Strategic Macroprudential Policy Setting in Emerging Markets: The Role of Coordination

Camilo Granados
University of Washington

July 27, 2020

Introduction

Research Question: Can Emerging Economies (EMEs) coordinate their macro-prudential tools to mitigate effects of financial shocks originating in Financial Centers?

Related: How do Centers respond to potential Regional Cooperation by peripheries?

Introduction

Research Question: Can Emerging Economies (EMEs) coordinate their macro-prudential tools to mitigate effects of financial shocks originating in Financial Centers?

Related: How do Centers respond to potential Regional Cooperation by peripheries?

Motivation:

- Global Financial Cycle Literature (Rey (2013); Passari and Rey (2015)) : EMEs are at the mercy of the cycles imposed by Financial Centers.
- Forbes (2019, AER, P&P): Effects of Macro-prudential policies

  "*there is accumulating evidence that [Macroprudential policies] can be effective on its direct targets, **albeit often with unintended leakages and spillovers**. There has been less progress in terms of understanding the ramifications of these leakages*"
- BIS, G20: Large Complex Financial Institutions (LCFIs) in economic centers are at the core of Financial Crises and current Systemic Risks:
  - Basel I, II, III: Centralized policy recommendations for all countries (not legally binding).
  - Basel III: Focus on limiting moral hazard by LCFIs.
  - Financial Stability Board: Priority $\rightarrow$ promote coordinated program of reforms.

Introduction

Research Question: Can Emerging Economies (EMEs) coordinate their macro-prudential tools to mitigate effects of financial shocks originating in Financial Centers?

Related: How do Centers respond to potential Regional Cooperation by peripheries?

Motivation:

- Global Financial Cycle Literature (Rey (2013); Passari and Rey (2015)) : EMEs are at the mercy of the cycles imposed by Financial Centers.
- Forbes (2019, AER, P&P): Effects of Macro-prudential policies

  "*there is accumulating evidence that [Macroprudential policies] can be effective on its direct targets, **albeit often with unintended leakages and spillovers**. There has been less progress in terms of understanding the ramifications of these leakages*"
- BIS, G20: Large Complex Financial Institutions (LCFIs) in economic centers are at the core of Financial Crises and current Systemic Risks:
  - Basel I, II, III: Centralized policy recommendations for all countries (not legally binding).
  - Basel III: Focus on limiting moral hazard by LCFIs.
  - Financial Stability Board: Priority $\rightarrow$ promote coordinated program of reforms.

Real life example (coordination effort):

European Union: the MaP Policies are set at the Supranational level and then implemented in each country
Establishment of Institutions aimed at overseeing coordination: ESRB (for MaP) and EBA, EIOPA and ESMA (for Micro-pru)

Introduction (cont'd)

Previous work: Finite horizon Setup with simple dynamics and **Static banking and policy model**.

Policy: One shot banking tax set in last period.

Aim: Study Welfare Policy Effects between financially integrated economies. Determine the scope for regulatory cooperation and relevance of interaction with additional peripheries.

Introduction (cont'd)

Previous work: Finite horizon Setup with simple dynamics and **Static banking and policy model**.

Policy: One shot banking tax set in last period.

Aim: Study Welfare Policy Effects between financially integrated economies. Determine the scope for regulatory cooperation and relevance of interaction with additional peripheries.

Lessons:

- Welfare effects are significant with positive policy spillovers
- Spillovers grow with financial friction
- Cooperation Gains: Not sizable (on impact) but can arise with policy implementation costs. Because Non-Coop. implies more active policy setting.
- If policy tool is perfect (flexible, costless) most setups approach the First Best.
- Interactions with extra periphery: relevant if not replicate of other EME.
- Optimal policy: Undo the Friction rather tran prioritize boosting intermediation/investment

How would these results change when accounting for full policy and welfare dynamics, in an environment of long-lived banks? Potential larger gains from policy cooperation and honesty by Bankers in repeated game.

Introduction (cont'd)

Previous work: Finite horizon Setup with simple dynamics and **Static banking and policy model**.

Policy: One shot banking tax set in last period.

Aim: Study Welfare Policy Effects between financially integrated economies. Determine the scope for regulatory cooperation and relevance of interaction with additional peripheries.

Lessons:

- Welfare effects are significant with positive policy spillovers
- Spillovers grow with financial friction
- Cooperation Gains: Not sizable (on impact) but can arise with policy implementation costs. Because Non-Coop. implies more active policy setting.
- If policy tool is perfect (flexible, costless) most setups approach the First Best.
- Interactions with extra periphery: relevant if not replicate of other EME.
- Optimal policy: Undo the Friction rather tran prioritize boosting intermediation/investment

How would these results change when accounting for full policy and welfare dynamics, in an environment of long-lived banks? Potential larger gains from policy cooperation and honesty by Bankers in repeated game.

Here: Dynamic banking problem and policy

What is the path of optimal macroprudential policies in open economies [Strategic interaction]

What is the role of Policy Cooperation in generating Welfare Gains?

Better welfare accounting that captures the total effect of policy (over time).

Results Preview

- Cooperation matters? Yes, but not any type: **Center Cooperation Matters**
  - Welfare Ranking: $Coop \succcurlyeq CoopAC \succsim Nash \succsim CoopEMEs$
- Time Consistency of Policies is important
  - Welfare Ranking: Any time consistent policy $\succsim$ Time Variant Coop
- Distributional issues may dificult cooperation.
  - Individually EMEs may prefer Nash
- best policies are also smoother and countercyclical (in relative terms)
  - Deliver smoother financial variables too.

Model

- Three economies: Core (c) with relative population size $1 - n_a - n_b$, and two Peripheries: a and b with sizes n_a and n_b such that $n_a + n_b \leq \frac{1}{2}$.

- There is an international financial market where the households trade non-contingent bonds.

  $\Rightarrow$ the peripheries saving opportunities are not affected by the relative inefficiency of the domestic banking sector.

- The model is set in real terms.

- Agents: Households, Production Sector (final consumption good and capital), **Banks** and Government.

- EMEs banks are funded with loans from Financial Center banks.

▸ Households ▸ Final Good Firms ▸ Capital Firms ▸ Bank-EMEs ▸ Bank-Center ▸ Government

Skip

Households

$$\max_{\{C_t, B_t, D_t\}_{t=0}^{\infty}} W_0^i = E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{i(1-\sigma)}}{1-\sigma} - \frac{H_t^{i(1+\psi)}}{1+\psi} \right)$$

s.t.,

$$C_t^i + B_t^i + D_t^i + \frac{\eta}{2}(B_t^i)^2 + \frac{\eta_D}{2}(D_t^i - \bar{D}^i)^2 = R_{t-1}^i B_{t-1}^i + R_{D,t-1}^i D_{t-1}^i + W_t^i H_t^i + \Pi_t^i, \quad i = \{a, b, c\}$$

B_t^i: Non-contingent international bonds (units of consumption bundle),

D_t^i: domestic deposits - dropped for the peripheries that rely on foreign lending,

$W_t^i H_t^i$: labor income,

Π_t^i : profits from banks and capital firms net of lump-sum taxes $\rightarrow$ quite different between Center and EMEs.

One good is produced worldwide and C^i is the corresponding consumption by the household in the country i.

Incomplete Mkts: Adjustment costs of assets allow the model to be stationary.

Back

Final goods firms

There is one single good produced in the world that is obtained from a CD technology:

$$Y_t^i = A_t^i \left(\xi_t^i K_{t-1}^i\right)^{\alpha} H_t^{i(1-\alpha)} \tag{technology}$$

H^i, K^i are labor and capital. A_t^i is a productivity shock and ξ^i is a capital-quality shock (AR(1) processes).

Profits are derived from production and the resale of undepreciated capital to investors.

The firms choose the inputs optimally to solve:

$$\max_{K_{t-1},H_t} \Pi_t^{i,prod} = Y_t^i + (1-\delta)\xi_t^i Q_t^i K_{t-1}^i - W_t^i H_t^i - \underbrace{\tilde{R}_{k,t}^i Q_{t-1}^i}_{\text{Repayment to bank}}$$

$$s.t. \quad \text{(technology)}$$

Back

Final goods firms and returns on Banking

Let $r_t^i \equiv \alpha A_t^i H_t^{i(1-\alpha)}(\xi^i K_{t-1}^i)^{(\alpha-1)} \propto MPK_t \longrightarrow$ we can obtain the optimal payments to each input (workers and bankers) as:

$$W_t^i = (1-\alpha) A_t^i H_t^{i(-\alpha)} \xi_t^{i\ \alpha} K_{t-1}^{i(\alpha)}$$

$$\tilde{R}_{k,t} = \xi_t^i \frac{r_t^i + (1-\delta) Q_{t-1}^i}{Q_{t-1}^i}$$

$\tilde{R}_{k,t}$ is the gross rate of return of bankers **before** paying the macroprudential taxes.

This structure reflects that Capital is funded by selling securities to domestic banks $Z_t^i = K_t^i$.

Capital Goods production

Physical capital is produced in a competitive market by using old capital and investment.

The depreciation rate of capital is $1 - (1-\delta)\xi_t^i$.

The investment will be subject to convex adjustment costs:

Total cost of Investing: $$C(I_t^i) = I_t^i \left(1 + \frac{\zeta}{2}\left(\frac{I_t^i}{I_{t-1}^i} - 1\right)^2\right)$$

The firms buy back the old capital stock at price Q_t^i and produce new capital units for future production.

Capital stock dynamics: $$K_t^i = I_t^i + (1-\delta)\xi_t^i K_{t-1}^i$$

Back

Banking Sector - EMEs

Sector targeted by Macroprudential policies. Set-up based on Gertler and Karadi (2011).

Banks start with a bequest from the households and continue their activities with prob. $\theta \Rightarrow$ **there is exit**

N^e_{jt} : net worth, F^e_{jt} : interbank borrowing j at a rate $R^e_{b,t}$ and D^e_{jt}: deposits from domestic households.

Balance sheet of the bank j: $$Q^e_t Z^e_{jt} = N^e_{jt} + F^e_{jt}$$ (e: EME)

Aggregate net worth of the banking system :

$$N^e_t = \underbrace{\theta N^e_{j,t}}_{\text{surviving banks}} + \underbrace{\delta_T Q^e_t K^e_{t-1}}_{\text{new banks start-up K}}$$

$N^e_{j,t}$: net worth of surviving banks: $$N^e_{j,t} = R^e_{k,t} Q^e_{t-1} Z^e_{j,t-1} - R^e_{b,t-1} F^e_{j,t-1}$$

Gross return on capital (after-tax): $$R^e_{k,t} = \xi^e_t \frac{(1-\tau^e_{k,t}) r^e_t + (1-\delta) Q^e_t}{Q^e_{t-1}}$$ $\tau^e_{k,t}$: macroprudential tax/subsidy

Banking Sector - EMEs (cont.)

Agency problem in EMEs

Lending contracts subject to **limited enfoceability**: a bank can default and run away with a portion κ^e of the assets.

The problem of the j banker is to maximize the value of the bank:

$$J^e(N^e_{j,t}) = \mathbb{E}_t \max_{N_t, Z^e_t, V^e_{s,t}} (1-\theta) \sum_{s=0}^{\infty} \Lambda^e_{t+1+s}[\theta^s N^e_{j,t+1+s}]$$

subject to: net worth ($N^{e_i}_{j,t}$) dynamics and Incentive Compatibility Constraint:

$$\underbrace{J^e_{j,t}}_{\text{value of bank}} \geq \underbrace{\kappa^e Q^e_t Z^e_{s,t}}_{\text{value of defaulting}}$$

ICC: the continuation value of the bank is larger than the profit from defaulting.

The bank's optimal decisions:

The F.O.C. of the banker's problem are:

$$[Z_t] : \qquad \mathbb{E}_t\{\Omega_{t+1|t}(R^{e_i}_{k,t+1} - R^{e_i}_{b,t})\} = \mu^e_t \kappa^e$$

the envelope condition:

$$[N^e_{j,t}] : \qquad J^{e'}(N^e_{j,t})(1 - \mu^{e_i}_t) = \mathbb{E}_t\{\Omega_{t+1|t} R^e_{b,t}\}$$

where $\mu^{e_i}_t$ is the lagrange multiplier associated with the ICC and $\Omega_{t+1|t} = \Lambda^e_{t+1}\left(1 - \theta + \theta J^{e'}_{t+1}\right)$ is the effective pricing kernel of the bank.

Back

Banking sector - Center Country

Most of the sectors are analogous to the EMEs. However, the banking sector differs in their degree of development and agency frictions.

Implications:

- Center banks can intermediate local deposits without restrictions.
  - Foreign lending flows from center to peripheries.
- Agency frictions can be present but can be milder.

The balance sheet of bank j: $$F^a_{j,t} + F^b_{j,t} + Q^c_t Z^c_{j,t} = N^c_{jt} + D^c_t$$

where $F^e_{j,t}$: claims on the j-th representative peripheral bank and $Q^c_t Z^c_{j,t}$: claims on the core country capital stock.

Return on capital is given as before: $R^c_{k,t} = \xi^c_t \frac{(1-\tau^c_{k,t})r^c_t + (1-\delta)Q^c_t}{Q^c_{t-1}}$

Banking sector - Center Country (cont.)

The bank j value function is:

$$J^c_{j,t}(N^c_{j,t}) = \mathbb{E}_t \max_{N^c_{j,t}, Z^c_t, F^e_{s,t}, D^c_t} \Lambda^c_{t+1}\Big[(1-\theta)(\underbrace{R^c_{k,t+1}Q^c_t Z^c_{j,t} + R^a_{b,t}F^a_{j,t} + R^b_{b,t}F^b_{j,t}}_{\text{gross return on assets}} - \underbrace{R^c_{D,t}D^c_t}_{\substack{\text{deposits}\\ \textit{repayment}}}) + \theta J^c_{j,t+1}(N^c_{j,t+1})\Big]$$

The bank determines such value while being subject to an incentive compatibility constraint:

$$J^c_{jt} \geq \kappa^c_{F_a} F^a_{jt} + \kappa^c_{F_b} F^b_{jt} + \kappa^c Q_{c,t} Z^c_{j,t} \tag{ICC-C}$$

with $\kappa^c_F, \kappa^c > 0$, i.e., the pledgeable fraction can be asymmetric across assets.

Optimality Conditions:

The F.O.C. are:

$$
\begin{aligned}
[Z_{j,t}]: &\quad \mathbb{E}_t \Omega^c_{t+1|t}(R^c_{k,t+1} - R^c_{D,t}) = \kappa^c \mu^c_t \\
[F^a_{j,t}]: &\quad \mathbb{E}_t \Omega^c_{t+1|t}\left(R^a_{b,t} - R^c_{D,t}\right) = \kappa^c_{F_a} \mu^c_t \\
[F^b_{j,t}]: &\quad \mathbb{E}_t \Omega^c_{t+1|t}\left(R^b_{b,t} - R^c_{D,t}\right) = \kappa^c_{F_b} \mu^c_t
\end{aligned}
$$

and the envelope condition,

$$
[N^c_{j,t}]: \quad J^{c'}(N^c_{j,t})(1 - \mu^c_t) - \mathbb{E}_t \Omega^c_{t+1|t} R^c_{D,t} = 0
$$

Back

Macroprudential Policy

Several potential choices (capital controls, taxes, leverate ratios, etc.).

Policy used here: **tax on return to capital**.

Advantage: targets the source of the friction (credit spread).

Government budget (balanced):

$$\tau^j_{k,t} r^j_{k,t} K^j_{t-1} + T^j_t = 0 \qquad j = \{a, b, c\}$$

Welfare objective of each policy maker is given by PV of agents utility.

However, there could be policy implementation costs.

$$\hat{W}^j_0 = W^j_0 \quad -\psi_{\tau,k} E_0 \sum_{t=0}^{\infty} \beta^t \tau^{j\,2}_{k,t}$$

Back

Ramsey Policy Problem

Cooperation: objective function of the planner is the weighted average of the welfare of coalition participants.

Non-cooperative equilibrium: *open-loop Nash* equilibrium.

We assume players know the initial state vector and define the whole sequence of actions taking the future path of tools for other planners as given.

Problem of the planner: Under commitment, choose the vector of endogenous variables and the policy instruments to solve:

$$\hat{W}_{coop,0} = \max_{\mathbf{x}_t, \boldsymbol{\tau}_t} [n_p \hat{W}_0^p + (1 - n_p)\hat{W}_0^c] = \max_{\mathbf{x}_t, \boldsymbol{\tau}_t} [n_a \hat{W}_0^a + n_b \hat{W}_0^b + (1 - n_a - n_b)\hat{W}_0^c]$$

s.t.,

$$\mathbb{E}_t F(\mathbf{x}_{t-1}, \mathbf{x}_t, \mathbf{x}_{t+1}, \boldsymbol{\tau}_{t-1}, \boldsymbol{\tau}_t, \boldsymbol{\tau}_{t+1}; \boldsymbol{\varphi}_t) = 0$$

where $\mathbf{x}_t$ is the vector of endogenous variables, $\boldsymbol{\tau}_t = (\tau_t^a, \tau_t^b, \tau_t^c)'$ is the vector of instruments and φ_t is a vector of exogenous variables and shocks.

Semi-cooperative cases: subsets of country form a coalition and solve:

$$\hat{W}_{coopAC,0} = \max_{\mathbf{x}_t, \tau_t^a, \tau_t^c} [n_a \hat{W}_0^a + n_c \hat{W}_0^c]$$

$$\text{s.t.,} \qquad \mathbb{E}_t F(\mathbf{x}_{t-1}, \mathbf{x}_t, \mathbf{x}_{t+1}, \boldsymbol{\tau}_{t-1}, \boldsymbol{\tau}_t, \boldsymbol{\tau}_{t+1}; \boldsymbol{\varphi}_t) = 0$$

Or for the case of regional (EMEs) cooperation:

$$\hat{W}_{coopEME,0} = \max_{\mathbf{x}_t, \tau_t^a, \tau_t^b} [n_a \hat{W}_0^a + n_b \hat{W}_0^b]$$

$$\text{s.t.,} \qquad \mathbb{E}_t F(\mathbf{x}_{t-1}, \mathbf{x}_t, \mathbf{x}_{t+1}, \boldsymbol{\tau}_{t-1}, \boldsymbol{\tau}_t, \boldsymbol{\tau}_{t+1}; \boldsymbol{\varphi}_t) = 0$$

Nash: On the other hand, the non-cooperative policy-maker of the country $j = \{a, b, c\}$ solves:

$$\hat{W}^j_{nash,0} = \max_{\mathbf{x}_t, \tau_t^j} \hat{W}_0^j$$

$$\text{s.t.,} \qquad \mathbb{E}_t F(\mathbf{x}_{t-1}, \mathbf{x}_t, \mathbf{x}_{t+1}, \boldsymbol{\tau}_{t-1}, \boldsymbol{\tau}_t, \boldsymbol{\tau}_{t+1}; \boldsymbol{\varphi}_t) = 0$$

Gains from cooperation

The gains from cooperative schemes will be given as the difference with respect to the strategic solution from cooperation will be computed as,

$$Gain \equiv \hat{W}_{coop,0} - (n_a \hat{W}^a_{nash,0} + n_b \hat{W}^b_{nash,0} + (1 - n_a - n_b)\hat{W}^c_{nash,0})$$

The gains are approximated at the second order around the non-stochastic steady state (Taylor expansion around $\varphi = 0$).

- The welfare obtained is the **conditional welfare**: the same initial state values are used in the simulation of each model.
- The Gain above is given in utility units. Hence, we normalize them by the change in utility from a 1% increase in Steady State consumption and get the **consumption equivalent variation** $\longrightarrow$ compensation in terms of an increase in the steady state consumption to be indifferent between models.
- We also compare the moments of key financial variables across models as well as the dynamics of the tools under each policy regime.

RESULTS

Steady State of Policy Instruments

	Nash	Cooperation (Center+EME-A)	Cooperation (EMEs)	Cooperation (All)	Cooperation (Time Variant)
τ^c	-0.850	-0.530	-0.806	-0.864	-0.140
τ^a	0.319	-0.164	0.348	-0.697	0.811
τ^b	0.319	0.328	0.348	-0.697	0.811

- We obtain the **Instrument conditional Steady States** Details
- In all cases the Center subsidizes the financial sector
- The peripheries use their tools to mitigate the friction

Welfare

- Welfare Ranking:

$Coop \succcurlyeq CoopAC \succcurlyeq Nash \succcurlyeq CoopEME$

	Nash	Cooperation (Center+EME-A)	Cooperation (EMEs)	Cooperation (All)
W^c	-4980.2	-4964.8	-4979.5	-4963.4
W^a	-5030.1	-5016.4	-5037.2	-5025.4
W^b	-5030.3	-5037.6	-5037.0	-5025.4
W	-5005.2	-4995.9	-5008.3	-4994.4
W^{ab}	-5030.2	-5027.0	-5037.1	-5025.4
Consumption Equivalent Compensation				
C	-10.9	4.8	-10.2	6.3
A	-17.0	-3.1	-24.2	-12.2
B	-16.6	-24.0	-23.4	-11.6
World	**-13.9**	**-4.4**	**-17.0**	**-2.9**
EMEs	-16.8	-13.5	-23.8	-11.9

Notes: Compensation using the First Best as benchmark.

In Cooperation symmetry between instruments rules is assumed for EMEs

Welfare

	Nash	Cooperation (Center+EME-A)	Cooperation (EMEs)	Cooperation (All)
W^c	-4980.2	-4964.8	-4979.5	-4963.4
W^a	-5030.1	-5016.4	-5037.2	-5025.4
W^b	-5030.3	-5037.6	-5037.0	-5025.4
W	-5005.2	-4995.9	-5008.3	-4994.4
W^{ab}	-5030.2	-5027.0	-5037.1	-5025.4
Consumption Equivalent Compensation				
C	-10.9	4.8	-10.2	6.3
A	-17.0	-3.1	-24.2	-12.2
B	-16.6	-24.0	-23.4	-11.6
World	**-13.9**	**-4.4**	**-17.0**	**-2.9**
EMEs	-16.8	-13.5	-23.8	-11.9

Notes: Compensation using the First Best as benchmark.

In Cooperation symmetry between instruments rules is assumed for EMEs

- Welfare Ranking:

$Coop \succcurlyeq CoopAC \succcurlyeq Nash \succcurlyeq CoopEME$

- Cooperation **by the Center** matters.

Not every type of cooperation improves on Nash

Welfare

	Nash	Cooperation (Center+EME-A)	Cooperation (EMEs)	Cooperation (All)
W^c	-4980.2	-4964.8	-4979.5	-4963.4
W^a	-5030.1	-5016.4	-5037.2	-5025.4
W^b	-5030.3	-5037.6	-5037.0	-5025.4
W	-5005.2	-4995.9	-5008.3	-4994.4
W^{ab}	-5030.2	-5027.0	-5037.1	-5025.4
Consumption Equivalent Compensation				
C	-10.9	4.8	-10.2	6.3
A	-17.0	-3.1	-24.2	-12.2
B	-16.6	-24.0	-23.4	-11.6
World	**-13.9**	**-4.4**	**-17.0**	**-2.9**
EMEs	-16.8	-13.5	-23.8	-11.9

Notes: Compensation using the First Best as benchmark.

In Cooperation symmetry between instruments rules is assumed for EMEs

- Welfare Ranking:

$Coop \succcurlyeq CoopAC \succcurlyeq Nash \succcurlyeq CoopEME$

- Cooperation **by the Center** matters.

Not every type of cooperation improves on Nash

- EMEs: better with Nash than with regional cooperation.

Peripheries improve with coop. only if Center joins.

Welfare

	Nash	Cooperation (Center+EME-A)	Cooperation (EMEs)	Cooperation (All)
W^c	-4980.2	-4964.8	-4979.5	-4963.4
W^a	-5030.1	-5016.4	-5037.2	-5025.4
W^b	-5030.3	-5037.6	-5037.0	-5025.4
W	-5005.2	-4995.9	-5008.3	-4994.4
W^{ab}	-5030.2	-5027.0	-5037.1	-5025.4
Consumption Equivalent Compensation				
C	-10.9	4.8	-10.2	6.3
A	-17.0	-3.1	-24.2	-12.2
B	-16.6	-24.0	-23.4	-11.6
World	**-13.9**	**-4.4**	**-17.0**	**-2.9**
EMEs	-16.8	-13.5	-23.8	-11.9

Notes: Compensation using the First Best as benchmark.

In Cooperation symmetry between instruments rules is assumed for EMEs

- Welfare Ranking:

Coop $\succcurlyeq$ *CoopAC* $\succcurlyeq$ *Nash* $\succcurlyeq$ *CoopEME*

- Cooperation **by the Center** matters.

Not every type of cooperation improves on Nash

- EMEs: better with Nash than with regional cooperation.

Peripheries improve with coop. only if Center joins.

- Distribution of gains:

C: better off with Coop or CoopAC. Its response affects EMEs significantly.

A: best off by Cooperating **with Center only**

$\rightarrow$ Potential Deviation Incentives

B: If full Cooperation is not credible prefers to play Individually (Nash)

-Potential credibility issues

Time consistency of policy is very important

- **Indeterminacy:** Non-cooperative policies and some semi-cooperative are not well defined if time inconsistent.

- **Benefits of Cooperation:** implementing cooperation overrides sunspot equilibria and allows to obtain a solution (i.e., Coop and CoopAC) $\longrightarrow$ Models with multiple solutions: when C plays individually (Nash and CoopEMEs).

	Nash	Cooperation (Center+EME-A)	Cooperation (EMEs)	Cooperation (All)	Cooperation (Time Variant)
W^c	-4980.2	-4964.8	-4979.5	-4963.4	**-5189.3**
W^a	-5030.1	-5016.4	-5037.2	-5025.4	**-5343.6**
W^b	-5030.3	-5037.6	-5037.0	-5025.4	**-5343.3**
W	-5005.2	-4995.9	-5008.3	-4994.4	**-5266.3**
W^{ab}	-5030.2	-5027.0	-5037.1	-5025.4	**-5343.4**
Consumption Equivalent Compensation					
C	-10.9	4.8	-10.2	6.3	**-224.9**
A	-17.0	-3.1	-24.2	-12.2	**-335.7**
B	-16.6	-24.0	-23.4	-11.6	**-334.5**
World	**-13.9**	**-4.4**	**-17.0**	**-2.9**	**-280.2**
EMEs	-16.8	-13.5	-23.8	-11.9	**-335.1**

Notes: Compensation using the First Best as benchmark.
In Cooperation symmetry between instruments rules is assumed for EMEs

Time Consistency in the model

CoopTVariant - in IRFs

Time consistency of policy is very important

- **Indeterminacy:** Non-cooperative policies and some semi-cooperative are not well defined if time inconsistent.

- **Benefits of Cooperation:** implementing cooperation overrides sunspot equilibria and allows to obtain a solution (i.e., Coop and CoopAC) $\longrightarrow$ Models with multiple solutions: when C plays individually (Nash and CoopEMEs).

- Still, the best of these models is much worse than any timeless-perspective model:

	Nash	Cooperation (Center+EME-A)	Cooperation (EMEs)	Cooperation (All)	Cooperation (Time Variant)
W^c	-4980.2	-4964.8	-4979.5	-4963.4	**-5189.3**
W^a	-5030.1	-5016.4	-5037.2	-5025.4	**-5343.6**
W^b	-5030.3	-5037.6	-5037.0	-5025.4	**-5343.3**
W	-5005.2	-4995.9	-5008.3	-4994.4	**-5266.3**
W^{ab}	-5030.2	-5027.0	-5037.1	-5025.4	**-5343.4**
Consumption Equivalent Compensation					
C	-10.9	4.8	-10.2	6.3	**-224.9**
A	-17.0	-3.1	-24.2	-12.2	**-335.7**
B	-16.6	-24.0	-23.4	-11.6	**-334.5**
World	**-13.9**	**-4.4**	**-17.0**	**-2.9**	**-280.2**
EMEs	-16.8	-13.5	-23.8	-11.9	**-335.1**

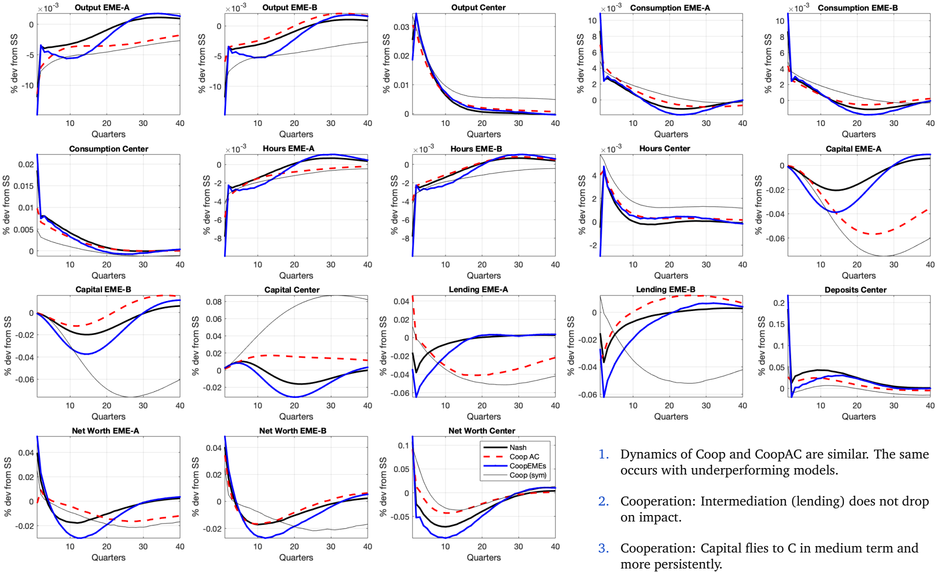
Notes: Compensation using the First Best as benchmark.
In Cooperation symmetry between instruments rules is assumed for EMEs

Time Consistency in the model
CoopTVariant - in IRFs

IRFs: Dynamic of variables and policies

Cases of interest: Shocks that originate in the Center

IRFs: Productivity shock on country C

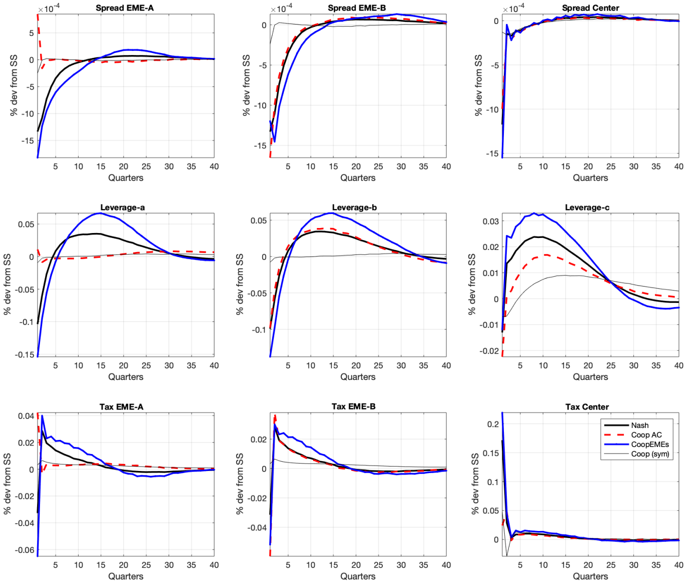


1. Dynamics of Coop and CoopAC are similar. The same occurs with underperforming models.

2. Cooperation: Intermediation (lending) does not drop on impact.

3. Cooperation: Capital flies to C in medium term and more persistently.

IRFs: Productivity shock on country C - Financial Variables and Policies



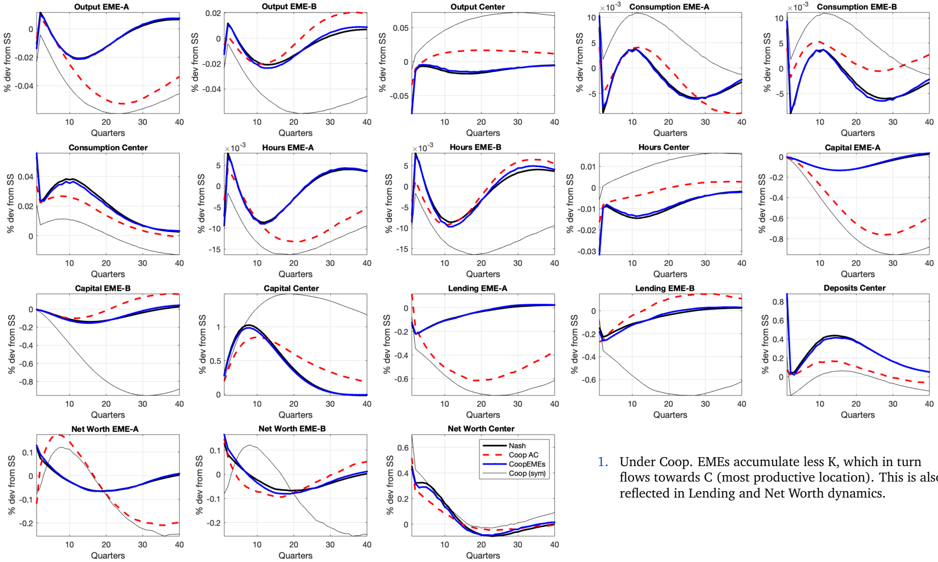
1. Non-Coop policies imply lowering Spread actively. Effect is noticeable between A and B in CoopAC case.
2. Cooperative policies lower the leverage of C more (countercyclical)

Taxes:

1. τ^c: Coop. schemes $\longrightarrow$ milder subsidy
2. Policy not quite countercyclical (as SG-U17). BUT, it is countercyclical **relative** to Non-Cooperation. Reconciles Bianchi'11 and SG-U?
3. τ^{emes}: Non-Coop. (with C) sets a higher subsidy. Effect is stronger with regional Coop.
4. τ^a: If Coop. with C $\Rightarrow$ sets a tax.

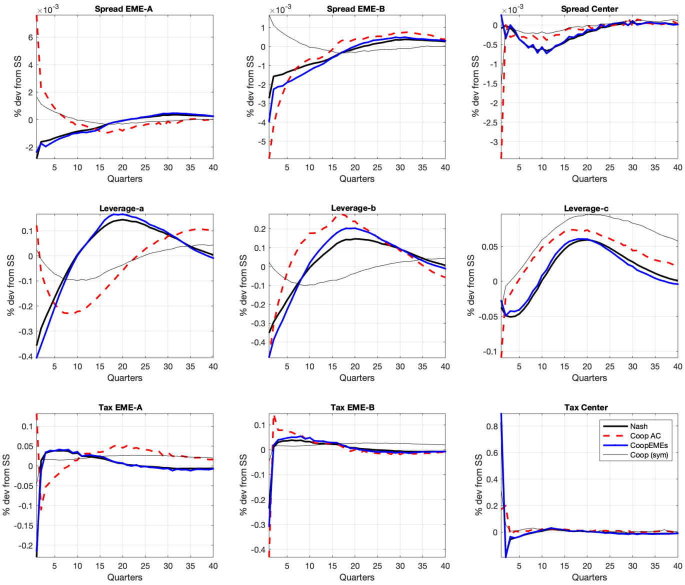
FB Corr(τ,Y)

IRFs: Capital Quality shock on C (Financial Shock)



1. Under Coop. EMEs accumulate less K, which in turn flows towards C (most productive location). This is also reflected in Lending and Net Worth dynamics.

IRFs: Capital Quality shock on C - Financial Variables and Policies



1. Cooperation pushes down the Center Spread.
   Undoes the spread shock

   w/ Partial Cooperation $\longrightarrow$ effect is stronger as it internalizes the strategic interaction with B.
2. Under Coop. the EMEs try to increase competition for K flows by $\uparrow$ Spread.
3. EMEs Leverage decreases by less with Cooperation, whereas C will increase it by more.

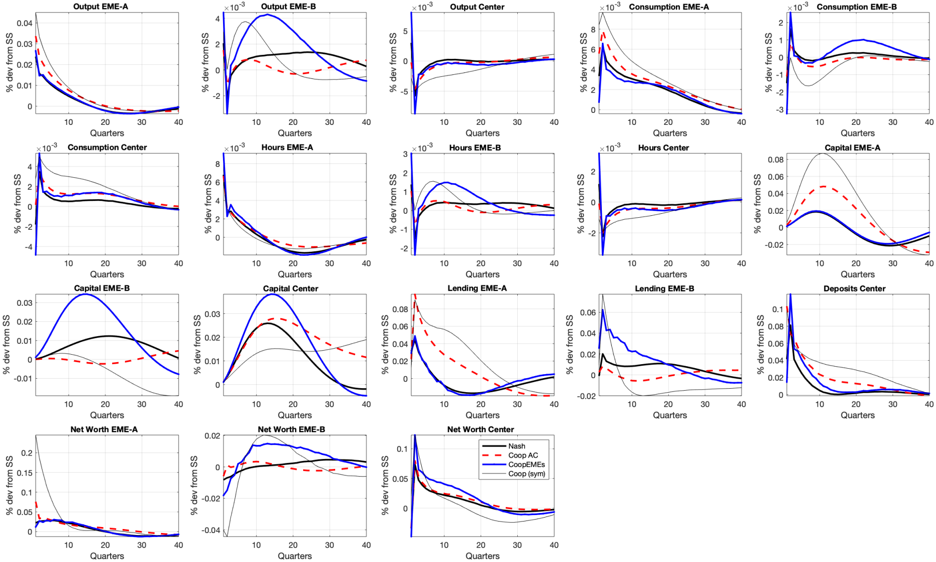
Taxes:

1. τ^c: w/ Coop. longer lasting tax. $\Rightarrow$ Coop. mitigates better local Spread shock.
2. τ^{emes}: Stronger subsidization under No-Coop.
3. τ^a: If Coop. with C it mimics the Center policy $\Rightarrow$ sets a tax.

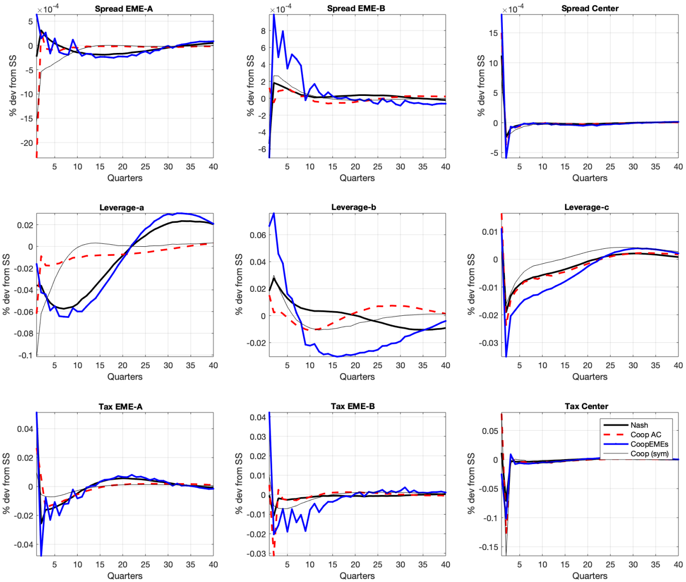
In general: τ^c is less persistent.
More effective policy at Center.

FB Skip $\rightarrow$ C

IRFs: Productivity shock on EME-A

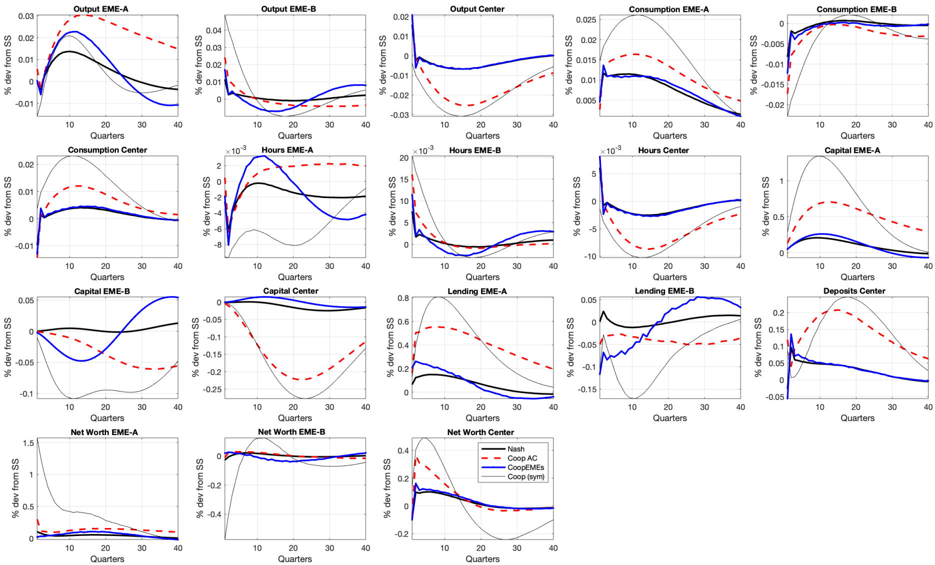


IRFs: Productivity shock on EME-A - Financial Variables and Policies

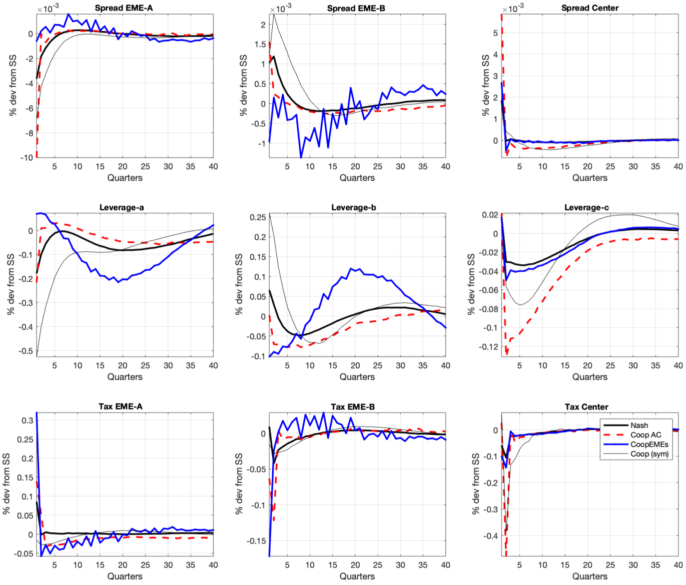


FB

IRFs: Capital Quality shock on EME-A



IRFs: Capital Quality shock on EME-A - Financial Variables and Policies



FB

Conclusions

- We set a multicountry open economy model with financially integrated banks in a dynamic setup (banking and policy have persistent effects)
- Welfare Accounting Ranking: $\mathit{Coop} \succcurlyeq \mathit{CoopAC} \succcurlyeq \mathit{Nash} \succcurlyeq \mathit{CoopEME}$
- There are gains from coordination. However, the **bulk of them come from coordinating with the Center**.
- **Regional Coordination can be detrimental**. EMEs may be worse off by forming a coalition.

  This is not only a matter of population size but also of Sources of Funding.
- Center tax is less persistent in general (potentially more effective as in static model)
- Best performing policy schemes are Countercyclical (for center) relative to other models. ▸ Corr(τ,Y)
- In overperforming models the IRFs show a pattern of externalities internalization: The transition is observable because the models vary by level of Coordination. (e.g. in CoopAC A mimics C's policies and departs from B's)

Next (tentative):

- Financial Friction Shock: $\kappa \xrightarrow{\text{becomes}} \kappa_t = (1-\rho)\kappa + \rho\kappa_{t-1} + \epsilon_t$
- Bubble-like shock: Unmaterialized news shock.
- Deviation incentives calculation.

The End (for now) ... Thank You!

Steady State of Ramsey model

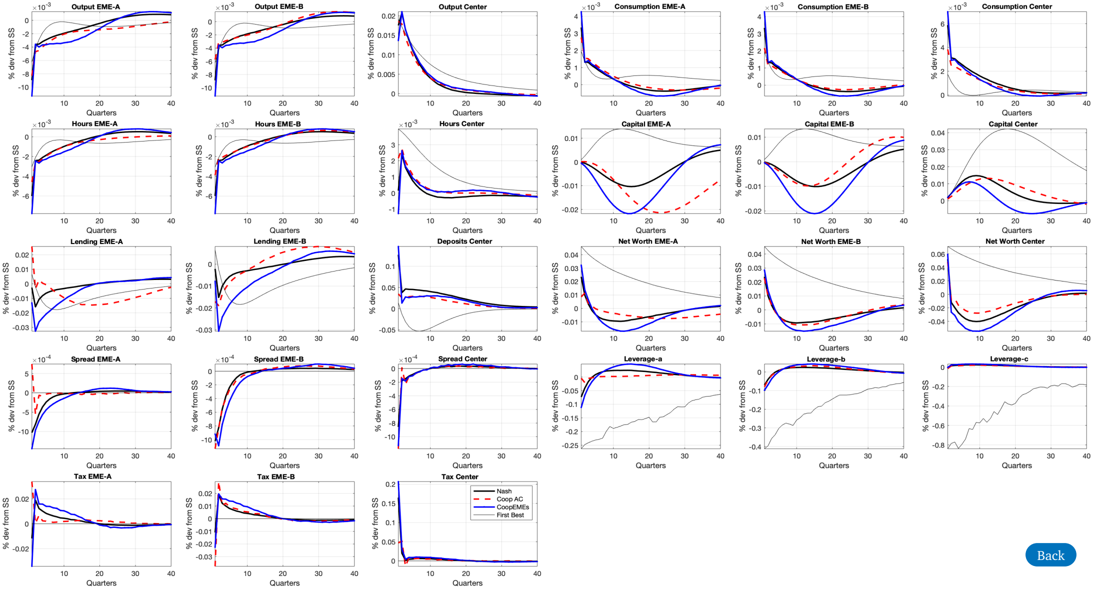
In the Ramsey model we work with a **instrument conditional steady state**, i.e., we set a value for the policy tools $\bar{\boldsymbol{\tau}}$ and obtain an associated steady state for the rest of the variables. **How to pick $\bar{\boldsymbol{\tau}}$?**

We follow an algorithm outlined in Christiano, Motto and Rostagno (2007):

1. set any value for $\bar{\boldsymbol{\tau}}$ and solve, using the static private FOCs, for the steady state of private variables: $\mathbf{x_t}$
2. replace $\mathbf{x_t}$ in remaining $N + k$ equations, the policy FOC w.r.t. the N endogenous variables and k tools: get a linear system of $N + k$ equations for N unknowns (policy multipliers)
3. More equations than unknowns. Then solution is subject to an approximation error $\mathbf{u}$:
   - set $N + k$ static equations in vector form as: $U_1 + \bar{\lambda}[1/\beta F_3 + F_2 + \beta F_1] = 0$
   - let $Y = U_1', X = [1/\beta F_3 + F_2 + \beta F_1]$ and $\beta = \bar{\lambda}'$
   - get the tools as: $\beta = (X'X)^{-1}X'Y$ with error $\mathbf{u} = Y - X\beta$
   - repeat for several $\bar{\boldsymbol{\tau}}$ and pick it as: $\bar{\boldsymbol{\tau}} = \arg\min_\tau \mathbf{u}$

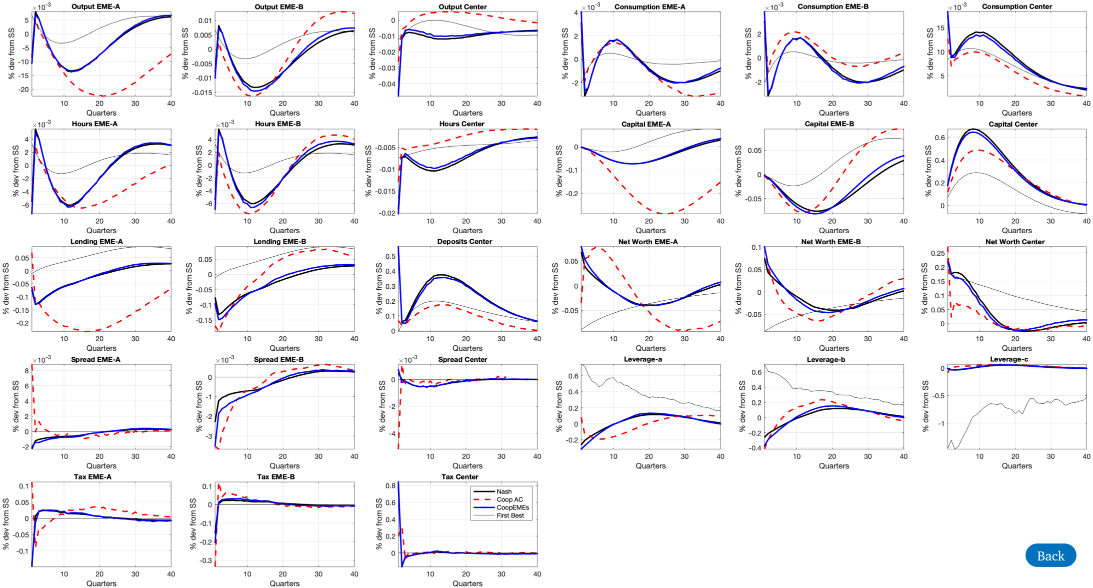
Back

IRFs: Productivity shock on C - includes First Best



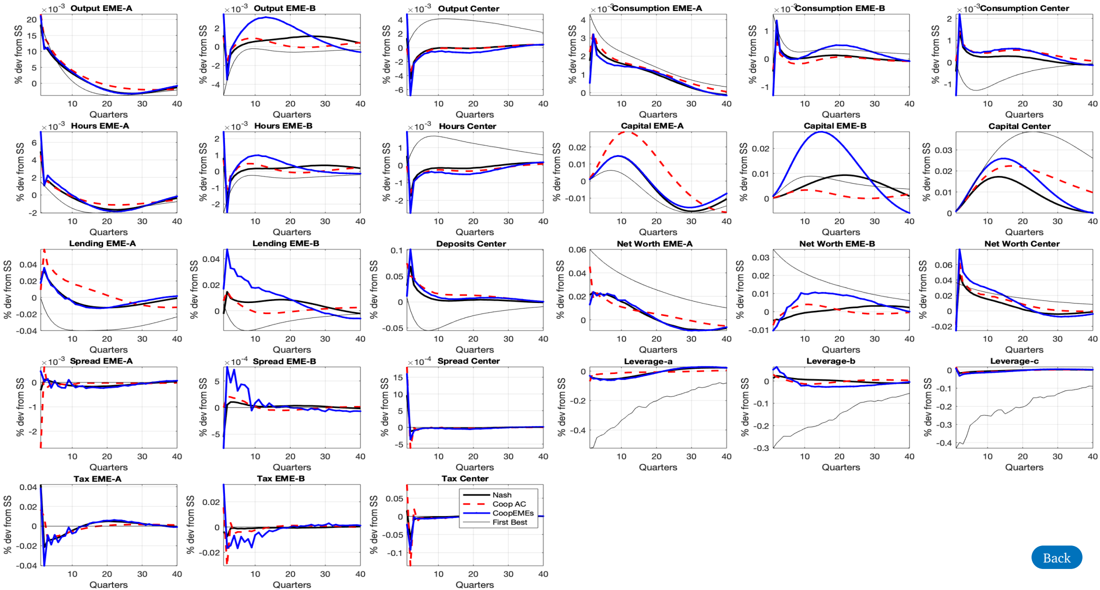
Back

IRFs: Capital Quality shock on C - includes First Best



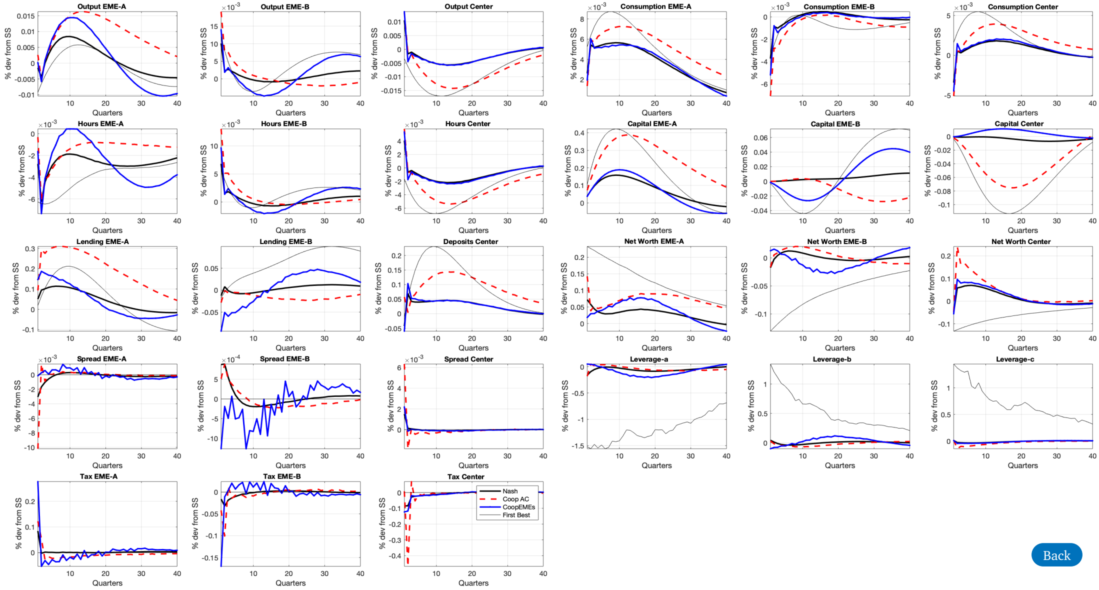
Back

IRFs: Productivity shock on EME-A - includes First Best



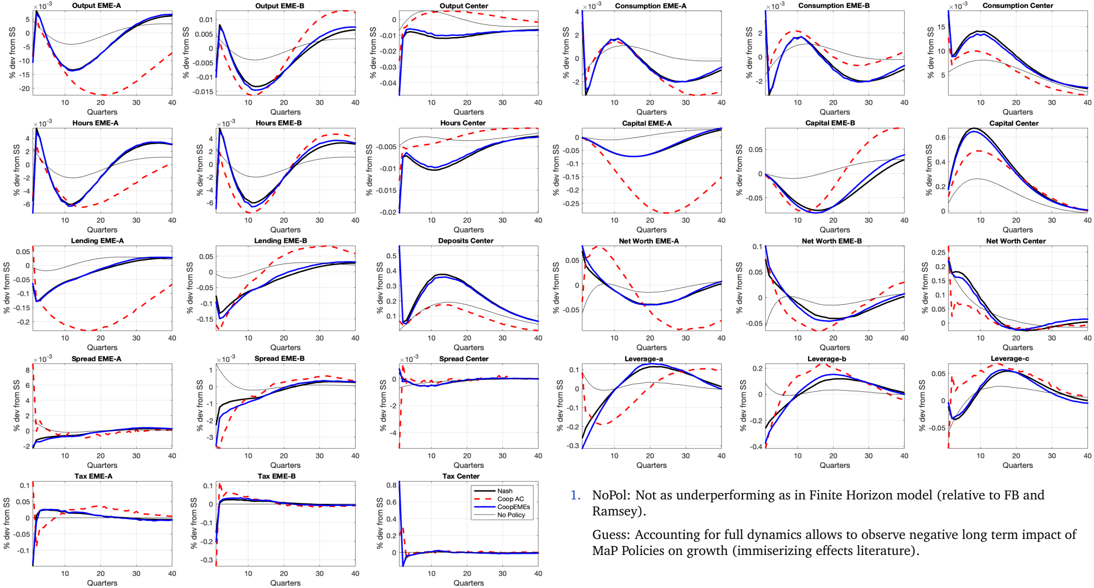
Back

IRFs: Capital Quality shock on EME-A - includes First Best



Back

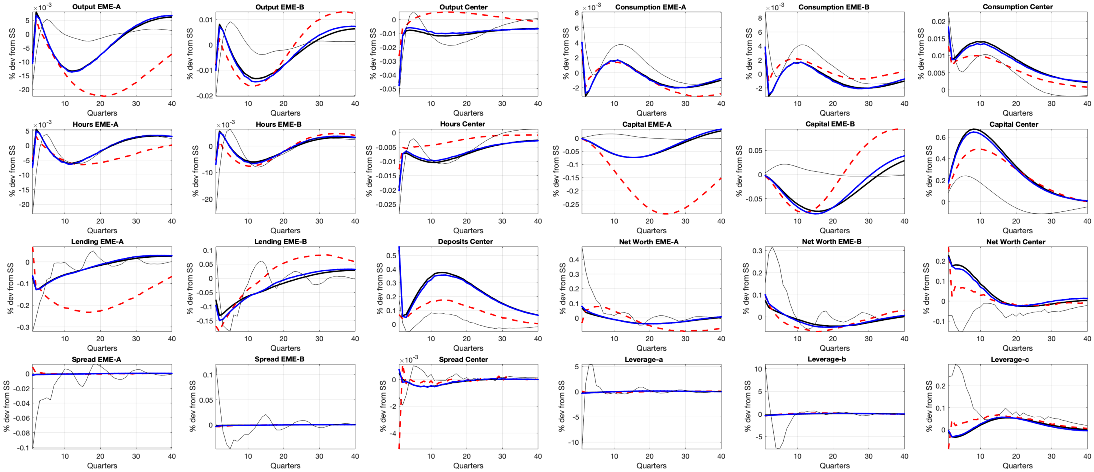
IRFs: Capital Quality shock on C - Comparison to No Policy

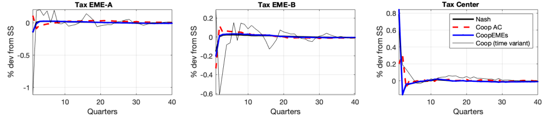


1. NoPol: Not as underperforming as in Finite Horizon model (relative to FB and Ramsey).

   Guess: Accounting for full dynamics allows to observe negative long term impact of MaP Policies on growth (immiserizing effects literature).

IRFs: Capital Quality shock on C - Includes Time Variant Cooperation





1. Financial variables fluctuations are **much more volatile** for Time Inconsistent model. This goes against policy goals.

   Similar effect is observed for policy tools.

Back

Time consistency

Policy problem in Lagrangian form (Nash):

$$\mathcal{L} = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{ U(\mathbf{x}_t, \mathbf{s}_t) + \boldsymbol{\lambda}_t' \overbrace{\mathbb{E}_t F(\mathbf{x}_{t-1}, \mathbf{x}_t, \mathbf{x}_{t+1}; \mathbf{s}_t, \mathbf{s}_{t+1})}^{\text{Private C. Eq. FOCs}} \right\}$$

F.O.C.

for $t > 0$

$$U_1(\mathbf{x}_t, \mathbf{s}_t) + \frac{1}{\beta} \boldsymbol{\lambda}_{t-1}' F_3(\mathbf{x}_{t-2}, \mathbf{x}_{t-1}, \mathbf{x}_t; \mathbf{s}_{t-1}, \mathbf{s}_t) + \boldsymbol{\lambda}_t' \mathbb{E}_t F_2(\mathbf{x}_{t-1}, \mathbf{x}_t, \mathbf{x}_{t+1}; \mathbf{s}_t, \mathbf{s}_{t+1}) + \beta \boldsymbol{\lambda}_{t+1}' \mathbb{E}_t F_1(\mathbf{x}_t, \mathbf{x}_{t+1}, \mathbf{x}_{t+2}; \mathbf{s}_{t+1}, \mathbf{s}_{t+2}) = 0$$

for $t = 0$, with $\boldsymbol{\lambda}_{t-1} = 0$

$$U_1(\mathbf{x}_t, \mathbf{s}_t) + \boldsymbol{\lambda}_t' \mathbb{E}_t F_2(\mathbf{x}_{t-1}, \mathbf{x}_t, \mathbf{x}_{t+1}; \mathbf{s}_t, \mathbf{s}_{t+1}) + \beta \boldsymbol{\lambda}_{t+1}' \mathbb{E}_t F_1(\mathbf{x}_t, \mathbf{x}_{t+1}, \mathbf{x}_{t+2}; \mathbf{s}_{t+1}, \mathbf{s}_{t+2}) = 0$$

Implications:

- Policies of $t = 0$ are **not consistent** with those of $t > 0$.

- Policymakers reoptimize at 0 and reset their policy weights, i.e., disregard the past (Juillard and Pelgrin, 2007)

- Multiple solutions (sunspot eq.) issues may arise, Evans and Honkapohja (2003 ReStud, 2006 ScandJofEcon).

Solution: Adopt *timeless perspective* (Woodford (2003), Woodford and Benigno (2003)) $\Longrightarrow$ set $\boldsymbol{\lambda}_{t-1} \neq 0$.

With this, we assume policy makers were making optimal decisions in the past in a time consistent manner (King and Wolman, 1999).

Back

Correlations with Output

$Corr(\tau^j, Y^j)$	Nash	Cooperation (EMEs)	Cooperation (Center+EME-A)	Cooperation (All)
EME-A	-0.164	-0.265	-0.611	-0.861
EME-B	-0.164	-0.265	-0.221	-0.861
Center	-0.419	-0.425	**0.085**	**0.138**

A policy τ is **Countercyclical** if $Corr(\tau^j, Y^j) > 0$ (higher taxes in booms)

- Cooperation for Center implies more countercyclical policies

- Cooperation for EMEs implies more procyclical policies

Back to IRFs Back to Conclusions