

Financial Crises, Monetary Policy, and Exchange Rate Dynamics

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Questions

- How should monetary policy be conducted during financial crises?
- What is the role of capital controls in managing crises?
- Is there a tradeoff between standard monetary policy goals and managing financial crises?
- Do things change if we have an exchange rate peg?

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Background

- Large literature on the *pecuniary externality problem* or *financial accelerator* or *Fisherian deflation*
 - Agents face borrowing limits
 - Limits depend on endogenous prices
 - As a result, borrowing decisions of individuals affect the ability of everyone else (inefficiency) if constraints are binding; these pecuniary externalities do not disappear via envelope conditions

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Illustration

- Two-period model from Korinek (2011)
- Preferences:

$$U = \sigma \log(c_{T,1}) + (1 - \sigma) \log(c_{N,1}) + c_{T,2}$$

- Budget constraints:

$$c_{T,1} + pc_{N,1} \leq y_{T,1} - d_0 + py_{N,1} + d_1$$

$$c_{T,2} + d_1 \leq y_{T,2}$$

- Borrowing constraint:

$$d_1 \leq \kappa(y_{T,1} + py_{N,1})$$

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Solution

- Normalize $y_{T,1} = \sigma$ and $y_{N,1} = 1 - \sigma$
- If constraint does not bind $c_{T,1} = \sigma$, $p = 1$
- If constraint binds:

$$c_{T,1} = \sigma \frac{(1 + \kappa y_{T,1}) - d_0}{\sigma - \kappa y_{N,1}} < \sigma$$

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- When constraint binds we get "financial amplification" (effect of decrease in wealth is larger since it tightens borrowing constraints) and a "financial crisis" (big drop in consumption)

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Policy Response

- Wealth is undervalued relative to (constrained) efficient allocation
- Leads to overborrowing (or even underborrowing)
- Two equivalent options for implementing CEA:
 - Subsidize nontraded sector (real exchange rate intervention)
 - Tax new borrowing (capital control)

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Prophylactic vs Palliative Policy

- In more elaborate models (longer horizon), capital controls and real exchange rate interventions are not equivalent
- Capital controls are "prophylactic" (no crisis today, crisis with positive probability tomorrow)
- Real exchange rate interventions are "palliative" (crisis today)
 - Capital controls can implement only second best, exchange rate interventions can reach first best
 - Good palliative policy can eliminate crises completely (credible off-equilibrium promises which never need to be used)

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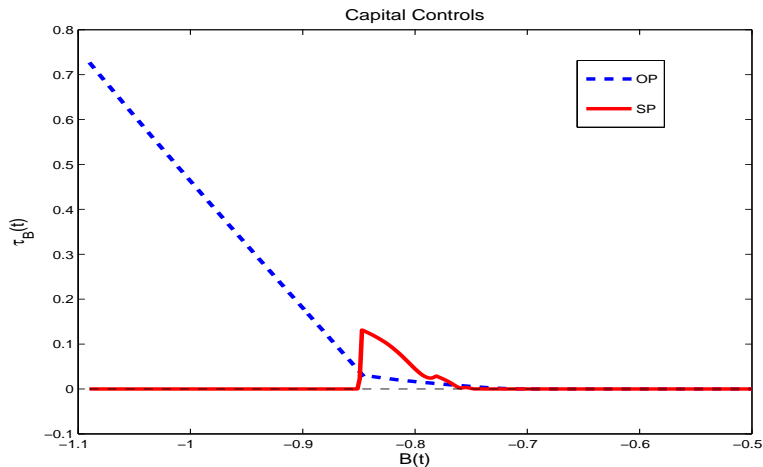
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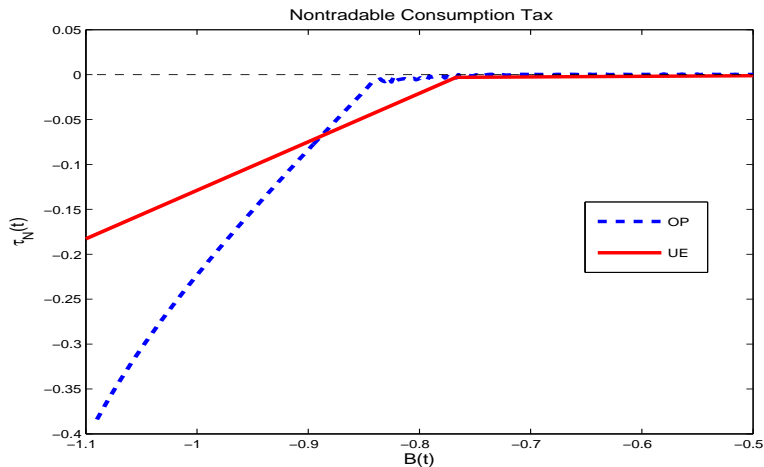
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Adding Monetary Policy

- Add monetary policy into the mix
- Several goals for the domestic monetary authority:
 - Price stability (fix nominal rigidity)
 - Exchange rate manipulation (exploit imperfectly-elastic foreign demand)
 - Financial stability (fix pecuniary externality)
- Is there a tradeoff? If so, how do we resolve it?

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Model Overview

- Wholesale sector uses capital (fixed), domestic labor, and imported intermediates
- Sells to local monopolies to produce differentiated final goods (consumed domestically or exported), Rotemberg-style nominal rigidity
- Incomplete financial markets (only nominal foreign and domestic bonds)
- Foreign-denominated bondholdings must be collateralized by capital
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Wholesale Sector

- Production function:

$$M_t = A_t Y_{F,t}^{\alpha_F} L_t^{\alpha_L} K_t^{\alpha_K}$$

- Intermediates:

$$Y_{F,t} = \left(\int_0^1 (Y_{F,t}(i))^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}}$$

- Export demand:

$$X_t = e_t^{-\rho}$$

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Households

- Preferences:

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t U(c_t, l_t) \right]$$

- Period utility is GHH:

$$U(c_t, l_t) = \frac{\left(c_t - \chi \frac{l_t^{1+\nu}}{1+\nu} \right)^{1-\gamma} - 1}{1-\gamma}$$

- Collateral constraint:

$$\vartheta Y_{F,t} - b_{t+1}^* \leq \kappa_t E_t \left[\frac{q_{t+1} k_{t+1}}{e_{t+1}} \right]$$

- Budget constraint is very long

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Final Goods Sector

- Consumption composite:

$$Y_t = \left(\int_0^1 (Y_t(i))^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}}$$

- Real profits:

$$(1 + \tau_H) Y_t - p_{M,t} Y_t - \frac{\phi_P}{2} (\pi_t - \pi)^2 Y_t$$

- Market clearing:

$$Y_t \left(1 - \frac{\phi_P}{2} (\pi_t - \pi)^2 \right) = C_t + X_t$$

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Government Policy

- Fiscal policy:

$$\frac{T_t}{P_t} = \tau_H Y_t$$

- Monetary policy:

$$R_{t+1} = R \left(\frac{\pi_t}{\pi} \right)^{\alpha_\pi} \left(\frac{Y_t}{Y} \right)^{\alpha_Y} \left(\frac{e_t}{e} \right)^{\alpha_e}$$

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Shocks

- Three shocks:
 - Domestic TFP A_t
 - Foreign Interest Rate R_{t+1}^*
 - Leverage ratio κ_t
- Two-state independent Markov chains for each (8 total states)

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Competitive Equilibrium

- Euler equation for foreign bonds:

$$1 = \mu_t R_{t+1}^* + \beta E_t \left[\frac{U_{c,t+1}}{U_{c,t}} \frac{e_{t+1}}{e_t} R_{t+1}^* \right]$$

- Euler equation for domestic bonds:

$$1 = \beta E_t \left[\frac{U_{c,t+1}}{U_{c,t}} \frac{R_{t+1}}{\pi_{t+1}} \right]$$

- Binding constraint generates incentive to increase e_t or π_t

$$E_t \left[M_{t+1} \frac{e_{t+1}}{e_t} \right] R_{t+1}^* < E_t \left[M_{t+1} \frac{1}{\pi_{t+1}} \right] R_{t+1}$$

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- Euler equation for capital:

$$q_t = \mu_t \kappa_t e_t E_t \left[\frac{q_{t+1}}{e_{t+1}} \right] + \beta E_t \left[\frac{U_{c,t+1}}{U_{c,t}} (r_{K,t+1} + q_{t+1}) \right]$$

- Third term is standard marginal gain from holding one additional unit of capital (dividend plus resale price)
- Second term is marginal relaxation of borrowing constraint from holding one additional unit of capital
- Pecuniary externality operates when constraint is binding through price of capital and exchange rate

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Constrained Efficient Allocation, Flexible Exchange Rates

- Planning Euler equation for foreign bonds:

$$1 = \mu_t^{SP} R_{t+1}^* + \beta E_t \left[\frac{\lambda_{2,t+1}}{\lambda_{2,t}} \frac{e_{t+1}}{e_t} R_{t+1}^* \right] + \mu_t^{SP} \kappa_t E_t \left[\frac{\partial (q_{t+1}/e_{t+1})}{\partial b_{t+1}^*} \right]$$

- Planner internalizes how real price of capital tomorrow depends on borrowing (value of collateral)

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- Optimal inflation is equal to target (no tradeoff!)

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Constrained Efficient Allocation, Flexible Exchange Rates

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$$q_t = \frac{\rho}{\rho - 1} \mu_t^{SP} \kappa_t e_t E_t \left[\frac{q_{t+1}}{e_{t+1}} \right] + \beta E_t \left[\frac{U_{c,t+1}}{U_{c,t}} (r_{K,t+1} + q_{t+1}) \right]$$

- ρ is elasticity of foreign demand
- Optimal inflation is equal to target (no tradeoff!)

Decentralizing CEA

- The CEA has "wedges" relative to decentralized equilibrium
- Can construct taxes that replicate these wedges
- Capital control

$$\tau_{f,t+1} = \frac{1}{\beta} \frac{\lambda_{2,t}}{\lambda_{2,t+1}} \frac{e_t}{e_{t+1}} \mu_t^{SP} \kappa_t \frac{\partial \left(\frac{q_{t+1}}{e_{t+1}} \right)}{\partial b_{t+1}^*}$$

- Also use constant subsidies to undo production distortion and manipulate terms of trade

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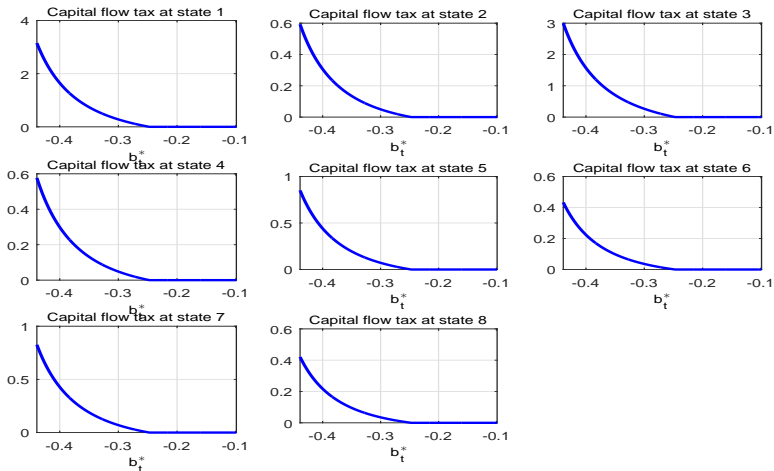
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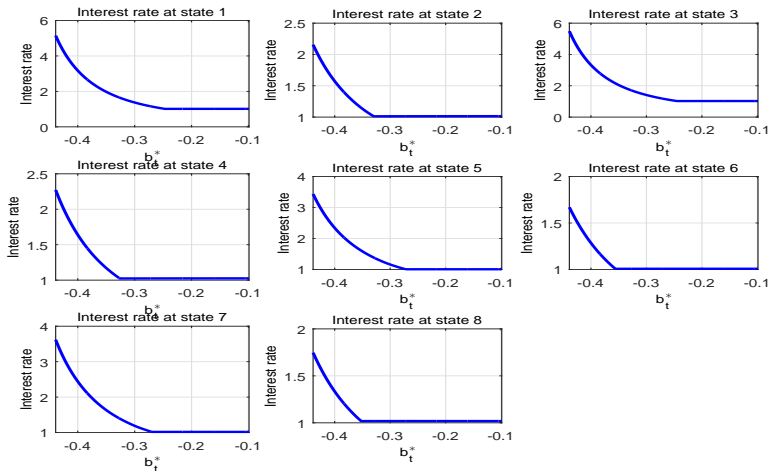
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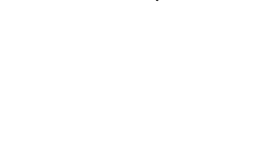
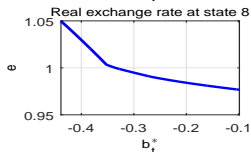
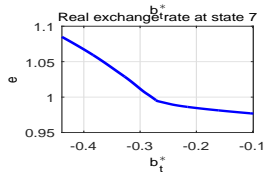
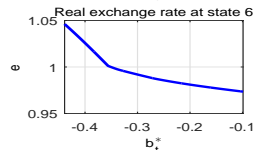
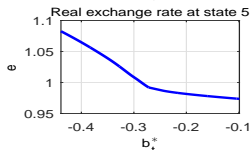
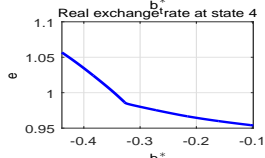
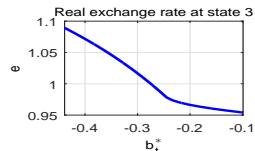
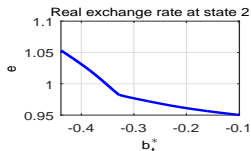
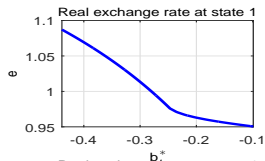
Optimal Tax



Optimal Nominal Interest Rate



Optimal Real Exchange Rate



Time-Consistent Policy

- Efficient allocations are used to "back out" required taxes
- Ramsey approach specifies the taxes ex ante, then computes best allocation
- Problem with CEA – the taxes may not be set optimally, and feasible allocations may exist that are better
- We look only at Markov-perfect policy outcomes (no commitment)
- Two cases – optimal monetary policy and optimal monetary plus capital controls

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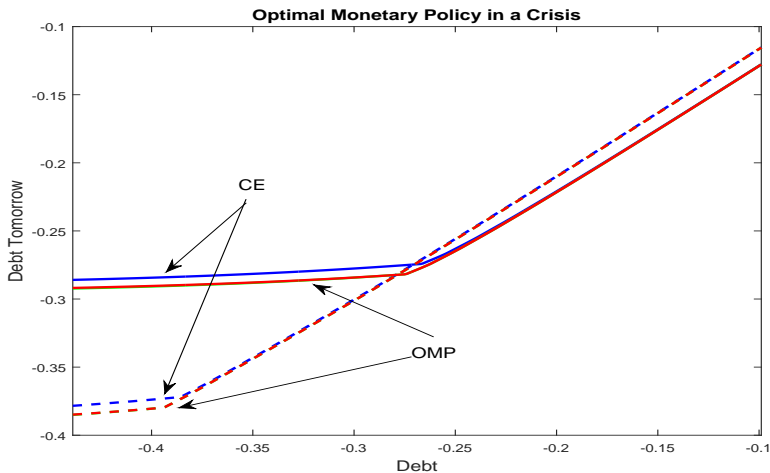
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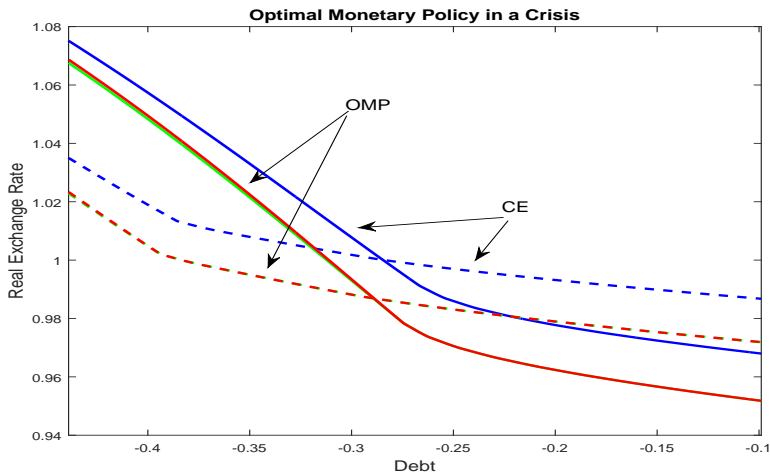
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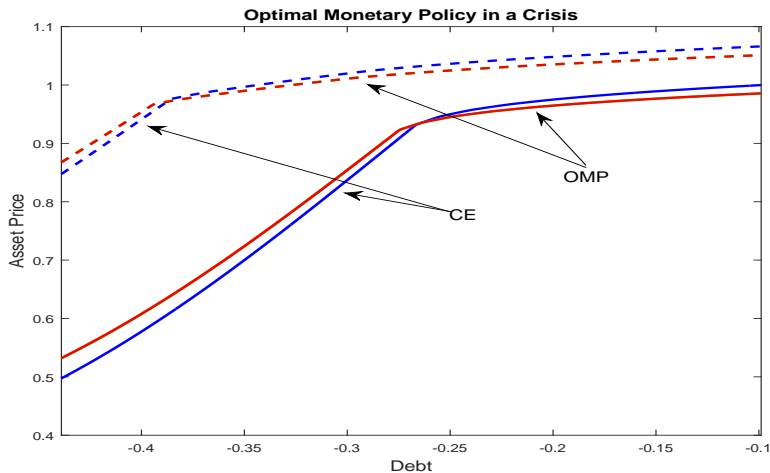
Debt During Crisis



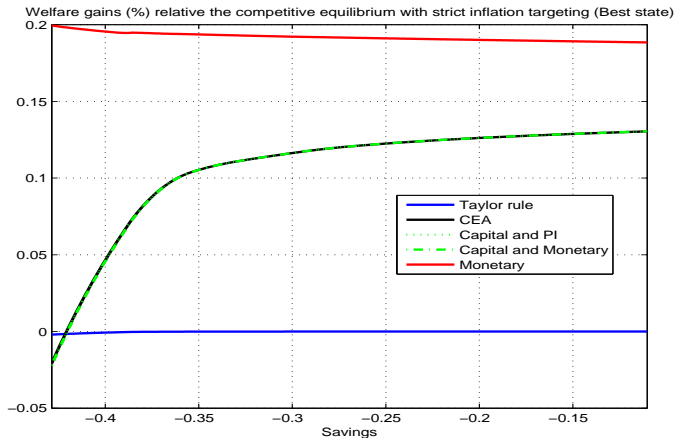
Exchange Rates During Crisis



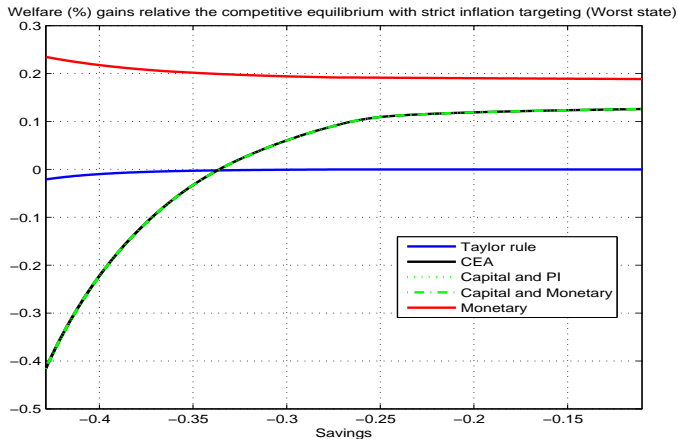
Asset Prices During Crisis



Welfare Comparisons



Welfare Comparisons



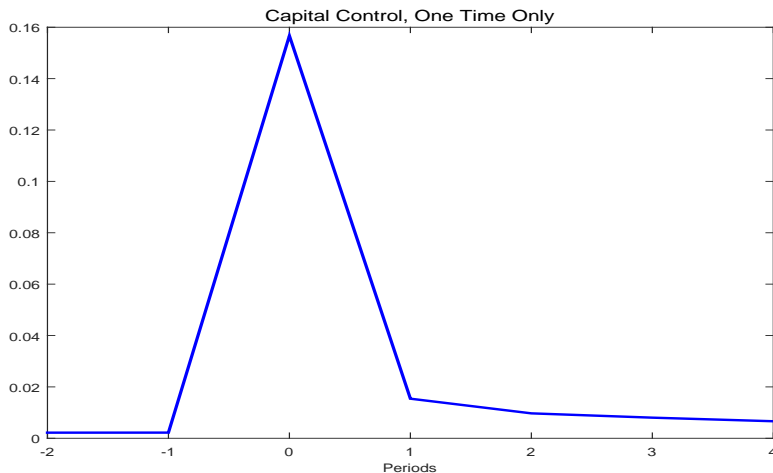
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