Aggregate Demand Externalities in a Global Liquidity Trap

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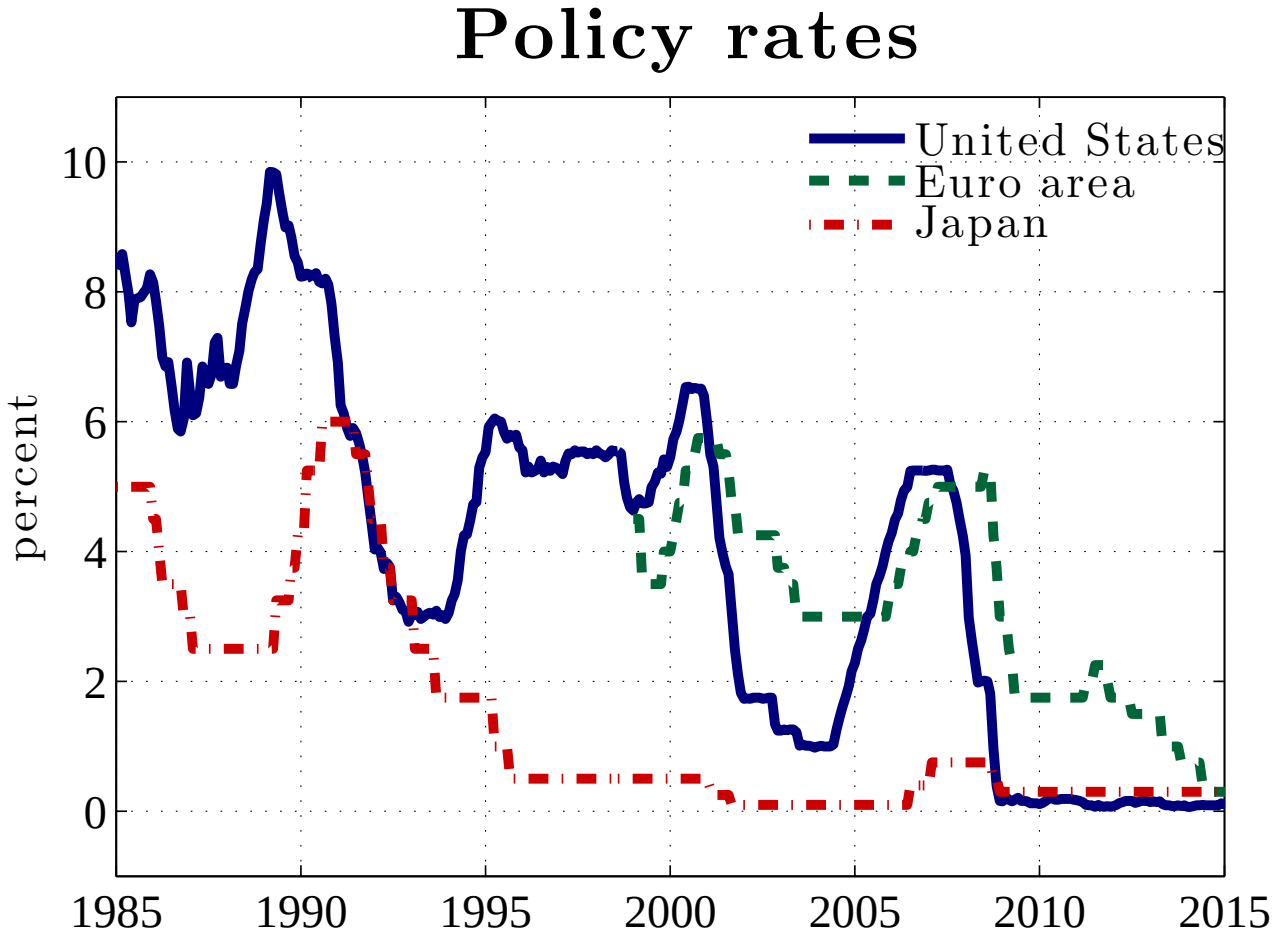
ADEMU
How Much of a Fiscal Union for the EMU?
18^{th} May 2017

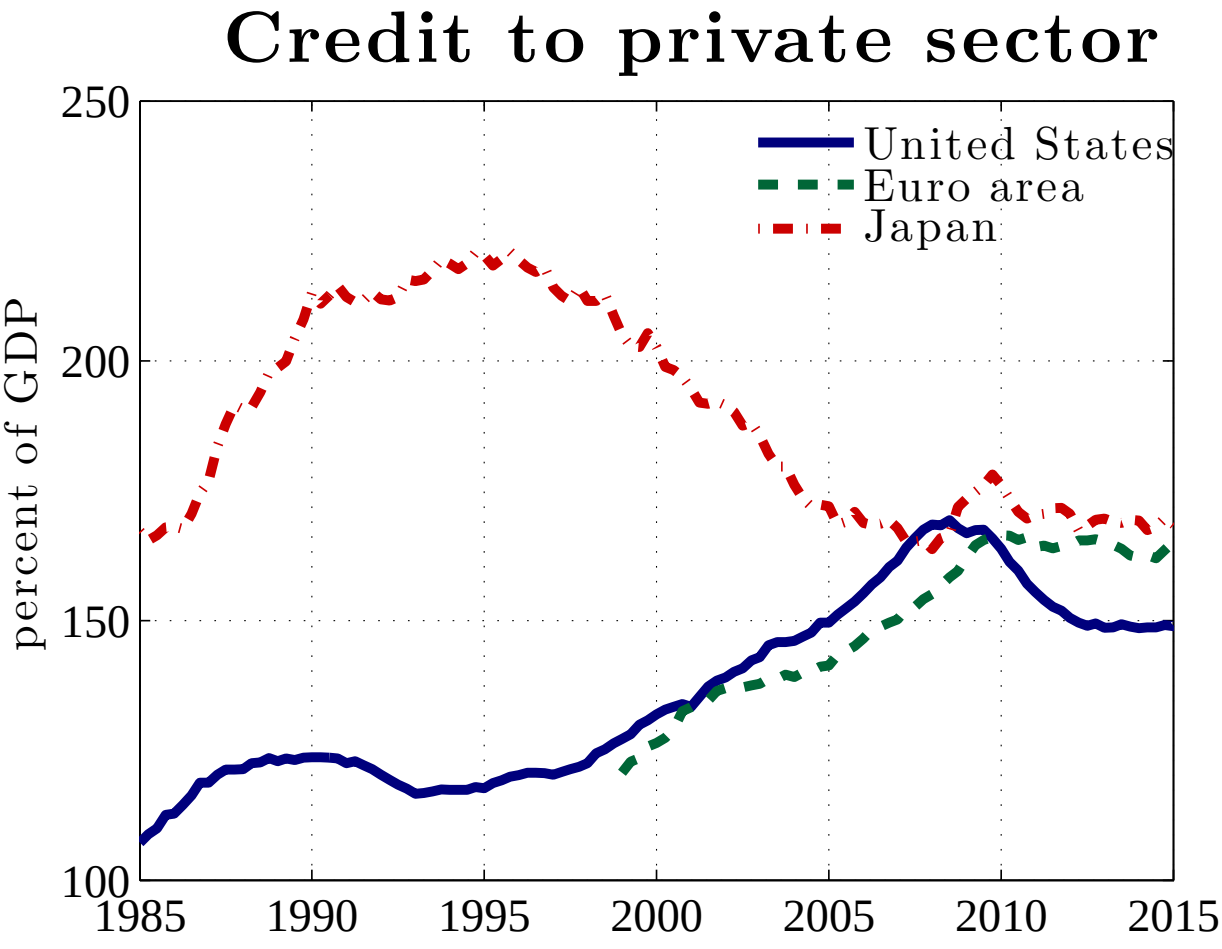
Motivation and research questions

- Recent history of advanced economies characterized by
  - Historically low real interest rates
  - Policy rates close to the zero lower bound
  - Liquidity traps accompanied by debt deleveraging

Policy rates: 1985-2015



Credit to private sector: 1985-2015



Motivation and research questions

- Recent history of advanced economies characterized by
  - Historically low real interest rates
  - Policy rates close to the zero lower bound
  - Liquidity traps accompanied by debt deleveraging
- Recent literature on macroprudential policies as stabilization tools
  - Farhi and Werning (2015, 2016);
  - Korinek and Simsek (2016);
  - Schmitt-Grohe and Uribe (2016).

Motivation and research questions

- Recent history of advanced economies characterized by
  - Historically low real interest rates
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- Recent literature on macroprudential policies as stabilization tools
- **Open questions**
  - What are the optimal macroprudential policies in a world characterized by low interest rates and high financial integration?
  - Is there a need for international cooperation?

This paper

Model of financially integrated world

- Continuum of small open economies
- Uninsurable idiosyncratic risk $\rightarrow$ trade in financial assets
- Nominal rigidities

Global liquidity trap

- Low real interest rates
- Monetary policy occasionally constrained by zlb
- Asymmetric business cycles and liquidity traps

Preview of results

Key result: Non-cooperative credit market interventions are inefficient

- Governments in booming countries implement counter-cyclical macroprudential policies to insure against future recessions
- Public intervention in credit markets increases the global demand of savings and decreases the global demand for consumption
- Recession in countries currently at the zlb gets worse

Need to coordinate credit market interventions.

Baseline model

- World composed of a continuum of small open economies
- Each economy is inhabited by identical households and firms
- Each economy has its own currency and central bank
- Perfect foresight

Households

- Representative household with lifetime utility

$$\sum_{t=0}^{\infty} \beta^t \log C_{i,t} \quad \text{with} \quad C_{i,t} = \left(C_{i,t}^T\right)^{\omega} \left(C_{i,t}^N\right)^{1-\omega}$$

- One unit labor endowment, no labor disutility
- Receives endowment of tradables
- Budget constraint

$$P_{i,t}^T C_{i,t}^T + P_{i,t}^N C_{i,t}^N + A_{i,t+1} = P_{i,t}^T Y_{i,t}^T + W_{i,t} L_{i,t} + R_{i,t-1}^A A_{i,t}$$

Financial assets and borrowing constraint

- Real bond B
  - Denominated in units of tradables
  - Pays world interest rate R_t
- Nominal bond B^n
  - Pays nominal interest rate $R^n_{i,t}$ (policy rate)
  - Zero net supply
- Borrowing limit

$$B_{i,t+1} + \frac{B^n_{i,t+1}}{P^T_{i,t}} \geq -\kappa \quad \text{with} \quad \kappa \to 0$$

Optimality conditions

- Euler equation

$$\frac{1}{C_{i,t}^T} = \frac{\beta R_t}{C_{i,t+1}^T} + \mu_{i,t}$$

$$\mu_{i,t}\left(B_{i,t+1} + \frac{B_{i,t+1}^n}{P_{i,t}^T}\right) = 0$$

Optimality conditions

- No arbitrage (uncovered interest parity)

$$R^n_{i,t} = R_t \frac{P^T_{i,t+1}}{P^T_{i,t}} \rightarrow R^n_{i,t} = R^n_{j,t} \frac{S^j_{i,t+1}}{S^j_{i,t}}$$

- Intratemporal allocation of expenditure

$$C^N_{i,t} = \frac{1-\omega}{\omega} \frac{P^T_{i,t}}{P^N_{i,t}} C^T_{i,t}$$

Optimality conditions

- No arbitrage (uncovered interest parity)

$$R^n_{i,t} \uparrow = R_t \frac{P^T_{i,t+1}}{P^T_{i,t} \downarrow} \rightarrow R^n_{i,t} = R^n_{j,t} \frac{S^j_{i,t+1}}{S^j_{i,t}}$$

- Intratemporal allocation of expenditure

$$C^N_{i,t} \downarrow = \frac{1-\omega}{\omega} \frac{P^T_{i,t} \downarrow}{P^N_{i,t}} C^T_{i,t}$$

Aggregate demand for non-tradable good

$$C_{i,t}^N = \frac{R\pi_{i,t+1}}{R_{i,t}^n} \frac{C_{i,t}^T}{C_{i,t+1}^T} C_{i,t+1}^N \qquad \text{(AD)}$$

Aggregate demand

- Decreasing in $R_{i,t}^n/\pi_{i,t+1}$, where $\pi_{i,t} \equiv P_{i,t}^N/P_{i,t-1}^N$
- Increasing in $C_{i,t+1}^N$
- Increasing in $C_{i,t}^T/C_{i,t+1}^T$
- Increasing in R

Firms and labor market

- Non-tradable good produced by competitive firms

$$Y_{i,t}^N = L_{i,t}$$

- Zero-profit condition implies

$$P_{i,t}^N = W_{i,t}$$

- Downward wage rigidities

$$W_{i,t} \geq \gamma W_{i,t-1}$$

- Equilibrium on labor market

$$(L_{i,t} - 1)(W_{i,t} - \gamma W_{i,t-1}) = 0$$

Monetary policy

- Central bank targets domestic inflation $\pi_{i,t}$
- Assume inflation target $\bar{\pi} > \gamma$ so that

$$\pi_{i,t} = \bar{\pi} \rightarrow Y_{i,t}^N = 1$$

- Central bank sets $R_{i,t}^n$, subject to $R_{i,t}^n \geq 1$

$$R_{i,t}^n = \begin{cases} \geq 1 & \text{if } Y_{i,t}^N = 1, \pi_{i,t} = \bar{\pi} \\ = 1 & \text{if } Y_{i,t}^N < 1, \pi_{i,t} = \gamma \end{cases} \qquad \text{(MP)}$$

Market clearing

- Goods market

$$C_{i,t}^T = Y_{i,t}^T - B_{i,t+1} + R_{t-1} B_{i,t}$$

$$C_{i,t}^N = Y_{i,t}^N$$

- Labor market

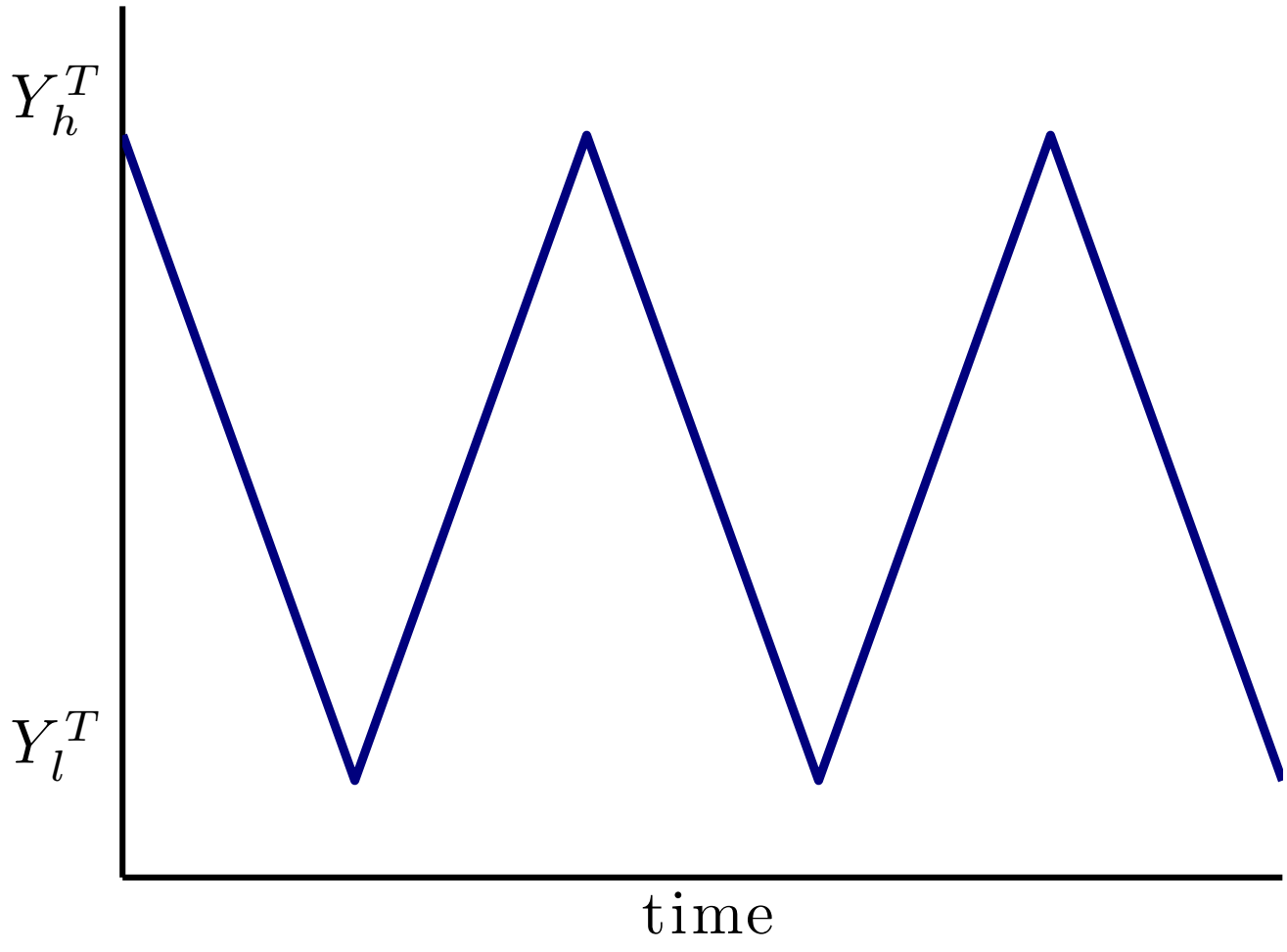
$$Y_{i,t}^N = L_{i,t} \leq 1$$

- Asset market

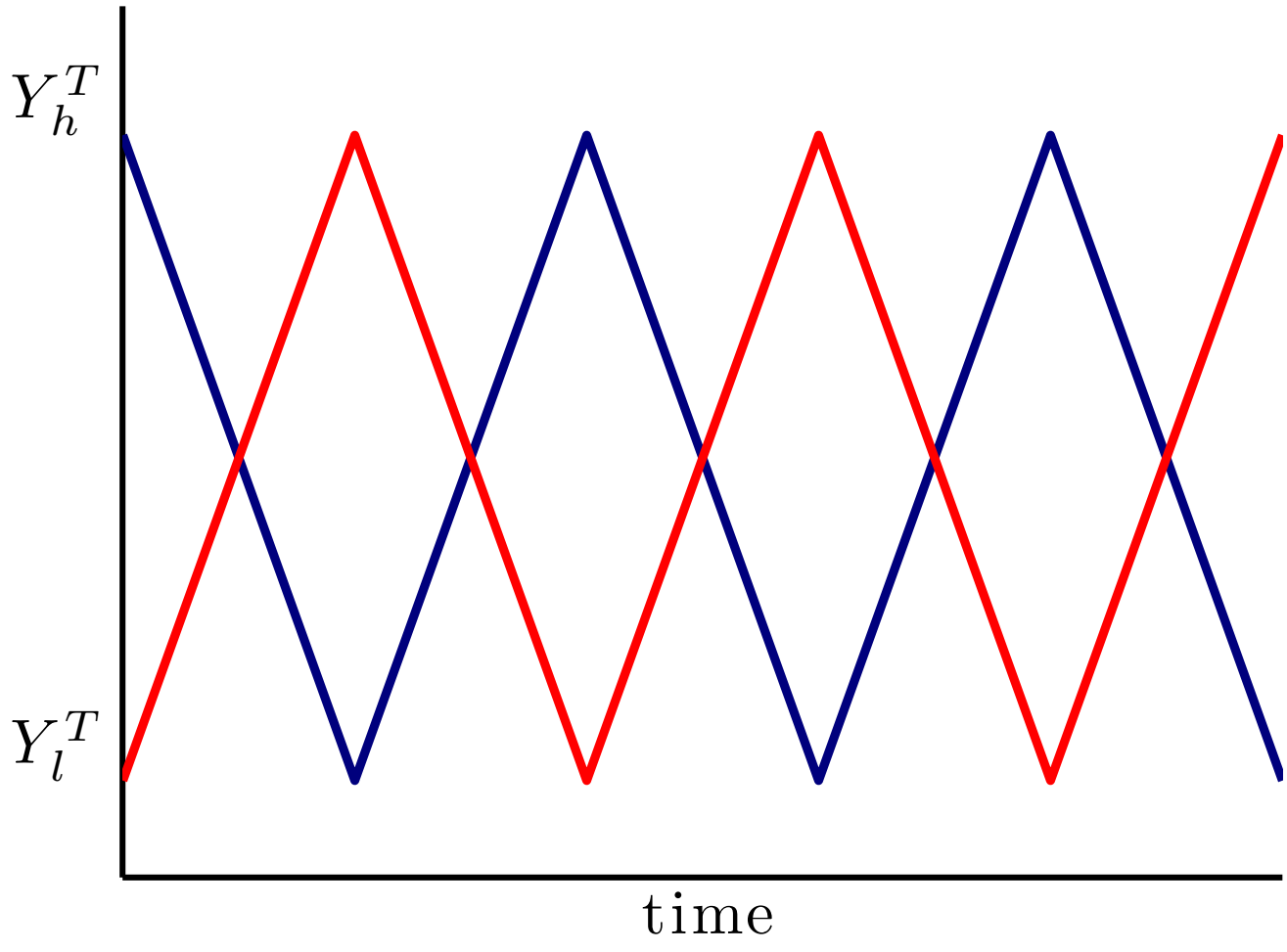
$$B_{i,t+1}^n = 0$$

$$\int_0^1 B_{i,t+1}\, di = 0 \quad \rightarrow \quad \int_0^1 C_{i,t}^T\, di = \int_0^1 Y_{i,t}^T\, di$$

Tradable endowment process



Tradable endowment process



Financial laissez faire

- Consider a small open economy with $\beta R < 1$
- Borrowing constraint binds in l state

$$B_l = 0$$

- Euler equation in h state

$$\frac{1}{C_h^T} \geq \frac{\beta R}{C_l^T} \quad \rightarrow \quad C_h^T > C_l^T$$

- Savings in h state

$$B_h = \max\left\{\frac{\beta R}{1+\beta}\left(Y_h^T - \frac{Y_l^T}{\beta R}\right), 0\right\}$$

Non-tradable good market

- Aggregate demand

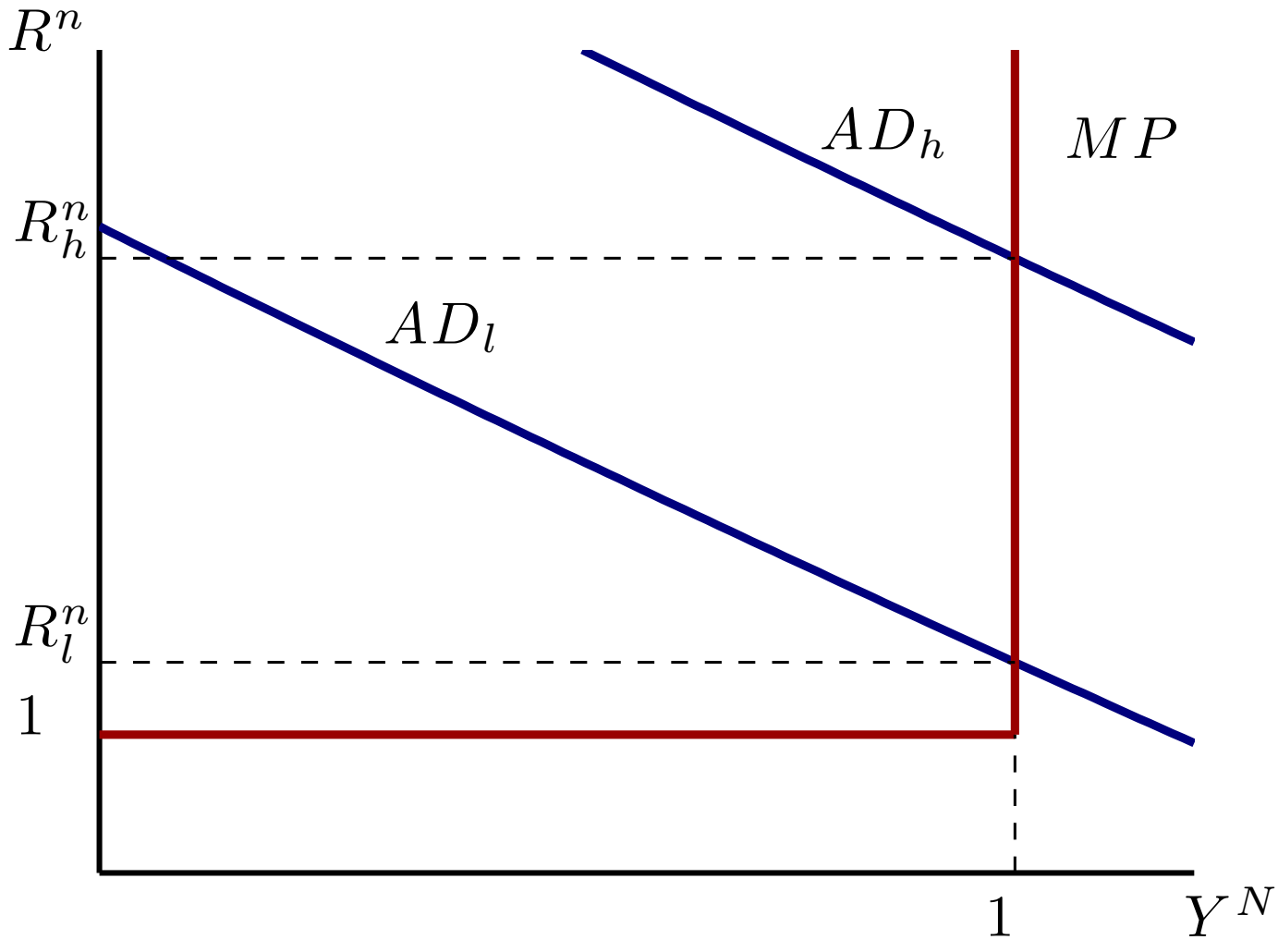
$$C_{i,t}^N = \frac{R\pi_{i,t+1}}{R_{i,t}^n} \frac{C_{i,t}^T}{C_{i,t+1}^T} C_{i,t+1}^N \qquad \text{(AD)}$$

- Monetary policy rule

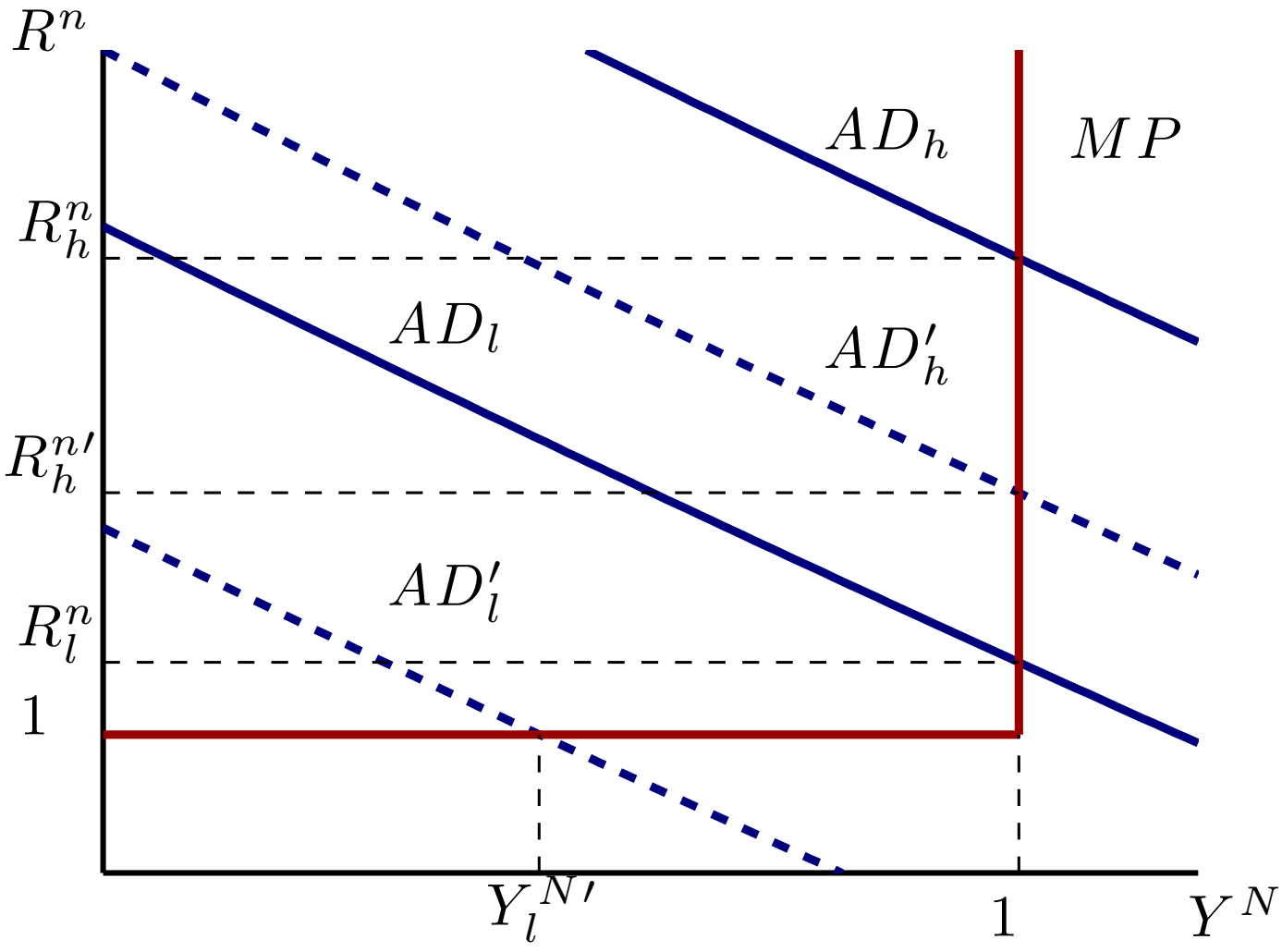
$$R_{i,t}^n = \begin{cases} \geq 1 & \text{if } Y_{i,t}^N = 1, \pi_{i,t} = \bar{\pi} \\ = 1 & \text{if } Y_{i,t}^N < 1, \pi_{i,t} = \gamma \end{cases} \qquad \text{(MP)}$$

- Equilibrium $C_{i,t}^N = Y_{i,t}^N$

Non-tradable good market



High R (solid lines) vs. low R (dashed lines)



Equilibrium on world asset market

- Equilibrium on asset market implies

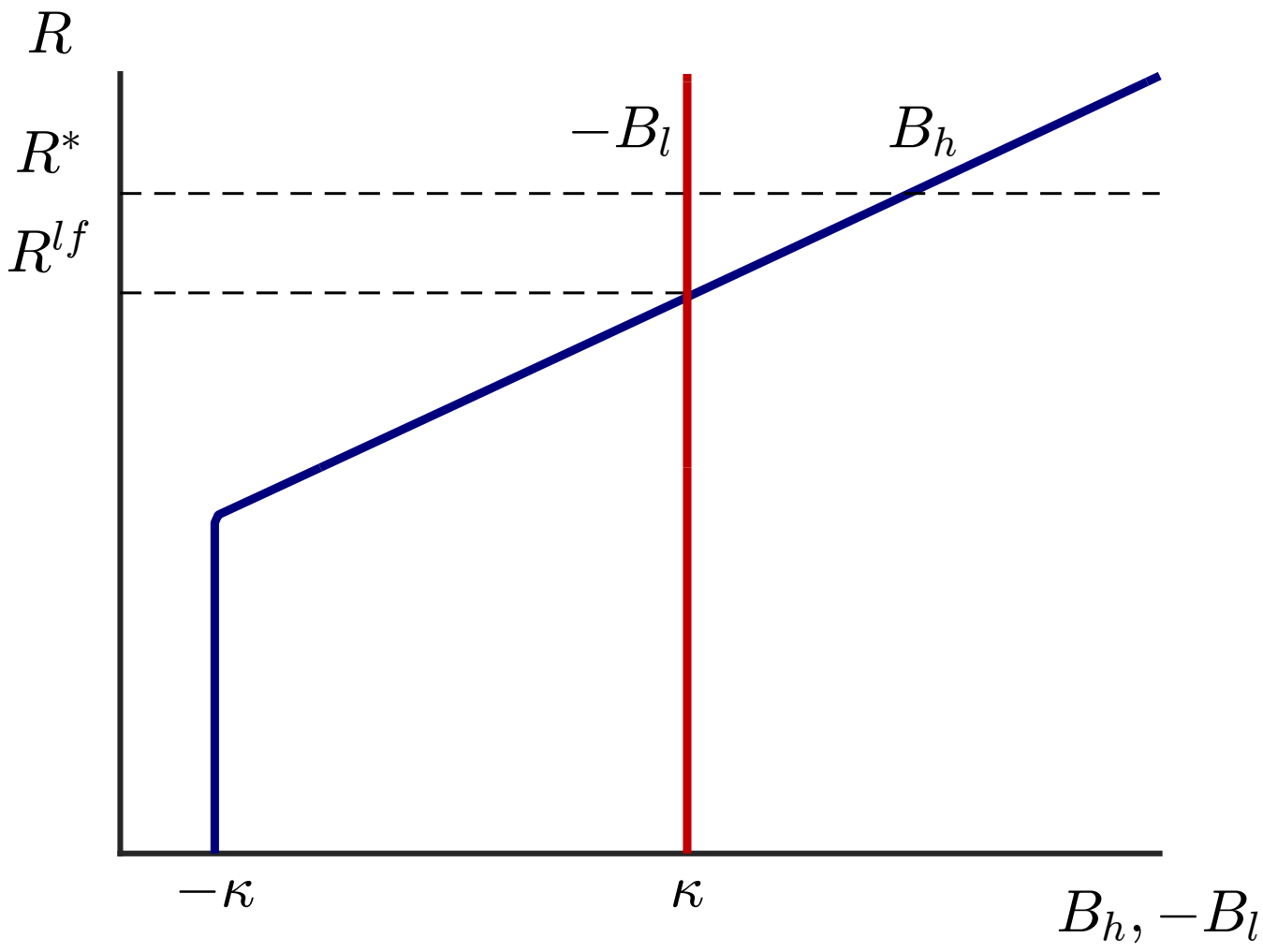
$$B_h = -B_l = \kappa \approx 0 \rightarrow C_h^T = Y_h^T, C_l^T = Y_l^T$$

- World interest rate given by

$$R = \frac{C_l^T}{\beta C_h^T} = \frac{Y_l^T}{\beta Y_h^T} \equiv R^{lf}$$

- If $R^{lf} < R^*$ world is in a global liquidity trap
  - Countries hit by negative shocks experience liquidity traps with unemployment
  - Permanent state of secular stagnation

Equilibrium on world asset market



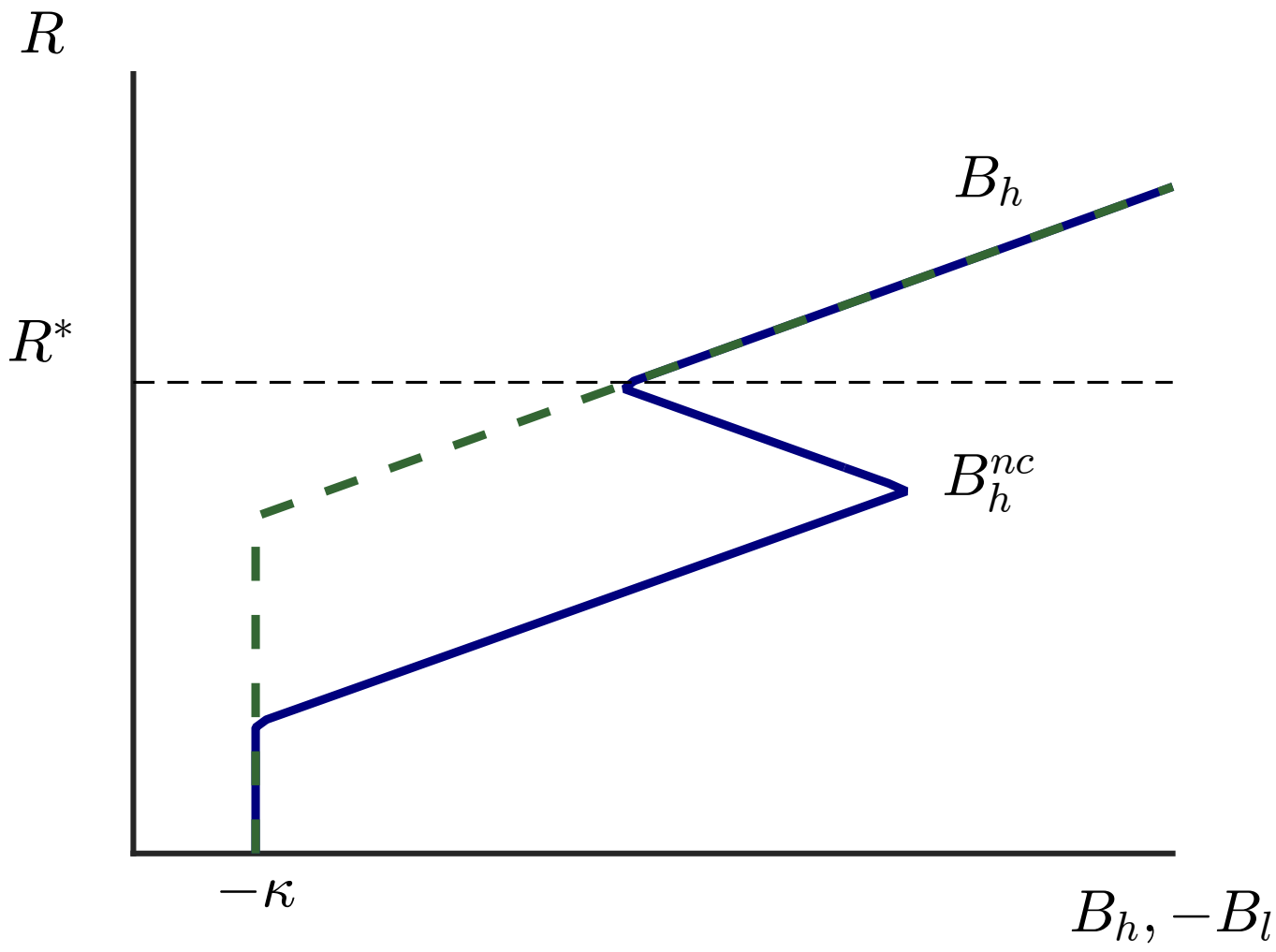
Credit policy as a stabilization tool

- Non-tradable output in low state

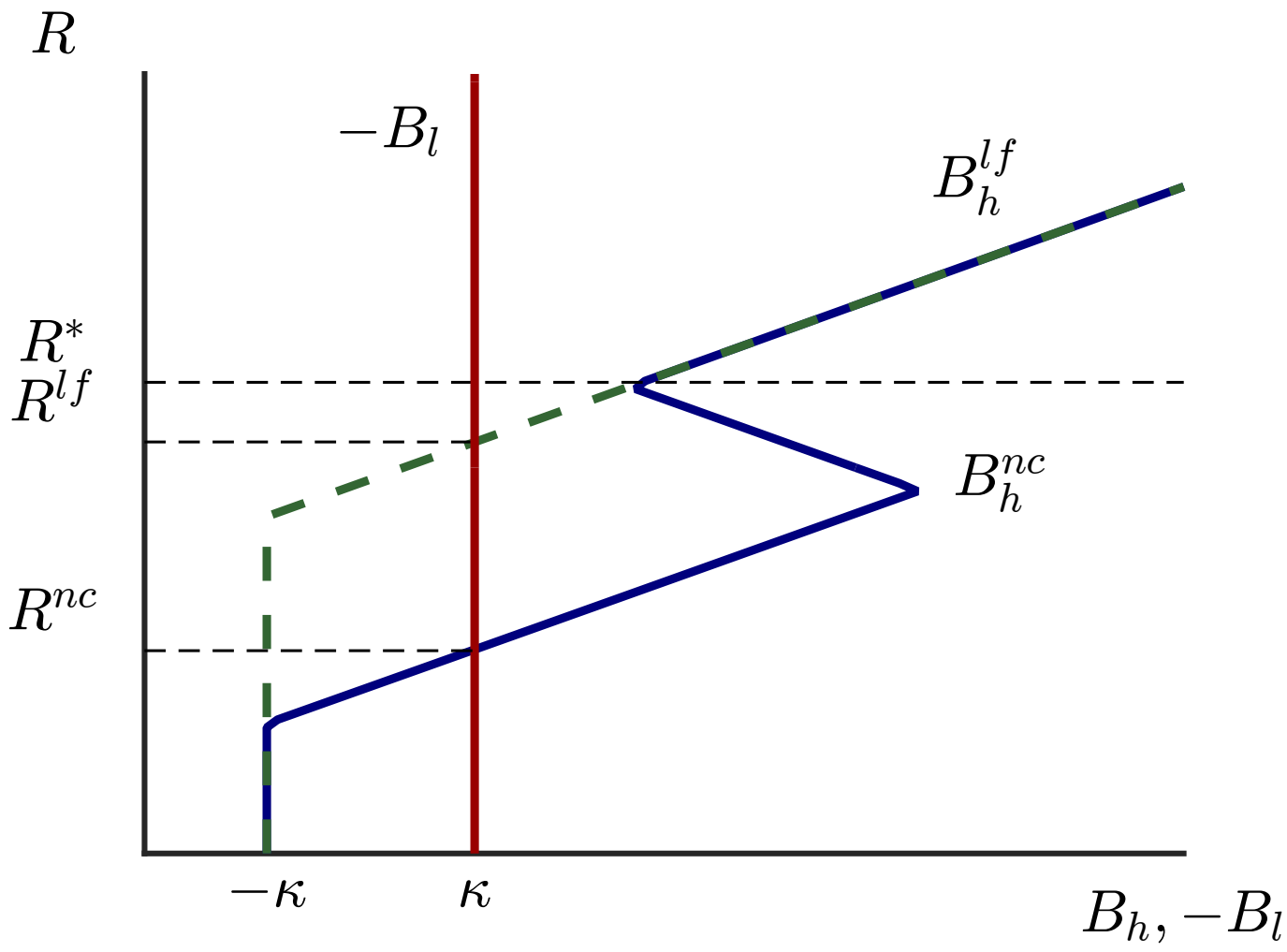
$$Y_l^N = \min\left(R\bar{\pi}\, C_l^T / C_h^T, 1\right)$$

- Suppose government policy generates $\uparrow B_h$
  - $\uparrow$ current account surplus in h state
  - $\uparrow$ tradable consumption and aggregate demand in l state
  - If zlb binds, $\uparrow$ employment and non-tradable consumption in l state
- **Domestic aggregate demand externality**: atomistic agents do not internalize the impact of their saving decisions in h state on employment in l state

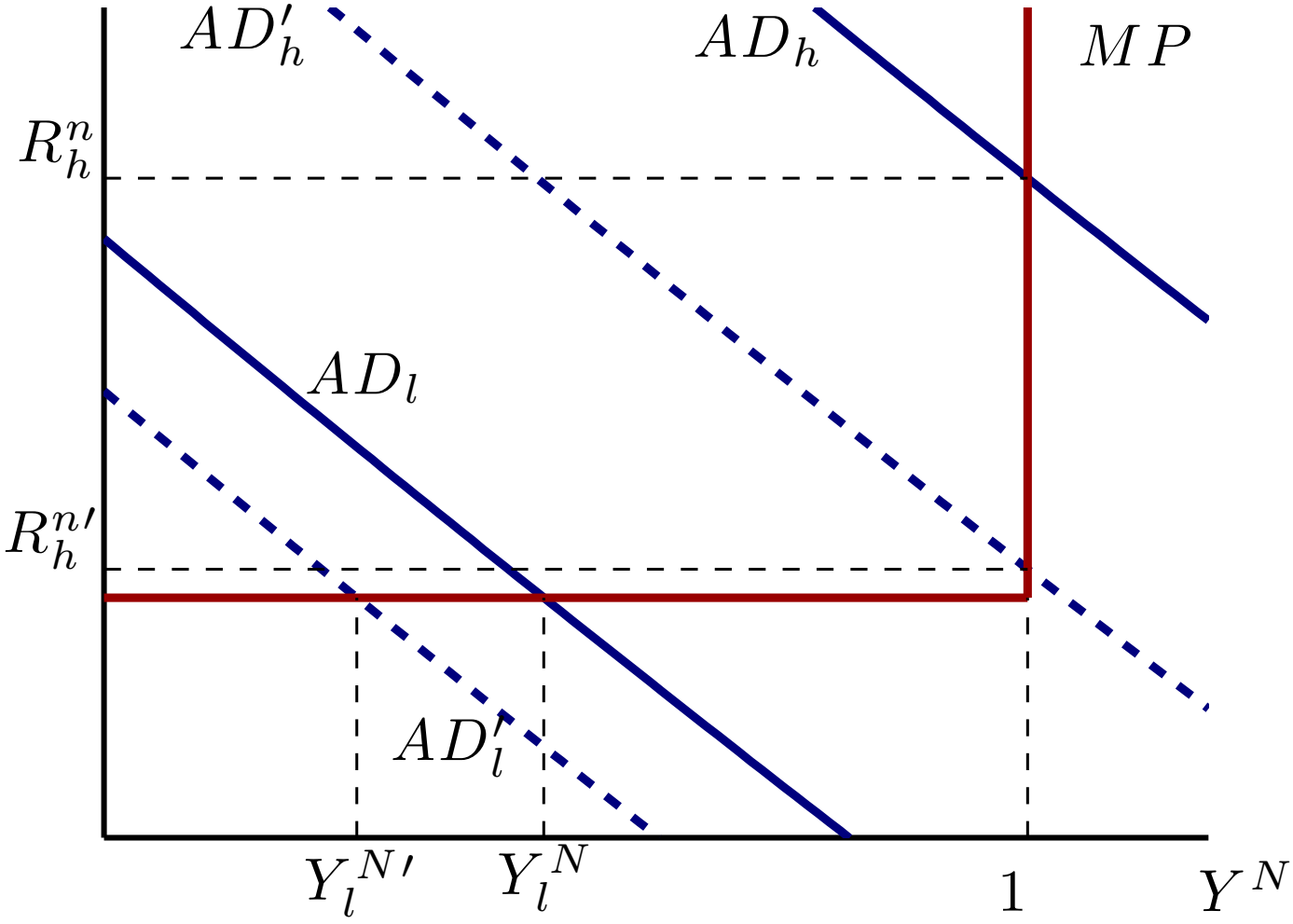
Uncooperative policy



Global impact of uncooperative policy



Global impact of uncooperative policy



Global impact of uncooperative policy

- When governments in booming countries intervene to improve current account
  - Rise in global supply of savings
  - World interest rate falls
  - Fall in global demand for non-tradables
  - Rise in unemployment in countries currently at zlb
- **International aggregate demand externality**: governments in booming countries do not internalize the impact of their policies on global demand and unemployment in bust countries

Optimal cooperative policy

World planner solves

$$\max_{C_{i,t}^T, Y_{i,t}^N, B_{i,t+1}, R} \sum_{t=0}^{\infty} \beta^t \int_0^1 \left(\omega \log C_{i,t}^T + (1-\omega) \log Y_{i,t}^N\right) di$$

subject to

$$C_{i,t}^T = Y_{i,t}^T$$

$$Y_{i,t}^N \leq 1$$

$$Y_{i,t}^N \leq R\pi_{t+1} \frac{C_{i,t}^T}{C_{i,t+1}^T} Y_{i,t+1}^N,$$

Optimal cooperative policy

- Global planner sets $R \geq R^*$ so that full employment is reached in every country ($Y_h^N = Y_l^N = 1$)
- This can be achieved by subsidizing borrowing in booming countries
- Pareto improvement with respect to laissez faire and uncooperative optimal policy
- Caveat: with $\kappa >> 0$ it might not be optimal to restore full employment. Still savings from booming countries under cooperation are smaller than in the uncooperative equilibrium

Conclusions

- We provide a framework of financial integration and low interest rates
- Governments have an incentive to implement policies that improve the current account during booms, to mitigate future recessions
- These policies lower global demand for consumption and aggravate the recession in countries currently stuck in a liquidity trap
- Need to coordinate capital market interventions in a low interest rate world

Thank you!

Deleveraging shock

- Normal times $\kappa_{i,t} = \kappa_h$
- Deleveraging shock

$$\log(\kappa_{i,t}) = \rho_\kappa \log(\kappa_{i,t}) + (1 - \rho_\kappa) \log(\kappa_l), \text{ where } \kappa_h > \kappa_l$$

- Fixed probabilities of transiting between states

$$P(\kappa_{i,t} = \kappa_h | \kappa_{i,t-1} = \kappa_h) > .5$$

$$P(\kappa_{i,t} = \kappa_h | \kappa_{i,t-1} < \kappa_h) < .5$$

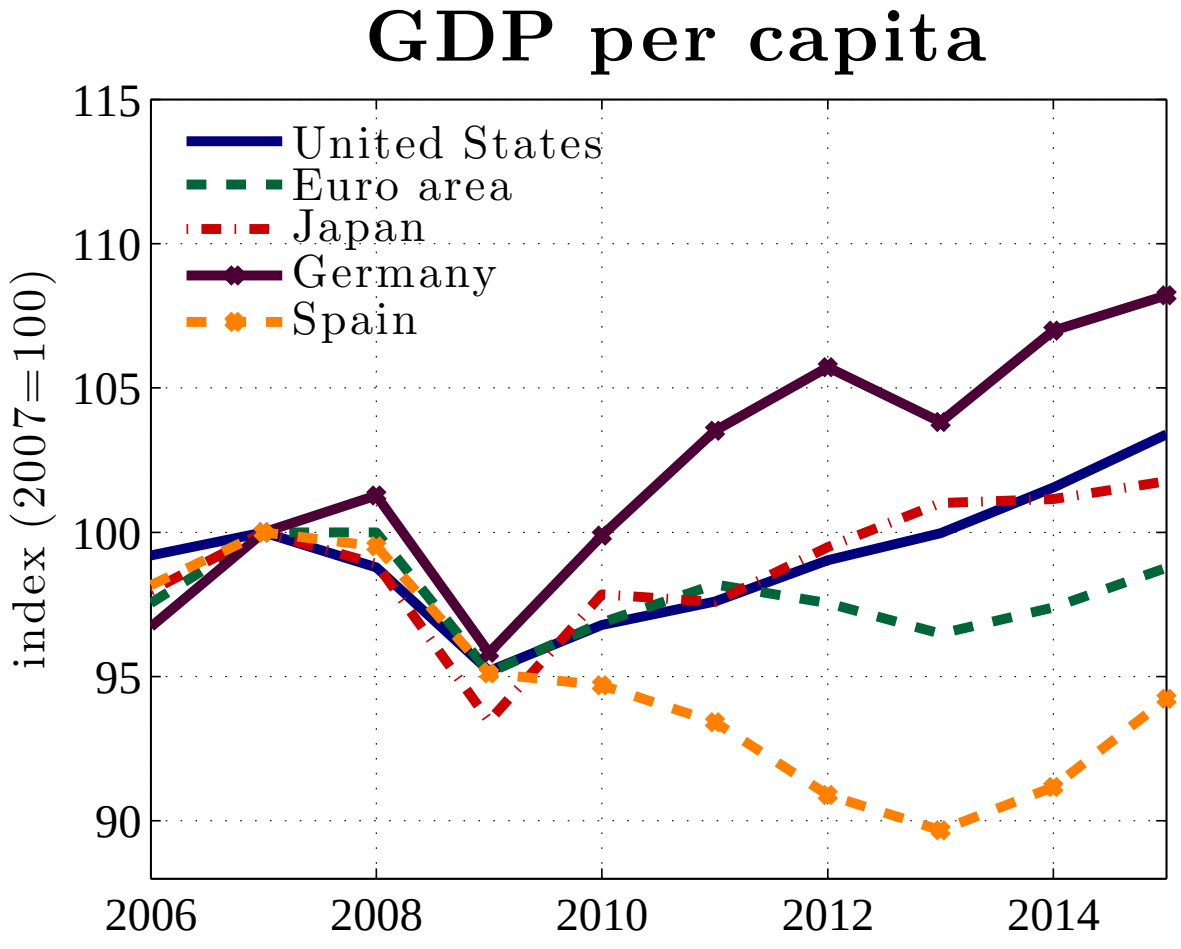
Back

Table 1: Parameters

	Value	Source/Target
Risk aversion	$\sigma = 2$	Standard value
Elasticity consumption aggr.	$\xi = 0.5$	Standard value
Tradable share in expenditure	$\omega = 0.25$	Standard value
Discount factor	$\beta = 0.985$	$R = 1.01$
Downward wage rigidities	$\gamma = 1$	Schmitt-Grohe and Uribe (2013)
Inflation target	$\bar{\pi} = 1.02$	Standard value
Endowment process	$\sigma_\epsilon = 0.041$, $\rho = 0.78$	Estimate for advanced economies
Tradable output high mean	$\mu_l = \log(1.7)$	Estimate for the advanced economies
Tradable output low mean	$\mu = 0$	Normalization
Fraction of very rich countries	$\pi_{l,l} = 0.96$	Estimate for the advanced countries
Prob. of remaining in high mean	$\pi_{h,h} = 0.78$	Standard deviation NFA/GDP =0.55
Bond supply r.o.w.	$B_{rw} = 0.28$	$B_{rw} / \int_0^1 GDP_{i,t}\, di = 7\%$
High borrowing limit	$\kappa_h = 0.2.75$	
Low borrowing limit	$\kappa_l = 2.27$	
Persistence deleveraging	$\rho_\kappa = 0.7$	
Prob. entry deleveraging	$P_{entry} = 0.08$	
Prob. exit deleveraging	$P_{exit} = 0.51$	

Back

GDP per capita: US, Euro area, Japan, Germany, Spain



Optimal uncooperative policy

Domestic planner operating under discretion solves

$$\max_{C_{i,t}^T, Y_{i,t}^N, B_{i,t+1}} \sum_{t=0}^{\infty} \beta^t \left(\omega \log C_{i,t}^T + (1-\omega) \log Y_{i,t}^N\right)$$

subject to

$$C_{i,t}^T = Y_{i,t}^T - B_{i,t+1} + RB_{i,t}$$

$$B_{i,t+1} \geq -\kappa$$

$$Y_{i,t}^N \leq 1$$

$$Y_{i,t}^N \leq R\pi_{t+1} \frac{C_{i,t}^T}{C_{i,t+1}^T} Y_{i,t+1}^N,$$

Optimal uncooperative policy

- Domestic planner Euler equation

$$\frac{1}{C_h^T} \geq \frac{\beta R}{C_l^T}\left(1 + \frac{\bar{v}_l\, Y_l^N}{\omega}\right)$$

- If $\bar{v}_l > 0$ planner saves more during booms compared to financial laissez faire

- Planning allocation can be decentralized by imposing tighter borrowing limit than the market one, or through subsidies to savings