Unconventional monetary policy in a monetary union

Presentation at EEA 2022, Milano

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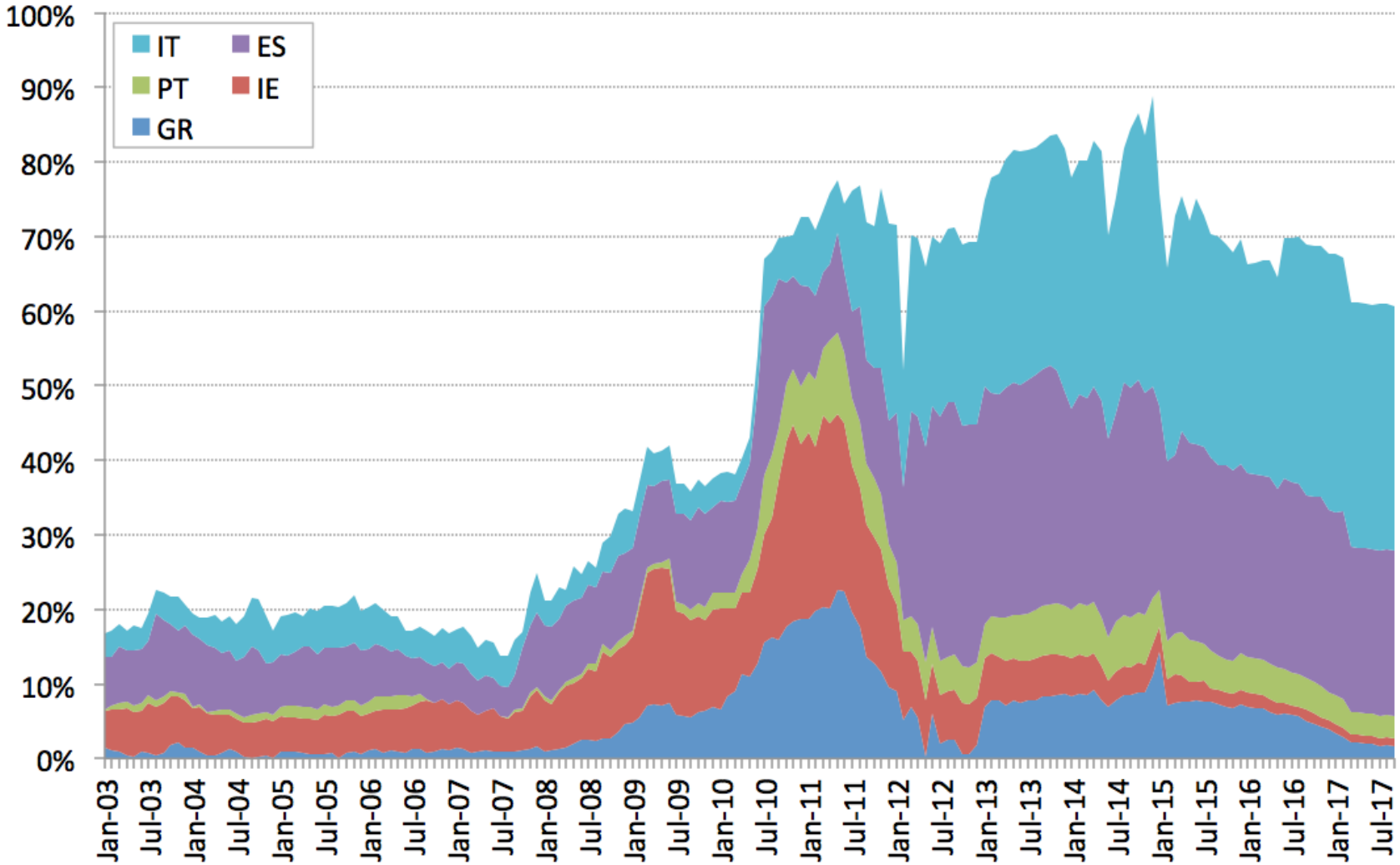
August 23, 2022

Research question

- How should unconventional monetary policy be designed in a monetary union with imperfectly correlated business cycles?
- In particular, is it desirable to use unconventional monetary policy to address *country-specific disturbances* in a monetary union?

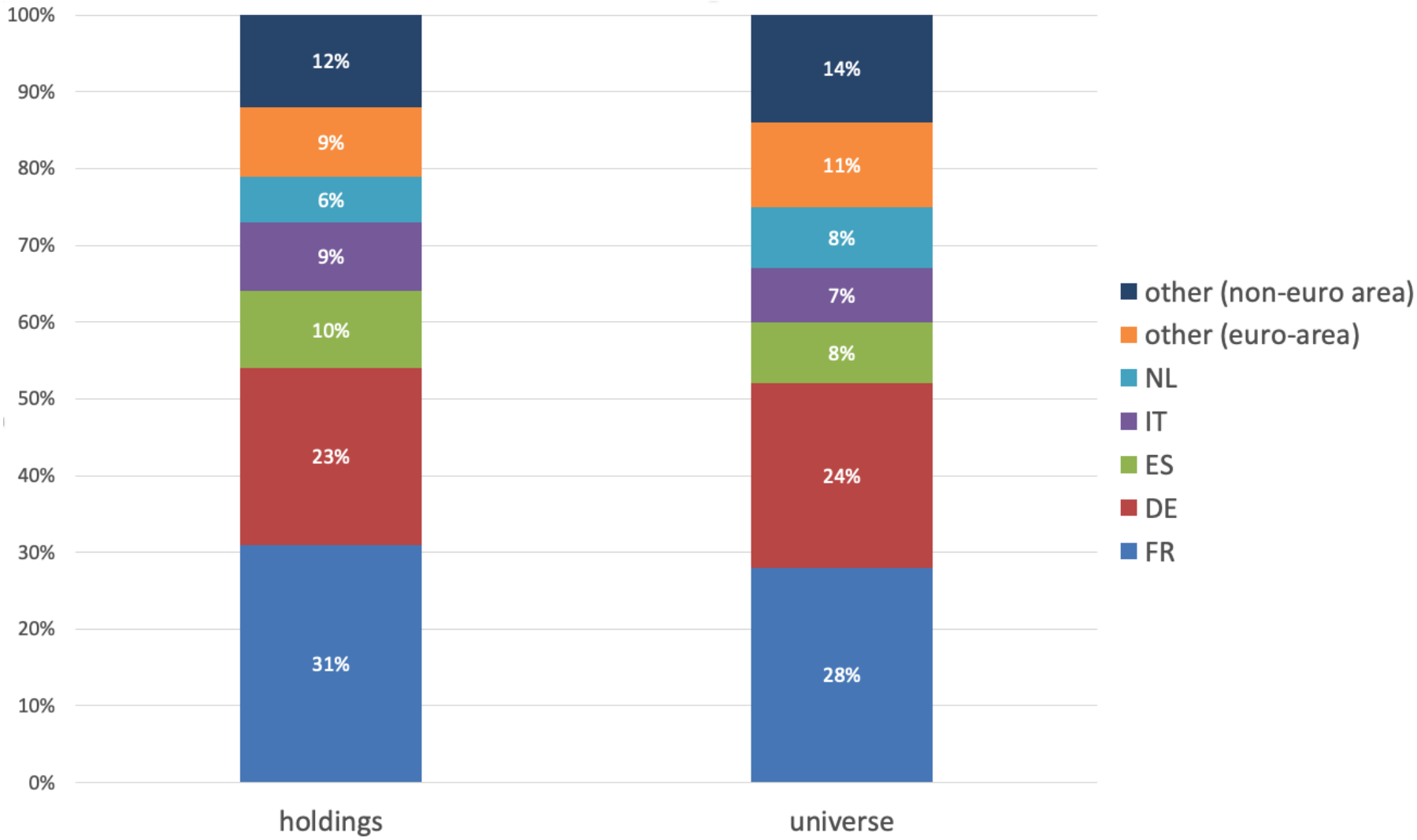
LTROs and MROs - Periphery's share



Quelle: Bruegel (2017)

country usage

Corporate Sector Purchase Program - Breakdown by country, Q3 2021



Quelle: ECB, own compilation

Motivation

- Joining a monetary union inevitably causes the loss of an instrument to address country-specific shocks.
- Global Financial Crisis, Great Recession, ZLB and Covid-19 pandemic forced major central banks around the world, including ECB, to embark upon a series of non-standard measures.
  - Have been shown to be effective in addressing shocks originating in or being propagated through the financial system.
  - Could be used to react to country-specific disturbances while still being coordinated on a union-wide level.

Model and main results

Using

- a two-country New Keynesian DSGE model of a monetary union
- featuring leverage constrained financial intermediaries,
- central bank credit policy à la Gertler/Karadi (2011) and Gertler/Kiyotaki (2011),
- international trade in goods, capital assets and bonds and
- country-specific shocks,

it is shown that

- country-specific rules are not necessarily desirable from a welfare point of view.
- If a central bank only has access to highly correlated indicators, union-wide rules are preferable.

bird's eye view | intuition | related literature

Unconventional monetary policy rules

details liq. fac. | details CCP

Union-wide rules:

$$\Phi_{j,t} = \Phi^*_{j,t} = \kappa_j \left[0.5 \left(\ln \left(\frac{E_t R_{k,t+1}}{R_t} \right) + \ln \left(\frac{E_t R^*_{k,t+1}}{R^*_t} \right) \right) - \ln \left(\frac{R_k}{R} \right) \right] \quad \text{(credit spread rule)}$$

$$\Phi_{j,t} = \Phi^*_{j,t} = -\kappa_j \ln \left(\frac{Q_t K_t + Q^*_t K^*_t}{Q_{t-1} K_{t-1} + Q^*_{t-1} K^*_{t-1}} \right) \quad \text{(credit growth rule)}$$

Country-specific rules:

$$\Phi_{j,t} = \kappa_j \left[\ln \left(\frac{E_t R_{k,t+1}}{R_t} \right) - \ln \left(\frac{R_k}{R} \right) \right] \quad \text{(credit spread rule)}$$

$$\Phi^*_{j,t} = \kappa_j \left[\ln \left(\frac{E_t R^*_{k,t+1}}{R^*_t} \right) - \ln \left(\frac{R_k}{R} \right) \right] \quad \text{(credit spread rule)}$$

$$\Phi_{j,t} = -\kappa_j \ln \left(\frac{Q_t K_t}{Q_{t-1} K_{t-1}} \right) \quad \text{(credit growth rule)}$$

$$\Phi^*_{j,t} = -\kappa_j \ln \left(\frac{Q^*_t K^*_t}{Q^*_{t-1} K^*_{t-1}} \right) \quad \text{(credit growth rule)}$$

with $j \in \{f, m\}$ (m - liquidity facilities; f - corporate credit policy).

Welfare analyses

- Model is solved up to second order.
- *Optimal simple rules*:
  - Solve for optimal value of κ_m or κ_f, with $\kappa_f, \kappa_m \in [0, 330]$.
  - Welfare criterion: Highest conditional welfare (see Schmitt-Grohé/Uribe, 2004).
  - Conditional on deterministic steady state.
- Welfare measure (g):
  - Permanent %-change in steady state consumption, necessary to make agents in the deterministic steady state as well off as those in the stochastic economy.
  - $g > 0$: Agents in the stochastic world are better off.
  - $g < 0$: Agents in the non-stochastic world are better off.

details

Optimal simple UMP rule - full model

	κ_f, κ_m	g	rel. gain	K	N
no UMP	-	-2.72	-	5.586	1.448
Rule 1 - credit spread rule					
LF, cou.	50	-2.45	0.27	5.621	1.449
LF, un.	67	-2.39	0.33	5.630	1.441
CCP, cou.	167	-1.77	0.95	5.643	1.243
CCP, un.	233	-1.62	1.10	5.653	1.144
Rule 2 - credit growth rule					
LF, cou.	63	2.43	5.15	5.974	1.262
LF, un.	70	2.19	4.91	5.945	1.272
CCP, cou.	137	4.07	6.79	6.040	1.198
CCP, un.	137	3.66	6.38	6.008	1.215

Table: Optimal rules and welfare, all shocks

LF: liquidity facilities. CCP: corporate credit policy. g: consumption equivalents in percent of steady state consumption. Relative gain: difference in g to case without unconventional policy. Columns 4-5 display the stochastic steady state of capital (K) and banks' net wealth (N).

Main takeaways

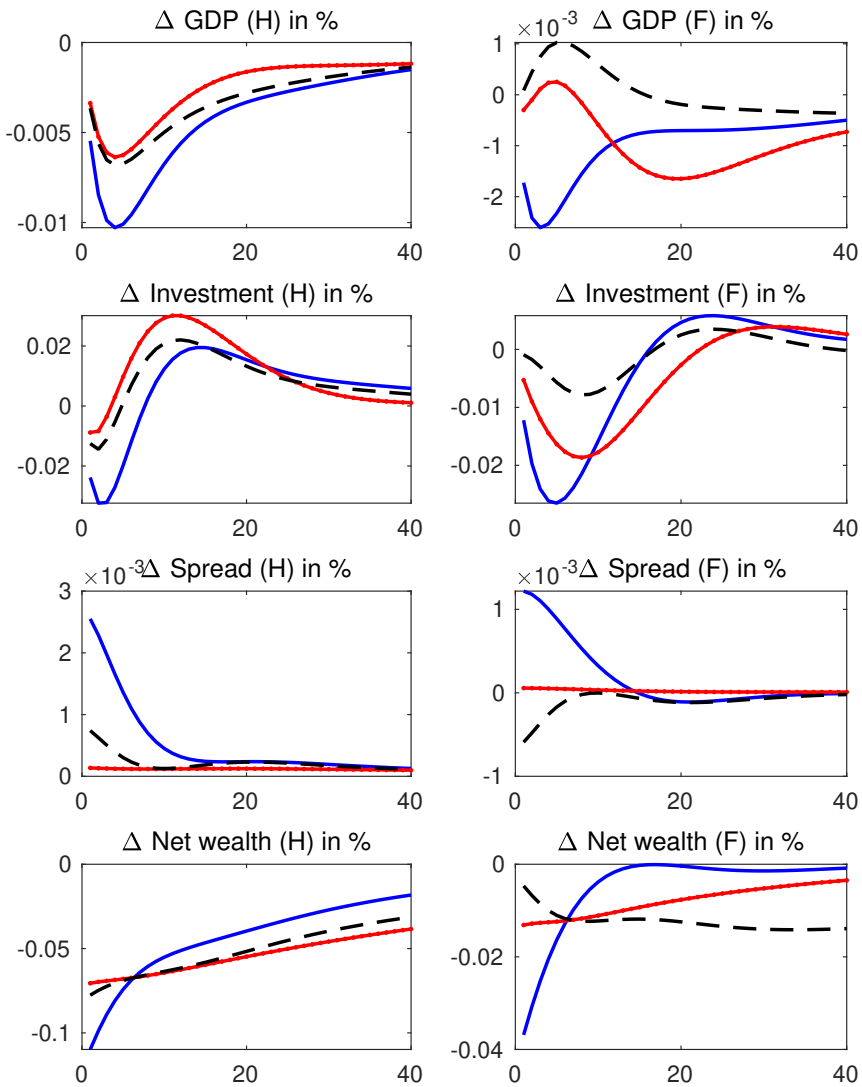
- When using a *credit spread rule*, welfare is higher when the central bank reacts to *union-wide* averages.
- When using a *credit growth rule*, welfare is higher when the central bank reacts to *country-specific* circumstances.
- Welfare is higher whenever the stochastic steady state value of capital is higher.
- Welfare is higher whenever the stochastic steady state value of banks' net wealth is lower.

One shock at a time

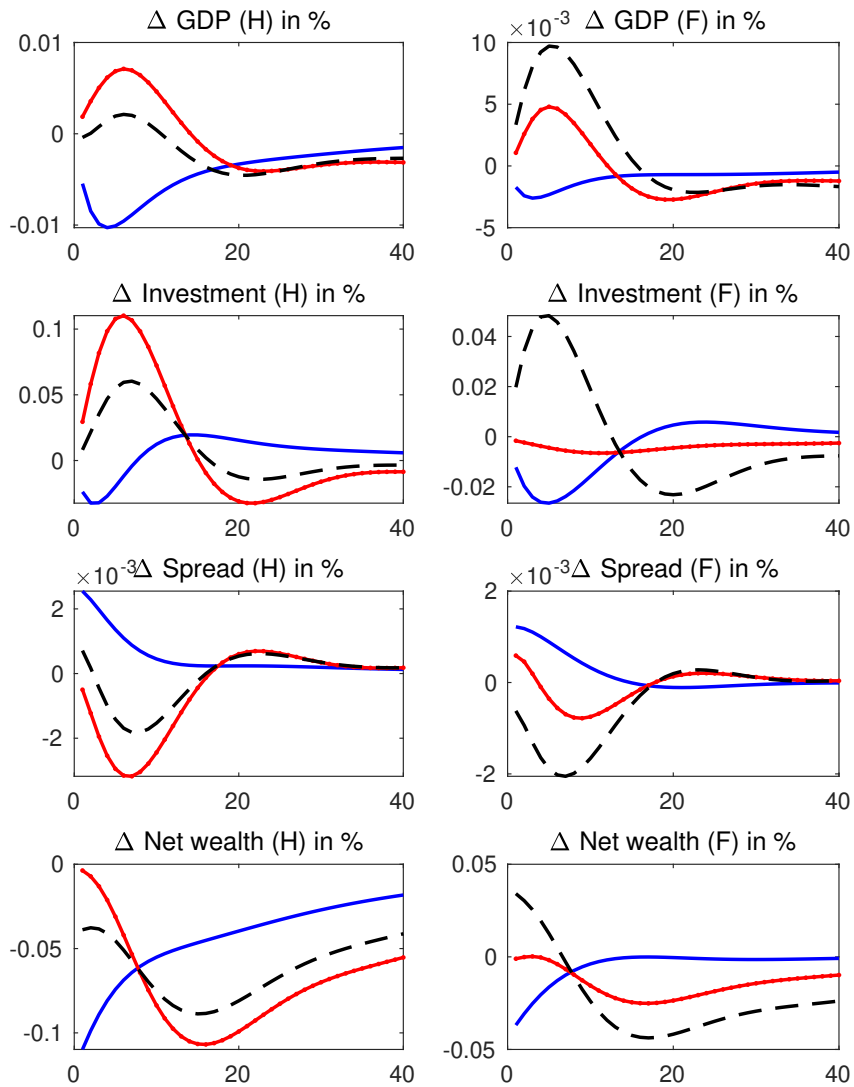
- Generally, welfare results are highly dependent on the underlying sources of risk.
- Conducting the welfare analysis for each shock individually shows that the *capital quality shock* is the main driver of results.

cap. qual. shock

IR to adverse home capital quality shock



(a) CCP, credit spread rule



(b) CCP, credit growth rule

no UMP; country-specific; union-wide

Drivers of correlation: Home bias in credit provision vs. full integration

Correlation	Benchmark ($\mu_A = 0.91$)	Full integration ($\mu_A = 0.5$)
$\frac{R_k}{R}, \frac{R_k^*}{R^*}$	0.790	0.177
QK, Q^*K^*	0.367	0.986

Table: Cross-country correlations of indicators, only capital quality shocks

- With a fully diversified asset portfolio, also the welfare result is parly turned around:
  - When using a *credit spread rule*, welfare is higher when the central bank reacts to *country-specific* circumstances.
  - When using a *credit growth rule*, welfare is higher when the central bank adjusts LF to *union-wide* averages (for CCP similar welfare for country-specific and union-wide policy).

portfolio choice

Conclusion

If the central bank reacts to indicator variables which are highly correlated between countries, it is welfare-superior to resort to union-wide rules.

- Similar stabilization in the economy hit by the shock.
- Less "overstabilization" in the economy not hit by the shock, but still enough to further reduce the effects of the financial friction.

intuition

Additional results on asymmetric union

Thank you for your attention!

Appendix

UMP in an asymmetric union

- *New assumption*: Home country (H) has sounder financial system than foreign country (F)
- Implementation: H introduces instrument which reduces lending cost of banks during downswings (credit-to-GDP-ratio below average) and increases lending cost during upswings (credit-to-GDP-ratio above average) details

→ Does the introduction of unconventional monetary policy change the incentives to reform financial structures in country F?

Optimal simple UMP rule - asymmetric countries

	Home (regulated fin. sector)		Foreign (non-regulated fin. sector)		Union average	Symm. union
	κ_f, κ_m (1)	g^H (2)	κ_f, κ_m (3)	g^F (4)	g^{UN} (5)	g (6)
no UMP	-	-2.46	-	-2.81	-2.64	-2.72
Rule 1 - Credit Spread Rule						
LF, cou.	79	-2.16	50	-2.41	-2.28	-2.45
LF, un.	73	-2.17	73	-2.36	-2.26	-2.39
CCP, cou.	330	0.37	172	-1.35	-0.49	-1.77
CCP, un.	330	2.36	330	-1.37	0.48	-1.62

Table: Optimal rules and welfare with asymmetric countries

LF: liquidity facilities. CCP: corporate credit policy. g^H (g^F): consumption equivalents in percent of steady state consumption in H (F). g^{UN}: union average g in the asymmetric case. Column 6 shows g from the symmetric case to facilitate comparisons.

UMP and incentives to reform

	g^F, no reform (1)	g^F, reform (2)	Relative gain from reform (2)-(1)
No UMP	-2.81	-2.52	0.29
Rule 1 - Credit Spread Rule			
LF, cou.	-2.41	-2.11	0.30
LF, un.	-2.36	-2.10	0.25
CCP, cou.	-1.35	0.84	2.19
CCP, un.	-1.37	0.84	2.20

Table: Incentives to reform financial structures in the foreign economy

LF: liquidity facilities. CCP: corporate credit policy. g^F: consumption equivalents in percent of steady state consumption in F.

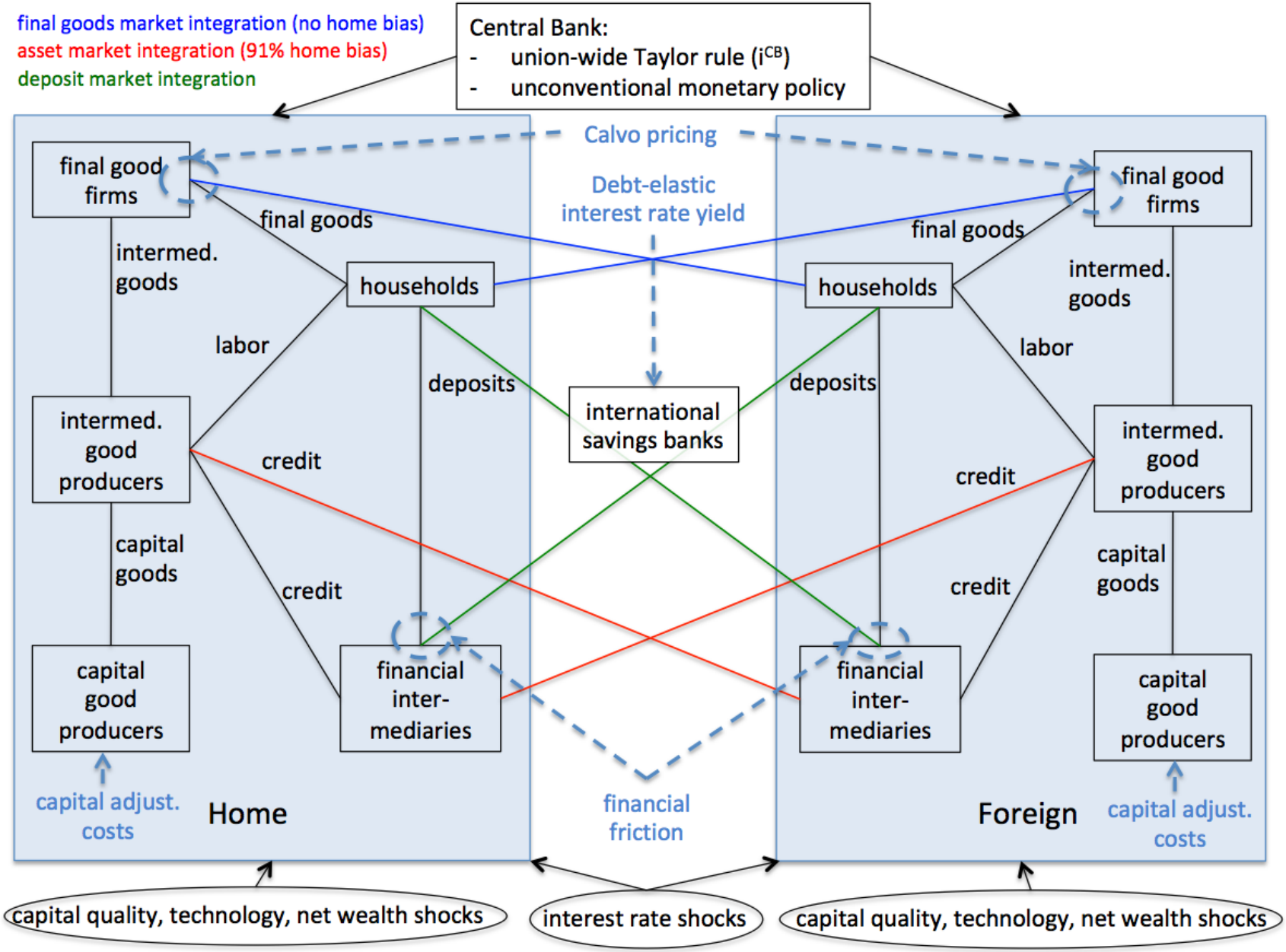
end

Baseline Calibration (1/2)

Parameter	Description	Value
h	habit formation parameter	0.815
χ	utility weight of labor	2.054
ϕ	inverse of Frisch elasticity of labor supply	0.276
η	elasticity of the discount factor w.r.t. consumption	0.01
ω_c	parameter from endogenous discount factor	0.9961
ω_D	parameter from debt-elastic interest rate premium	0.01
η_i	inverse elasticity of net investment to the price of capital	1.728
α	capital share	0.33
$\delta(U)$	steady state depreciation rate	0.025
ζ	elasticity of marginal depreciation w.r.t. utilization rate	7.2
b	parameter from variable capital utilization	0.0377
θ	probability of not being able to change price	0.779
θ_π	degree of price indexation	0.241
ϵ	elasticity of substitution between varieties	4.167
ι	elasticity of substitution between home and foreign goods	4

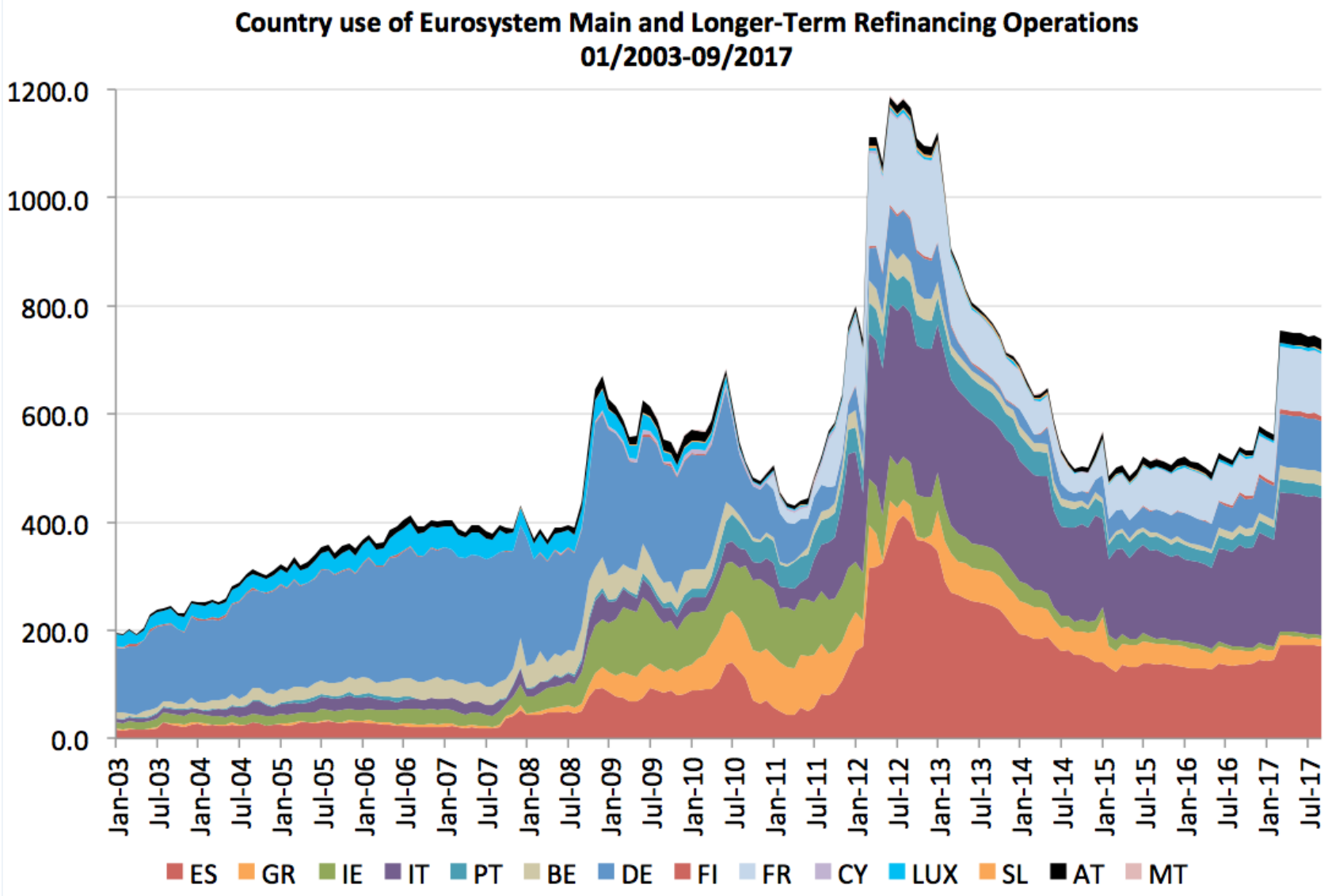
Baseline Calibration (2/2)

Parameter	Description	Value
λ_B	fraction of divertable assets	0.3815
ω	transfer to entering banks	0.002
θ_B	quarterly survival rate of banks	0.972
ι_A	elasticity of substitution between home and foreign assets	2.02
μ_A	home bias in asset holdings	0.91
γ_y	feedback coefficient on the output gap	0.125
γ_π	feedback coefficient on inflation	1.5
ρ_i	interest rate smoothing coefficient	0.8
λ_m	parameter to determine divertibility of central bank funds	0.5
κ_m	feedback coefficient from liquidity facilities rule	-
κ_f	feedback coefficient from corporate credit policy rule	-
τ_1	intermediation cost parameter	0.000125
τ_2	intermediation cost parameter	0.0012
ρ_ψ	persistence of capital quality shock	0.66
ρ_A	persistence of technology shock	0.95
ρ_N	persistence of financial shocks	0.8
$\sigma_\psi, \sigma_A,$ σ_N, σ_M	standard deviations of shocks	0.01



back to intro | back to rules | banks

LTROs and MROs - country usage



Quelle: Bruegel (2017)

back to main

Optimal simple UMP rule - one shock at a time

	κ_f, κ_m	g	rel. gain	K	N
no UMP	-	0	-	5.655	1.423
Rule 1 - credit spread rule					
LF, cou.	0	0	0	5.655	1.423
LF, un.	0	0	0	5.655	1.423
CCP, cou.	0	0	0	5.655	1.423
CCP, un.	120	0.04	0.04	5.656	1.391
Rule 2 - credit growth rule					
LF, cou.	40	0.93	0.93	5.740	1.381
LF, un.	40	0.66	0.66	5.710	1.394
CCP, cou.	137	1.54	1.54	5.781	1.338
CCP, un.	1137	1.13	1.13	5.749	1.356

Table: Optimal rules and welfare, only capital quality shock

cap. qual. shock back to main

Capital quality shock

- Production function of intermediate goods producers

$$Y_{m,t} = A_t(U_t \Psi_t K_{t-1})^{\alpha} L_t^{1-\alpha}.$$

- Capital stock evolves according to

$$K_t = (1 - \delta(U_t))\Psi_t K_{t-1} + I_t.$$

- Capital purchases are financed through issuance of state-contingent securities to home and foreign banks, i.e., the capital market clearing condition is

$$Q_t(S_{H,t} + S^*_{H,t}) = Q_t K_t.$$

$Y_{m,t}$ - intermediate goods output, A_t - technology, L_t - labor, Ψ_t - capital quality shock, U_t - capital utilization rate, $\delta(U_t)$ - depreciation rate, K_t - capital stock, I_t - investment, Q_t - capital price, $S_{H,t}$ ($S^*_{H,t}$) - home capital assets held by home (foreign) banks

back to main

Welfare analyses

g solves

$$W_0 = \frac{\ln((1+g)(1-h)\overline{C}) - \chi\frac{\overline{L}^{1+\phi}}{1+\phi}}{1-\omega_c(1+(1+g)\overline{C})^{-\eta_c}}$$

- with conditional expectation of lifetime utility as of time 0

$$W_0 = E_0 \sum_{t=0}^{\infty} \beta(C_{A,t}) \left(\ln(C_t - hC_{t-1}) - \chi\frac{L_t^{1+\phi}}{1+\phi} \right)$$

- and deterministic steady state welfare

$$\overline{W} = \frac{U(\overline{C},\overline{L})}{1-\beta(\overline{C})} = \frac{\ln((1-h)\overline{C}) - \chi\frac{\overline{L}^{1+\phi}}{1+\phi}}{1-\omega_c(1+\overline{C})^{-\eta_c}}$$

back to main

Intuition

	country-specific policy	*union-wide policy*
economy hit by shock	stabilization according to country-specific needs	understabilization
economy not hit by shock	stabilization according to country-specific needs	"overstabilization" (→ effects of financial friction are further alleviated)

When indicators are highly correlated:

positive welfare effects resulting from additional reduction of the financial friction

>

negative welfare effects due to understabilization

back to main results back to conclusion

Liquidity facilities

- Central bank can lend funds, M_t, directly to banks at rate $R_{m,t}$.
- Central bank has superior enforcement possibilities:
  - Only fraction $\lambda_B(1-\lambda_m)$, with $0 < \lambda_m < 1$, of central bank assets can be diverted (Gertler/Kiyotaki 2011).
- Home intermediary's balance sheet is now given by

$$Q_t S_{iH,t} + Q_t^* S_{iF,t} = D_{i,t}^B + N_{i,t} + M_{i,t}.$$

- Incentive constraint is now given by

$$V_{i,t} \geq \lambda_B(B_{i,t} - \lambda_m M_{i,t}).$$

- Amount of funds provided by the central bank can be expressed as a fraction of total home credit demand, i.e.,

$$M_t = \Phi_{m,t} Q_t K_t.$$

back to rules

Corporate credit policy

- Central bank can purchase private sector assets.
- Amount of private sector assets purchased by the central bank, F_t, can be expressed as a fraction of each country's overall funding needs, i.e.,

$$F_t = \Phi_{f,t} Q_t K_t.$$

- Only capital market clearing condition has to be modified

$$(1 - \Phi_{f,t}) Q_t K_t = Q_t (S_{h,t} + S^*_{h,t}).$$

back to rules

Bank balance sheet

- Bank i channels deposits from households ($D^B_{i,t} = D_{iH,t} + D^*_{iH,t}$) and internal funds (net worth, $N_{i,t}$) to intermediate goods producers (home and foreign assets, $Q_t S_{iH,t}$ and $Q^*_t S_{iF,t}$)

$$Q_t S_{iH,t} + Q^*_t S_{iF,t} = D^B_{i,t} + N_{i,t}.$$

- Net worth evolves according to

$$N_{i,t} = R_{k,t} Q_{t-1} S_{iH,t-1} + R^*_{k,t} Q^*_{t-1} S_{iF,t-1} - R_{t-1} D^B_{i,t-1}.$$

$R_{k,t}$, $R^*_{k,t}$ - state-contingent gross real rates of return of home and foreign capital assets, R_t - real deposit rate

back to model overview back to rules

Financial friction

- Each period, fraction $1-\theta_B$ of bankers exits and pays out terminal net worth to respective household, hence, banks maximize the terminal value of their net worth

$$V_{i,t} = \max \quad E_t \Lambda_{t,t+1}\left[(1-\theta_B)N_{i,t+1} + \theta_{B+1}V_{i,t+1}\right].$$

- Banker can choose to divert a fraction $0 < \lambda_B < 1$ of total assets ($\rightarrow$ bankruptcy), hence, depositors only provide funds as long the following incentive constraint holds

$$V_{i,t} \geq \lambda_B B_{i,t},$$

where $B_{i,t}$ is a CES composite of home and foreign capital assets.

back to model overview back to rules

Bank portfolio choice

Banks choose between home and foreign asset holdings in order to maximize the expected revenue of total asset holdings given by

$$E_t R_{k,t+1} Q_t S_{H,t} + E_t R^*_{k,t+1} Q^*_t S_{F,t},$$

such that the asset composite is smaller or equal than $B_{i,t}$,

$$\left(\mu_b^{\frac{1}{\iota_b}} \left(Q_t S_{iH,t}\right)^{\frac{\iota_b - 1}{\iota_b}} + (1-\mu_b)^{\frac{1}{\iota_b}} \left(Q^*_t S_{iF,t}\right)^{\frac{\iota_b - 1}{\iota_b}} \right)^{\frac{\iota_b}{\iota_b - 1}} \leq B_{i,t}.$$

back to correlation

Bank portfolio choice

The optimal demand equations for home and foreign assets are given by

$$Q_t S_{iH,t} = \mu_b \left(\frac{E_t R_{k,t+1}}{R_t^{\mathrm{B}}} \right)^{-\iota_b} B_{i,t},$$

$$Q_t^* S_{iF,t} = (1-\mu_b) \left(\frac{E_t R_{K,t+1}^*}{R_t^{\mathrm{B}}} \right)^{-\iota_b} B_{i,t},$$

where

$$R_t^B \equiv \left(\mu_b \left(E_t R_{k,t+1} \right)^{1-\iota_b} + (1-\mu_b) \left(E_t R_{k,t+1}^* \right)^{1-\iota_b} \right)^{\frac{\iota_b}{\iota_b - 1}}.$$

back to correlation back

Banks aggregated

Net worth of existing and new bankers is given by

$$N_t = N_{n,t} + N_{e,t}\varepsilon_{n,t}, \text{ with}$$

$$N_{e,t} = \theta_b \left[(R_{k,t} - R_{t-1}) \frac{Q_t S_{H,t-1}}{N_{t-1}} + (R^*_{k,t} - R_{t-1}) \frac{Q^*_t S_{F,t-1}}{N_{t-1}} + R_{t-1} \right] N_{t-1}$$

$$N_{n,t} = \omega_b (Q_t S_{H,t-1} + Q^*_t S_{F,t-1}),$$

where ω_b is the fraction of the assets given to new bankers and $\varepsilon_{n,t}$ a shock to the net wealth of existing bankers.

back to model overview

Subsidy on net worth

Country H introduces a subsidy on net worth, τ_t^N, which adjusts in proportion to variations in the credit-to-GDP-ratio (c.f. Ghilardi/Peiris 2016; Levine/Lima 2015),

$$\ln(1+\tau_t^N) = -\kappa_\tau \ln\left(\frac{B_t/Y_t}{B/Y}\right),$$

where $\kappa_\tau = 0.1$. Given the subsidy, intermediary i's net worth evolves according to the following equation

$$N_{i,t} = R_{k,t}Q_{t-1}S_{iH,t-1} + R^*_{k,t}Q^*_{t-1}S_{iF,t-1} - R_{t-1}D^B_{i,t-1} + \tau^N_{t-1}N_{i,t-1}.$$

$\rightarrow$ Subsidy increases net wealth/facilitates lending when credit-to-GDP-ratio is below average and decrease net wealth/impedes lending when credit-to-GDP-ratio is above average.

back to main

Related literature (1/2)

- UMP in closed economy DSGE models with financial intermediaries (Gertler/Kiyotaki, 2011; Gertler/Karadi, 2011; Cúrdia/Woodford 2011)
  - show that there can be substantial gains from expanding central bank credit during crises
- UMP in two-independent-country DSGE models with banking sectors as in Gertler/Kiyotaki (2011) and Gertler/Karadi (2011); main focus on non-coordination vs. coordination (Dedola et al., 2013 - symmetric setup; Nuguer, 2016 - core-periphery setup with interbank market)
  - show that there can be substantial gains from coordination

Related literature (2/2)

- UMP in two-country DSGE models of a monetary union with different foci
  - Tischbirek (2016) shows that gov. debt purchases can be used to stabilize country-specific shocks in case of cross-country segmentation of government bond markets; no financial sector
  - Auray et al. (2016) analyze the welfare effects of different unconventional measures in a core-periphery model with a Gertler/Karadi (2011) banking system with additional sectors, assets and government risk
  - Schwanebeck (2017) uses a core-periphery model with a Gertler/Karadi (2011) banking system to analyze the effects of different UMP measures on the wholesale banking market; no welfare analysis

back to main