

# Macroprudential Policy Interactions Across Countries: What Has Changed Since the Global Financial Crisis?

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# Introduction

- In recent decades we have seen a more active macroprudential regulation (Basel II, Basel III, FSB)
- More countries using macroprudential policies (MaPP) + More instruments available
- New Regulation Dynamics Backed by: GFC episode, studies on MaPP effectiveness
- However, these policies are subject to **policy leakages, trade-offs, spillover effects** (Forbes, 2019)
- Spillovers involve: Other regulators, Other economic sectors, Cross-country effects.
- Here I study whether this interdependency may translate into a corresponding policy reaction between financial regulators:

**Research Question:** Do Regulators React (in response) to the Macroprudential Policies Enacted Abroad?

Related: Has there been any change in this interactions after the GFC?

## Literature

The interest on this type of policy is relatively recent and so is the literature on it.

Still, there have been empirical contributions on several fronts:

- **Studies on its direct effect:** MaPP are effective on their targets (Claessens, Cerutti, Laeven, 2017), Aikman et al (2019, JEL), Akinci and Olmstead-Rumsey (2018)

### Evidence of policy leakages:

- **Intermediation with other types of policies:** Aikman, Bush, and Taylor (2016, BOE wp), Bruno, Shim, and Shin (2017, JFS), Lloyd, et al (2019, BOE wp.)
- **Macroeconomic Cost of MaPP:** Schularick, Richter, and Shim (2019, JIE), Codruta et al (2017, BIS Quarterly Review)
- **Cross-country effect on financial and economic variables:** Buch and Goldberg (2016), Forbes, Reinhardt and Wieladek (2017, JME), Agenor et al (2016, BIS wp 643).

However, the empirical **policy interaction**, i.e., the local regulations' reaction to foreign MaPPs hasn't been verified thoroughly.

I do it here, exploiting cross-country information before and after the GFC and a newly available dataset on Macroprudential Policy Stances (tightenings and loosenings).

## Indicator of MaPP Stance

For 17 instruments, an indicator is created indicating its net tightening:

$$MaPP^{\text{instrument } j} = \begin{cases} 1 & \text{if tightened} \\ 0 & \text{if unchanged} \\ -1 & \text{if loosened} \end{cases}$$

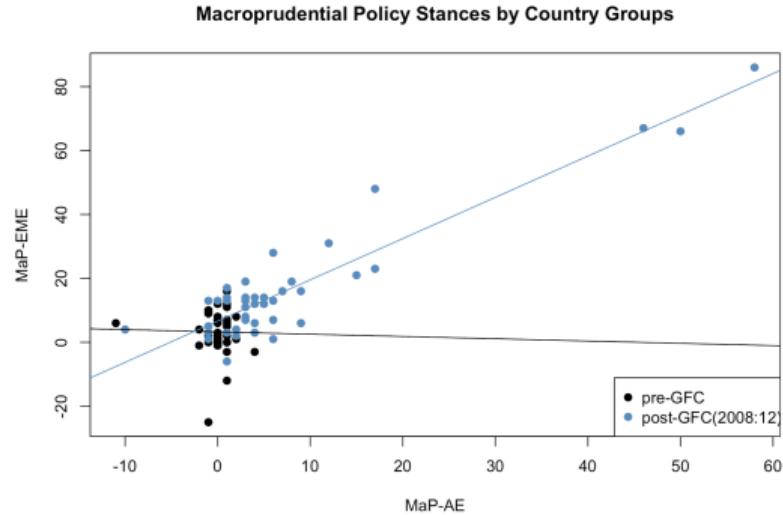
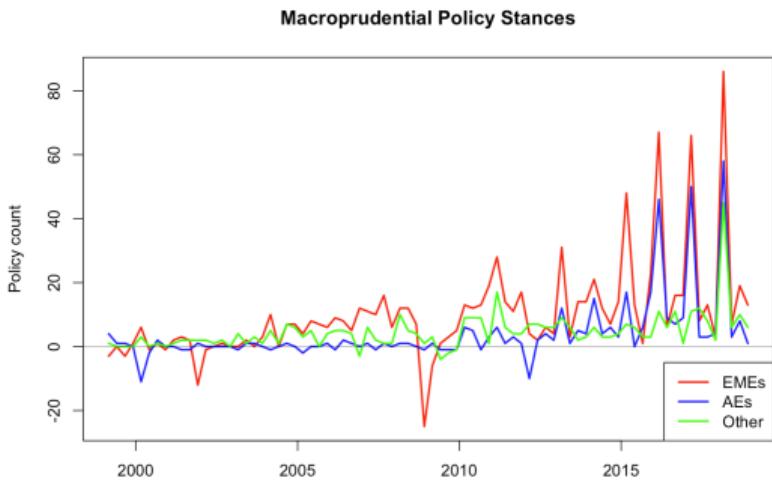
Then a policy stance indicator at the country level is computed by aggregating over all instruments:

$$MaPP_{\text{country } i} = \sum_{j=1}^{17} MaPP_i^{\text{instrument } j}$$

These are the 17 tools considered:

Countercyclical Capital Buffer	Conservation Cap. Buffer	Capital Requirements
Limits to Leverage	Loan Loss Provision	Limits to Credit Growth
Loan Restrictions	Limits on Foreign Currency Lending	Debt Service to Income Ratio
Loan-to-Value Ratio	Taxes	Liquidity Requirements
Loan-to-Deposit Ratio	Limits on FX positions	Reserve Requirements
SIFI (Too-big-to-fail institutions)	Other (e.g. stress testing, structural measures)	

# Policy Stances by Country Type



Source: Integrated Macroprudential Policy Database (iMAPP database), IMF.

**Correlations:**

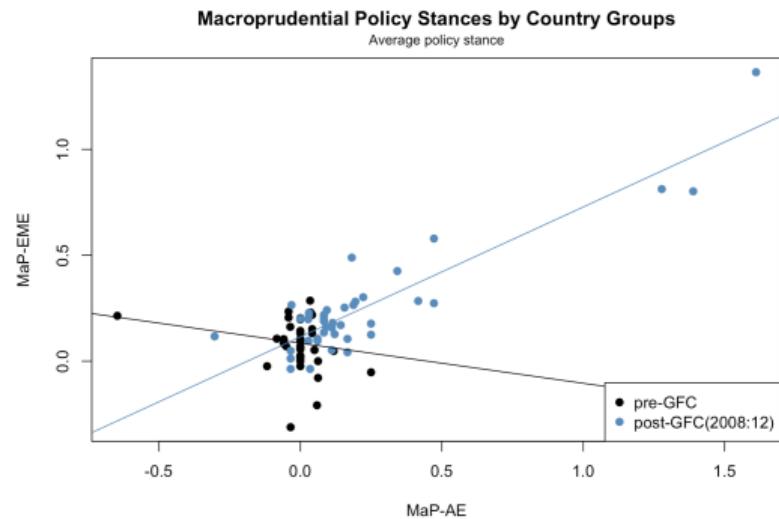
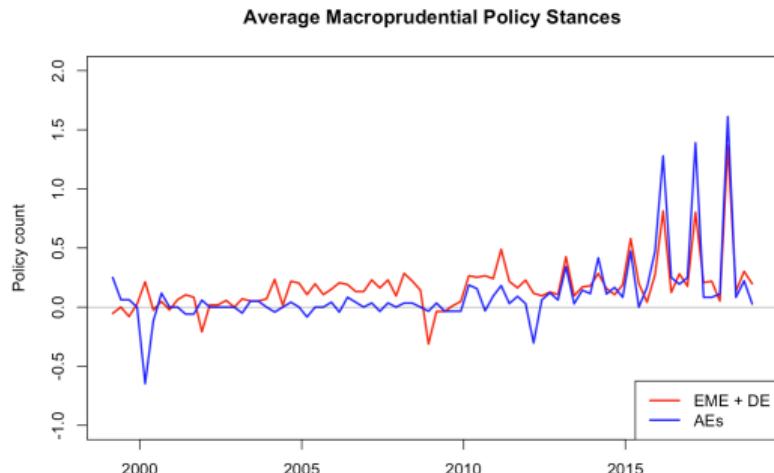
**Pre-GFC:**  $\text{Corr}(AE, EM) = -0.021$

**Post-GFC:**  $\text{Corr}(AE, EM) = 0.925$

Policy indicator: Sum net tightenings for 17 macroprudential instruments

## Average Policy Stances by Country Type

It could be argued the increase in interventions is just reflecting a higher number of user countries rather than a change in policy stances → I do the same exercise for the average policy



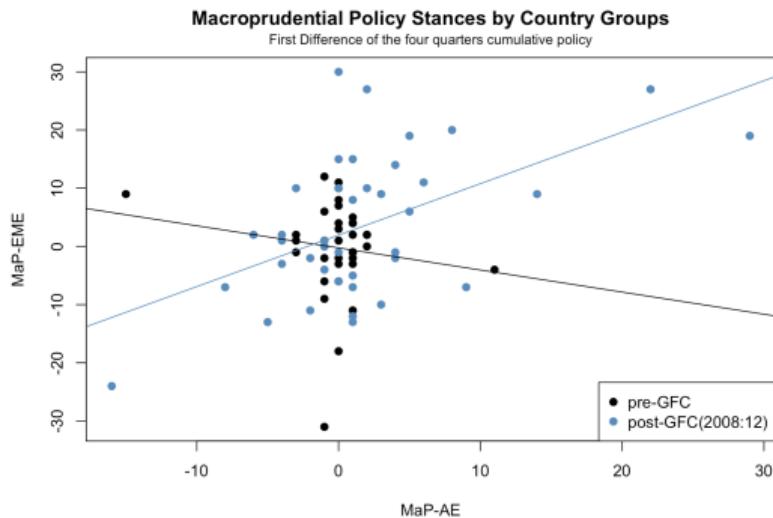
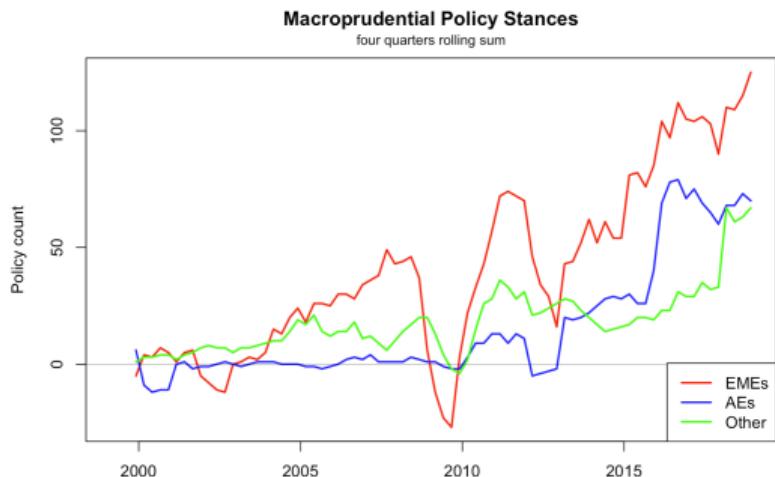
**Correlations:**

**Pre-GFC:**  $\text{Corr}(AE, EM) = 0.221$

**Post-GFC:**  $\text{Corr}(AE, EM) = 0.812$

# Annual Policy Stance

- To smooth the effect of intervention peaks, the literature focuses on the **annually accumulated policy**.
- **Annual Policy Stance:** 4 quarter sum of policy intervention indicators
- To be conservative I focus on this indicator for the rest of the paper.



**Correlations:**

**Pre-GFC:**  $\text{Corr}(AE, EM) = 0.298$

**Post-GFC:**  $\text{Corr}(AE, EM) = 0.862$

▶ Plot of differences

## A Policy Indicator for the Rest of the World

To exploit the cross-country variation for these policies we must construct an corresponding policy indicator for the rest of the world (from the perspective of each country).

For each country " $i$ " and period: I compute a weighted average of the policies of remaining countries " $-i$ ".

With financial weights approximated using the Coordinated Portfolio Investment Survey (CPIS-IMF).

The policy of the the ROW from the perspective of country  $i$  is:

$$MaPP_{-i,t} = \sum_{s \setminus i} \omega_{s,t} MaPP_{s,t}$$

with,

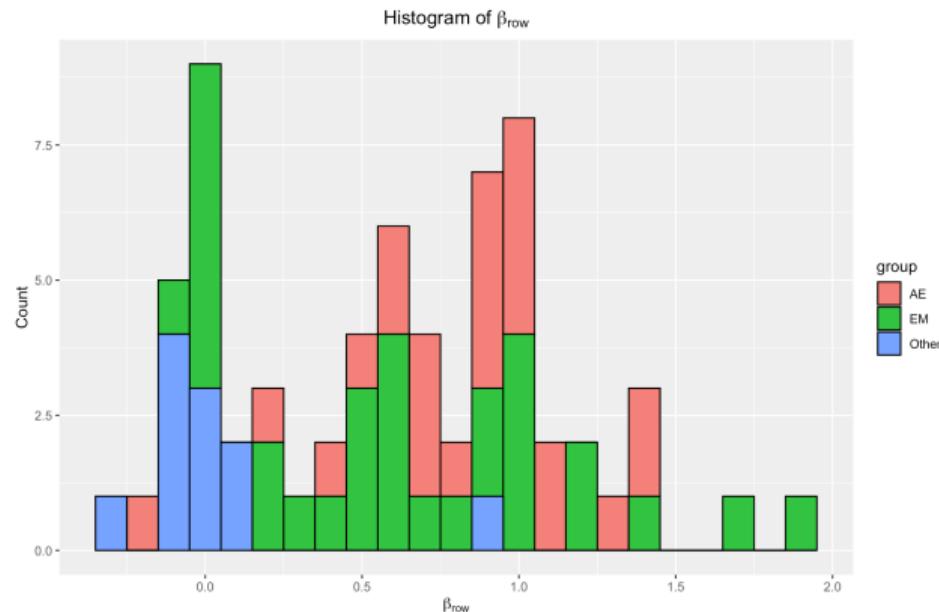
$$\omega_{s,t} = \frac{\text{Port. Investments of country } s \text{ on country } i \text{ on period } t}{\text{Total foreign port. investments on country } i \text{ on period } t}$$

I construct this index for the period 1999Q1 - 2018Q4.

## Country wise-regressions

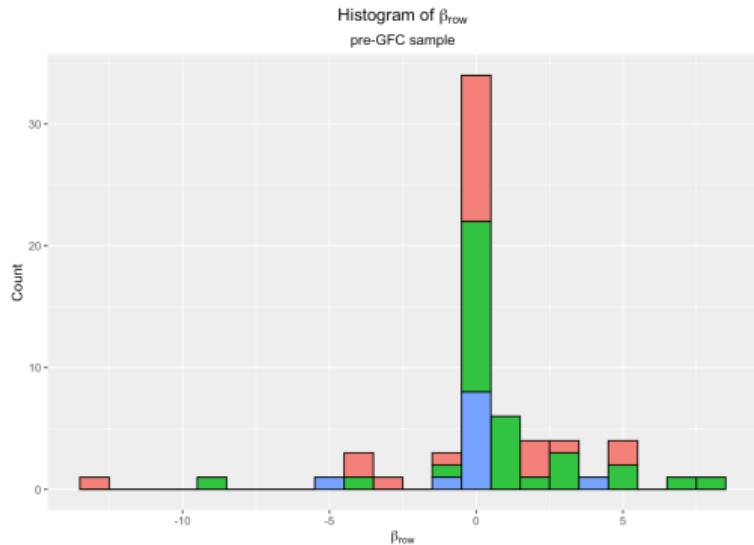
For each country  $i$  and period (with policy  $Pol_{i,t}$ ) I create a Rest-of-the-World (ROW) Policy Indicator:  $Pol_{-i,t}$

Then run a regression of the policy of country  $i$  vs. the policy of the ROW ( $-i$ ):

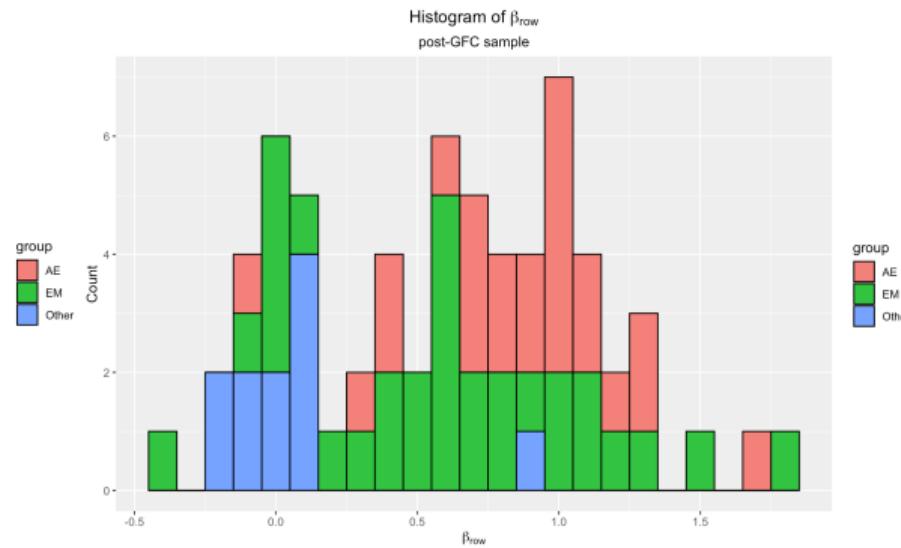


# Country wise-regressions - subperiods

Before and after the GFC: The Co-movement arises only in the post-crisis data



► Betas for difference of annual sum



# Data Sources

## Policies:

Macroprudential Policy Indicator: IMF - Intergrated Macroprudential Policy Database (iMaPP) (Quarterly, 1999-2018)

Financial Weights: IMF - Coordinated Porftolio Investment Survey (Annual, 2001-2018) (previous weights based on 2001)

## Controls:

GDP, CPI Inflation, Capital Flows, Domestic Credit, Monetary Policy Rate:

IMF-IFS database, BIS Credit Statistics, Monnet and Puy (2020) (They complete missing data on IFS statistics for a panel of countries)

Verified each data-base sequentially, if a datapoint was missing then replaced with the following available source.

Financial Development Index: Financial Development Database - IMF

Other Global Controls: VIX, TED spread from St. Louis FED, FRED.

Remaining missing data: if available - National Central Banks or Statistics Deparments.

**Period of this study:** 1999Q1-2018Q4 (the sample is split almost evenly at the GFC in 2008Q4)

## Cross-sectional analysis - Baseline Estimation Equation

$$\Delta_h MaPP_{i,t} = \alpha_i^{(h)} + \beta^{(h)} \Delta MaPP_{-i,t-1} + \underbrace{\sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k}}_{\text{domestic controls}} + \underbrace{\sum_{k=0}^4 \gamma_k^{(h)} G_{t-k}}_{\text{global controls}} + \varepsilon_{i,t+h}$$

$$MaPP_{i,t+h} - MaPP_{i,t-1} = \alpha_i^{(h)} + \beta^{(h)} \Delta MaPP_{-i,t-1} + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h}$$

for  $h = 0, 1, \dots, H$

$h = 0$ : Typical panel

$h \geq 0$ : Linear Projection Analysis (Jorda, 2005)  $\Rightarrow$  Approximation of the IRF for the domestic policy

### Interpretation:

$\beta^{(h)}$ : how much larger will the policy stance (indicator) be  $h$  periods after  $t$  (observing a foreign policy tightening).

# Estimation Equation

Table: Baseline model of Macroprudential Interactions

Model for $\Delta MaPP_i$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta MaPP_{-i}$	0.235 *** (0.05)	0.297 *** (0.07)	0.273 *** (0.08)	0.256 *** (0.08)	0.242 *** (0.08)	0.252 *** (0.08)	0.235 *** (0.08)
Domestic Economic Controls	Yes						
Global Economic Controls		Yes	Yes	Yes	Yes	Yes	Yes
Domestic Financial Controls					Yes		Yes
Global Financial Controls				Yes	Yes	Yes	Yes
Extra Domestic Financial Controls						Yes	Yes
n	5135	4135	4135	4135	4135	3917	3858
R <sup>2</sup>	0.01	0.02	0.03	0.03	0.04	0.04	0.04
F	16.91	3.71	8.55	7.65	16.22	27.72	733.21
P-value (F)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Number of countries	65	65	65	65	65	65	65

List of controls: (all variables in changes unless annual growth is used)

Domestic    **Economic:** Real GDP growth, yoy CPI inflation, change in monetary policy rate (shadow rate used for ZLB cases)

**Financial:** Financial Development Index, depreciation of ER

**Financial (extra):** Credit to GDP, Capital Inflows to GDP

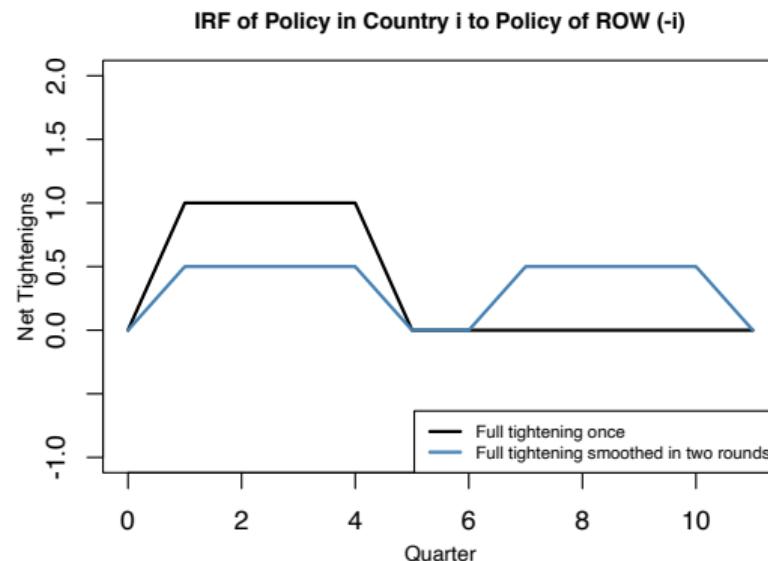
Global      **Economic:** Global growth (PComp of US, UK, JP), Global Interest Rate (PComp of US, EU, UK) (Aizenman, et al, 2014)

**Financial:** VIX, TED spread.

## How to read the IRF

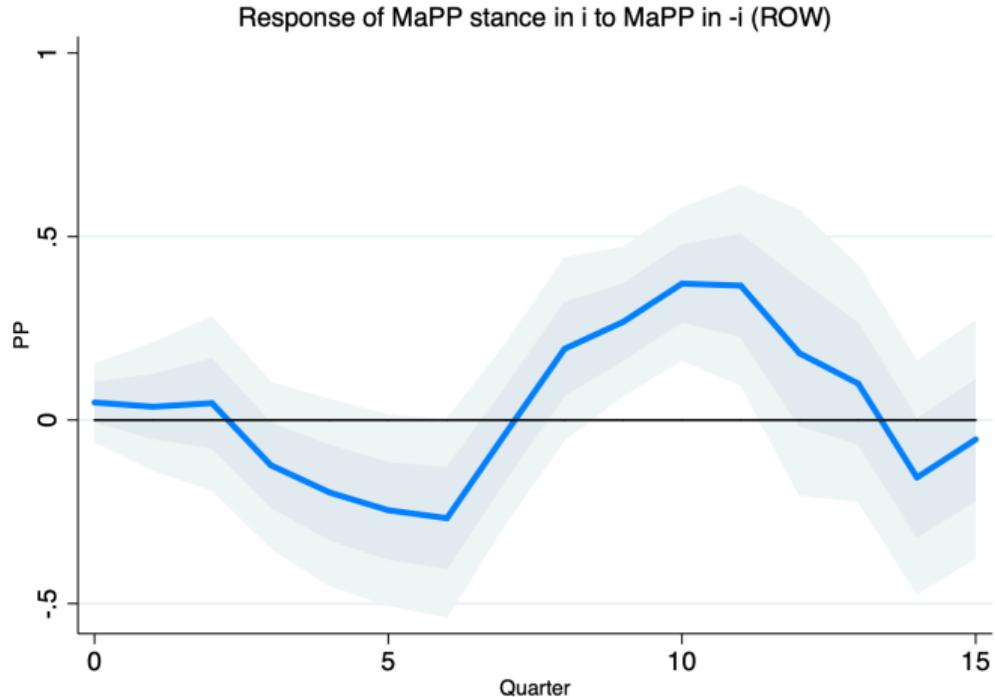
- Each point in the IRF tells us the expected level of the MaPP indicator  $h$  quarters ahead relative to  $t - 1$
- the MaPP indicator used is the 4 quarter rolling sum of the policy actions.
- Thus, a response today, would persist in following quarters without indicating additional policy actions.
- Can interpret as several rounds of responses if separation between reactions is long or if change persists for long.

Examples: IRF in **black**: reaction implies implementing a full tightening once, and **blue**: tightening in two stages.



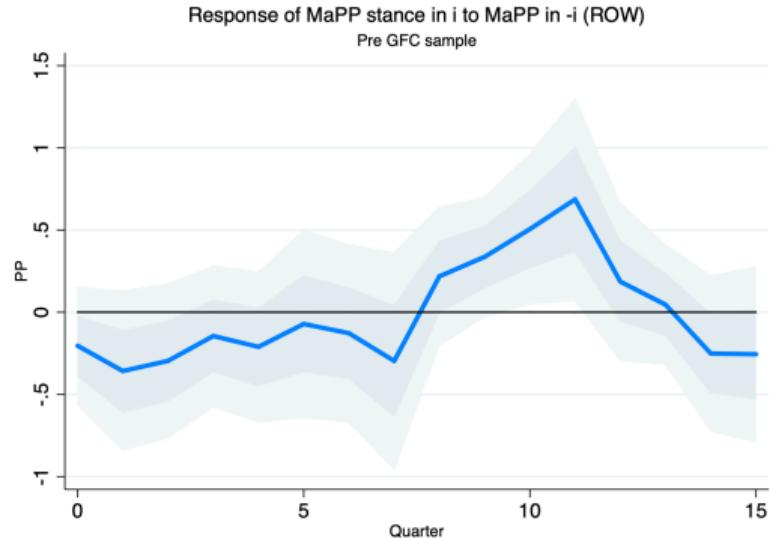
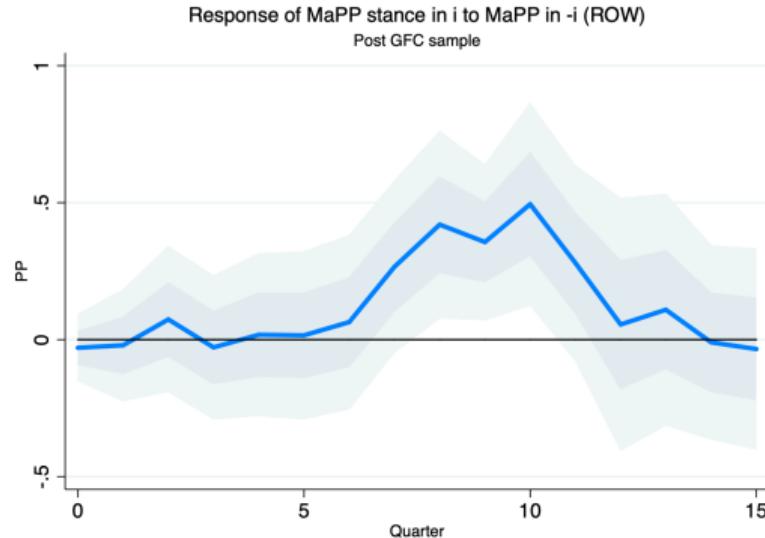
## RESULTS - Dynamic Policy Reaction

# All Instruments, All Countries



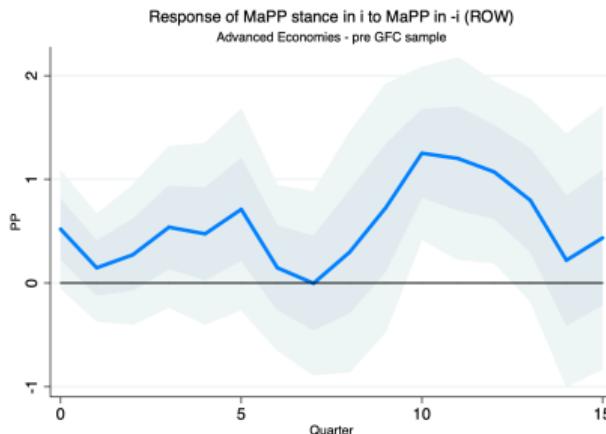
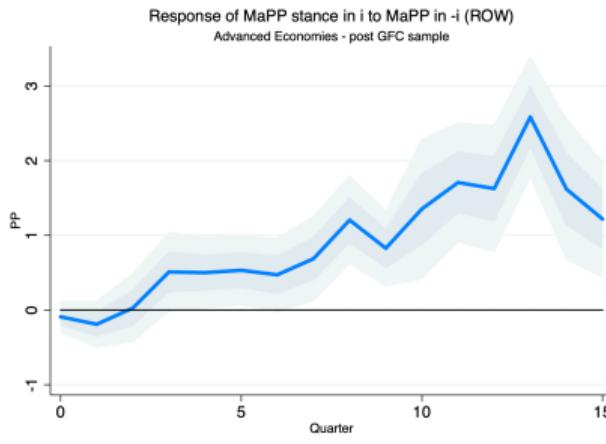
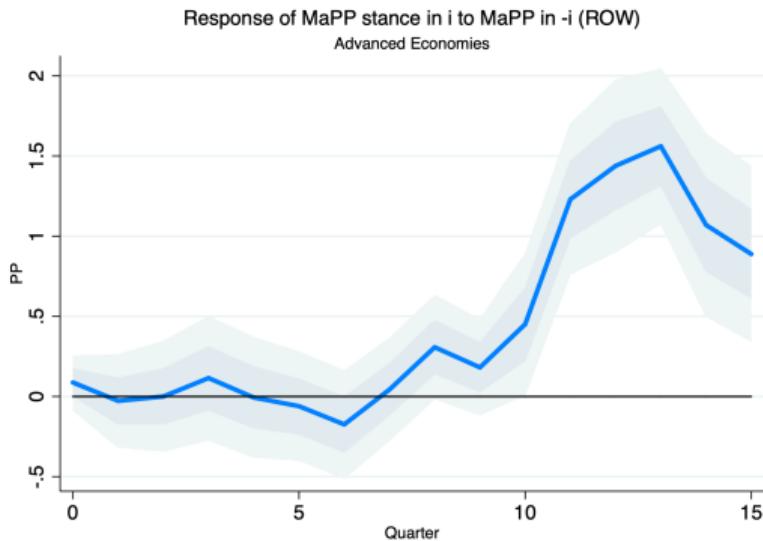
- Policy reaction is **positive** on average.
- A tightening in ROW → local tightening adjustment
- Response more resembling of post GFC data.
- Caveat: this IRF averages over many features (tools, periods, type of country reacting, type of ROW)  
↳ disentangled later

# All Instruments, All Countries - Subsample Periods



Delayed and more persistent reaction: more resembling of post GFC data.

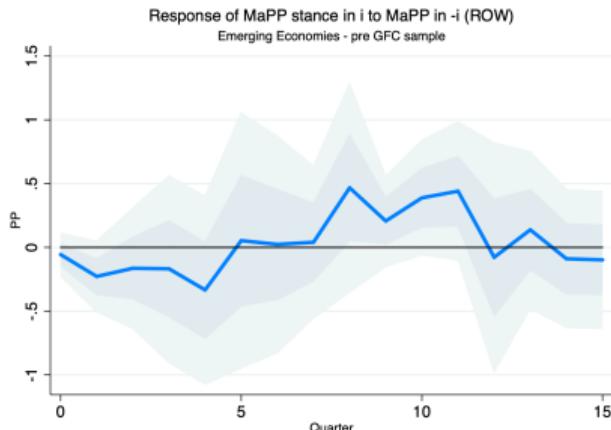
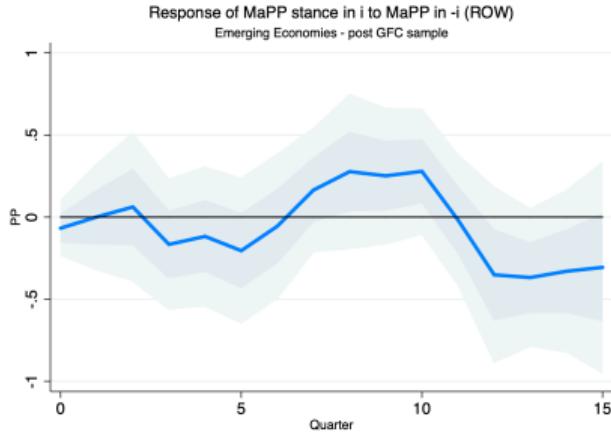
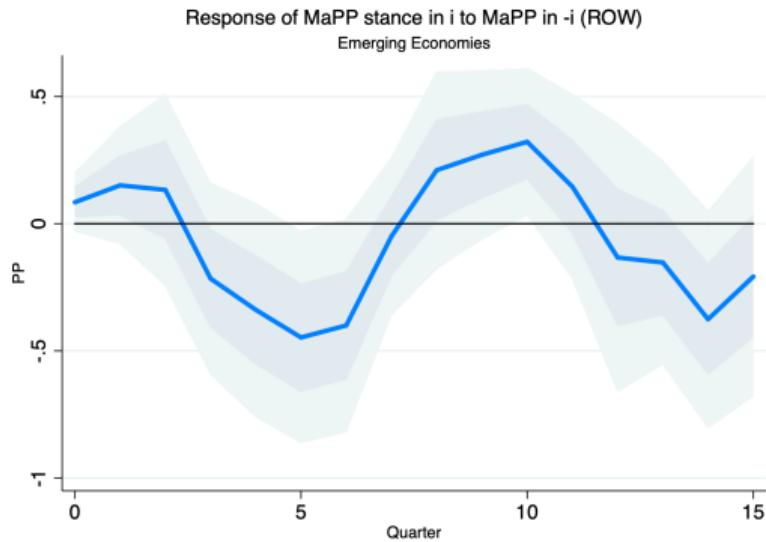
# All Instruments, Advanced Economies



Sustained positive response. Present in subsamples.

But **stronger reaction** in Advanced Economies

# All Instruments, Emerging Economies

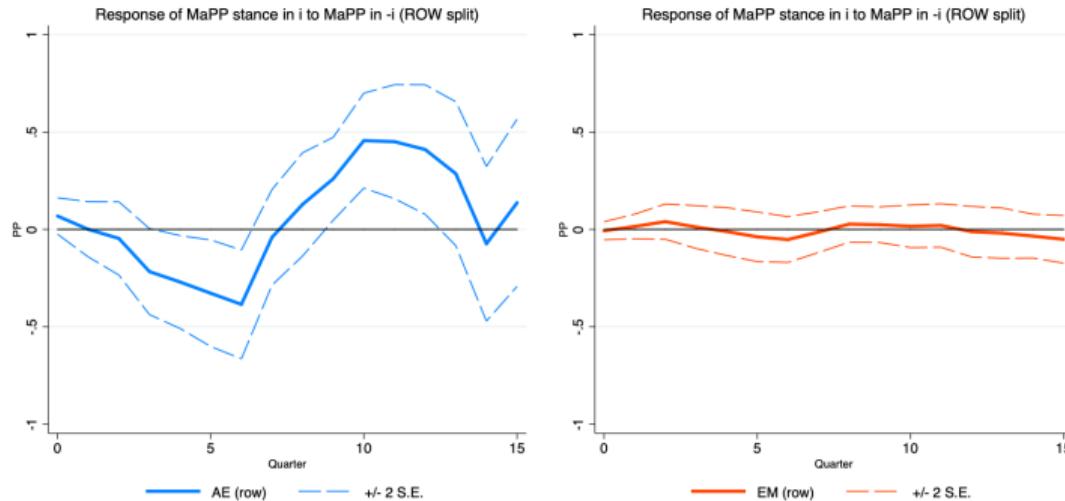


On average: No effect on Emerging Economies

## Splitting the Rest of the World

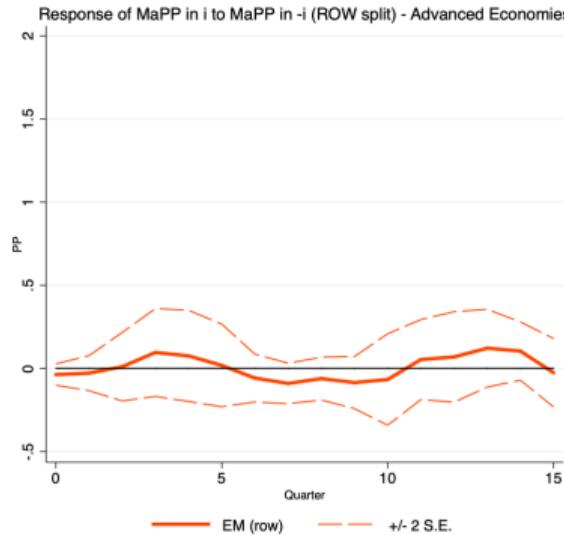
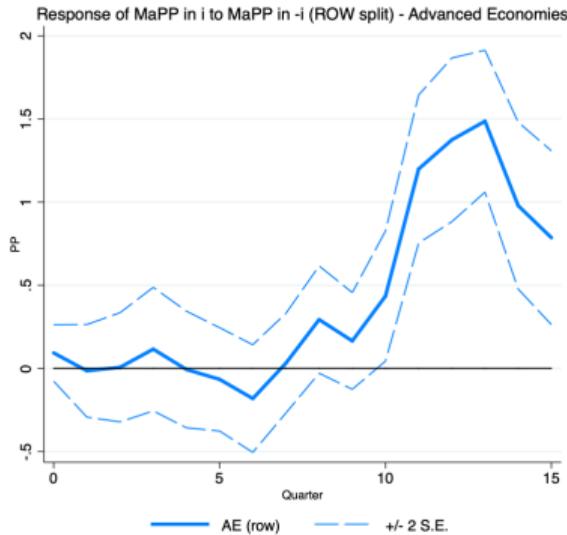
We can consider the policies in the ROW separately to gauge whose policy effects are relevant and for whom:

$$MaPP_{i,t+h} - MaPP_{i,t-1} = \alpha_i^{(h)} + \beta_1^{(h)} \Delta MaPP_{-i,t}^{AE} + \beta_2^{(h)} \Delta MaPP_{-i,t}^{EM} + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h}$$



Mixed sign pattern for response to AE policies → Need to dig further.

## ROW Split - Advanced Economies

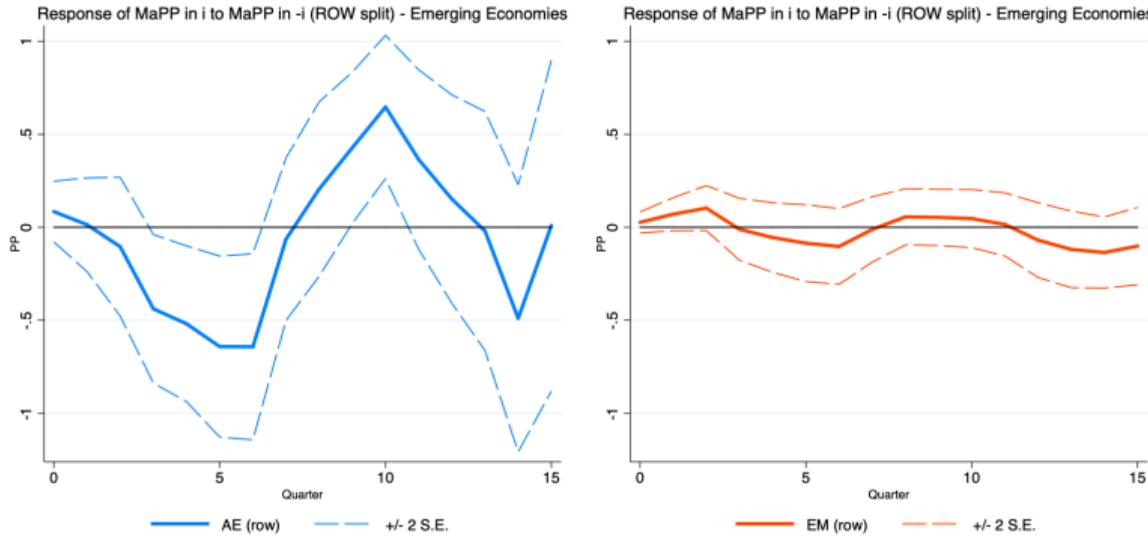


Positive Domestic AE to Foreign AE policy reaction.

No response to EME policy changes

subperiods

## ROW Split - Emerging Economies



subperiods

Negative Domestic EM reaction to AE prudential policies

Potential Policy Free-Riding Incentives

## How reasonable are these reactions?

Both a positive and negative policy reactions can be related to empirical literature findings:

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**Positive response:** foreign tightening may generate regulation arbitrage efforts by banks with global activities.

- Banks compensate the policy effects abroad by increasing intermediation in domestic country
- Destabilizing effects of financial intermediation are partially exported
  - e.g. (Aiyar, Calomiris, and Wieladek, 2017, JMCB) for US to UK case.
- Local may regulators respond by tightening their tools too.

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**Negative response:** ROW tightening effects on financial stability can leak to local economy.

- Foreign tightening takes place and banks adjust balance sheets as intended.
- The stabilizing effect leaks to other economies through subsidiaries of regulated bank.
- Case of Spain and Mexico through regulations affecting BBVA (Tripathy, 2020, JIE)
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Both related to struggle between global nature of banking vs. local scope of regulation.

These effects can co-exist through different regulations/tools → disentangle ROW effect by type of policy tool

## Effect by types of Instruments

It's feasible that some countries care more about certain tools, implemented in some countries, periods, etc ...

Hence, we should break down the effect by type of tools too.

Classifications Considered:

### 1. Borrower and Lending (financial institutions) tools (Claessens, Cerutti, Laeven, 2017)

- **Borrower:** Loan-to-value (LTV), Debt-Service-to-Income (DSTI)
- **Financial Institutions (Lender):** The rest

### 2. Capital, Asset-side, Liquidity and Foreign Currency tools (ECB 2019, BIS 2012)

- **Capital:** Counter-Cyclical Capital Buffer, Capital Conservation Buffer, Capital Requirements, Leverage Limits, Loan Loss Provisions, SIFI (too-big-to-fail banks).
- **Asset-side:** limits on Credit Growth, Loan Restrictions, LTV, DSTI, Tax
- **Liquidity and Foreign Currency:** Liquidity Requirements, Limits on Loan-to-Deposit ratio, Limits on Foreign Exchange Positions, Limits on Foreign Currency Lending, Reserve Requirements.

# Classification 1: Borrower and Lender tools

## Approach for separate effects

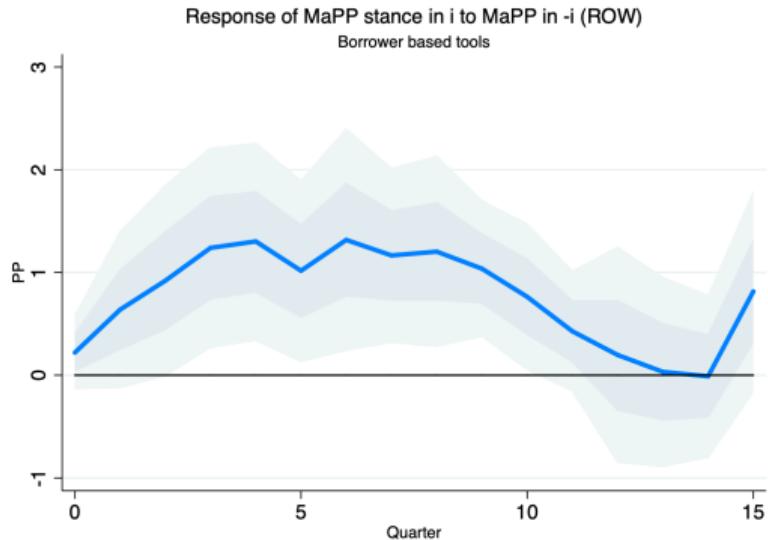
$$\Delta MaPP_{i,t+h} = \alpha_i^{(h)} + \beta_1^{(h)} \Delta MaPP_{-i,t}^{\text{Borrow}} + \beta_2^{(h)} \Delta MaPP_{-i,t}^{\text{Lender}} + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h}$$

$\beta_1^{(h)}$ : Domestic response to tightenings of Foreign **Borrower** tools

$\beta_2^{(h)}$ : Domestic response to tightenings of Foreign **Lender** tools

In additional exercises I also split the ROW into EM and AE tools, in such case there are four types of policy on RHS.

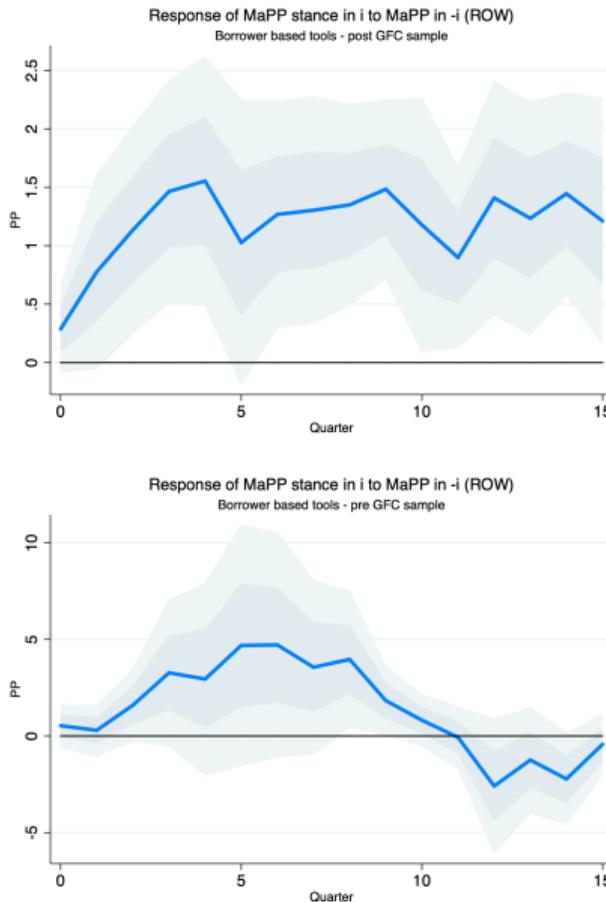
## Borrower tools - Model for All Countries



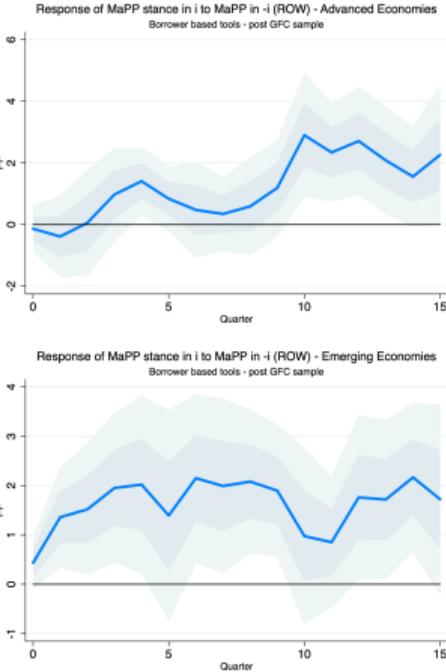
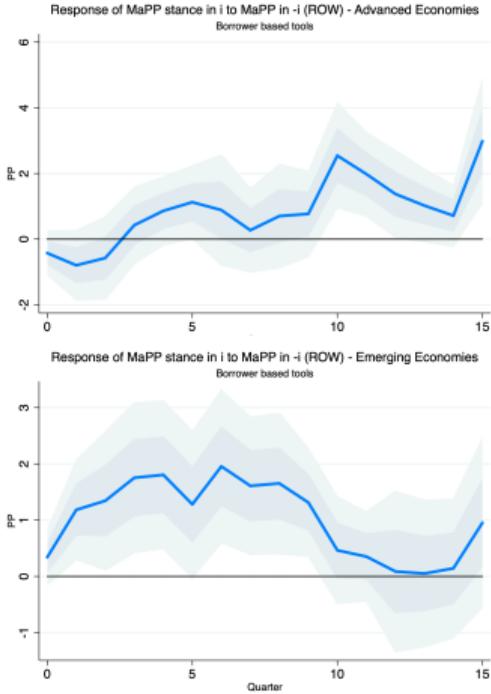
Positive effect as in baseline.

Captured only by post-GFC behavior

Split ROW



## Borrower - Models for Groups of Countries



- Positive reaction by each type of economy (AE, EM)

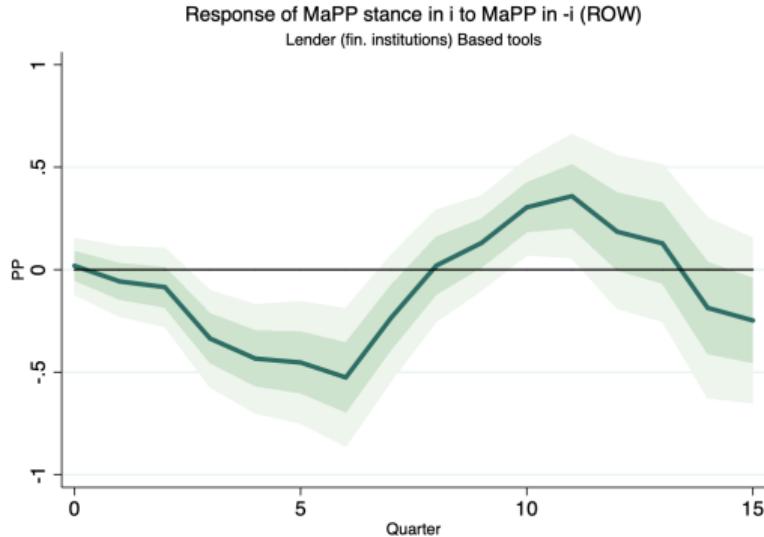
Not shown here:

AE react only to policies in foreign AE.

EME reacts to both, positively and more strongly to AE policies.

Split ROW

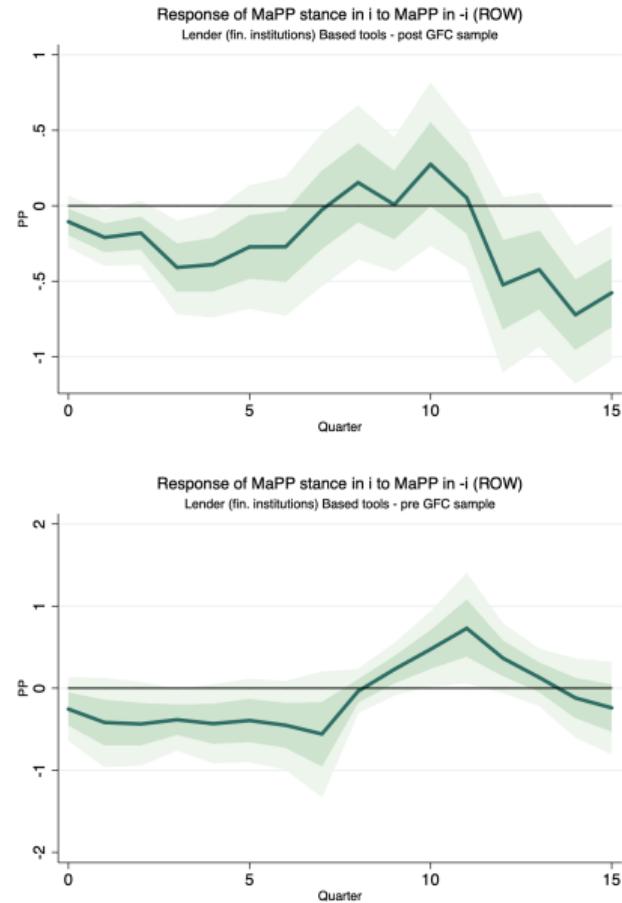
# Lender tools - Model for All Countries



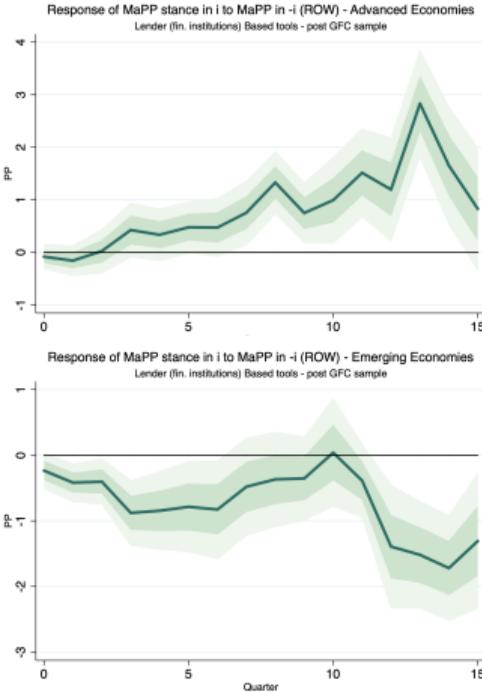
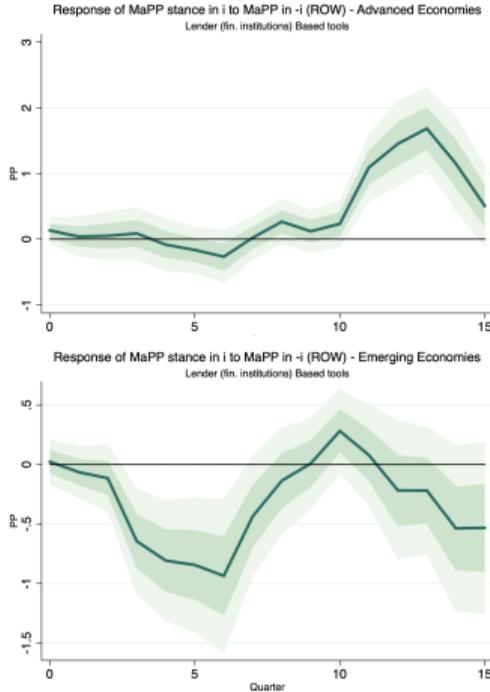
**Mixed sign pattern** in response to lenders

Not shown here: Mixed sign associates to response to AE tools.

Split ROW



# Lender tools - Models for Groups of Countries



- Policy reaction in AE is positive and stronger for recent data.
- Negative reaction (pol. relaxation) shows up in EM

Not shown here:

- EM tools react negatively only to AE policies.
- EM-to-EM reaction is positive as in baseline.

Split ROW

## Classification 1: Borrower and Lender tools - Summary

- Positive (strong) responses implemented by AE for any tool.
- In contrast **EM adjusts reaction depending on origin** of foreign policy
  - Negative reaction to AE Lender tools' changes
  - Positive reactions to tightenigs in foreign EM
- Dynamic of responses are captured better by post GFC data.

**Table:** All sub-sample results (summary)

<b>Response to</b> $\Delta MaPP_{-i,t}$	All Countries			Advanced Economies			Emerging Economies		
	ROW All	ROW AE	ROW EM	ROW All	ROW AE	ROW EM	ROW All	ROW AE	ROW EM
<b>Full Sample</b>									
Borrower	+	+	+	+	+	-	+	+	+
Lender	-	+,- net o		+	+		-	-,+	+
<b>Post GFC</b>									
Borrower	+	+	+	+	+		+	+	+
Lender	-			+	+		-	-	
<b>Pre GFC</b>									
Borrower					+				
Lender				+	+	-		+	

## Classification 2: Capital, Asset, Liquidity and FX flows

## Approach for separate effects

$$\Delta MaPP_{i,t+h} = \alpha_i^{(h)} + \beta_1^{(h)} \Delta MaPP_{-i,t}^{\text{Capital}} + \beta_2^{(h)} \Delta MaPP_{-i,t}^{\text{Asset}} + \beta_3^{(h)} \Delta MaPP_{-i,t}^{\text{Liquidity}} \\ + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h}$$

$\beta_1^{(h)}$ : Domestic response to tightenings of Foreign **Capital** tools

$\beta_2^{(h)}$ : Domestic response to tightenings of Foreign **Asset-side** tools

$\beta_3^{(h)}$ : Domestic response to tightenings of Foreign **Liquidity and FX flows** tools

Recap:

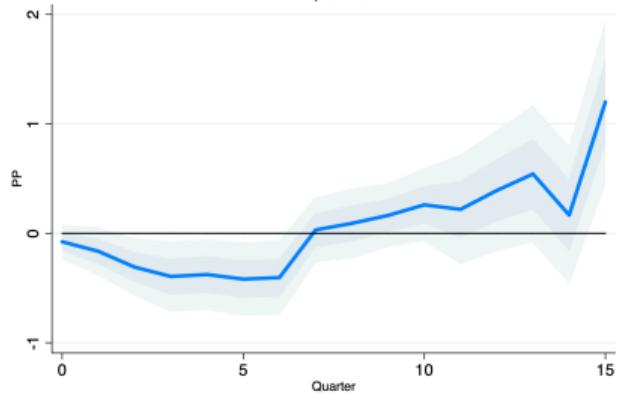
Capital tools → Financial sector Resilience

Asset-side → Global Financial Cycle

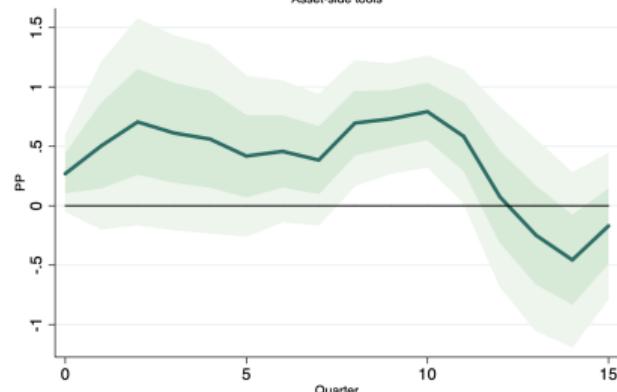
Liquidity and FX flows → Insolvency, liquidity risk.

## Capital tools - Model for All countries

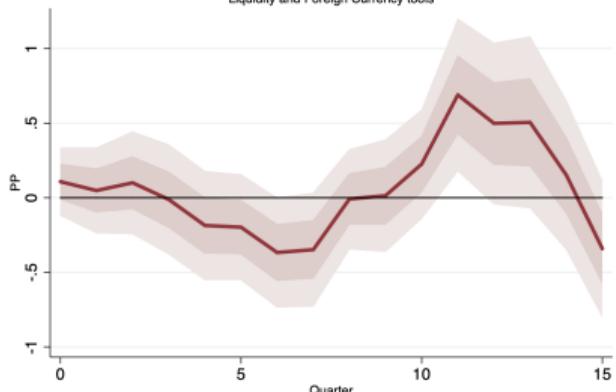
Response of MaPP stance in  $i$  to MaPP in  $-i$  (ROW)  
Capital tools



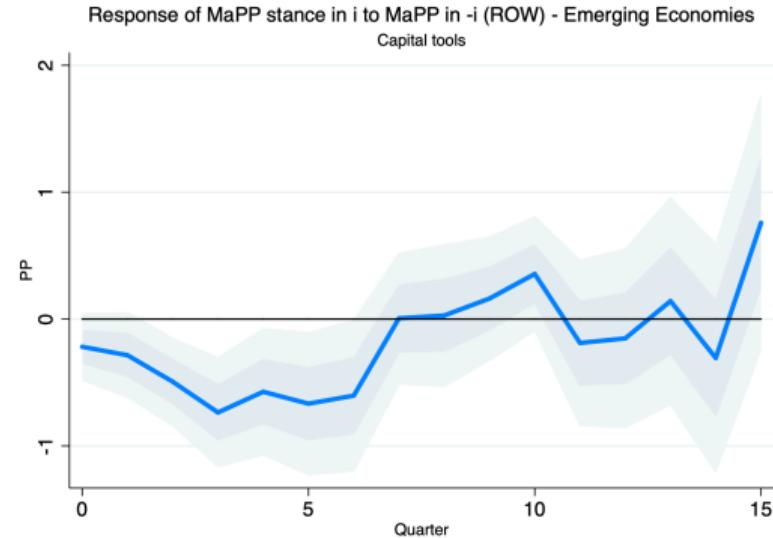
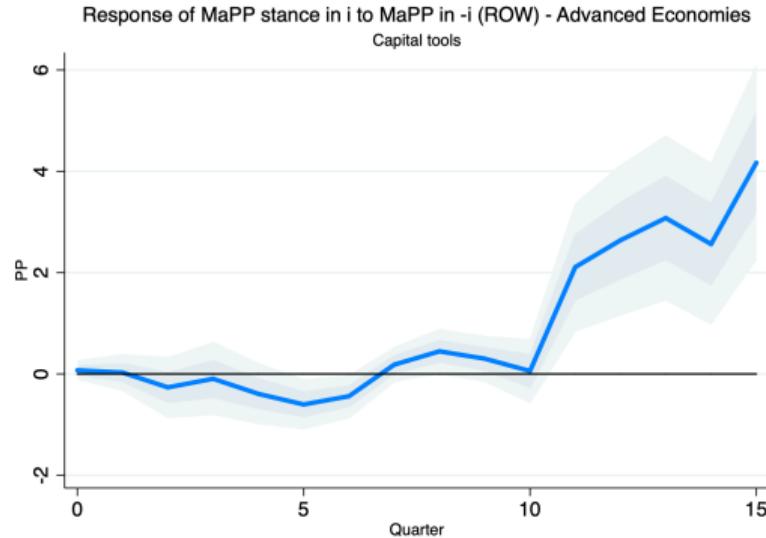
Response of MaPP stance in  $i$  to MaPP in  $-i$  (ROW)  
Asset-side tools



Response of MaPP stance in  $i$  to MaPP in  $-i$  (ROW)  
Liquidity and Foreign Currency tools

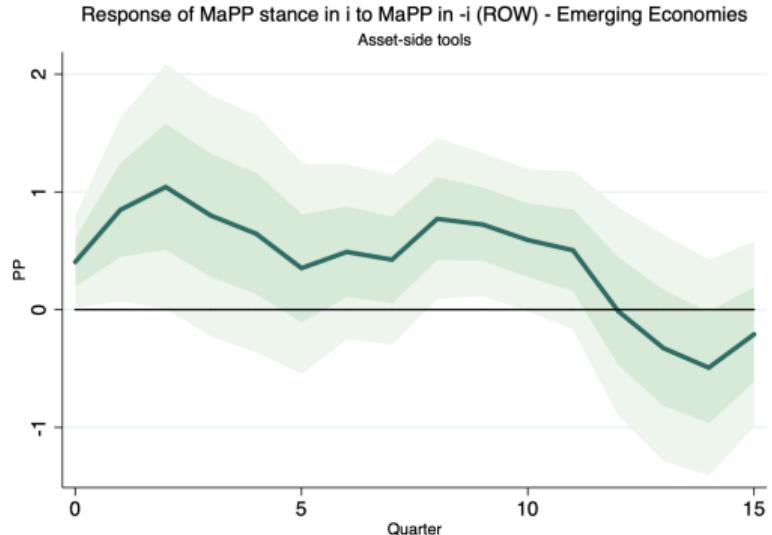
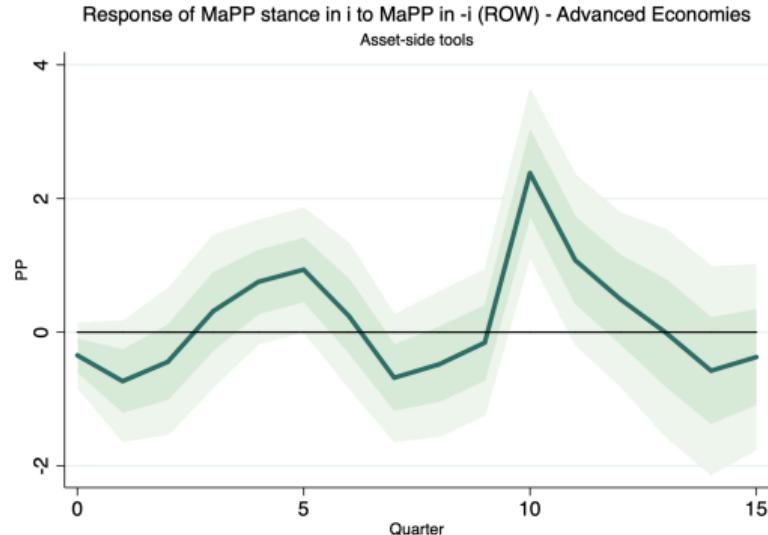


## Capital tools - By Country Groups



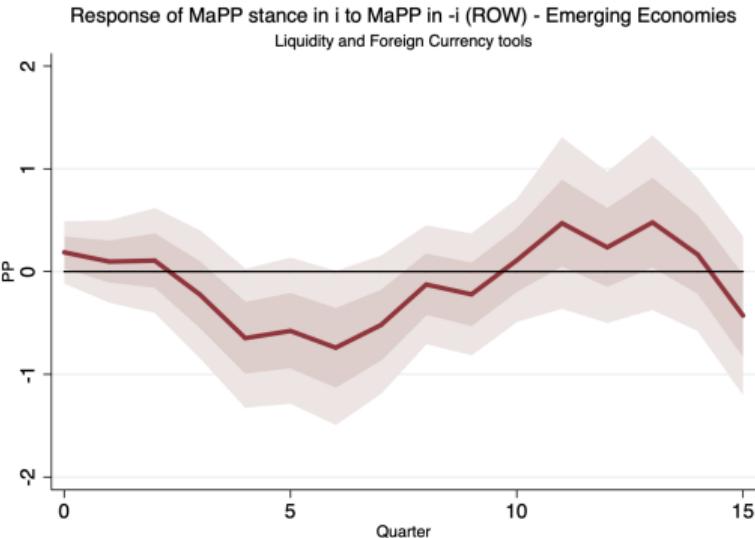
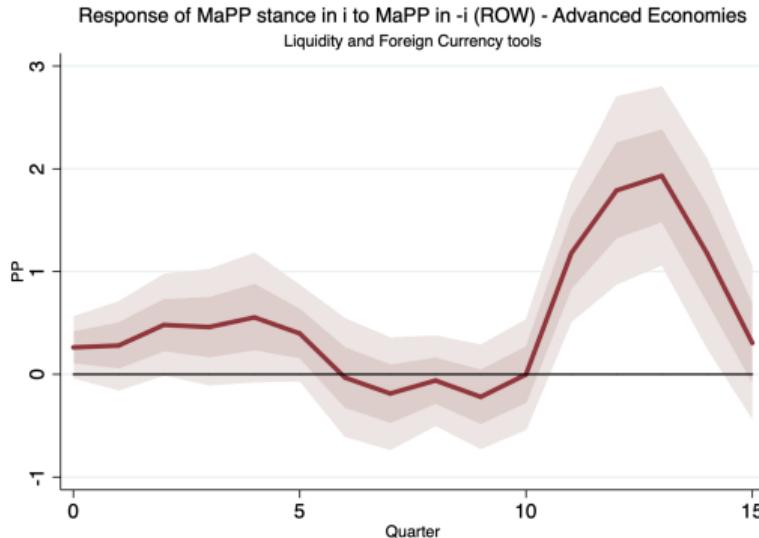
- **Negative Reaction can be tracked down to Emerging Economies** (relax policy in response to foreign tightenings)
  - They rely on Policy Effects from Advanced Economies (negative reaction to AE capital policies)
  - The reaction by AE is positive as in the baseline

## Asset tools - By Country Groups



- Positive policy response for Asset-side tools (LTV, Credit Growth Cap, ...)
- **Interpretation:** AE and EM care about shielding their markets from the Global Financial Cycle

## Liquidity tools - By Country Groups



- Positive policy response only by Advanced Economies
- Concerns about Insolvency risk gained traction in AEs after interbank markets failure in the GFC

## Classification 2: Capital, Asset, Liquidity and FX flows tools - Summary

- Policy response in AE largely positive for all instruments. Specially in reaction to other AE' policies.
- In contrast, **EM relax policy stance** in presence of tightenings of **capital tools in AE**
- But also react positively (**tighter stance**) to **tightenings in Asset tools in EM** (regional pattern)  
(for Global Financial Cycle issues, regional effects in EM may matter more)

**Table:** All sub-sample results

Response to $\Delta MaPP_{-i,t}$	All Countries			Advanced Economies			Emerging Economies		
	ROW	ROW (split)	ROW	ROW	ROW (split)	ROW	ROW	ROW (split)	
	All	AE	EM	All	AE	EM	All	AE	EM
<b>Full Sample</b>									
Capital	-	-, +		+	+	+	-		
Asset	+	+	+	+	+	-	+		+
Liquidity	+	+	-	+	+	+		+	
<b>Post GFC</b>									
Capital	-	+		+	+	-	-	-	+
Asset	+			+	+	+	+		+
Liquidity		+	+	+	+	+			-
<b>Pre GFC</b>									
Capital		-				+			
Asset	+			+					
Liquidity	+	+		+	+	-		+	

## Conclusions

- We studied the **empirical policy reaction** of financial regulators facing macroprudential policy changes in the ROW.
- The average reaction is **positive**: (to tighten in response to tightenings)
- But EMEs react negatively for changes in some instruments of Advanced Economies.

Important to disentangle the reactions by type of policy, tool and period:

- The policy reactions are usually stronger for Post GFC data, also when reacting to AE policy changes
- The countries reacting more strongly are the Advanced Economies too → **strong AE-to-AE effects**
- Responses to EME policies are not as common. But may arise, by AEs and EMEs.
- Then there are patterns of **regional and global** policy interactions.

Potential **Scope For Coordination** (cooperation):

- **In general**: for positively related tools → risk of excessive regulatory activity (race to the bottom)
- **Regionally and for selected tools**: a negative reaction → suboptimal level of regulation (free riding)

## Conclusions (cont.)

BUT ...

Stating whether the policy-to-policy adjustments imply Welfare Gains from Coordination goes beyond the scope of this empirical study.

- That is a normative statement and requires a normative approach (welfare accounting) (e.g. done in Granados (2021))
- e.g. these results may be part of an Efficient Cross-Country policy adjustment mechanism (Korinek, 2019)
- But these **effects are still a necessary condition** for International Coordination Gains (just not sufficient).

In what way they can be consistent with theoretical contributions?

► Cross-Border GEQ Spillovers in a model

Gains from limiting regulatory activity: Granados (2021a,b), Korinek (2019), Davis and Devereaux (2021)

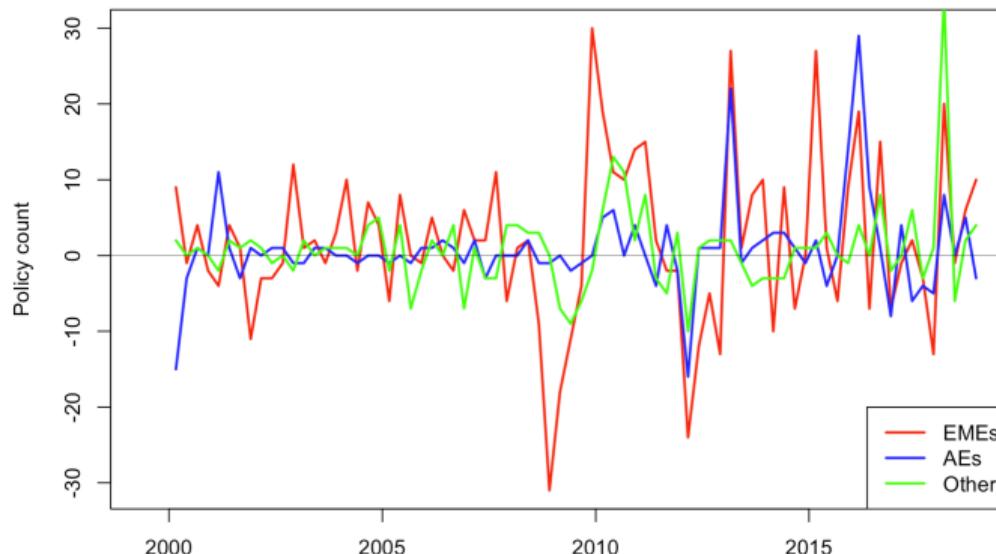
Gains from increasing regulatory activity: Kara (2016)

# Appendix

# Annual Policy Stance

## Change in Macroprudential Policy Stances

First Difference of the four quarters cumulative policy

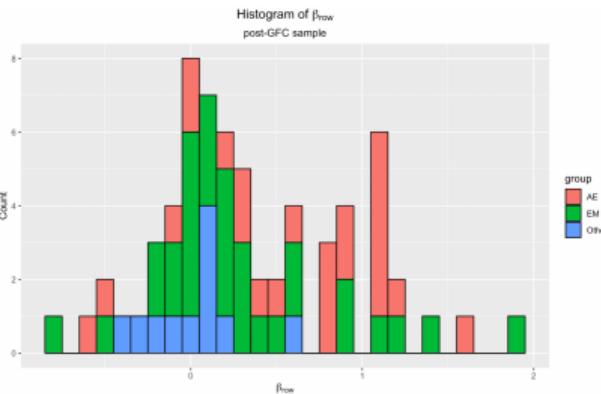
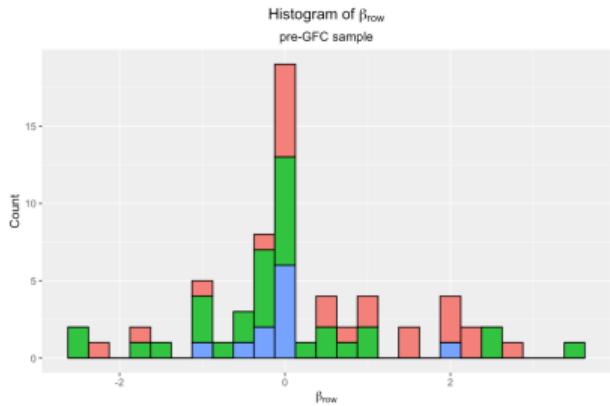
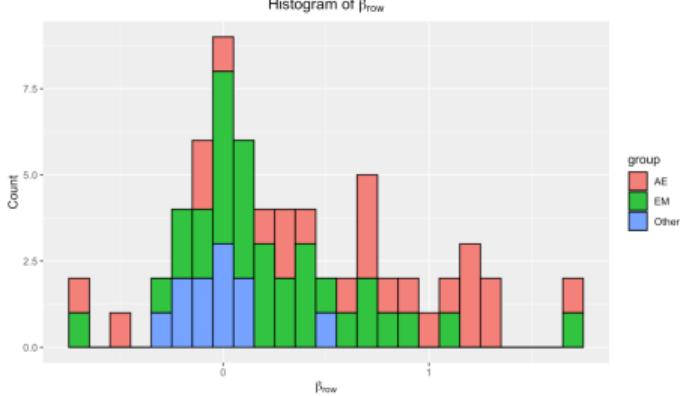


Source: IMF-IFS and BOP statistics.

Correlations: Pre-GFC:  $\text{Corr}(AE, EM) = 0.298$  Post-GFC:  $\text{Corr}(AE, EM) = 0.862$

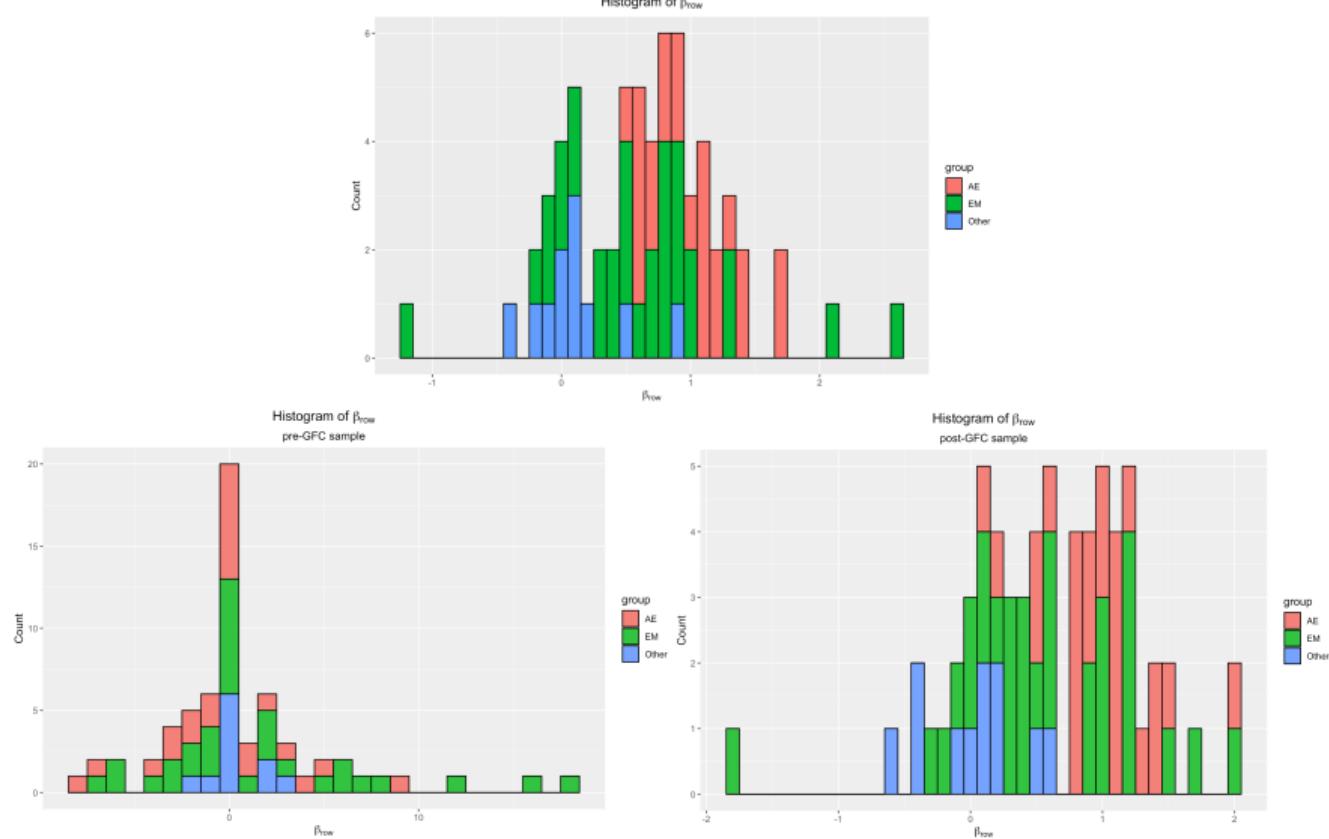
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# Country wise-regressions - model for annual policy (4 quarter sum) in differences



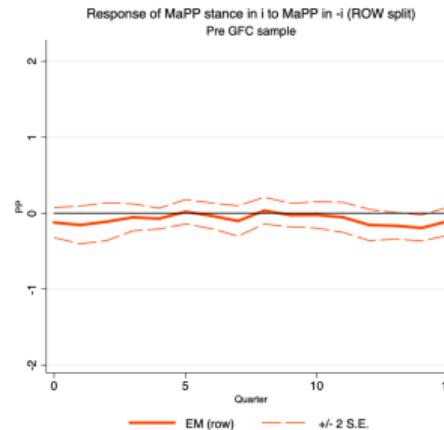
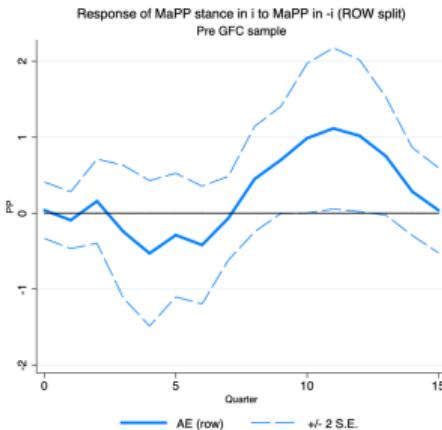
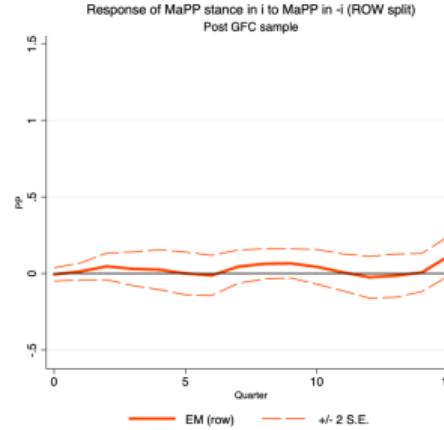
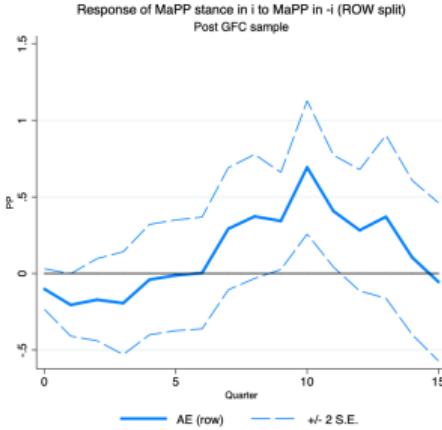
Source: IMF-IFS and BOP statistics.

# Country wise-regressions - model for annual policy (4 quarter sum) in levels



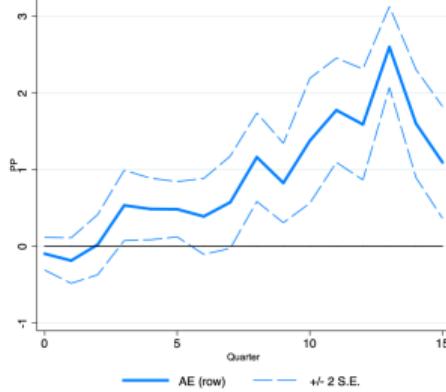
Source: IMF-IFS and BOP statistics.

# ROW Split - Subsample periods

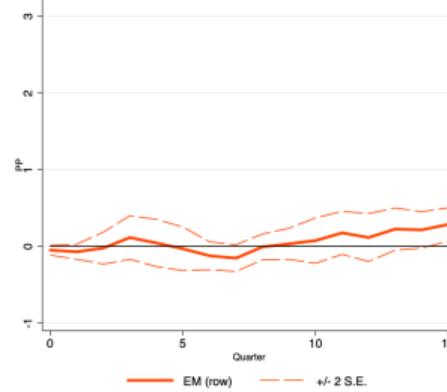


# ROW Split - Advanced Economies

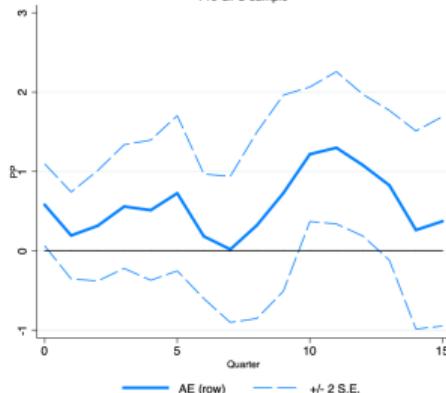
Response of MaPP in  $i$  to MaPP in  $-i$  (ROW split) - Advanced Economies  
Post GFC sample



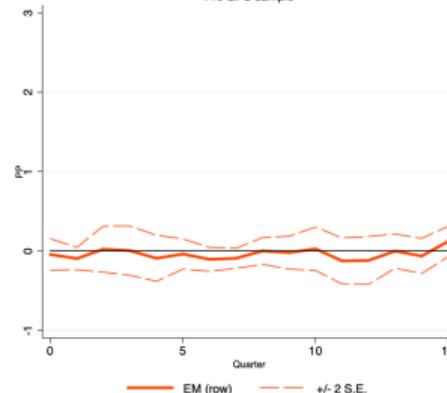
Response of MaPP in  $i$  to MaPP in  $-i$  (ROW split) - Advanced Economies  
Post GFC sample



Response of MaPP in  $i$  to MaPP in  $-i$  (ROW split) - Advanced Economies  
Pre GFC sample

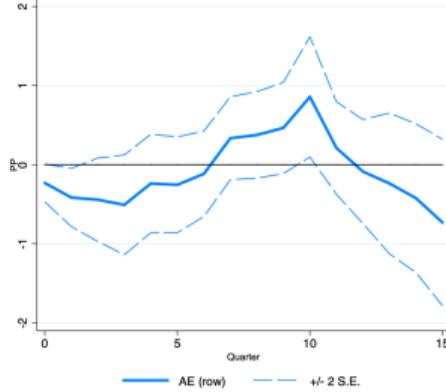


Response of MaPP in  $i$  to MaPP in  $-i$  (ROW split) - Advanced Economies  
Pre GFC sample

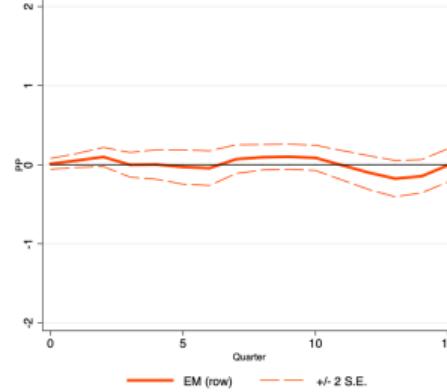


# ROW Split - Advanced Economies

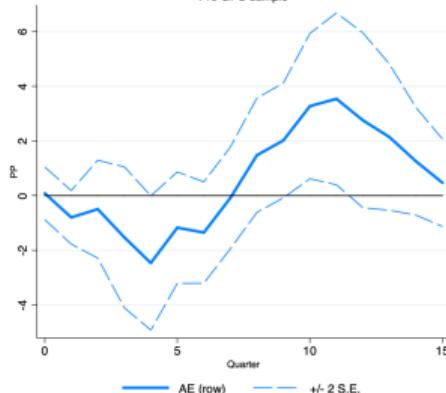
Response of MaPP in  $i$  to MaPP in  $-i$  (ROW split) - Emerging Economies  
Post GFC sample



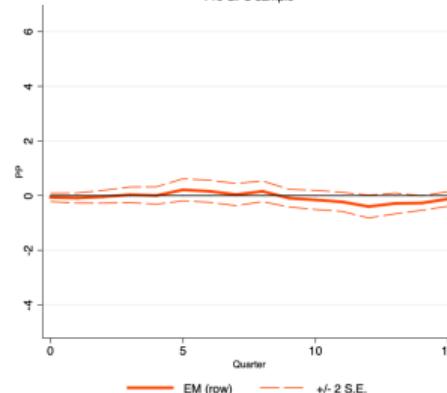
Response of MaPP in  $i$  to MaPP in  $-i$  (ROW split) - Emerging Economies  
Post GFC sample



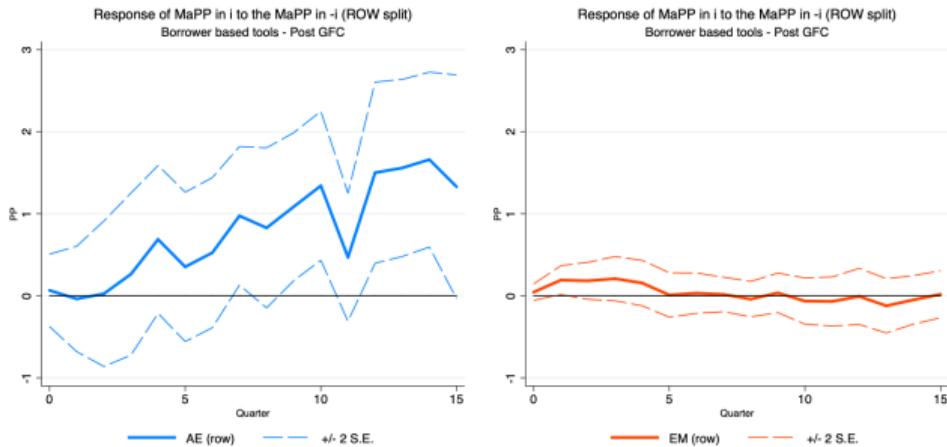
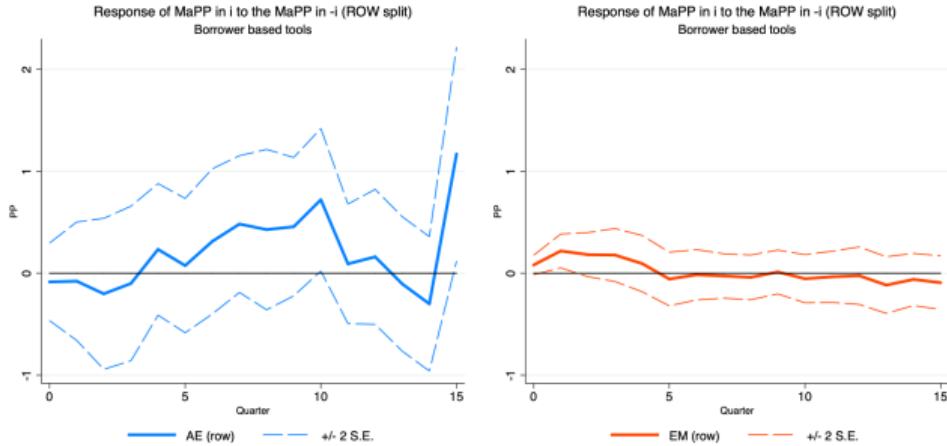
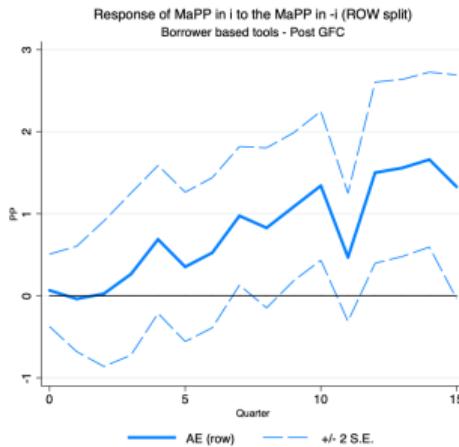
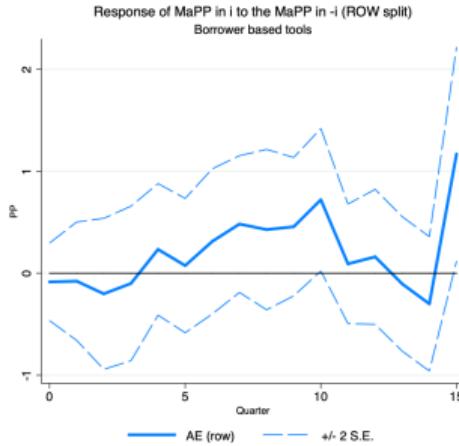
Response of MaPP in  $i$  to MaPP in  $-i$  (ROW split) - Emerging Economies  
Pre GFC sample



Response of MaPP in  $i$  to MaPP in  $-i$  (ROW split) - Emerging Economies  
Pre GFC sample



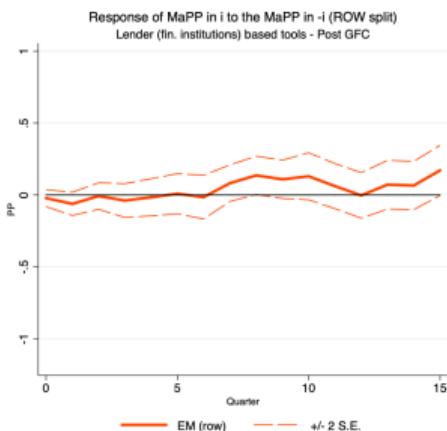
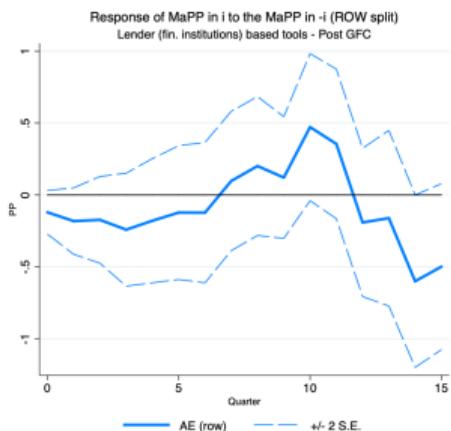
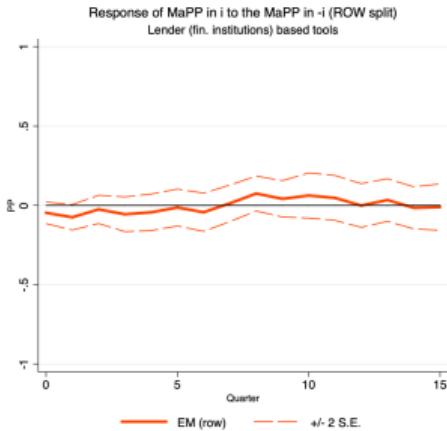
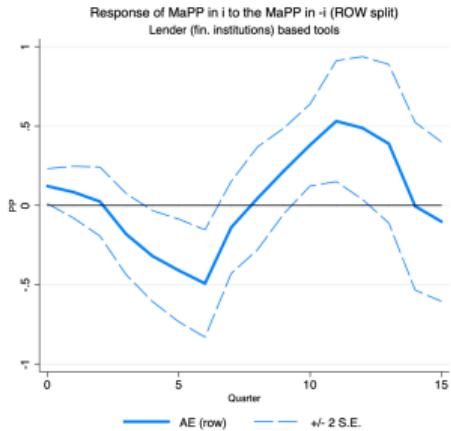
# Borrower - Split ROW



- Positive response to both AE, EM
- Higher magnitude of responses to AE tools
- Responses explained by post-GFC data.

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# Lender - Split ROW

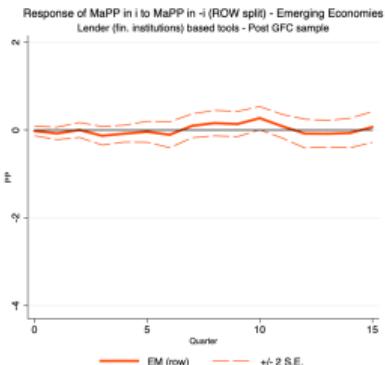
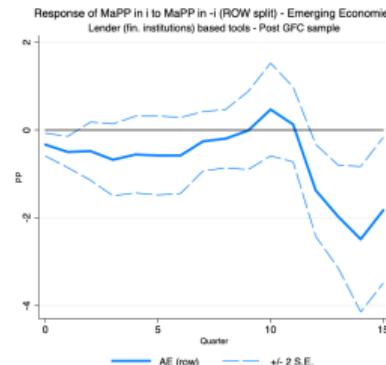
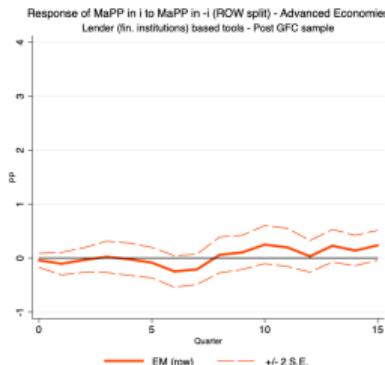
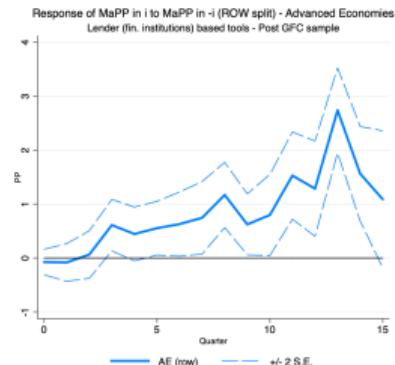
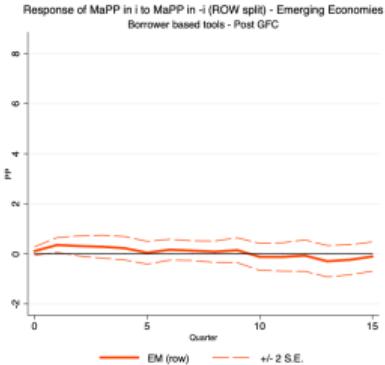
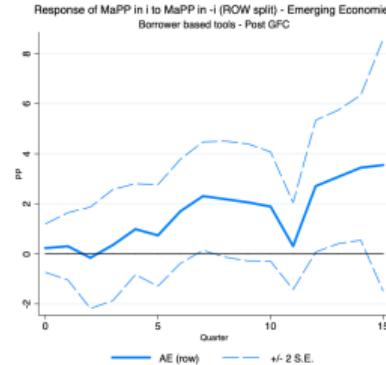
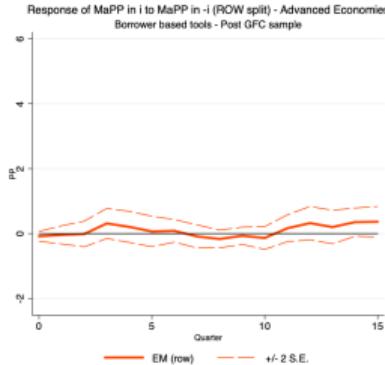
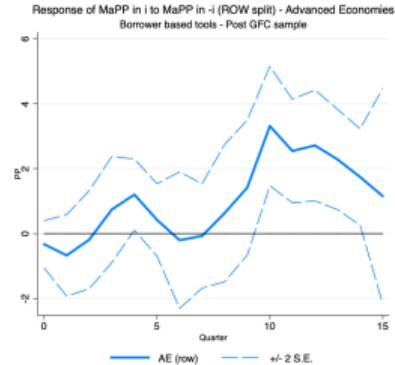


- Mixed sign for response to AE Lender tools.

- No response to EM tools.

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# Borrower and Lender - Models for Advanced and for Emerging economies - Split ROW



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[back to Lender](#)

## A small 3-period model

As an initial approximation I set a toy model to analyze the main mechanisms at play.

Three periods ( $t = \{1, 2, 3\}$ ) and Three country model, with two EMEs ( $a, b$ ) and a Center ( $c$ ).

LOE setup: Each economy has a size  $n_i$  with  $i = \{a, b, c\}$  and  $\sum_i n_i = 1$  and  $n_c \geq \frac{1}{2}$

Production takes place by aggregating capital.

Initial capital is given, after that the banks intermediate it → 2 periods of intermediation.

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. <b>Funds capital with banking loans</b>
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). Reinvest/retain profits if continuing in business <b>Subject to a costly enforcement friction ⇒ charged with a MaP Tax</b>

# Numerical exercise

Policy effect on Welfare

I solve the model for several combinations of taxes and approximate the marginal welfare effect of a MaPP tax:

Effect		Change in Macroprudential Tax			
		1%	3%	5%	8%
Direct effect of $\tau_2$	$\tau^a \rightarrow W^a$	0.146	0.144	0.142	0.138
	$\tau^b \rightarrow W^b$	0.146	0.144	0.142	0.138
	$\tau^c \rightarrow W^c$	-0.242	-0.457	-0.179	-0.027
Cross-border effect	$\tau^a \rightarrow W^b$	-0.047	-0.047	-0.047	-0.048
	$\tau^a \rightarrow W^c$	-0.016	-0.017	-0.017	-0.017
	$\tau^b \rightarrow W^a$	-0.047	-0.047	-0.047	-0.048
	$\tau^b \rightarrow W^c$	-0.016	-0.017	-0.017	-0.017
	$\tau^c \rightarrow W^a$	-0.162	-0.226	-0.180	-0.155
	$\tau^c \rightarrow W^b$	-0.162	-0.226	-0.180	-0.155
Direct effect of $\tau_3$	$\tau^a \rightarrow W^a$	0.057	0.057	0.056	0.056
	$\tau^b \rightarrow W^b$	0.057	0.057	0.056	0.056
	$\tau^c \rightarrow W^c$	-0.087	-0.122	-0.243	-0.134
Cross-border effect	$\tau^a \rightarrow W^b$	-0.018	-0.018	-0.018	-0.018
	$\tau^a \rightarrow W^c$	0.006	0.005	0.004	0.003
	$\tau^b \rightarrow W^a$	-0.018	-0.018	-0.018	-0.018
	$\tau^b \rightarrow W^c$	0.006	0.005	0.004	0.003
	$\tau^c \rightarrow W^a$	-0.051	-0.059	-0.087	-0.074
	$\tau^c \rightarrow W^b$	-0.051	-0.059	-0.087	-0.074

Note: change approximated with respect to the no-policy case as  $\frac{\Delta W}{\Delta \tau} \approx \frac{\partial W}{\partial \tau}$ .

The center has a stronger cross-country policy effect.

Positive Policy Spillover from Center taxes: EMEs may want to free-ride

Stronger Effects from **Forward Looking taxes ( $\tau_2$ )** than from **static ( $\tau_3$ )**: Why? —> retained banking profits