Macroprudential Policy Implementation in a Heterogeneous Monetary Union

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ECB conference on "Heterogenity in currency areas and macroeconomic policies" - 28-29 November 2013

Introduction

- The crisis has taught us that the new direction of policy measures should contain the so-called macroprudential approach
- Scholars and policy makers agree that macroprudential measures could help avoid systemic risks and ensure a more stable financial system
- Macroprudential policy implementation is a question open to debate:
  - No empirical evidence
  - Possible conflicts with monetary policy
  - **Implementation in a monetary union**

Macroprudential policies in a monetary union

- The implementation of these macroprudential tools becomes more complex if countries are not able to manage their own monetary policy
- Optimal currency areas has been a much-discussed topic
  - Cross-country asymmetries or country-specific shocks have been an issue of concern and skepticism for the well-functioning of EMU.
- Do asymmetries also matter for macroprudential policy implementation in a monetary union?

Motivation

- Countries in Europe clearly differ in their housing markets
    - Different loan-to-value ratios (LTVs)
    - Different proportions of residential debt relative to GDP
    - Heterogeneous mortgage contracts.
    - Different housing and business cycles
- These differences should matter...
    - Studies show that they do for monetary policy
    - What about macroprudential policy?

Evidence

Country	LTV	Debt/GDP	Rate
BELGIUM	83	43,3	F
FINLAND	75	58	V
FRANCE	75	38	F
GERMANY	70	47,6	F
ITALY	50	21,7	V
IRELAND	70	90,3	F
NETHERLANDS	90	105,6	F
PORTUGAL	75	67,5	V
SPAIN	70	66,4	V

Table 1: Characteristics of mortgage markets. Source: IMF (2008)

Research Questions

- Does heterogeneity matter for the optimal design of macroprudential policies in a monetary union?
- Should macroprudential policies be implemented at a national or at a centralized level? Not a straightforward answer:
  - Given heterogeneity, the national level may be the best option
  - A national level macroprudential policy could exacerbate heterogeneity and worsen the well-functioning of the single monetary policy

Aim of the Paper

- Explore the implementation in a heterogeneous monetary union of a specific macroprudential tool
  - A rule on the LTV that can be implemented at a centralized or a decentralized level
- Study the optimal way to implement the rule
- Study the implications of the rule for shock transmission and volatilities

Novelty of the Paper

- This issues have been studied considering asymmetric shocks and differences in country size
- NOVELTY: cross-country structural differences in housing markets

Model Overview

- Two-country, microfounded DSGE with housing (different LTVs, different proportion of borrowers, mortgage contracts, asymmetric shocks)
- Heterogeneous households: Savers, fixed-rate borrowers, variable-rate borrowers
- Borrowers face a collateral constraint which is more or less tight depending on LTVs
- The LTV ratio follows a Taylor-type rule
  - Centralized
  - Decentralized
- The ECB sets interest rates following a Taylor rule

Savers Country A

$$\max \; E_0 \sum_{t=0}^{\infty} \beta^t \left(\ln C_t^u + j_t \ln H_t^u - \frac{(L_t^u)^\eta}{\eta} \right)$$

s.t.

$$C_{At}^u + \frac{P_{Bt}}{P_{At}} C_{Bt}^u + q_t H_t^u + \frac{R_{At-1} b_{t-1}^u}{\pi_{At}} + R_{Bt-1} d_{t-1} \leq$$
$$q_t H_{t-1}^u + w_t^u L_t^u + b_t^u + d_t + F_t + S_t$$

FOCs

Borrowers Country A

- $\widetilde{\beta} < \beta$ and need to collateralize their debt
- α_A of them borrow at a variable rate, the rest at a fixed rate
- Maximize utility function subject to BC + an extra collateral constraint:

$$E_t \frac{R_{At}}{\pi_{At+1}} b^{cv}_{At} \leq k_{At} E_t q_{t+1} H^{cv}_t$$

$$E_t \frac{\overline{R}_{At}}{\pi_{At+1}} b^{cf}_{At} \leq k_{At} E_t q_{t+1} H^{cf}_t$$

- Collateral constraint holds with equality⇒economy is endogenously divided into borrowers and savers

FOCs

Financial Intermediary in Country A

- Accepts deposits, and extends both fixed and variable-rate loans to consumers
- Optimality condition for setting the fixed interest rate implies that at each point in time, the intermediary is indifferent between lending at a variable or at a fixed rate OC
- Financial markets clear⇒domestic savings=domestic borrowings

Firms in Country A

- Firms produce consumption goods ▸ Firm
- Sticky prices⇒Phillips Curve ▸ PC
- Housing supply is fixed

Monetary Policy

- **Monetary Union. Taylor rule responds to inflation in both countries**

$$R_t = (R_{t-1})^{\rho} \left(\left[(\pi_{At})^{n} (\pi_{Bt})^{(1-n)} \right]^{(1+\phi_{\pi})} R \right)^{1-\rho} \varepsilon_{R,t}$$

Macroprudential Policy

- **Centralized**

$$k_t = k_{SS} \left[\left(\frac{Y_{At}}{Y_A} \right)^n \left(\frac{Y_{Bt}}{Y_B} \right)^{1-n} \right]^{-\phi_y^k} \left[\left(\frac{q_{At}}{q_A} \right)^n \left(\frac{q_{Bt}}{q_B} \right)^{1-n} \right]^{-\phi_q^k}$$

- **Decentralized**

$$k_{At} = k_{SSA} \left(\frac{Y_{At}}{Y_A} \right)^{-\phi_{Ay}^k} \left(\frac{q_{At}}{q_A} \right)^{-\phi_{Aq}^k}$$

$$k_{Bt} = k_{SSB} \left(\frac{Y_{Bt}}{Y_B} \right)^{-\phi_{By}^k} \left(\frac{q_{Bt}}{q_B} \right)^{-\phi_{Bq}^k}$$

Welfare

- Second order approximation of future stream of utility of each agents
- Aggregate across agents and countries
- Present results in consumption equivalents

Welfare

Parameter Values

Parameter Values in Baseline Model		
β	.99	Discount Factor for Savers
$\tilde{\beta}$	.98	Discount Factor for Borrowers
j	.1	Weight of Housing in Utility Function
$\eta - 1$	1	Inverse of labor elasticity
k_{SS}	.9	SS Loan-to-value ratio
γ	.7	Labor-income share for Savers
X	1.2	Steady-state markup
n	.5	Country size
θ	.75	Probability of not changing prices
ρ	.8	Interest-Rate-Smoothing Parameter in TR
ϕ_π	.5	Inflation Parameter in TR

Cases Studied

- Common techno shock and symmetric countries
- Asymmetric techno shock and symmetric countries
- Common techno shock and asymmetric countries (different mortgage contracts, different share of borrowers, different LTVs)

Optimal Macroprudential Policy

- For given monetary policy, find the parameters in the LTV rule that maximize welfare
- Consider the centralized and the decentralized setting and see which one delivers higher welfare
- Consider all sources of asymmetries, one by one

Symmetry-Dynamics

- A common technology shock generates a boom
- Output increases and inflation decreases.
- The decrease in inflation makes monetary policy react and interest rates go down
- House prices, which move inversely with the interest rate, go up, generating collateral effects
- Since the collateral has more value now borrowing can increase, making consumption and output increase even further.

IR Functions

Symmetry-Optimal Macroprudential

- The optimal macroprudential policy is one in which the LTV responds little to changes in output while relatively more aggressively to changes in house prices.
- This policy is welfare enhancing because it ensures a more stable financial system (lower volatility of borrowing)

▸ Opt Policy

▸ Volatilities

Symmetry-Dynamics (Optimal Macroprudential)

- We compare the baseline case in which there is no macroprudential policy with the case in which the loan-to-value rule is active.
- Since output and house prices are increasing and this could potentially generate a situation of excessive credit growth, the regulator cuts the LTV.
- Then, borrowing does not increase as much
- The effects of the shock on output are mitigated

IR Functions

LTV

Asymmetric shock-Dynamics

- A techno shock in Country A increases output and decreases inflation in that country
- Monetary policy reacts to inflation and the common interest rate goes down
- This expansionary monetary policy measure makes production and inflation in B increase
- House prices are increasing because they move inversely with the interest rate
- Real rates decrease strongly in B and therefore borrowing in this country is increasing more strongly than in the country that receives the shock

IR Functions

Asymmetric shock-Optimal Macroprudential

- Higher macro volatility in A, higher financial volatility in B
- CENTRALIZED: Similar parameters as in symmetric case
- DECENTRALIZED: Macropru policy more aggressive in B
- CENTRALIZED POLICIES PREFERRED: Manage to reduce aggregate volatility in both countries

Opt Policy

Volatilities

Different LTV-Dynamics

- A common techno shock, Country A has a high LTV and Country B has a low LTV, 0.9 and 0.5, respectively
- In the country in which the LTV is higher, the financial accelerator effects will be stronger
- In Country A, the country with a higher LTV, borrowing increases by more than in the other country
- Also consumption increases by more, however in aggregate terms differences are not as noticeable.

IR Functions

Different LTV-Optimal Macroprudential

- Similar macro volatilities, higher financial volatility in A
- CENTRALIZED: Macropru targets output more than in symmetric case (to equalize financial accelerator effects)
- DECENTRALIZED: Macropru more aggressive in A, targeting output even more
- DECENTRALIZED SLIGHTLY PREFERRED: Volatilities are equalized more effectively than in the centralized case

Opt Policy

Volatilities

Different borrower proportion-Dynamics

- High proportion of borrowers in Country A
- Consumption in Country A increases by more than in the other country, given the high proportion of borrowers
- However, aggregate differences are not so noticeable

IR Functions

Borrower proportion-Optimal Macroprudential

- Macroeconomic and financial volatilities very similar
- CENTRALIZED AND DECENTRALIZED POLICIES DELIVER SIMILAR RESULTS (Similar to the symmetric case)

Opt Policy

Volatilities

Mortgage Contracts-Dynamics

- Borrowers in Country A take mortgages at a variable interest rate, while borrowers in Country B do it at a fixed rate
- Given a common technology shock, the union interest rate goes down.
- This affects more strongly borrowers in Country A, since their mortgage rates vary one for one with the policy rate
- In Country B the nominal interest rate is fixed. Since inflation is decreasing, real rates are increasing in B.
- Borrowing in Country B decreases.

IR Functions

Mortgage Contracts-Optimal Macroprudential

- Similar macro volatilities, higher financial volatility in B
- CENTRALIZED: The optimal macroprudential policy responds more strongly to house prices than in the previous cases to compensate the lack of effectiveness of monetary policy for the fixed-rate case
- DECENTRALIZED: More aggressive for the fixed-rate country
- DECENTRALIZED ARE PREFERRED

Opt Policy

Volatilities

Conclusions (1)

- I build a two-country DSGE model, with housing, and collateral constraints in order to explore the effects of macroprudential policies in a monetary union
- The policy can be implemented at a national level or at a union level.
- As a benchmark, I consider a monetary union in which members are symmetric and shocks are synchronized
- Then, I consider four sources of asymmetries within the monetary union
  - non-synchronized business cycles
  - asymmetries on the strength of financial accelerator effects
  - differences in the labor income share of borrowers
  - mortgage contract asymmetries: fixed- vs. variable-rate mortgages

Conclusions (2)

- For the symmetric case, the optimal rule is one that responds more strongly to house prices than to output deviations
- For asymmetries: Macropru policy is more aggressive in the country with higher financial volatility
  - Asymmetric shock: The decentralized policy targets the country that does not receive the shock
  - LTV ratio asymmetry: The output response is higher in the country with high LTV to equalize financial accelerator effects
  - Different prop. of borrowers: Similar volatilities so it does not matter if the policy is centralized or decentralized
  - Different mortgage contracts: Macropru policy more aggressive in the country with fixed rates (to compensate for less efficiency of monetary policy)

To do

- Experiment with other specifications of the LTV rule (include credit variables)
- Optimize monetary policy (coordinated vs. non-coordinated case)

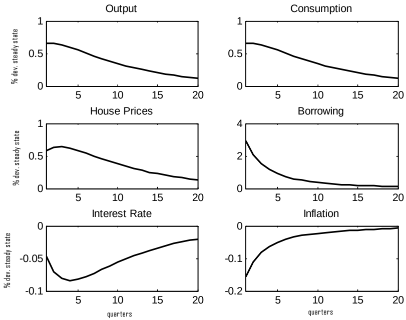

Figure: Impulse Responses to a Technology Shock. Symmetric Countries

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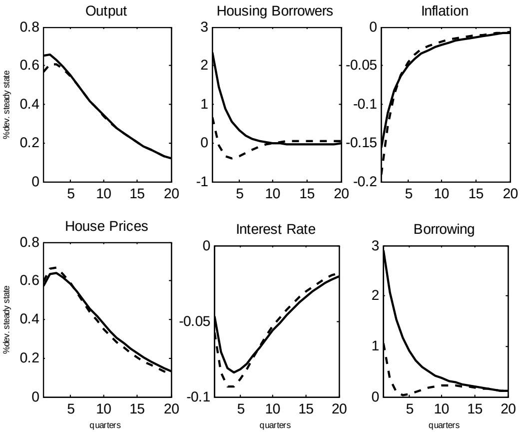

Figure: Impulse responses to a common technology shock. Symmetric countries. Optimized Macroprudential Rule.

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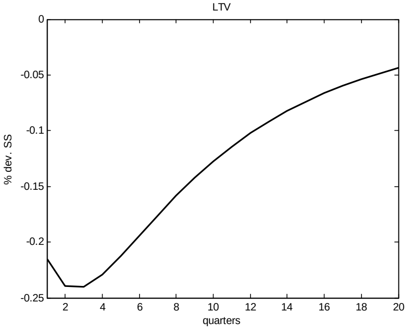

Figure: LTV response to a common technology shock. Symmetric countries. Optimized Macroprudential Rule.

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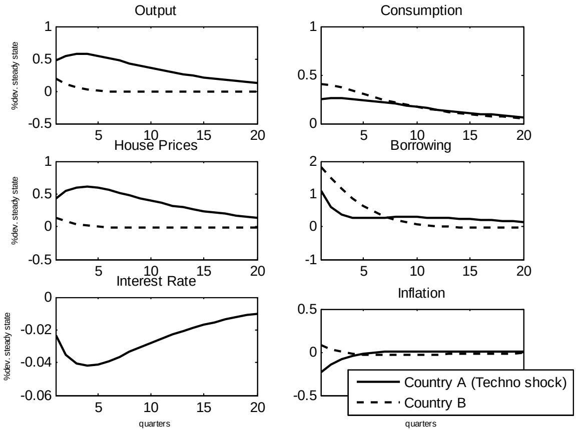

Figure: Impulse responses to a technology shock in Country A. No macroprudential policy. Country A versus Country B.

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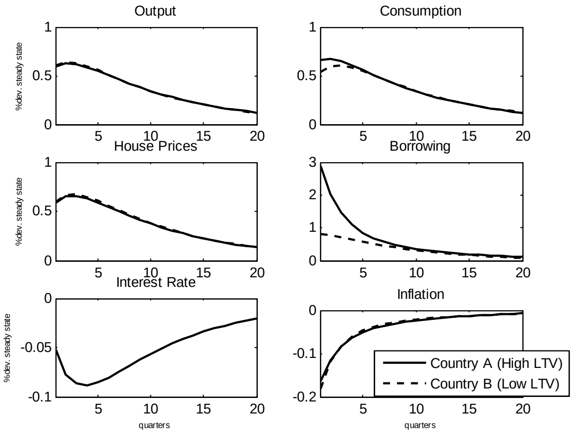

Figure: Impulse responses to a common technology shock. High LTV in Country A, low LTV in Country B

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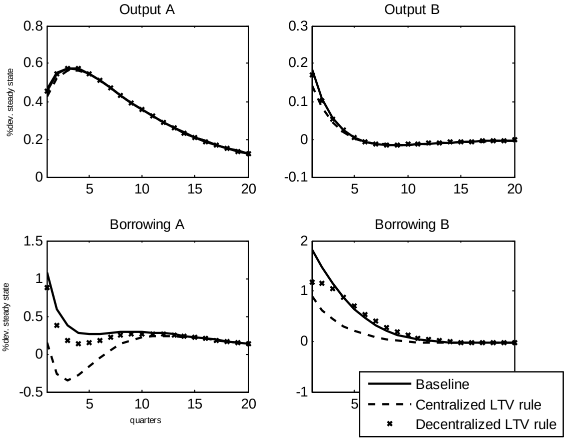

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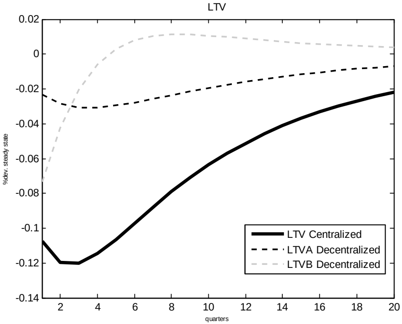

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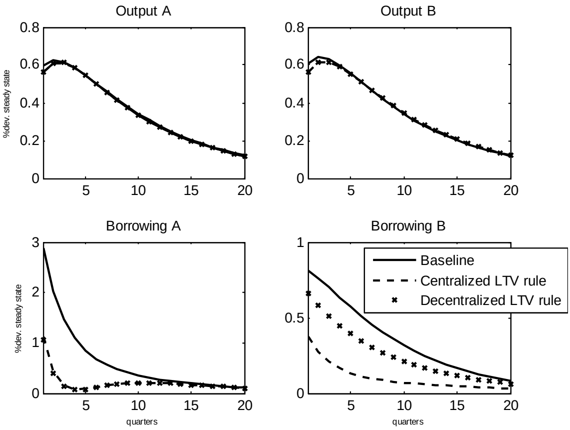

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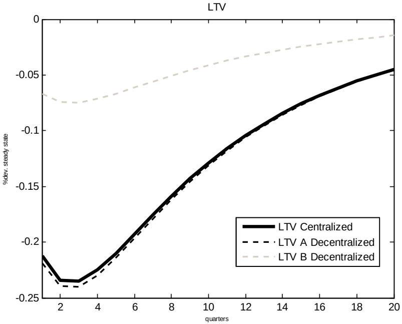

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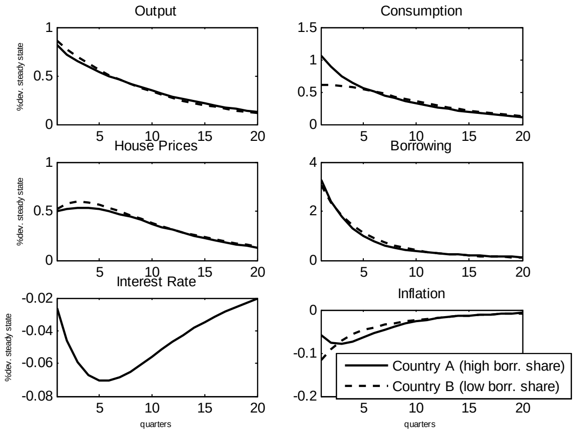
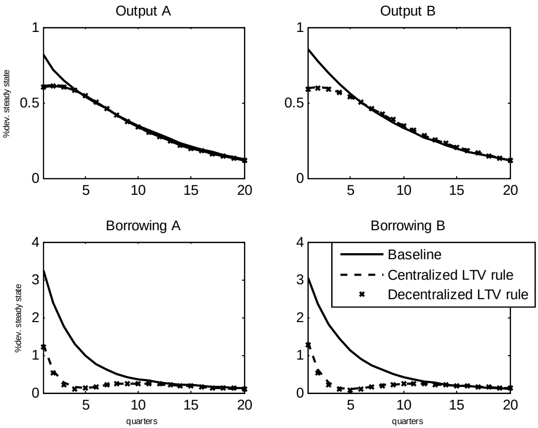


Figure: Impulse responses to a common technology shock. High proportion of borrowers in Country A, low proportion in Country B.



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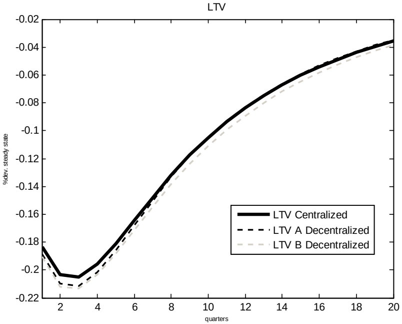

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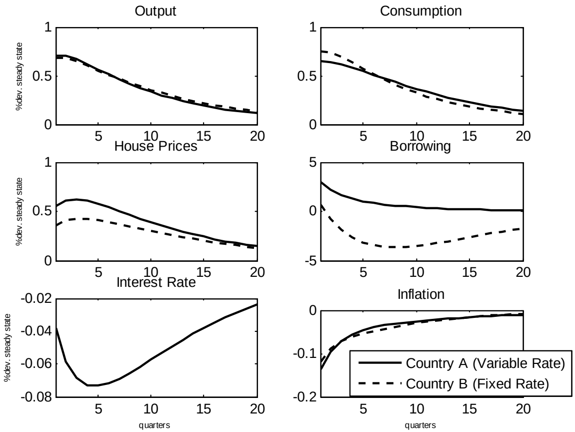

Figure: Impulse responses to a common technology shock. Variable rates in Country A, fixed rates in Country B.

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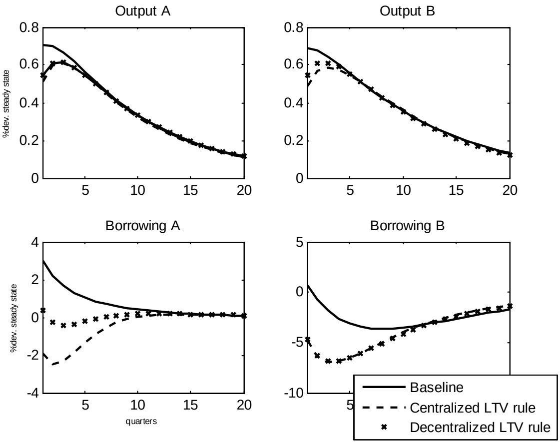

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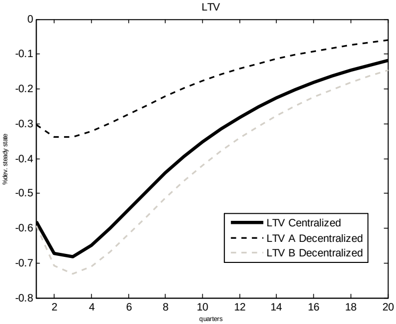

Figure: LTV response to a common technology shock. Variable rates in Country A. Optimized Macroprudential Rule.

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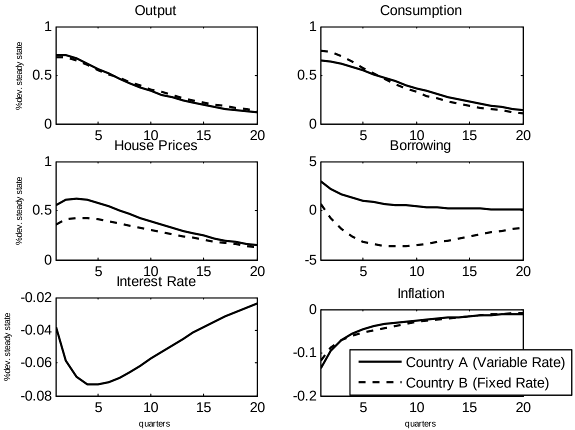

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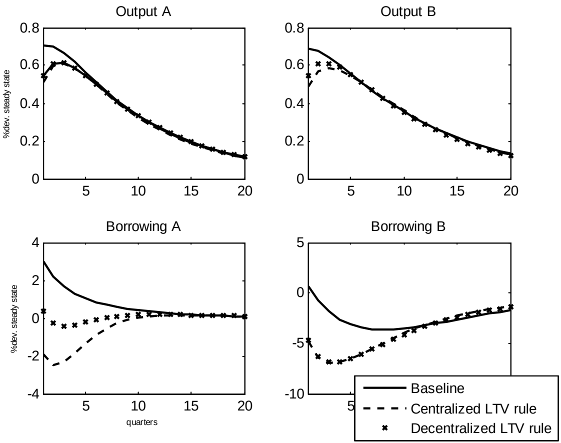

Figure: Impulse responses to a common technology shock. Variable rates in Country A. Optimized Macroprudential Rule.

$$\frac{C^u_{At}}{C^u_{Bt}} = \frac{nP_{Bt}}{(1-n)P_{At}}$$

$$\frac{1}{C^u_{At}} = \beta E_t \left(\frac{R_{At}}{\pi_{At+1} C^u_{At+1}} \right),$$

$$\frac{1}{C^u_{At}} = \beta E_t \left(\frac{R_{Bt}}{\pi_{At+1} C^u_{At+1}} \right),$$

$$w^u_t = (L^u_t)^{\eta-1} \frac{C^u_{At}}{n},$$

$$\frac{j_t}{H^u_t} = \frac{n}{C^u_{At}} q_t - \beta E_t \frac{n}{C^u_{At+1}} q_{t+1}.$$

Back

$$\frac{C^{cv}_{At}}{C^{cv}_{Bt}} = \frac{nP_{Bt}}{(1-n)P_{At}}$$

$$\frac{n}{C^{cv}_{At}} = \widetilde{\beta} E_t \left(\frac{nR_{At}}{\pi_{At+1} C^{cv}_{At+1}} \right) + \lambda^{cv}_{At} R_{At},$$

$$w^{cv}_t = (L^{cv}_t)^{\eta-1} \frac{C^{cv}_{At}}{n},$$

$$\frac{j_t}{H^{cv}_t} = \frac{n}{C^{cv}_{At}} q_t - \widetilde{\beta} E_t \frac{n}{C^{cv}_{At+1}} q_{t+1} - \lambda^{cv}_{At} k_A E_t q_{t+1} \pi_{At+1}.$$

Back

$$\overline{R}_{A\tau}^{OPT} = \frac{E_\tau \sum_{i=\tau+1}^{\infty} \beta^{i-\tau} \Lambda_{\tau,i} R_{Ai-1}}{E_\tau \sum_{i=\tau+1}^{\infty} \beta^{i-\tau} \Lambda_{\tau,i}}.$$

$$\overline{R}_{At} = \frac{\overline{R}_{At-1} b_{t-1}^{cf} + \overline{R}_{At}^{OPT} \left(b_t^{cf} - b_{t-1}^{cf} \right)}{b_t^{cf}}.$$

Back

$$Y_{At}(z) = \xi_t \left(L_t^u(z)\right)^{\gamma_A} \left(L_t^c(z)\right)^{(1-\gamma_A)}$$

$$w_t^u = \frac{\xi_t}{X_t} \gamma_A \frac{Y_{At}}{L_t^u},$$

$$w_t^{cv} = w_t^{cf} = \frac{\xi_t}{X_t} (1-\gamma_A) \frac{Y_{At}}{L_t^c},$$

Back

$$\hat{\pi}_{At} = \beta\hat{\pi}_{At+1} - \widetilde{k}\hat{x}_t + u_{At},$$

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$$nY_{At} = nC_{At} + (1-n)\,C^*_{At}$$

$$b^c_t = b^u_t$$

$$nd_t + (1-n)\,\frac{P_{Bt}}{P_{At}}d^*_t = 0$$

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Table 1: Optimal Macroprudential Policy, given TR

	Country A/Country B
ϕ_y^{k*}	0.02
ϕ_q^{k*}	0.34
Welfare gain	0.975

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Table 2: Volatilities. Symmetry

	Baseline	Optimal Macroprudential
stdev (y)	1.8204	1.7587
stdev (π)	0.2382	0.2672
stdev (b)	4.3871	1.3309

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Table 3: Optimal Macroprudential Policy, given TR

	Centralized	Decentralized	
		Country A	Country B
ϕ_y^{k*}	0.02	0.02	0.02
ϕ_q^{k*}	0.34	0.03	0.5
Welfare Gain	0.171	0.044	

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Table 4: Volatilities. Techno shock in A

	Country A			Country B		
	Baseline	MP Cent	MP Dec	Baseline	MP Cent	MP Dec
stdev (y)	1.7218	1.6953	1.7185	0.2259	0.1766	0.2105
stdev (π)	0.2903	0.3095	0.2938	0.1354	0.1189	0.1337
stdev (b)	1.6720	0.9691	1.3406	2.9039	1.2525	2.3829

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Table 5: Optimal Macroprudential Policy, given TR. High LTV in A

	Centralized	Decentralized	
		Country A	Country B
ϕ_y^{k*}	0.12	0.26	0.01
ϕ_q^{k*}	0.23	0.1	0.1
Welfare Gain	0.334	0.343	

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Table 6: Volatilities. High LTV in A

	Country A			Country B		
	Baseline	MP Cent	MP Dec	Baseline	MP Cent	MP Dec
stdev (y)	1.7813	1.7510	1.7520	1.8066	1.7785	1.7790
stdev (π)	0.2484	0.2655	0.2651	0.2582	0.2698	0.2688
stdev (b)	4.2801	1.4055	1.3467	1.9128	0.6097	1.3940

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Table 7: Optimal Macroprudential Policy, given TR

	Centralized	Decentralized	
		Country A	Country B
ϕ_y^{k*}	0.02	0.02	0.02
ϕ_q^{k*}	0.29	0.3	0.3
Welfare Gain	3.336	3.271	

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Table 8: Volatilities. High proportion borrowers A

	Country A			Country B		
	Baseline	MP Cent	MP Dec	Baseline	MP Cent	MP Dec
stdev (y)	1.9252	1.7774	1.7721	1.9697	1.7679	1.7628
stdev (π)	0.1877	0.2666	0.2695	0.1991	0.2678	0.2700
stdev (b)	4.9073	1.6390	1.5616	4.9122	1.6952	1.5863

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Table 9: Optimal Macroprudential Policy, given TR

	Centralized	Decentralized	
		Country A	Country B
ϕ_y^{k*}	0.01	0.02	0.03
ϕ_q^{k*}	1.13	0.48	1.45
Welfare Gain	0.853	7.757	

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Table 10: Volatilities. Variable Rates in A

	Country A			Country B		
	Baseline	MP Cent	MP Dec	Baseline	MP Cent	MP Dec
stdev (y)	1.8687	1.7105	1.7422	1.8819	1.7513	1.7772
stdev (π)	0.2167	0.2946	0.2720	0.2123	0.2824	0.2730
stdev (b)	4.6647	4.6620	0.9552	12.9066	19.7884	20.0673

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$$V_{u,t} \equiv E_t \sum_{m=0}^{\infty} \beta^m \left(\ln C^u_{t+m} + j_t \ln H^u_{t+m} - \frac{\left(L^u_{t+m}\right)^\eta}{\eta} \right),$$

$$V_{cv,t} \equiv E_t \sum_{m=0}^{\infty} \widetilde{\beta}^m \left(\ln C^{cv}_{t+m} + j_t \ln H^{cv}_{t+m} - \frac{\left(L^{cv}_{t+m}\right)^\eta}{\eta} \right),$$

$$V_{cf,t} \equiv E_t \sum_{m=0}^{\infty} \widetilde{\beta}^m \left(\ln C^{cf}_{t+m} + j_t \ln H^{cf}_{t+m} - \frac{\left(L^{cf}_{t+m}\right)^\eta}{\eta} \right).$$

$$V_t = (1-\beta)\, V_{u,t} + \left(1-\widetilde{\beta}\right) \left[\alpha_A V_{cv,t} + (1-\alpha_A)\, V_{cf,t}\right]$$

$$W_t = nV_t + (1-n)V_t^*$$

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