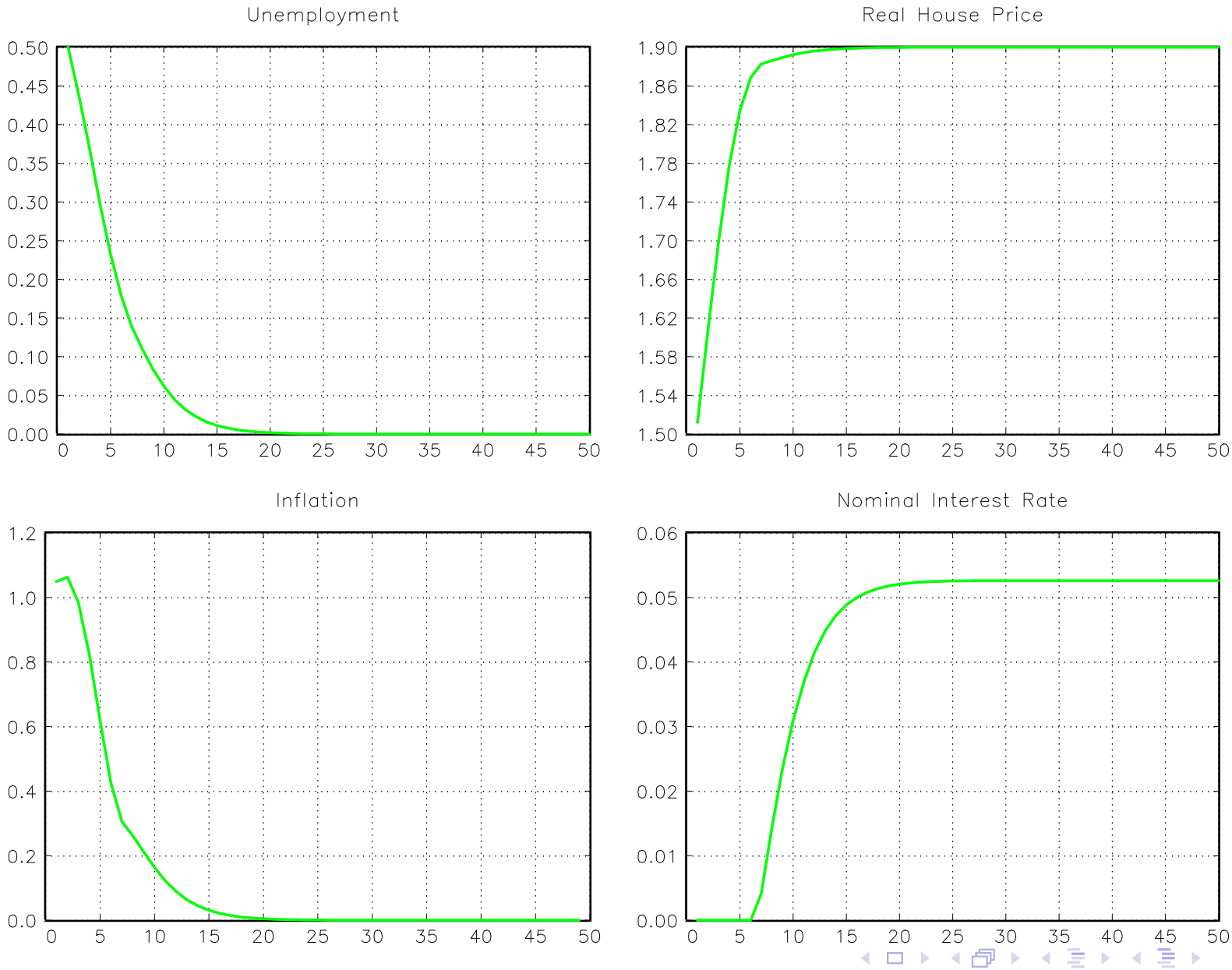
Phase diagram for totally passive Fed



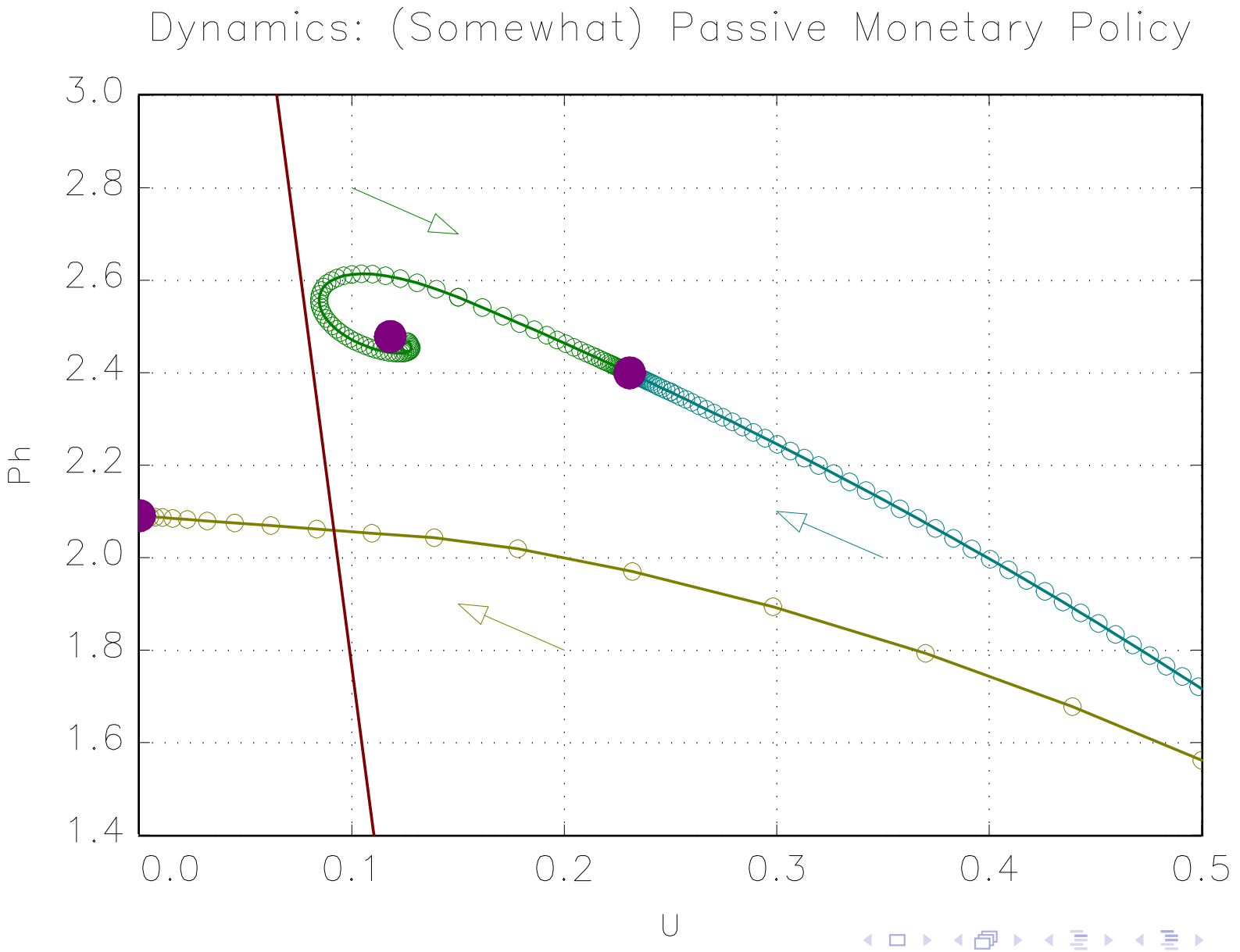
Why?

- Household co-ordinate on jump in unemployment
- Fed does not respond aggressively
- Transition back to $u = 0$ during which:
  - Expected growth is positive (motive to borrow)
  - Inflation is positive (motive to borrow)
  - But precautionary motive to save

Impulse response for shock going to u^+



Phase diagram for moderately passive Fed



Sunspots

- So far focussed on perfect foresight equilibria

  sunspot shocks zero probability

- Now construct equilibria in which economy probabilistically cycles between $u = 0$ and $u > 0$, w. prob. λ of remaining in same state

- Half the time households are optimistic about unemployment

  - by setting $i > 0$ appropriately, monetary authority delivers $u = 0$

- When people become pessimistic, flip to state with $u > 0$, low p, high w/p

Example with $\lambda = 0.95$

	Good	Bad
u	0	18.4%
i	4.0%	0.0%
$\frac{p^h}{p}$	2.30	2.48
p	1.1	1.08
$E[\pi]$	-0.09%	0.09%

Sunspots (cont.)

- Precautionary motive crucial to supporting self-fulfilling loss of confidence in equilibrium:
  - Fed cuts i to 0 => encourages borrowing
  - Expected income growth => encourages borrowing
  - Expected $\frac{p_{t+1}}{p_t} > 0$ => encourages borrowing
  - But $u > 0$ encourages precautionary saving
- Important point: λ must be large
  - If recession state not expected to last long, permanent income logic dictates strong borrow and spend motive
  - => demand-driven logic for depression unravels
- Confidence driven recessions will tend to be persistent

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 & Krugman)
   - Shock hard to interpret
   - Shock has to be temporary
   - Negative real rate => fast growth at ZLB
   - ZLB experience in US involved protracted slump
2. Flip to nominal wage and price deflation (e.g., Schmitt-Grohe & Uribe)
   - Deflationary steady state has $\pi = -\rho$
   - ZLB experience in US involved low r, not $\pi < 0$

Interpreting the Great Recession

- Decline in ϕ reduced p^h and pushed economy into region where multiple steady states and possibility of sunspots arises
- This didn't by itself create a recession but left economy vulnerable to a confidence shock
- Collective loss of confidence triggered sunspot shock taking us to $u > 0$
- Fed cut i to boost demand, but could not restore full employment given strong precautionary motive and low equilibrium r coupled with ZLB

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

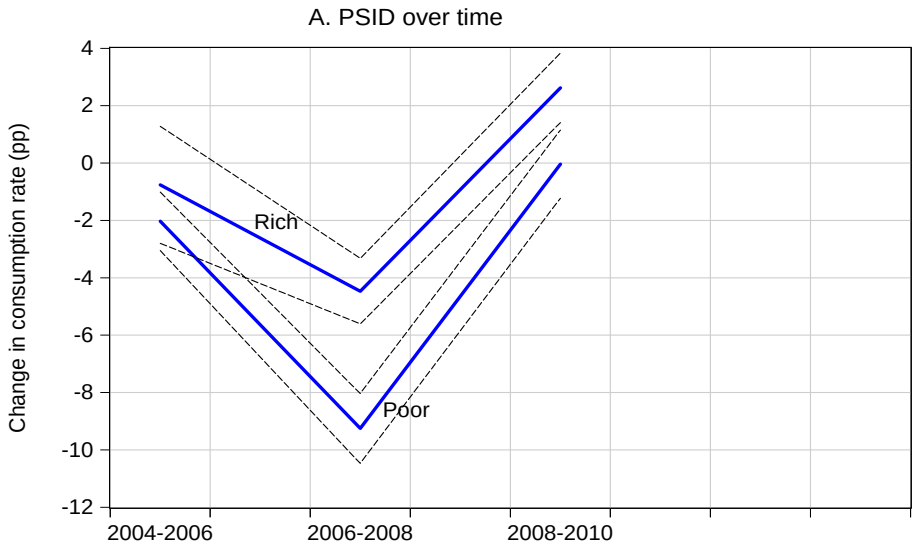
- Use both the CEX (higher frequency) and the PSID (longer panel)
- Focus on households of working age
- Divide sample by household wealth (net financial wealth plus home equity) relative to avg. expenditure
- Compare panel change in expenditure to income ratio for the high v/s low wealth groups
- Do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

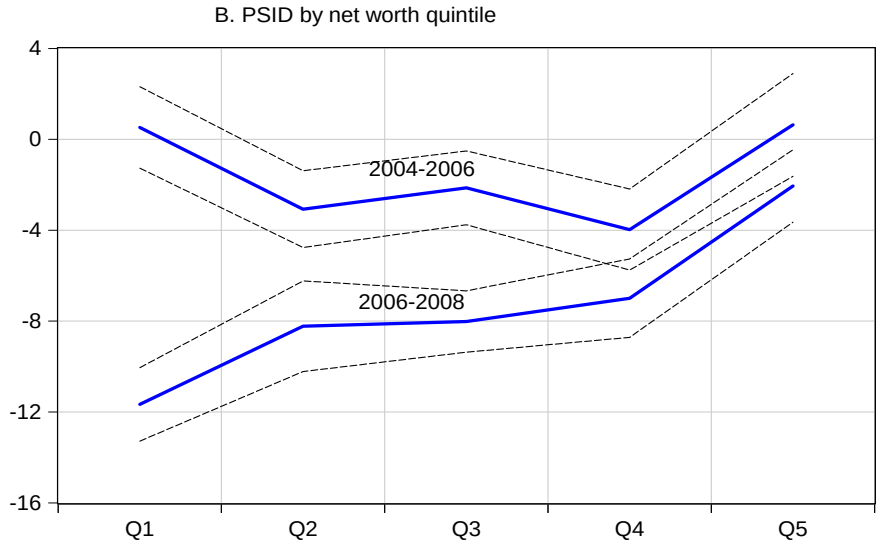
Characteristics of Rich versus Poor

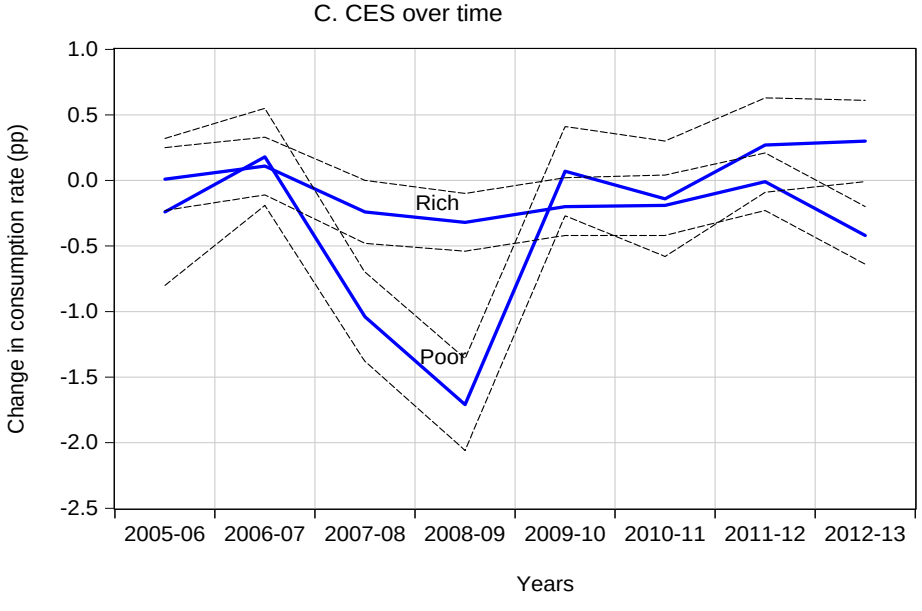
	PSID		CES	
	Poor	Rich	Poor	Rich
Sample size	3446	2523	1915	1960
Mean age of head	37.9	47.1	40.2	46.4
	(0.21)	(0.21)	(0.25)	(0.24)
Heads with college (%)	21.3	36.5	24.8	39.4
	(0.86)	(1.1)	(1.1)	(1.2)
Mean household size	2.45	2.72	2.84	2.79
	(0.04)	(0.03)	(0.04)	(0.04)
Mean household net worth (current $)	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)

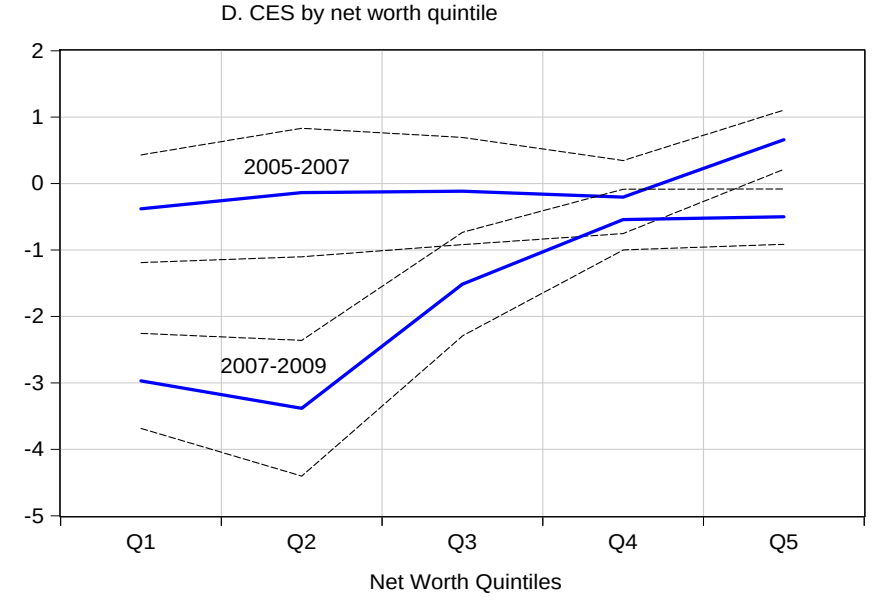
Note: Bootstrapped standard errors are in parentheses.

Wealth and changes in expenditure rates









Note: the thin dashed lines delimit 2 (bootstrapped) standard error bands.

Are differential changes in exp. rates driven by differential wealth losses or income prospects?

		2004-2006	2006-2008	2008-2010
POOR				
1.	Δ consumption rate (pp)	-2.03	-9.25	-0.04
		(1.2)	(1.2)	(1.2)
2.	Δ net worth (% of income)	113	83	61
		(15)	(32)	(11)
3.	Δ future income (%)	14.4	5.6	
		(1.6)	(1.3)	
RICH				
4.	Δ consumption rate (pp)	-0.76	-4.47	2.62
		(1.8)	(1.1)	(1.1)
5.	Δ net worth (% of income)	189	-137	-22
		(71)	(50)	(23)
6.	Δ future income (%)	7.39	-0.2	
		(1.8)	(1.9)	

Note: Bootstrapped standard errors are in parentheses.

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 reduced consumption most sharply
- Can evaluate effectiveness of policies geared toward stabilization of these fluctuations

Median and Mean Real Household Net Worth (from SCF)