Macroprudential Policy Coordination in Emerging Markets: A Multicountry Framework

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Introduction

Macroprudential Policies (MaP): regulatory policies aimed at preserving the stability of the financial system.

Why are needed?:

- First Best (FB): Financial Markets allow flow of resources to more productive destinations.

  SB: Distortions prevent productive countries from atracting K flows: Gourinchas, Fahri, Caballero (2008, 2016)

- First Best: Credit and Return Rates reflect actual risk of investment projects [No Financial Accelerator]

  SB: External Risk Premium, Overborrowing and Excessive Risk Taking.

- Consequence: Countries are subject to Global Financial Cycle and too volatile credit dynamics (H. Rey, 2013)

What do we know about MaP policies?: Forbes (2019, AER P&P)

"there is accumulating evidence that it 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".*

How to "MacroPru"?:

If effective, should MaP be applied indiscriminately? ... Not necessarily:

- Trade-offs between other policy goals and Financial Stability (Rey and Coimbra, 2017)
- Aggresive limitations can curtail long term investment flows.
- Regulation is Costly (e.g., subsidies, acquiring FX reserves, etc.)
- MaP interdependency may lead to regulatory wars: Race to the Bottom.

A call for coordination:

Both institutions (BIS, 2017) and academics (Obstfeld, 2015; Schoemaker, 2011; and Claessens et al, 2010) refer to a new *Financial Trilemma*:

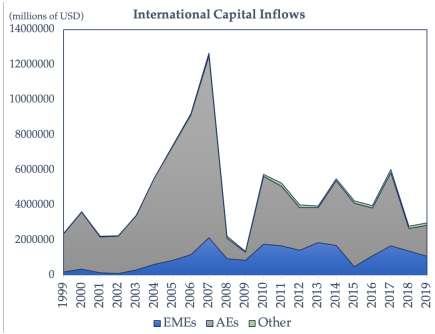
· Financial Stability · International Integration · Independent Financial Regulation

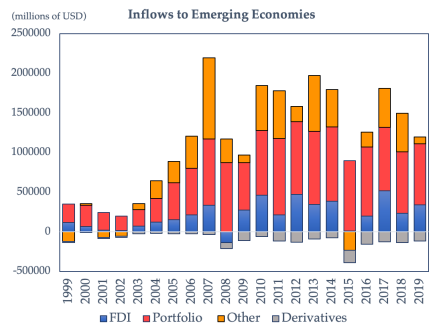
The three can't be achieved in isolated action due to the interdependence of the MaP.

Capital Flows: EMEs as new destination of volatile K flows

Total flows: switch toward emerging economies

Type of flows: Increase is concentrated in short term flows (portfolio + banking) → **highly volatile**



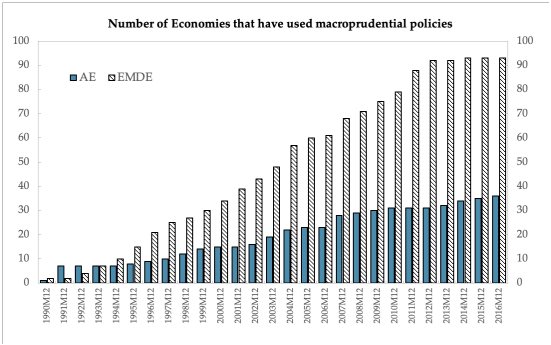


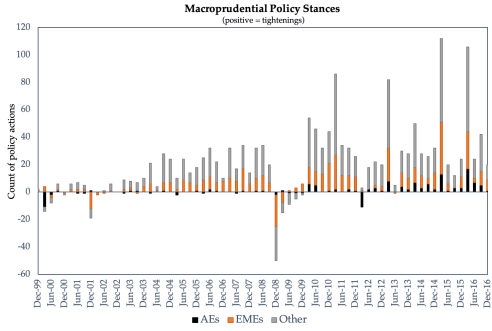
Source: IMF-IFS amd BOP statistics.

Policy Response: Increased Use of MaP + Tightenings

In response the macroprudential policies have been used more in EMEs

Most frequent policy: Tightening





Source: Left panel: Alam et al (2019), right: IMF-iMaPP (2019)

Possible cross-border comovement patterns: **The MaP Policies have an international dimension**.

Can governments exploit this dimension to improve MaP policy implementation?

Research Questions

- **International policy effects:** Do they Exist? If so, of what nature?
- Are there **global gains from MaP policy coordination** when interacting with EMEs?
- Under what conditions EMEs want to coordinate policy tools?
  - How are MaP tools set in each policy setup?
- Does **EMEs coordination matter** for a financial **center**?

What I do

Set an **Multi-Country** Open Economy Model with Banking Financial **Frictions** and obtain Optimal **Policies** for **regimes** with different types of Cooperation ⇒ Check for Welfare Gains

Countries: Center-Peripheries setup (3 Countries).

Center: Global Creditor
EMEs/Periphery: Financially constrained country that depends on lending from Center.

Friction: Agency friction in financial lending that amplify credit spreads.

Policy: I consider a MaP tax (or leverage cap) on banks.

Regimes: With 3 Countries I can analyze Cooperative, Semi-Cooperative (Coalitions) and Non-Cooperative cases.

Contribution:

I study interactions of peripheries that have general equilibrium effects but are still fragile to a policy active center.

I analyze a wider array of policies than other papers.

I study different types of cross-border effects (Periphery-Periphery and Periphry-Center)

Related Literature

- **Financial Accelerator Channel:**

  Bernanke, Gertler and Gilchrist (1999), Gertler and Kiyotaki (1997), Bernanke and Gertler (1989)

- **Explicit banks modelling**:

  Gertler and Karadi (2011, JIE), Gertler and Kiyotaki (2010), Adrian and Shin (2010)

- **Macroprudential issues in EMEs:**

  Bianchi (2011, AER), Nuguer (2016), Nuguer and Cuadra (2016, RED), Benigno, Kiyotaki, Aoki (2018, wp), Cespedes, Chang and Velasco (2017, JIE)

- **Coordination of policies involving Financial or MaP features.**

  Banerjee, Devereux and Lombardo (2015, JIMF), Fujiwara and Teranishi (2017, JIE), De Paoli and Paustian (2017, JMCB), Bodenstein, Guerrieri, La Briola (2019, JME).

- **Coordination of Macroprudential Policies.** ▸ zoom

  Kara (2016, JIE), Agenor et al (2018, BIS wp), Davis and Devereux (202X, AEJ Macro), Jin and Shen (2020, RED), Bengui (2014, wp), Korinek (2020).

▸ literature elements in model

Coordination of Macroprudential Policies:

- **Capital Controls:** Korinek (2020), Jin and Shen (2020, RED), Davis and Devereux (2020, AEJ Macro)
- **Liquidity Requirements**: Bengui (2014)
- **Capital Adequacy**: Kara (2016, JIE)
- **Banking taxes**: Agenor et al (2018, BIS wp)

Findings:

Group1: DD202X, Bengui(2020), K2020: Cooperation Gains arise due to Planners Internalizing ToT manipulation motive

Group 2: JS2020: Gains generated by pooling SOE policy incentives to manipulate actively Global Rates.

Kara(2016): Non-cooperative planners apply inefficiently low level of regulation. Gains arise from increasing regulatory activities.

Comparison with this study:

Group 1: **Similar findings**, removing sources of variation from policy is welfare improving. I analyze the case of banking frictions.

Group 2: **Contrary findings** because interaction between symmetric countries. (then too much regulation ≠ Regulatory War)

Results Preview:

- Welfare Effects of MaP: Present on the target and **abroad**.
- **Policy Spillovers** are Positive between countries.

  Center: *Weaker direct* effect. *Stronger cross-country*.
- Spillovers **grow with financial friction**

  Determinant of Effects: Asset positions, production distruption, profit (banking).
- **Cooperation Gains**: Not sizable in baseline model.
- **First Best is mimicked** by optimal policies $\longrightarrow$ Welfare gains wrt No Policy
- Cooperation implies Conservative Policy Making: **prevents excessive regulation**.
- Cooperation **gains can arise**: with inclusion of strong policy trade-offs.

Roadmap of Talk

Model

Welfare Effects of Macroprudential Policies

Optimal Policy: Endogenizing the taxes

Results

Conclusions

The Model: Simple two period economy with a static banking sector

2 periods (finite horizon), three country model with two EMEs (a,b) and a Center (c)

LOE framework: size of each economy is n_i with $i = \{a, b, c\}$, $\sum_i n_i = 1$, and $n_c \geq \frac{1}{2}$.

Capital: Used for production. Given at $t = 1$, funded with banking lending at $t = 2$.

Then, there is **one** period of banking intermediation.

To simplify: LOP, PPP, UIP holds. Homogeneous (and freely traded) consumption good.

Agent	**Role**
Households	Buy consumption goods, assets (bonds, deposits), own firms, and pay a lump sum tax (-)
Investors	Buy old capital and produce new capital goods to generate investment
Firms	Produce consumption good, sell undepreciated capital. **Funds capital with banking loans**
Government	Balanced budget, levies macroprudential tax on banks, rebates it to households
Banks	Lend to firms and participate in the interbank market (EMEs borrow from Center). Exist for only one period **Subject to a costly enforcement friction** ⇒ **charged with a MaP Tax**

▸ Households ▸ Final Good Firms ▸ Capital Firms ▸ Banks ▸ Government ▸ Skip

Environment

Financial Flows in the model

Households assets: international bonds and deposits (center).

Firms funded with banking loans.

Interbank lending between economies.

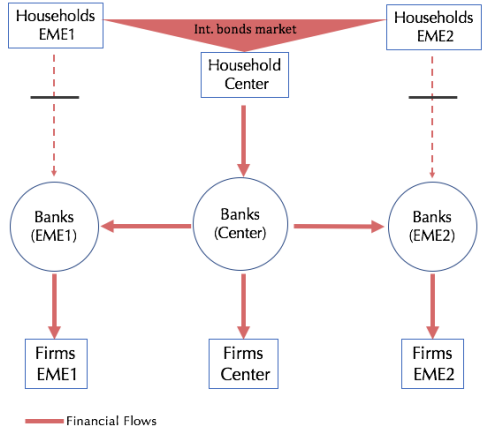


Figure: Financial flows in the model

Investors

Investment separated from the household decisions and subject to adjustment costs $\Rightarrow$ Capital Rel. Price is dynamic.

The investor solves:

$$\max_{I_1} \; Q_1 I_1 - I_1 \left(1 + \frac{\zeta}{2}\left(\frac{I_1}{\bar{I}} - 1\right)^2\right)$$

Where $\bar{I}$ is the reference level (we choose I_0).

the F.O.C is,

$$[I_1]: \qquad Q_1 = 1 + \frac{\zeta}{2}\left(\frac{I_1}{\bar{I}} - 1\right)^2 + \zeta\left(\frac{I_1}{\bar{I}} - 1\right)\frac{I_1}{\bar{I}}$$

Similarly, for period 2 (when investment is zero),

$$Q_2 = 1 + \frac{\zeta}{2}$$

back

Firms

Technology: The firm operates with a Cobb-Douglas technology that aggregates capital: $Y_t = A_t(\xi_t K_{t-1})^{\alpha}$

Capital:

- The capital dynamics for accumulation period: $K_1 = I_1 + (1-\delta)\xi_1 K_0$
- First period: given capital (K_0), rented directly to firms by households → Standard Firm PMP in $t = 1$
- Second period: **the EME relies on lending for funding capital accumulation** → firms fund K_1 with banks loans.

The problem of the firm in the second period is:

$$\max_{K_1} \ \pi_{f,2} = Y_2 + Q_2(1-\delta)\xi_2 K_1 \quad - \quad \underbrace{\tilde{R}_{k,2} Q_1 K_1}_{\text{Repayment to bank}} \qquad s.t. \quad Y_2 = A_2(\xi_2 K_1)^{\alpha}$$

back

Gross Intermediation Returns Gross Intermediation Returns

Solving from F.O.C., we get $R_{k,2}$, the gross **return from intermediation for the bank**

This rate will be variable targeted by the policy tool:

$$R_{k,2} = \frac{(1-\tau)r_2 + (1-\delta)\xi_2 Q_2}{Q_1}$$ After tax rate

With $r_2 = \frac{\partial Y_2}{\partial K_1}$ and τ is the macro-prudential policy tool: a tax/subsidy on the bankers revenue rate.

The tax is NOT paid by the firms but by the banks directly.

Government

Setting and enforcing the rate is the only role of the government which will have a balanced budget constraint:

$$T + \tau r_2 K_1 = 0$$

back

Banks

- Target sector of MaP Policies. Set up based in Gertler and Karadi (2011).
- Financial intermediation sector in $t = 1$ that facilitates funding

  At interbank and firms level.

Financial under-development of the EMEs will be reflected:

- EME banks are subject to an Incentive Compatibility Constraint $\longrightarrow$ can divert a portion of assets intermediated.

  After realizing the return on capital holdings

- EME: limited capacity of intermediation

  will NOT have be able to hold local deposits from households

  will rely on foreign lending from the center bank in order to supply capital to the firms.

example

Agency problem: debtor bank can default and divert a portion κ of the assets.

The EME bank solves:

$$\max_{F_1, L_1} J_1 = \mathbb{E}_1 \Lambda_{1,2} \pi_{b,2} = \mathbb{E}_1 \Lambda_{1,2} (R_{k,2} L_1 - R_{B,1} F_1)$$

$$s.t. \quad L_1 = F_1 + \delta_B Q_1 K_0 \qquad \text{[Balance sheet]}$$

$$J_1 \geq \kappa \, \mathbb{E}_1 \Lambda_{1,2} R_{k,2} L_1 \qquad \text{[ICC]}$$

$L_1 = Q_1 K_1$: total lending intermediated, F_1: foreign borrowing and $\delta_B Q_1 K_0$: household bequest.

The F.O.C. implies a positive credit spread when the ICC binds:

$$[F_1]: \qquad \mathbb{E}_1 (R_{k,2} - R_{B,1}) = \mu \mathbb{E}_1 \left(\kappa R_{k,2} - (R_{k,2} - R_{B,1}) \right)$$

μ: Lagrange multiplier of the ICC.

κ: Financial Friction Parameter.

back

The center economy bank is frictionless and solves:

$$\max_{F_1^a, L_1^c, D_1} J_1 = \mathbb{E}_1 \Lambda_{1,2} \pi_{b,2}^c = \mathbb{E}_1 \Lambda_{1,2} (R_{B,1}^a F_1^a + R_{B,1}^b F_1^b + R_{k,2}^c L_1^c - R_{D,1} D_1)$$

$$s.t. \quad F_1^a + F_1^b + L_1^c = D_1 + \delta_b Q_1^c K_0^c$$

the associated F.O.C. are:

$$[F_1^a]: \quad \mathbb{E}_1 (R_{B,1}^a - R_{D,1}) = 0$$
$$[F_1^b]: \quad \mathbb{E}_1 (R_{B,1}^b - R_{D,1}) = 0$$
$$[L_1^c]: \quad \mathbb{E}_1 (R_{k,2}^c - R_{D,1}) = 0$$

In this case the problem and resulting conditions are simpler given I assume there is No agency problem in the Center economy.

back

Leverage and Credit Spread Implications from banking setup

Proposition 1: *If the ICC binds the credit spread is positive and increases in κ and μ*

From EME Banks F.O.C.:

$$R_{k,2} = \underbrace{\frac{1+\mu}{1+(1-\kappa)\mu}}_{\Phi>1} R_1$$

$\Phi > 1$ guarantees the credit spread is positive. The larger Φ the greater the spread ($R_{k,2} - R_1 \propto \Phi$).

$\mu > 0$ (def. of ICC). It follows that,

$$\frac{\partial \Phi}{\partial \kappa} = \frac{\mu(1+\mu)}{(1-(1-\kappa)\mu)^2} > 0$$

and,

$$\frac{\partial \Phi}{\partial \mu} = \frac{2(1-\kappa)\mu - \kappa}{(1-(1-\kappa)\mu)^2} > 0$$

These results are relevant to understand the role of the friction $\longrightarrow$ can exogenously increase the financial friction by $\uparrow \kappa$

Macroprudential policy tool

Several MaP policies available. We consider one of the general types, a tax targeted at the banks. This can encompass other types of policies (leverage constraints, capital controls, among others).

In addition, the planner compares whether to set the tax individually or cooperatively.

We can map the leverage with the MaP Tax:

Proposition 2: *An increase in the tax lowers the leverage ratio of banks*

$$L_1 = \underbrace{\frac{R^e_{b,1}}{R^e_{b_1} - (1-\kappa^e)R_{k,2}}}_{\phi_L\text{: leverage ratio}} \delta_B Q^e_1 K^e_0$$

We can substitute $R^e_{k,2} = [(1-\tau^e)r^e_2 = (1-\delta)\xi^e_2 Q_2]/Q_1$ and differentiate with respect to τ^e:

$$\frac{\partial \phi_L}{\partial \tau^e} = -\frac{(1-\kappa^e)R^e_{b,1}(r^e_2)}{(R^e_{b,1} - (1-\kappa^e)R^e_{k,2})^2 Q^e_1} < 0$$

Households

The household lifetime utility is given by $U = u(c_1) + \beta u(c_2)$ with $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$.

The budget constraints for emergent markets in each period are the following:

Emerging markets:

$$C_1^s + \frac{B_1^s}{R_1^s} = r_1^s K_0^s + \pi_{f,1}^s + \pi_{inv,1}^s - \delta_B Q_1^s K_0^s$$
$$C_2^s = \pi_{f,2}^s + \pi_{b,2}^s + B_1^s - T^s, \quad for\ s = \{a, b\}$$

Advanced Economy:

$$C_1^c + \frac{B_1^c}{R_1^c} + \boldsymbol{D_1} = r_1^c K_0^c + \pi_{f,1}^c + \pi_{inv,1}^c - \delta_B Q_1^c K_0^c$$
$$C_2^c = \pi_{f,2}^c + \boldsymbol{\pi_{b,2}^c} + B_1^c + R_{D,1} D_1 - T^c$$

HH (F.O.C.)

back

Market Clearing

- Int. Bonds: given at zero-net-supply

$$n_a B_1^a + n_b B_1^b + n_c B_1^c = 0$$

- Goods:

$$n_a \left(C_1^a + C(I_1^a)\right) + n_b \left(C_1^b + C(I_1^b)\right) + n_c \left(C_1^c + C(I_1^c)\right) = n_a Y_2^a + n_b Y_2^b + n_c Y_2^c$$

$$n_a C_2^a + n_b C_2^b + n_c C_2^c = n_a Y_2^a + n_b Y_2^b + n_c Y_2^c$$

where $C(I_1) = I_1(1 + (I_1/\bar{I} - 1)^2)$

Finally, given that there is only one final good and the law of one price holds ($RER = 1$), we have by an UIP argument:

$$R_1^a = R_1^b = R_1^c = R_1$$

where R denotes the world interest rate on bonds.

Simplified Equations used for solving the model (summary)

Common to all countries:

$$Q_1 = 1 + \frac{\zeta}{2}\left(\frac{I_1}{\bar{I}} - 1\right)^2 + \zeta\left(\frac{I_1}{\bar{I}} - 1\right)\frac{I_1}{\bar{I}} \qquad \text{[Price of Capital]}$$

$$K_1 = I_1 + (1-\delta)K_0 \qquad \text{[Capital Dynamics]}$$

$$R_{k,2} = \frac{(1-\tau)\alpha A_2 K_1^{\alpha-1} + (1-\delta)Q_2}{Q_1} \qquad \text{[Banks rate of return]}$$

$$C_1^{-\sigma} = \beta R_1 C_2^{-\sigma} \qquad \text{[Euler Equation w.r.t. Bonds]}$$

for EMEs:

$$R_{k,2}Q_1K_1 - R_1Q_1K_1 + R_1\delta_B Q_1K_0 = \kappa R_{k,2}Q_1K_1 \qquad \text{[ICC]}$$

$$R_{k,2} - R_1 = \mu\left(\kappa R_{k,2} - (R_{k,2} - R_1)\right) \qquad \text{[Credit Spread]}$$

$$C_1 + \frac{B_1}{R_1} = A_1K_0^{\alpha} + Q_1I_1 - C(I_1) - \delta_b Q_1K_0 \qquad \text{[BC for t=1]}$$

$$C_2 = (1-\alpha)A_2K_1^{\alpha} + R_{k,2}Q_1K_1 - R_1Q_1K_1 + R_1\delta_B Q_1K_0 + B_1 + \tau r_2 K_1 \qquad \text{[BC for t=2]}$$

for the Center:

$$Q_1^aK_1^a - \delta_B Q_1^aK_0^a + Q_1^bK_1^b - \delta_B Q_1^bK_0^b + Q_1^cK_1^c = D_1 + \delta_B Q_1^cK_0^c \qquad \text{[Bal. Sheet of Banks]}$$

$$C_1 + \frac{B_1}{R_1} + D_1 = A_1K_0^{\alpha} + Q_1I_1 - C(I_1) - \delta_B Q_1K_0 \qquad \text{[BC for t=1]}$$

$$C_2^c = (1-\alpha)A_2^cK_1^{c\,\alpha} + R_1Q_1^aK_1^a - R_1\delta_B Q_1^aK_0^a + R_1Q_1^bK_1^b - R_1\delta_B Q_1^bK_0^b + R_1Q_1^cK_1^c + B_1^c + \tau^c r_2^c K_1^c \qquad \text{[BC for t=2]}$$

International Links:

$$n_aB_1^a + n_bB_1^b + n_cB_1^c = 0 \qquad \text{[Zero Net Supply of Bonds]}$$

Roadmap of Talk

Model

Welfare Effects of Macroprudential Policies

Optimal Policy: Endogenizing the taxes

Results

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Analytical Welfare Analysis

We set a social planner problem and analyze the welfare expressions following Davis and Devereux (2019):

The welfare of a country is set as $W = U + \lambda_1 BC_1 + \beta\lambda_2 BC_2$:

$$W^s = U^s + \lambda_1^s \left(r_1^s K_0^s + \pi_{f,1}^s + \pi_{inv,1}^s - \delta_B Q_1^s K_0^s - C_1^s - \frac{B_1^s}{R_1^s} \right) \qquad \text{(For EMEs)}$$
$$+ \beta\lambda_2^s \left(\pi_{f,2}^s + \pi_{b,2}^s + B_1^s - T^s - C_2^s \right) \quad \text{for } s = \{a, b\}$$

$$W^c = U^c + \lambda_1^c \left(r_1^c K_0^c + \pi_{f,1}^c + \pi_{inv,1}^c - \delta_B Q_1^c K_0^c - C_1^c - \frac{B_1^c}{R_1^c} - D_1 \right)$$
$$+ \beta\lambda_2^c \left(\pi_{f,2}^c + \pi_{b,2}^c + B_1^c + R_{D,1} D_1 - T^c - C_2^c \right) \qquad \text{(For the Center)}$$

A non-cooperative planner will maximize the welfare of her country W^j.

In contrast, a global planner (the one acting under cooperation) will maximize: $W = n_a W^a + n_b W^b + n_c W^c$

▸ Welfare Analysis Method steps

We substitute the profits for banks and firms from the Competitive Equilibrium equations (ICCs included) and the tax rebates:

$$W^s = u(C_1^s) + \beta u(C_2^s) + \lambda_1^s \left(A_1^s {K_0^s}^{\alpha} + Q_1^s I_1^s - C(I_1^s) - C_1^s - \frac{B_1^s}{R_1^w} \right) \qquad \text{EMEs}$$
$$+ \beta \lambda_2^s \left(\phi(\tau^s) A_2^s {K_1^s}^{\alpha} + \kappa^s (1-\delta) Q_2^s K_1^s + B_1^s - C_2^s \right) \quad \text{for } s = \{a, b\}$$

$$W^c = u(C_1^c) + \beta u(C_2^c) + \lambda_1^c \left(A_1^c {K_0^c}^{\alpha} + Q_1^c I_1^c - C(I_1^c) - C_1^c - D_1^c - \frac{B_1^c}{R_1^w} \right)$$
$$+ \beta \lambda_2^c \left(A_2^c K_1^{\alpha} + R_{b,1}^a F_1^a + R_{b,1}^b F_1^b + (1-\delta) Q_2^c K_1^c + B_1^c - C_2^c \right) \qquad \text{Center}$$

with $\phi(\tau) = 1 - \alpha(1-\kappa)(1-\tau)$

From this welfare expressions we will obtain the effects of taxes via implicit differentiation and will simplify with the FOCs of the Competitive Equilibrium.

Welfare Effects

Nash Case

I set a Social Planner Problem and obtain simplified welfare expressions based on the equilibrium conditions.
(Follows DD2020)

Each national planner will take W^i as their welfare function ($W^i = u(C_1^i) + \beta u(C_2^i)$)

In contrast, the cooperative welfare would be a sum of the individual welfare expressions.

Direct Effects

Welfare effect of the tax for EMEs:

$$\frac{dW^a}{d\tau^a} = \beta\lambda_2^a\{\underbrace{\alpha_1(\kappa^a)\frac{dK_1^a}{d\tau^a}}_{①} + \underbrace{\frac{B_1^a}{R_1^w}\frac{dR_1^w}{d\tau^a}}_{②} + \underbrace{\frac{I_1^a}{R_1^w}\frac{dQ_1^a}{d\tau^a}}_{③} + \underbrace{\alpha(1-\kappa^a)Y_2^a}_{\text{Direct effect of } \tau}\}$$

with $\alpha_1(\kappa^a) = \left(\phi(\tau^a)\alpha A_2^a {K_1^a}^{\alpha-1} + \kappa^a(1-\delta)Q_2^a\right)$ and $\alpha_1'(\kappa^a) > 0$

①: Halting of K Accumulation. [Negative welfare effect] → effect grows with tax and distortion (κ).

②: NFA variation effect: Sign changes for borrower/lender.

③: Variation in investment profits.

Welfare Effects

Nash Case (Cont.)

Direct effect for Center:

$$\frac{dW^c}{d\tau^c} = \beta\lambda_2^c\left\{\frac{I_1^c}{R_1^w}\frac{dQ_1^c}{d\tau^c} + \frac{B_1^c}{R_1^w}\frac{dR_1^w}{d\tau^c} + \alpha_2\frac{dK_1^c}{d\tau^c} + \underbrace{\left[R_{b,1}^{eme}\left(\frac{dF_1^a}{d\tau^c} + \frac{dF_1^b}{d\tau^c}\right) + \frac{dR_{b,1}^{eme}}{d\tau^c}\left(F_1^a + F_1^b\right)\right]}_{\substack{\text{welfare effect of changes} \\ \text{in intermediation profits} \\ \textcircled{4}}}\right\}$$

with $\alpha_2 = \left(\alpha A_2^c {K_1^c}^{\alpha-1} + (1-\delta)Q_2^c\right)$

④: Change in Global Intermediation Profits [Sign: ambiguous]

Cross-country effects: will have a similar structure, but without direct effects for peripheries.

▸ Cross-country Effects

Optimal tax

For obtaining the optimal tax: set $\frac{dW^a}{d\tau^b} = 0$ and solve for τ^a

$$\tau^{a\,*} = -\frac{1}{\alpha(1-\kappa^a)}\left\{\frac{1}{r_2^a}\left[\left(R_1 I_1^a \frac{dQ_1^a}{dK_1^a} + \frac{B_1^a}{R_1}\frac{dR_1}{dK_1^a}\right) + \kappa^a(1-\delta)\xi_2^a Q_2\right] + 1 + \alpha(\kappa^a - 1)\right\}$$

Relevant features:

- Effects driving the tax are **amplified with the friction** (κ)
  - But sign of $(\cdot)$ term tends to be negative $\Rightarrow$ sign of optimal tax is hard to determine $\longrightarrow$ Depends on reference point for derivatives
- Tax decreases with Marginal Productivity of K
- Investment $\lessgtr \bar{I}$
- country being a saver of borrower and change in int. bonds rate

We follow a similar process for obtaining an expression for the optimal tax in the center. Center tax

Cooperative cases

The welfare for the cooperative setups can be obtained as weighted averages from Nash results:

Table: Welfare spillovers in the model

	Planners	Obj. Function	Effect of taxes
Case: Cooperation (all countries)			
	World	$W = n_a W^a + n_b W^b + n_c W^c$	$\frac{dW}{d\tau^j} = n_a \frac{dW^a}{d\tau^j} + n_b \frac{dW^b}{d\tau^j} + n_c \frac{dW^c}{d\tau^j}$
Case: Semi-Cooperation (EMEs vs. Center)			
	Periphery block A+B	$W^{ab} = n_a W^a + n_b W^b$	$\frac{dW^{ab}}{d\tau^j} = n_a \frac{dW^a}{d\tau^j} + n_b \frac{dW^b}{d\tau^j}$
	Center	W^c	$\frac{dW^c}{d\tau^j}$
Case: Semi-Cooperation (EME-A + C vs. EME-B)			
	Cooperative A+C	$W^{ac} = n_a W^a + n_c W^c$	$\frac{dW^{ac}}{d\tau^j} = n_a \frac{dW^a}{d\tau^j} + n_c \frac{dW^c}{d\tau^j}$
	EME-B	W^b	$\frac{dW^b}{d\tau^j}$

Note: $j = a, b, c$

Simulation results

Welfare Effects

Numerical

Table: Welfare effect of 1% increase in taxes

Direct Effects	
$\tau_a \to W^a$	-1.560
$\tau_b \to W^b$	-1.560
$\tau_c \to W^c$	**-0.847**

Cross-country Effects	
$\tau_a \to W^b$	-0.078
$\tau_a \to W^c$	-0.039
$\tau_b \to W^a$	-0.078
$\tau_b \to W^c$	-0.039
$\tau_c \to W^a$	**-0.308**
$\tau_c \to W^b$	**-0.308**

- Stronger Direct effect

- Positive MaP Policy Spillovers.

A welfare increasing policy is *prosper-thy-neighbor*

Policy free riding incentives.

- **Stronger cross-country effects from the center.**

Together with **weaker** direct effect ⇒ Strong Spillovers

- EME tax effects are stronger between peripheries

The welfare gain is approximated, based on the numerical results, as: $\frac{\partial W^j}{\partial \tau^k} \approx \frac{\Delta W^j}{\Delta \tau^k} = \frac{W^j_{\tau^k=0.01} - W^j_{\vec{\tau}=0}}{\tau^k - 0}$

Calibration | Consumption units | Cooperative effects

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Ramsey Planner Problem

Policy problem that allows us to recover the optimal tool levels.

The Ramsey planner maximizes an objective function subject to the private decisions of agents.

Generally:

$$\begin{aligned} \max_{\mathbf{x_t}, \tilde{\tau}_t} \quad & W_t^{objective} = f(\alpha^i, W_t^i) \\ s.t. \quad & \mathbb{E}_t F(\mathbf{x_{t-1}}, \mathbf{x_t}, \mathbf{x_{t+1}}, \tau_t, \theta) \end{aligned}$$

with $\tilde{\tau} \subseteq \tau$ and welfare weights $\alpha^i \geq 0 \quad \forall j$.

$F(\cdot)$: System of equations that characterize private equilibrium (e.g., FOC, BC and MC Conds)

$\mathbf{x_t}$: Endogenous (decision) variables to agents. θ: Other parameters.

I set 4 possible setups: Nash and 3 types of cooperation.

Nash

In each country a planner solves:

$$\max_{\mathbf{x_t^j}, \tau_t^j} \quad W^j_{Nash,t} = W^j_t$$

$$s.t. \qquad \mathbb{E}_t F(\mathbf{x_{t-1}}, \mathbf{x_t}, \mathbf{x_{t+1}}, \tau_t, \theta)$$

for $t = 1$.

In this case we compute an *Open Loop Nash Equilibrium*: Each planner j will only take the tools of the other players (τ^{-j}) as given and decide on optimal actions ($\mathbf{x_t^j}$, τ_t^j) at the start of the game.

Cooperative cases

Table: Cooperative Cases

	Planners/Players	Obj. Function	Decision variables
Cooperation (all countries)	World	$W_{Coop,t} = n_a W_t^a + n_b W_t^b + n_c W_t^c$	$\mathbf{x_t}, \tau_t$
Semi-Cooperation (EMEs vs. Center)	Periphery block A+B	$W^{ab} = n_a W^a + n_b W^b$	$\mathbf{x_t}, \tau_t^a, \tau_t^b$
	Center	W^c	$\mathbf{x_t}, \tau_t^c$
Semi-Cooperation (EME-A + C vs. EME-B)	Cooperative A+C	$W^{ac} = n_a W^a + n_c W^c$	$\mathbf{x_t}, \tau_t^a, \tau_t^c$
	EME-B	W^b	$\mathbf{x_t}, \tau_t^b$

Note: $j = a, b, c$

In all cases the constraints are the same: $\mathbb{E}_t F(\mathbf{x_{t-1}}, \mathbf{x_t}, \mathbf{x_{t+1}}, \tau_t, \theta)$

Roadmap of Talk

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Results: baseline model

Table: Welfare comparison across policy schemes with respect to the Nash Equilibrium

	Policy Scheme		
Country	Cooperation (All)	Cooperation (EMEs)	Cooperation (Center + EME-A)
C (Center)	1.00	1.00	1.00
A	1.00	1.00	1.00
B	1.00	1.00	1.00
World	1.00	1.00	1.00
EME Block	1.00	1.00	1.00

Units: **Proportional steady state consumption increase** in the benchmark (Nash) model
1: Model is as good as Benchmark; > 1 : Model is better

- No Gains from Cooperative setups relative to Nash Equilibrium
- Including semi-cooperative frameworks

Baseline results (cont)

Optimal Taxes

Table: Ramsey-Optimal taxes under each policy setup

	Policy Scheme			
Country tool	Nash	Cooperation (All)	Cooperation (EMEs)	Cooperation (Center + EME-A)
τ^a	0.38	-0.11	0.15	0.30
τ^b	0.38	-0.11	0.15	0.34
τ^c	1.19	0.96	1.11	1.14

Units: proportional tax on banking rate of return

- Frequent Policy: set a **Tax to undo the friction** (↓ Credit Spread)
- Taxes are **lower under cooperation**
- Only Cooperation (world) gives scope for some subsidizing
- **Taxes by Center**: much larger ($\approx 3 \times \tau^{eme}$)
- Center tax is set with different aims: to foster trade of assets and intermediation
  (↓ price of bonds and implicit subsidy to demand of EME Banks)

Policy trade-off:
Increasing Production vs. Undoing Friction

Baseline results (cont)

Optimal Taxes

Table: Ramsey-Optimal taxes under each policy setup

	Policy Scheme			
Country tool	Nash	Cooperation (All)	Cooperation (EMEs)	Cooperation (Center + EME-A)
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τ^b	0.38	-0.11	0.15	0.34
τ^c	1.19	0.96	1.11	1.14

Units: proportional tax on banking rate of return

- Frequent Policy: set a Tax to undo the friction (↓ Credit Spread)
- Taxes are **lower under cooperation** ⟶[More effective regulation]
- Only Cooperation (world) gives scope for some subsidizing
- **Taxes by Center**: much larger ($\approx 3 \times \tau^{eme}$)
- Center tax is set with different aims: to foster trade of assets and intermediation
  (↓ price of bonds and implicit subsidy to demand of EME Banks)

Policy trade-off:
Increasing Production vs. Undoing Friction

Baseline results (cont)

Optimal Taxes

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- **Taxes by Center**: much larger ($\approx 3 \times \tau^{eme}$)
- Center tax is set with different aims: to foster trade of assets and intermediation
  (↓ price of bonds and implicit subsidy to demand of EME Banks)

Policy trade-off:
Increasing Production vs. Undoing Friction

No policy setup and First Best

Country	Policy Scheme			
	Nash	Coop (All)	Coop (EMEs)	Coop (Center and EME-A)
C (Center)	1.01	1.01	1.01	1.01
A	0.99	0.99	0.99	0.99
B	0.99	0.99	0.99	0.99
World	**1.00**	**1.00**	**1.00**	**1.00**
EME Block	0.99	0.99	0.99	0.99

Units: Proportional steady state consumption increase in the baseline (First Best) model

Country	Policy Scheme				
	First Best	Nash	Coop (All)	Coop (EMEs)	Coop (Center and EME-A)
C (Center)	1.05	1.06	1.06	1.06	1.06
A	1.03	1.02	1.03	1.02	1.02
B	1.03	1.02	1.03	1.02	1.02
World	1.04	1.04	1.04	1.04	1.04
EME Block	1.03	1.02	1.03	1.02	1.02

Units: Proportional steady state consumption increase in the baseline (No Policy) model

- World level: friction mitigated, **FB mimicked** by all Ramsey Equilibria

- Country level: Distributional issues (against EMEs)

  No scope for Pareto improvements

▸ Results with $\sigma = 1.5$

No policy setup and First Best

Country	Policy Scheme: Nash	Coop (All)	Coop (EMEs)	Coop (Center and EME-A)
C (Center)	1.01	1.01	1.01	1.01
A	0.99	0.99	0.99	0.99
B	0.99	0.99	0.99	0.99
World	1.00	1.00	1.00	1.00
EME Block	0.99	0.99	0.99	0.99

Units: Proportional steady state consumption increase in the baseline (First Best) model

Country	Policy Scheme: First Best	Nash	Coop (All)	Coop (EMEs)	Coop (Center and EME-A)
C (Center)	1.05	1.06	1.06	1.06	1.06
A	1.03	1.02	1.03	1.02	1.02
B	1.03	1.02	1.03	1.02	1.02
World	**1.04**	**1.04**	**1.04**	**1.04**	**1.04**
EME Block	1.03	1.02	1.03	1.02	1.02

Units: Proportional steady state consumption increase in the baseline (No Policy) model

- World level: friction mitigated, FB mimicked by all Ramsey Equilibria
- Country level: Distributional issues (against EMEs)

  No scope for Pareto improvements
- Substantial **Welfare Improvement wrt No Policy** setup
- Equivalent to 4% Consumption increase

▸ Results with $\sigma = 1.5$

Experiments: changes in baseline model

I explore whether the results change with variations in a number of parameters.

Q: How important is the **friction** in shaping the results? Does the **population size** structure matters?

Cases:

- Changes in Financial Friction
  - Stronger Friction (both EMEs) $\longrightarrow$ No Gains from Cooperation; larger gains wrt No Policy

go

- Changes in population size
  - Larger Center $\longrightarrow$ No Gains, no model matches FB

go

Skip

Experiments: changes in baseline model

I explore whether the results change with variations in a number of parameters.

Q: How important is the **friction** in shaping the results? Does the **population size** structure matters?

Cases:

- Changes in Financial Friction
  - Stronger Friction (both EMEs) $\longrightarrow$ No Gains from Cooperation; larger gains wrt No Policy go
  - Stronger Friction in one EME $\longrightarrow$ **Small Gains** from World Cooperation; Nash won't match the FB go
- Changes in population size
  - Larger Center $\longrightarrow$ No Gains, no model matches FB go
  - Asymmetric EMEs: Smaller EME2 $\longrightarrow$ **Small Gains** in SemiCoop1 (between EMEs) go

Interesting patterns arise with **asymmetryc changes** in EMEs Skip

Experiment 1: higher financial friction in both EMEs ($\kappa^a = \kappa^b = \frac{1}{2}$)

Table: Welfare comparison

Country	Bechmark: Nash			Bechmark: First Best			
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)
C (Center)	1.00	1.00	1.00	1.01	1.01	1.01	1.01
A	1.00	1.00	1.00	0.99	0.99	0.99	0.99
B	1.00	1.00	1.00	0.99	0.99	0.99	0.99
World	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EME Block	1.00	1.00	1.00	0.99	0.99	0.99	0.99

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme			
	Nash	Cooperation (All)	Cooperation (EMEs)	Cooperation (Center+EME-A)
τ^a	0.20	-0.30	-0.04	0.15
τ^b	0.20	-0.30	-0.04	0.16
τ^c	1.29	1.09	1.23	1.25

Units: proportional tax on banking rate of return

- No gains from Cooperation
- Larger gain wrt No Policy (expected)
- Consistent w increased Welfare Effects given $\uparrow \kappa$:

  Stronger taxes in Center

Experiment 2: higher financial friction in EME-A ($\kappa^a = \frac{1}{2}$, $\kappa^b = 0.399$)

Table: Welfare comparison

Country	Bechmark: Nash				Bechmark: First Best				
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Coop (C+EME-B)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Coop (C+EME-B)
C (Center)	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.01
A	1.01	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.99
B	1.01	1.01	1.01	1.01	0.98	0.99	0.99	0.99	0.99
World	1.01	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00
EME Block	1.01	1.01	1.01	1.01	0.98	0.99	0.99	0.99	0.99

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme				
	Nash	Coop (All)	Coop (EMEs)	Coop (Center+EME-A)	Coop (Center+EME-B)
τ^a	-0.05	-0.28	-0.08	0.08	0.11
τ^b	0.09	-0.12	0.18	0.40	0.37
τ^c	1.19	1.03	1.17	1.20	1.20

Units: proportional tax on banking rate of return

- Small gains from World Cooperation
- EME with lower distortion is benefited from cooperation.
- Cooperative Planners match the FB
- Country with larger distortion: Sets Subsidy or lower tax when cooperating
- Consistent w increased Welfare Effects given $\uparrow \kappa$:

  EMEs: Less aggressive policy setting ($\tau^{eme} < \tau^{eme}_{base}$)

▸ Results with $\sigma = 1.5$

Experiment 3: Larger financial center $(n_a, n_b, n_c) = (\frac{1}{6}, \frac{1}{6}, \frac{2}{3})$

Table: Welfare comparison

Country	Bechmark: Nash			Bechmark: First Best			
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)
C (Center)	1.00	1.00	1.00	0.98	0.98	0.98	0.98
A	1.00	0.99	1.00	0.99	1.00	0.99	1.00
B	1.00	0.99	1.01	0.99	1.00	0.99	1.00
World	1.00	1.00	1.00	0.98	0.99	0.98	0.99
EME Block	1.00	0.99	1.01	0.99	1.00	0.99	1.00

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme			
	Nash	Cooperation (All)	Cooperation (EMEs)	Cooperation (Center and EME-A)
τ^a	-0.71	-0.90	-0.44	-1.14
τ^b	-0.71	-0.91	-0.44	-0.92
τ^c	0.09	-0.05	0.30	-0.11

Units: proportional tax on banking rate of return

- No Gains from Cooperation
- Larger welfare (expected)
- Planners no longer can match FB

  Guess: lower effect of τ^{eme} $\rightarrow$ less effective tools

- Smallest departure from FB: World Cooperation

Experiment 4: Smaller periphery $(n_a, n_b, n_c) = (\frac{1}{3}, \frac{1}{6}, \frac{1}{2})$

Table: Welfare comparison

Country	Bechmark: Nash				Bechmark: First Best				
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Coop (C+EME-B)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Coop (C+EME-B)
C (Center)	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01
A	1.00	1.01	1.00	1.00	0.99	0.99	1.00	0.99	0.99
B	1.01	1.01	1.01	1.01	0.97	0.99	0.99	0.99	0.99
World	1.00	1.01	1.00	1.00	0.99	1.00	1.00	1.00	1.00
EME Block	1.01	1.01	1.00	1.00	0.98	0.99	0.99	0.99	0.99

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme				
	Nash	Coop (All)	Coop (EMEs)	Coop (Center + EME-A)	Coop (Center + EME-B)
τ^a	0.30	0.25	0.13	0.32	0.35
τ^b	-0.16	0.11	-0.67	0.33	0.27
τ^c	1.12	1.06	0.97	1.14	1.15

Units: proportional tax on banking rate of return

- Small gains from Cooperation for smaller EME
- For both EMEs in Regional Cooperation
- CoopEMEs: Better-off EMEs $\Rightarrow$ Small gains from Cooperation (World)
- Smaller EME wants to subsidize in more setups

▶ Results with $\sigma = 1.5$

Explained results

- Baseline model shows No gains from cooperation.
- Experiments can generate gains, but small.

Explained results

- Baseline model shows No gains from cooperation.

- Experiments can generate gains, but small.

Can we rationalize this based on Korinek (2020, REStud)?

Cooperation Gains exist only if Nash Eq. is Pareto Inefficient and fails to achieve FB

First Welfare Theorem of Open Economies: The Nash Eq. is Pareto Efficient IF conditions 1-3 hold.

1. *Competition:* Policy makers act as **price takers** by not manipulating international assets prices.
2. *Sufficient Instruments:* The policy tool is **flexible and effective** enough.
3. *Frictionless International Markets:* International market for assets is free of imperfections and frictions.

In my model **2-3** hold.

1 not necessarily (LOE assumption), hence the **small gains** $\longrightarrow$ but the effect is not strong enough.

We can exacerbate the effects by breaking down 2,3

Cases: ▸ Policy Costs ▸ Frictions in All Countries

Generating gains from cooperation

First modification: Every country suffers from Agency frictions.

Before, a Center without frictions implied important simplifications in equilibrium (equalization of rates).

The Center bank now solves:

$$\max_{F_1, L_1, D_1} J_1 = \mathbb{E}_1 \Lambda_{1,2} \pi^c_{b,2} = \mathbb{E}_1 \left[\Lambda_{1,2} (R^a_{b,1} F^a_1 + R^b_{b,1} F^b_1 + R^c_{k,2} L^c_1 - R_{D,1} D_1) \right]$$

$$s.t. \quad F^a_1 + F^b_1 + L^c_1 = D_1 + \delta_b Q^c_1 K^c_0$$

$$J_1 \geq k^c \mathbb{E}_1 \Lambda^c_{1,2} \left[R^a_{a,1} F^a_1 + R^b_{b,1} F^b_1 + R^c_{k,2} L^c_1 \right]$$

F.O.C.:

$$[F^a_1]: \quad \mathbb{E}_1 (R^a_{b,1} - R_{D,1}) = \mu^c_1 \left[\kappa^c R^a_{b,1} - (R^a_{b,1} - R_{D,1}) \right]$$

$$[F^b_1]: \quad \mathbb{E}_1 (R^b_{b,1} - R_{D,1}) = \mu^c_1 \left[\kappa^c R^b_{b,1} - (R^b_{b,1} - R_{D,1}) \right]$$

$$[L^c_1]: \quad \mathbb{E}_1 (R^c_{k,2} - R_{D,1}) = \mu^c_1 \left[\kappa^c R^c_{k,2} - (R^c_{k,2} - R_{D,1}) \right]$$

Thus, the credit spread is > 0 for the center as well.

Generating gains from coordination

model with frictions in every economy ($\kappa^a = \kappa^b = 0.399$ and $\kappa^c = 0.1$)

Table: Welfare comparison

	Bechmark: Nash			Bechmark: First Best			
Country	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)
C (Center)	1.00	1.00	1.00	1.03	1.04	1.03	1.03
A	1.00	1.00	1.00	0.97	0.98	0.98	0.97
B	1.00	1.00	1.00	0.97	0.98	0.98	0.98
World	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EME Block	1.00	1.00	1.00	0.97	0.98	0.98	0.98

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

	Policy Scheme			
Country	Nash	Cooperation (All)	Cooperation (EMEs)	Cooperation (Center and EME-A)
τ^a	-0.11	-0.68	-0.19	-0.47
τ^b	-0.11	-0.68	-0.19	-0.22
τ^c	0.68	0.34	0.65	0.55

Units: proportional tax on banking rate of return

- No Gains from Cooperation
- FB achieved at world level. Same distributional issues as baseline
- **Lower Gains wrt No Policy**

  with $\kappa^c > 0$ the Cr.Spread in EMEs will be lower by default
- Smaller tax in Center wrt baseline
- Now EMEs subsidize in all cases

  Offsetting frictions (between countries) already mitigate distortion $\Rightarrow$ they can subsidize

Generating gains from coordination

Policy Implementation Costs

Now we break the flexibility of the policy tool. Can no longer be set without costs:

The welfare for the planner now is:

$$\max_{\mathbf{x_t}, \tilde{\tau}_t} \quad W_t^{objective} = f(\alpha^j, W_t^j) - \Gamma(\tau^j)$$
$$s.t. \qquad \mathbb{E}_t F(\mathbf{x_{t-1}}, \mathbf{x_t}, \mathbf{x_{t+1}}, \tau_t, \theta)$$

with: $\Gamma(\tau^j) = \psi(\tau^j)^2$

$\tilde{\tau} \subseteq \tau$ and welfare weights $\alpha^j \geq 0 \quad \forall j$

Generating gains from coordination (cont.)

Policy Implementation Costs: $\kappa^a = \kappa^b = 0.399$ and $\kappa^c = 0.1$ and $\psi = 1$

Table: Welfare comparison

Country	Bechmark: Nash			Bechmark: First Best			
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)
C (Center)	**1.02**	**1.02**	**1.02**	1.00	1.02	1.02	1.02
A	**1.01**	**1.01**	**1.01**	0.97	0.98	0.98	0.98
B	**1.01**	**1.01**	**1.01**	0.97	0.98	0.98	0.98
World	**1.01**	**1.01**	**1.01**	0.99	**1.00**	**1.00**	**1.00**
EME Block	1.01	1.01	1.01	0.97	0.98	0.98	0.98

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme			
	Nash	Cooperation (All)	Cooperation (EMEs)	Cooperation (Center and EME-A)
τ^a	0.20	-0.30	-0.04	0.15
τ^b	0.20	-0.30	-0.04	0.16
τ^c	1.29	1.09	1.23	1.25

Units: proportional tax on banking rate of return

- Large Cost ⇒ Significantly lower taxes by all countries
- **Gains from Coordination for all countries and at the world level**
- **FB at world level is achieved by all policies but Nash**
- **Cooperative planners are more efficient** (set lower taxes to mitigate the same friction). Then are not limited by the Policy Costs.

Results with $\sigma = 1.02$

Roadmap of Talk

Model

Welfare Effects of Macroprudential Policies

Optimal Policy: Endogenizing the taxes

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Conclusions

Conclusions

- I study the presence of **gains from international coordination** of Macroprudential policies (MaP) aimed at a banking sector with agency frictions.
- Questions of interest:
  - (i) Can EMEs benefit from coordination in an environment of strong Center-Periphery spillovers?
  - (ii) Is the Center affected by cooperative arrangements?
- An additional periphery is included to determine value of modelling regional interactions
  - Given the 2nd EME I can verify: Cooperation and Semi-Cooperative Policy frameworks
- Policy tool: **taxes on banking** sector revenues
- Cross-country policy spillovers are verified $\Rightarrow$ we look for Coordination Gains
- Baseline result: Cooperative frameworks **do not deliver sizable welfare gains**

Conclusions (cont.)

- Optimal policy [usually] consists on **setting taxes** to undo financial distortion
- Cooperative planners set more conservative taxes: **Higher regulatory efficiency**
- Absence of large gains can be explained by omission of policy costs and frictions in international markets
- I explore these features. **Sizable gains appear** when large costs are assumed.

Finally,

- Considering a second periphery:
  - Delivers similar results to 2 country model if new EME is a replicate of EME-1 [Scale Effect]
  - Different [qualitative] outcomes when EME-2 has idiosyncratic features [Interaction Effect]

Conclusions (cont.)

Further research Still Needed in a number of directions:

- **Stochastic analysis:** idiosyncratic shocks transmission
- Timing of policies: Prudential vs. Crisis Management
- **Dynamic banking sector** ⇒ Persistent MaP
  - Crucial: in reality banks retain profits
  - then a tax on banking revenues has long-lasting effects

} I do this in my JMP

- Trade-offs with other policies
- Role of shadowbanking and regulatory arbitrage

Thank you for your attention!

EXTRA-MATERIAL

References followed for the model setup

Article	**Feature used in the model**
Gertler and Karadi (2011, JME), *A model of unconventional monetary policy*	framework for modelling the balance sheet of banks and financial constraint.
Banerjee, Devereux and Lombardo (2016, JIMF) *Self-oriented monetary policy, global financial markets and excess volatility of international capital flows*	General equilibrium model structure for center and periphery.
Cespedes, Chang and Velasco (2017, JIE): *Financial Intermediation, Real Exchange Rates, and Unconventional Policies in an Open Economy*	Modelling of banks in finite horizon
Davis and Devereux (2019, NBER wp): *Capital Controls as Macro-prudential Policy in a Large Open Economy*	Analytical welfare analysis method (and coordination gains framework)

Back to Literature

Welfare Analysis Methodology Description

The welfare analysis method is borrowed from Davis and Devereux (2019, NBER wp)

0. Characterize Competitive Equilibrium Conditions.
1. Set a Social Planner Problem: individual welfare is $W^j = U^j + \lambda_1^j BC_1^j + \beta\lambda_2^j BC_2^j$ or jointly as the weighted sum.
2. Substitute from CEq conditions variables/equations characterizing optimal behaviour of non-household decision variables (profits of bankers and constraints, production, taxes rebate, etc.)
3. Obtain welfare effects via implicit differentiation: here we recognize that the CEq-derived variables are a function of the taxes (taken as exogenous by agents). -> *Tax distorted equilibrium*
4. Based on numerical/calibrated estimation of CEq, obtain approximated values of welfare effects and optimal taxes.

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Cross-country Effects

The welfare effect between emergent countries is,

$$\frac{dW^a}{d\tau^b} = \lambda_1^a I_1^a \frac{dQ_1^a}{d\tau^b} + \beta\lambda_2^a \frac{B_1^a}{R_1^w}\frac{dR_1^w}{d\tau^b} + \beta\lambda_2^a \left(\phi(\tau^a)\alpha A_2^a {K_1^a}^{\alpha-1} + \kappa^a(1-\delta)Q_2^a\right)\frac{dK_1^a}{d\tau^b}$$

and the emerging country welfare effect of a change in the center country tax is,

$$\frac{dW^a}{d\tau^c} = \lambda_1^a I_1^a \frac{dQ_1^a}{d\tau^c} + \beta\lambda_2^a \frac{B_1^a}{R_1^w}\frac{dR_1^w}{d\tau^c} + \beta\lambda_2^a \left(\phi(\tau^a)\alpha A_2^a {K_1^a}^{\alpha-1} + \kappa^a(1-\delta)Q_2^a\right)\frac{dK_1^a}{d\tau^c}$$

On the other hand the emerging economy welfare effect of a change in the center economy tax is,

$$\frac{dW^c}{d\tau^a} = \lambda_1^c I_1^c \frac{dQ_1^c}{d\tau^a} + \beta\lambda_2^c \frac{B_1^c}{R_1^w}\frac{dR_1^w}{d\tau^a} + \beta\lambda_2^c \left(\alpha A_2^c {K_1^c}^{\alpha-1} + (1-\delta)Q_2^c\right)\frac{dK_1^c}{d\tau^b} + \beta\lambda_2^c \left[R_{b,1}^{eme}\left(\frac{dF_1^a}{d\tau^a} + \frac{dF_1^b}{d\tau^a}\right) + \frac{dR_{b,1}^{eme}}{d\tau^a}\left(F_1^a + F_1^b\right)\right]$$

Back to Welfare Effects

Optimal tax (cont.)

For c:

$$\tau^{c\,*} = \frac{Q_1^c}{\alpha A_2^c \xi_2^{c\,\alpha} K_1^{c\,\alpha-1}} \left\{ R_1 I_1^c \frac{dQ_1^c}{dF_1^S} + \frac{B_1^c}{R_1} \frac{dR_1}{dF_1^S} + (\alpha A_2^c \xi_2^{c\,\alpha} K_1^{c\,\alpha-1} + (1-\delta)\xi_2^c Q_2) \frac{dK_1^c}{dF_1^S} \right.$$
$$\left. + (F_1^a + F_1^b) \frac{dR_{b,1}^{eme}}{dF_1^S} + (1-\delta)\xi_2^c \frac{Q_2}{Q_1^c} \right\} + 1$$

with $dF_1^S = dF_1^a + dF_1^b$

- prevalent role for cross-border lending variables.
- Quantities role is analogous to physical capital effects on EMEs.

In both expressions: Inside brackets sign may not coincide: policy trade-off.

Simulation choices

The model is solved using non-linear methods. For the private model we must provide the taxes as a parameter.

Parameter choices

Parameter		Value	Comment/Source
Adjustment costs of investment	ζ	4.65	Cespedes, Chang and Velasco (2017)
Start-up transfer rate to banks	δ_b	0.005	Gertler and Karadi (2011), Gertler and Kiyotaki (2010)
Fraction of capital that can be diverted	$\kappa^a = \kappa^b$	0.399	Aoki, Benigno and Kiyotaki (2019)
Discount factor	β	0.99	
Risk Aversion parameter	σ	2	
Country size	$n_a = n_b$	0.25	
Depreciation rate	δ	0.6	Targets a longer than quarterly period duration $\sim$ 5 years
Capital share	α	0.333	

Predetermined variables: $K_0^a,\ K_0^b,\ K_0^c,\ \bar{I}^a,\ \bar{I}^b,\ \bar{I}^c$

We use literature values for the parameters. Given the model simplicity, most of them won't change drastically relative to quarterly calibration counterparts.

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Welfare gains computation

I compute the welfare gains as a proportional change in the consumption stream of the agents.

Thus, if I want to compare the welfare gains of a policy that leads to 'welfare 1' given by $W_1 = u(c_{1,1}) + \beta u(c_{1,2})$ relative to a benchmark $W_0 = u(c_{0,1}) + \beta u(c_{0,2})$ we just find the proportional change in average consumption ϕ such that:

$$W_0 = u(\boldsymbol{\phi}\bar{c}_0) + \beta u(\boldsymbol{\phi}\bar{c}_0) = W_1$$

Where $\bar{c}_0$ would be the equivalent constant stream of consumption that would yield the welfare (W_0) delivered by the baseline model.

For the CRRA we get ϕ as:

$$\begin{aligned} \frac{(\phi\bar{c}_0)^{1-\sigma}}{1-\sigma} + \beta\frac{(\phi\bar{c}_0)^{1-\sigma}}{1-\sigma} &= W_1 \\ \phi^{1-\sigma}W_0 &= W_1 \\ \phi &= \left(\frac{W_1}{W_0}\right)^{\frac{1}{1-\sigma}} \end{aligned}$$

Back to policy comparison

Welfare Effects: Consumption Equivalent Units

Table: Welfare effect of 1% increase in taxes

Direct Effects	
$\tau_a \to W^a$	-1.560
$\tau_b \to W^b$	-1.560
$\tau_c \to W^c$	-0.847

Cross-country Effects	
$\tau_a \to W^b$	-0.078
$\tau_a \to W^c$	-0.039
$\tau_b \to W^a$	-0.078
$\tau_b \to W^c$	-0.039
$\tau_c \to W^a$	-0.308
$\tau_c \to W^b$	-0.308

Table: Welfare effect - Proportional Consumption Equivalent

Direct Effects	
$\tau_a \to W^a$	0.9958
$\tau_b \to W^b$	0.9958
$\tau_c \to W^c$	0.9972

Cross-country Effects	
$\tau_a \to W^b$	0.9998
$\tau_a \to W^c$	0.9999
$\tau_b \to W^a$	0.9998
$\tau_b \to W^c$	0.9999
$\tau_c \to W^a$	0.9992
$\tau_c \to W^b$	0.9992

The welfare effect is approximated as: $\frac{\partial W^j}{\partial \tau^k} = \frac{W^j_{\tau^k=0.01} - W^j_{\tau=0}}{\tau^k - 0}$

This is the marginal effect around the zero taxes vector, the magnitude of the effect can change depending of the benchmark point

Cooperative effects - numerical example

The cooperative welfare effects will be given by population weighted averages of the individual counterparts:

Table: Welfare effect of 1% increase in taxes: Cooperative Planners

World Planner		EME Planner		AC Coalition Planner	
$\tau_a \to W$	-0.429	$\tau_a \to W^{eme}$	-0.819	$\tau_a \to W^{ac}$	-0.546
$\tau_b \to W$	-0.429	$\tau_a \to W^{eme}$	-0.819	$\tau_a \to W^{ac}$	-0.668
$\tau_c \to W$	-0.578				

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Households (cont.)

In the first period each household will maximize the present value of its life-time utility subject to the budget constraints for the first and second period.

The associated F.O.C.s for the three types of households are:

$$u'(C_1) = \beta R_1 u'(C_2)$$
$$u'(C_1^c) = \beta R_{D,1} u'(C_2^c)$$

The first three are the Euler Equations for bonds and the last one, applying only for country c, is the Euler Equation for local deposits.

Back to HH-UMP

Alternative microfoundation for policy cost

Change Government structure

Current: balanced budget $T + \tau r_2 K_1 = 0$

Alternative: MaP Subsidy funded by other sectors: $\tau_w W_2 L_2 + \tau_r r_2 K_1 = 0$

In that way a subsidy to the banks imply taxing the workers sector.

In the case of a Ramsey tax, wages will be pushed upwards increasing production which may be inefficient.

back

Baseline model with $\sigma = 1.5$

Table: Welfare comparison

Country	Bechmark: Nash			Bechmark: First Best			
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)
C (Center)	1.00	1.00	1.00	1.02	1.02	1.02	1.02
A	1.00	1.00	1.00	0.99	0.99	0.99	0.99
B	1.00	1.00	1.00	0.99	0.99	0.99	0.99
World	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EME Block	1.00	1.00	1.00	0.99	0.99	0.99	0.99

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme			
	Nash	Coop (All)	Coop (EMEs)	Coop (Center+EME-A)
τ^a	0.86	0.37	0.75	0.83
τ^b	0.86	0.37	0.75	0.84
τ^c	1.71	1.55	1.69	1.68

Units: proportional tax on banking rate of return

back

Higher financial friction in one emerging economy ($\kappa^a = 0.399$, $\kappa^b = \frac{1}{2}$)

$\sigma = 1.5$

Table: Welfare comparison

Country	Bechmark: Nash			Bechmark: First Best			
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)
C (Center)	1.00	1.00	1.00	1.01	1.02	1.02	1.02
A	1.00	1.02	1.02	0.96	0.97	0.99	0.99
B	1.02	1.02	1.02	0.96	0.98	0.99	0.99
World	1.01	1.01	1.01	0.99	1.00	1.00	1.00
EME Block	1.01	1.02	1.02	0.96	0.98	0.99	0.99

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme			
	Nash	Coop (All)	Coop (EMEs)	Coop (Center+EME-A)
τ^a	0.68	0.49	0.60	0.83
τ^b	0.37	0.09	0.28	0.57
τ^c	1.72	1.57	1.66	1.68

Units: proportional tax on banking rate of return

back

Smaller periphery $(n_a, n_b, n_c) = (\frac{1}{3}, \frac{1}{6}, \frac{1}{2})$

$\sigma = 1.5$

Table: Welfare comparison

Country	Bechmark: Nash			Bechmark: First Best			
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)
C (Center)	1.00	1.00	1.00	1.02	1.02	1.02	1.02
A	0.99	1.01	1.00	0.99	0.97	0.99	0.99
B	1.02	1.02	1.02	0.97	0.98	0.98	0.99
World	1.00	1.01	1.00	1.00	1.00	1.00	1.00
EME Block	1.00	1.01	1.01	0.98	0.98	0.99	0.99

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme			
	Nash	Coop (All)	Coop (EMEs)	Coop (Center + EME-A)
τ^a	0.84	0.58	0.72	0.84
τ^b	0.65	0.24	0.09	0.83
τ^c	1.70	1.55	1.61	1.68

Units: proportional tax on banking rate of return

back

Policy Implementation Costs: $\kappa^a = \kappa^b = 0.399$ and $\kappa^c = 0.1$ and $\psi = 1$ $\sigma = 1.02$

Table: Welfare comparison

Country	Bechmark: Nash			Bechmark: First Best			
	Coop (All)	Coop (EMEs)	Coop (C+EME-A)	Nash	Coop (All)	Coop (EMEs)	Coop (C+EME-A)
C (Center)	0.96	0.94	1.00	1.05	1.01	0.99	1.04
A	1.09	1.08	1.07	0.91	0.99	0.99	0.98
B	1.09	1.08	1.06	0.91	0.99	0.99	0.96
World	1.02	1.01	1.03	0.98	1.00	0.99	1.01
EME Block	1.09	1.08	1.06	0.91	0.99	0.99	0.97

Units: Proportional steady state consumption increase in the benchmark model

Table: Ramsey-Optimal taxes

Country	Policy Scheme			
	Nash	Cooperation (All)	Cooperation (EMEs)	Cooperation (Center and EME-A)
τ^a	0.01	-0.01	1.20	1.25
τ^b	0.01	-0.01	1.20	-0.01
τ^c	2.00	0.02	0.02	1.98

Units: proportional tax on banking rate of return

back

Relative Importance of Local Deposits

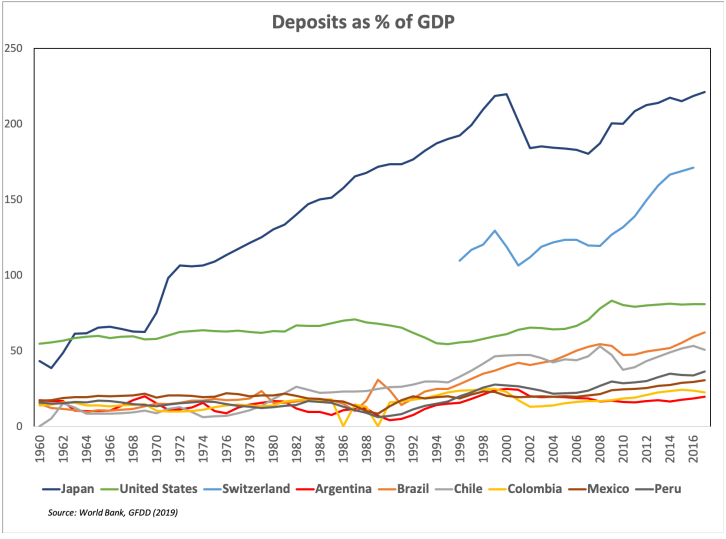

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Figure: Deposits as percentage of GDP (AE vs. EMEs)