

Macroprudential Policy Interactions: What has Changed Since the Global Financial Crisis? *

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Abstract

We study the empirical international policy interactions between macroprudential regulators with the objective of determining whether these adjust their policies with cross-border strategic considerations in mind. For that, we analyze the policy-to-policy interactions for a panel of 65 economies using a local projection approach. Our findings suggest that domestic regulators do react in response to foreign policy changes positively and on average will tighten their domestic tools in response to stricter foreign financial regulations (tightenings). We apply additional specifications to disentangle the average policy effect and obtain that: (i) regulators react mainly to policy changes in advanced economies, (ii) the reaction to foreign policy changes is stronger in advanced economies, (iii) reactions to emerging regulations are less important, but can exist at the regional level (emerging-to-emerging). Additionally, results by type of foreign policy instruments suggest that, other than the typical positive response in our baseline, there can also be occasional loosening adjustments in emerging economies after foreign policy tightenings of some prudential instruments. Our results point to the existence of important policy interactions that can create the scope for coordinated policy frameworks aimed to mitigate inefficiencies in the level of macroprudential interventionism.

JEL Codes: F38, F42, E44, G18

Key words: Macroprudential Policies, International Policy Interactions, Global Financial Cycle.

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1 Introduction

Do countries adjust their macroprudential policies in presence of foreign regulatory changes for strategic purposes? We investigate whether this is the case for advanced and emerging economies, focusing on the change of these potential policy interactions after the Global Financial Crisis.

The macroeconomic effects of prudential regulations have been studied actively since the onset of the Global Financial Crisis. In that effort, a consensus has been reached suggesting these policies are effective on their targets ([Cerutti et al. \(2017\)](#), [Akinci and Olmstead-Rumsey \(2018\)](#), [Claessens et al. \(2013\)](#), [Aikman et al. \(2019\)](#)), but also imply unintended policy leakages and external effects that can be detrimental for agents outside the financial system ([Richter et al. \(2019\)](#), [Boar et al. \(2017\)](#), [Aikman et al. \(2016\)](#)). This property of the prudential tools generates a trade-off for regulators between financial stability and other desired features for policymakers (e.g., macroeconomic growth), and because of that, a key emphasis of macroprudential regulation relates the application of the appropriate but least necessary level of interventions.

Simultaneously, these external effects can extend to other economies ([Buch and Goldberg \(2017\)](#), [Forbes et al. \(2017\)](#)), and as suggested by [Forbes \(2020\)](#), these leakages can mitigate the effectiveness of these policies or even generate new vulnerabilities. In light of that, it can be natural for a domestic regulator to adjust its own policies, not only in response to the local and global fundamentals, but also strategically as a function of foreign policy dynamics. We refer to such cross-border reaction, that is not based on the observed state of fundamentals, as international policy interactions.

Verifying the presence of these policy-to-policy interactions can be relevant as these may constitute a critical feature for the design and evaluation of regulation. Such effects may imply important departures between the actual and intended outcome of policy and may become a source of economic inefficiency, for example, in the case that countries engage in international feedback loops with their instruments that lead to excessive interventionism.

With this in mind, we use a local projection approach to estimate the empirical domestic macroprudential dynamic response to changes in the prudential policies implemented in the rest of the world after accounting for the policy response to changes in economic and financial fundamentals. In doing this, we exploit information about multiple macroprudential instruments at the cross-country level for a panel of 65 economies that include 23 advanced economies, 31 emerging economies, and 11 low income economies.

This methodology provides a flexible framework for separating the effects of a foreign policy that are intermediated by fluctuations in domestic fundamentals (policy-to-fundamentals effect) from the direct effects of changes in foreign regulations (policy-to-policy effects), and can be easily applied for a large number of specifications that vary by type of policies, of domestic economy, of origin of foreign policy and sample period.

Our main results suggest that countries tend to adjust their policies in response to policy changes abroad beyond what could be justified by the direct spillover of these foreign regulations in observed local fundamentals, i.e. a policy-to-policy interaction takes place in the sense that domestic policymakers adjust their regulations strategically and in anticipation to potential foreign policy leakages. The average reaction is positive, implying that a foreign policy tightening is followed by a local tightening adjustment. This effect can vary by the type of local economy reacting (advanced or emerging), the type of foreign country implementing the policy, the type of instrument changing abroad, and the period of reference for estimating the effect.

On the type of country dimension, there are strong reactions to foreign policies implemented in advanced economies and such response is stronger in advanced economies as well. Simultaneously, the reactions to policies enacted in foreign emerging economies is weak or null, but they can still emerge for some instrument categories for both types of economies.

The results by the type of instrument changing abroad are also revealing. They confirm the strong advanced-to-advanced policy effects but also show potential regional effects at the emerging level. Moreover, from these specifications we can also obtain that, unlike in the baseline result, the local policy reaction can be negative in some cases, implying a domestic relaxation of the regulations in presence of stricter foreign policies. This loosening reaction is tracked down to the response implemented by emerging economies to the foreign policies of advanced economies related to tools that target the financial institutions or capital requirements. In contrast, the emerging economies will react positively (as in the baseline) to policy changes in instruments related to the dynamics of the Global Financial Cycle (asset-side instruments), in this former case, the regional effect is even more relevant for emerging economies.

From these results we find evidence suggesting that country regulators indeed react strategically to the policy changes in foreign economies. The policies implemented in advanced economies will be of particular interest for any type of economy. However, the tightening-to-tightenign adjustment will generally be given in cases where regulation arbitrage is more likely to occur which is between peer or similar economies (advanded-

to-advanced or emerging-to-emerging). Unlike the regulators in advanced economies that care about any type of tool, the emerging ones will only care about the Global Financial Cycle related tools for engaging in this positive international policy feedback-loop.

For other types of tools the response of the emerging policymakers can be that of relaxing their toolkit which may indicate potential free-riding incentives of these regulators on the policy actions of their foreign advanced countries counterparts.

These policy interactions are not elicited by observable changes in fundamentals (even several periods after the foreign policy change) and can imply an additional degree of macroprudential interventionism, usually in the direction of implementing more policy tightenings, which may not be desirable from the prudential policy perspective and could imply a higher scope than expected (or implied only by prudential foreign spillovers) for improvements in the outcomes of regulations from the implementation of internationally coordinated policy stipulations.

These results are novel and help clarify the policy considerations made by regulators that internalize the effect of global banking activities and foreign macroprudential policies in their domestic financial sector. Until now, the literature had documented direct and indirect effects of these policies, which in itself justifies domestic policy adjustments based on the state of economic fundamentals, but it wasn't clear if there were additional mechanisms at work implying policy adjustments by policymakers.

Related Literature. This paper is related to the empirical studies of the effects of macroprudential policies.¹ More specifically, it relates closely to articles concerned about the external effects of the macroprudential toolkit.

These external effects can involve the real and financial sector, and more importantly for this paper, can have an international dimension. For example, [Buch and Goldberg \(2017\)](#) obtain that there are significant cross-border credit effects that spill over through the interbank lending, while [Forbes et al. \(2017\)](#) find that the volume of foreign lending itself is affected by these prudential policies. As mentioned before, this can affect the intended outcome and effectiveness of these policy tools substantially.

Related studies also suggest that the cross-border impact on the financial stability

¹Another group of contributions touch these same topics from a theoretical standpoint, both in terms of the direct effects of these policies ([Gertler and Kiyotaki \(2010\)](#), [Aoki et al. \(2018\)](#), [Farhi and Werning \(2016\)](#)), the interactions with other types of policies ([Coimbra and Rey \(2017\)](#), [De Paoli and Paustian \(2017\)](#)), and the potential cross-border policy effects and international coordination of these instruments ([Granados \(2021\)](#), [Davis and Devereux \(2019\)](#), [Korinek \(2020\)](#))

could go in different directions, i.e., after a foreign policy change, a domestic country can import the financial instability of foreign economies or it can also import part of the intended, and stabilizing effects of the regulations. An example of the latter is found in [Aiyar et al. \(2014\)](#) who study the UK case and explain how foreign banks with activities in this economy can mitigate the effect of local prudential policies by increasing their level of intermediation, which is indicative of regulatory circumvention effects (e.g., foreign countries affected by regulation attempting to compensate the policy effect by increasing activities in UK). On the other hand, an example of a positive effect is given by [Tripathy \(2020\)](#) for Mexico and Spain in 2012, where Mexico absorbed the financial stabilizing effects of policies targeting the Spanish real state sector through the activities of subsidiaries of BBVA in Mexico.

The evidence on the cross-border spillovers of these policies, as well as the potential policy interactions involving these instruments is what motivates this study, e.g., it may be reasonable to think the regulators internalize the external effects of foreign prudential policy changes in their economies and react in response by adjusting the domestic toolkit, both in response to changes in observed fundamentals, but also preemptively, in anticipation of potential policy leakages stemming from abroad. Simultaneously, the former policy incentive may lead to strategic interactions between policy makers at the cross-country level.

Despite this, and in contrast with the study of external policy-to-fundamental effects, the literature on the empirical strategic response between financial regulators (or lack thereof) is scarce, which is where our article represents a contribution.

On this front, [Agénor et al. \(2017\)](#) study the static policy response to foreign policies based on data on the usage of macroprudential tools, i.e., they study whether a country would increase their extensive utilization of prudential tools in presence of an increased use abroad and obtain a negative relationship. We complement that study, by investigating the dynamic international policy interaction effects in terms of the policy stances (and not only the usage), i.e., we account for the type of policy change (tightening, loosening), while also considering an ample number of additional specifications by type of local and foreign country, sample period, and type of policy change abroad.

2 The Macroprudential policies in the last decades

The first half of the last two decades was characterized by a deregulation of the banking sector in the advanced economies (e.g. the termination of Glass-Steagal Act of 1933 in the US) and an increase in the scale of activities of these firms in the global financial markets. The latter was reflected in a steady increase of capital flows, initially to advanced, and after the Global Financial Crisis to the emerging economies. This increase has been largely explained by portfolio investments, the most volatile type of international capital flow.

These partial change in the potential sources of risk, from advanced to emerging², was in part caused by a tightening in the financial regulation stance in the US, implemented in response to the global financial crisis experience (Frank Dodd Act of 2010) that prompted a subsequent flight of international investment flows to less regulated economies.

In this context, there have been regulatory responses in the form of updates the Basel Accords, and the establishment of several institutional bodies specifically aimed to strengthen the oversight of the international financial system (e.g. the Financial Stability Board). The revisions of the Basel accords in particular, have tried to address the shortcomings of previous versions that proved in some way or another to be unable to prevent or mitigate the effects of financial crises.

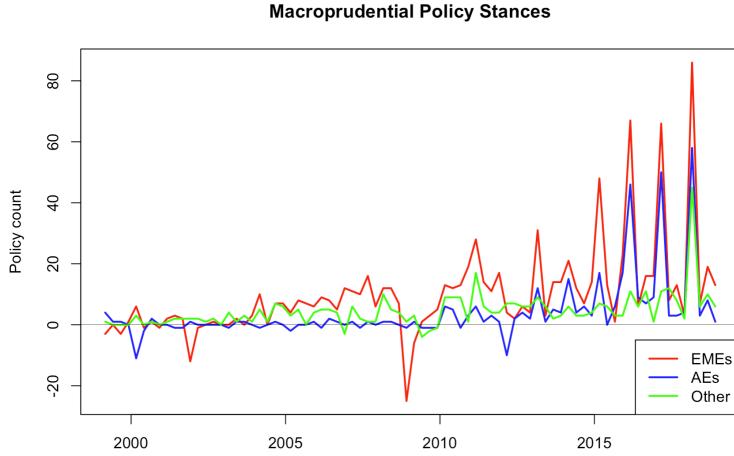
The specific drawbacks of the Basel II accord that motivated the latest update are particularly important for this study, as it relates to the failure to account for the sources of systemic risk that extend beyond the individual sustainability of a regulated bank, and whose effects are driven by the interlinks between financial firms at the national and cross-country level as well as by the global nature of the banking business. In fact, intuition could dictate that this interdependence may justify for a national regulator to look closely at the foreign regulations before setting the level of their own policy toolkit.

We can see in figure 1 the macroprudential policy responses during this period. In the left panel we show the interventions by country groups in each quarter, where a positive policy count denotes a net macroprudential tightening (i.e. a stricter stance) and negative a net loosening or a more accommodative stance.³ Before the crisis the level of regulatory activity reflected in these policy interventions was relatively small, however, after 2008 there was a steep increase in regulatory activity as well as a generalized tendency to implement less accommodative policy stances (apply more tightenings).

²For a detailed description of the change in the direction of capital flows and towards emerging see [McQuade and Schmitz \(2017\)](#)

³For example, at the start of 2015 the indicator for emerging economies takes a value of 64, meaning that these countries applied that many more tightenings across policy instruments in relation to loosenings.

Figure 1: Macroprudential Policy Stance by Country Type

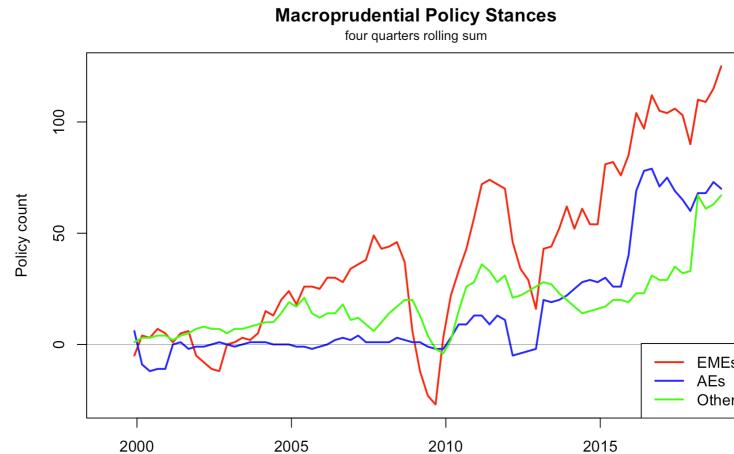


Note: Policy Indicator level. The indicator denotes the policy stance calculated by the indicators of net tightenings across policy tools, increasing by 1 for each tightening and decreasing by -1 for a loosening. At each point the policy indicators at the country level are summed by type of country.

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

The policy indicator shown above only accounts by the date of a tightening, or policy change, but afterwards may not reflect the policy stance of regulators (unless there are further changes). Because of this, to provide a better account of the policy stance over time, the literature usually focuses on the cumulative policy stance at longer horizons (e.g. [Richter et al. \(2019\)](#), or [Coman and Lloyd \(2019\)](#)). We also report such type of indicator in figure 2, where we show the annual policy stance defined as the four quarter rolling sum (current and previous three quarters) at each period. In the case of the annual policy stance we can see even more clearly the tightening pattern in the last decade.

Figure 2: Macroprudential Annual Policy Stance by Country Type



Note: Four quarter rolling sum of the quarterly indicator. The indicator measure net tightenings across policy tools by group of countries. A higher value denotes a tighter (or less accommodative) policy stance.

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

In addition to the tightening and higher interventionism patterns we could also expect these policies to co-move over time between economies and particularly so after the crisis episode, if we account for the potential regulatory arbitrage efforts that could be made by banks operating in several economies. In the appendix A we confirm that is the case. Before the crisis of 2008 these policies are virtually uncorrelated across countries, however, after that they become highly correlated. This pattern holds for both quarterly and annual indicators, and even for the average policy stances, i.e. after filtering out the effect of the increase in the number of countries using these tools which has risen steadily over time.

Now, as our aim is to analyze the cross-border policy co-movement it is more appropriate to depart from the analysis of country group aggregates, and instead exploit the cross-sectional variation at the country level of this data. However, for carrying out a country-level analysis we must construct a policy indicator for the rest of the world, from each country's perspective. This constitutes the foreign policy stance they each economy deems relevant when setting their own policy toolkit. We generate such variable based on the financial links between economies approximated by the portfolio investment position data reported by the economies in our sample, we describe the construction and data sources in more detail in the section 3.

With the policy indicator of the rest of the world we can perform a basic descriptive analysis at the country cross-section level before our main estimation. We report the coefficients of simple country regressions between the macroprudential policy stance and the policy in the rest of the world in the figure 16 in the appendix A. In absence of other controls these figures account for the covariance between the policy stance and that of the rest of the world for each country. We find that the distribution of covariances is bimodal, with some countries reporting a covariance close to zero, and the majority of economies depicting a positive coefficient around the unity. Additionally, the economies displaying no relationship are mostly in the "Other" category which are the Low Income Countries, although some emerging are also included in this group. In contrast, the majority of advanced and emerging countries show a positive relationship with foreign policies.

A similar analysis by sub-periods confirms the lack of a co-movement before the crisis, as the modal correlation is zero in every country group, while in the post-crisis sample the positive relationship between domestic and foreign policies for advanced and domestic economies is clearer.

In the sections that follow we will perform a more comprehensive empirical analysis of the cross-country relationship between these policies, both on average, but also by type of policy instruments, domestic and foreign economies, and time period.

3 Methodology and Empirical Strategy

Our objective consists in approximating the empirical policy-to-policy effects, that we also denote as "policy interactions" at the cross-border level. These refer to potential local policy adjustments made in response to foreign policies developments that cannot be explained by observable fundamentals. The existence of these effects could imply that prudential regulators also act strategically when setting their policies.

On the other hand, the effect intermediated by fundamentals may also obey to international policy spillovers but can be consistent with nationally oriented policies, for example, a local regulator may react to changes in fundamentals after these are affected by a foreign regulations. Such change in domestic policies would be just an adjustment given some observed spillovers, but does not imply that local regulators are interacting (ex-post or preemptively) with their foreign counterparts when setting their toolkit.

In this section we describe the data sources, the policy indicators, the construction of the rest-of-the-world policies, and the baseline setup used to obtain this interaction.

3.1 Data

We carry out our analysis based on quarterly data for 65 economies for the period 1999Q1 to 2018Q4. Our sample includes 23 advanced economies, 31 emerging economies and 11 low income economies, the list of countries can be seen in the table 5. Our database includes macroprudential policy variables, as well as economic and financial variables we use as controls in the estimations.

The macroprudential policies are obtained from the Integrated Macroprudential Policy Database (iMAPP) from the IMF and [Alam et al. \(2019\)](#). From this source we obtain the policy stance indicators for 17 policy tools and the level of the average Loan-to-Value for a subsample of 52 economies. We discuss the structure of the policy indicators and the specific instruments considered in the next subsection.

On the other hand, we construct a measure of the Macroprudential policy of the rest of the world from the perspective of each economy. This variable will be calculated as the weighted average of the policy instruments of the countries, with weights given by the financial links between economies that we approximate using the investment portfolio flows in the Coordinated Portfolio Investment Survey from the IMF.

The economic and financial data used as controls is obtained from several sources,

the GDP, CPI, capital flows, exchange rate, and monetary policy rate is obtained from the International Finance Statistics (IFS) from the IMF. The IFS is relatively imbalanced, then as a second step, missing data on credit and policy rates was obtained from the BIS statistics warehouse. Other missing data was obtained from [Monnet and Puy \(2019\)](#) that provide IFS consistent series for a large number of economies. Finally, at last and in some remaining cases we replaced additional available missing data from national sources, such as central banks and statistics departments.

Other variables considered were the Financial Development Index from the IMF Financial Development Database, and other global controls such as the CBOE VIX and TED spread were obtained from the St. Louis FRED.

We also adjust some monetary policy rates with zero lower bound issues by replacing them for their associated shadow rates, that can take on negative values and are constructed to reflect changes in the monetary policy stance even at times where the official rate is fixed at zero. For the US, EU, and UK, we obtained the shadow rates from [Wu and Xia \(2016\)](#), and for Japan we obtain the rate from [Krippner \(2013\)](#).

3.1.1 Macroprudential Policy Variables

We obtain a measure of the macroprudential policy stance from the iMAPP-IMF database based on [Alam et al. \(2019\)](#). The data consists on policy indicators for 17 instruments (shown in table 1). For each tool and period an indicator is calculated according the policy change observed:

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

Then, we aggregate through the available instruments and obtain the indicator of the average policy stance of the economy i at time t :

$$MaPP_{i,t} = \sum_{j=1}^{17} MaPP_{i,t}^{\text{instrument } j}$$

This indicator will take values between -17 and 17 at each date depending on the individual changes in each instrument. In that sense, the indicator can be interpreted as a measure of the net macroprudential tightenings of an economy.

It should also be noticed that although this measure accounts for the stance, it is given in terms of policy instrument changes. Which implies that a less accommodative policy stance (a tightening) may be reflected only once in the indicator. Because of that, a common practice in this literature consist on using a rolling sum of this indicator. We do that as well and focus in the 4 quarter rolling sum, meaning that in each period our policy index accounts for the annual macroprudential policy stance (current and previous three quarters).

This database is recent and improves on previously available panel data on macroprudential policies at the country level. Before, the data available consisted on an indicator on the number of instruments being used each period in an economy. In that sense, it was not possible to distinguish the policy stance, and instead policy indicator only accounted by the level of policy activity (see for example, [Cerutti, Claessens, and Laeven \(2017\)](#))

At the same time, this dataset also provides the level for one of the tools for a smaller set of countries (52 out of our 65 countries sample), that is the average Loan-to-Value. Data on the actual policy tool is even more meaningful than the policy stance indicator, as it not only accounts for the policy stance (tightening or loosening) but also for its intensity. However, the availability is limited as it abstracts from the dynamics of many tools and relates to a tool that only targets borrowers rather than financial institutions. Because of this limitation we still mainly focus on the aggregate policy indicator (and some associated instruments classifications). However, we also estimate the model for the LTV requirement as an additional exercise.

Table 1: Macroprudential policy instruments 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 (LTV)	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)	

3.1.2 Policy Indicator for the Rest of the World

As mentioned before, we want to exploit the cross-country variation of these policies rather than only analyzing the co-movement policy aggregates by type of economy. To do that, we must construct a policy indicator for the rest of the world that we can relate vis-a-vis with the policy indicator of each economy, i.e. we should have a rest-of-the-world

(ROW) indicator from the perspective of each economy and at each period of time.

Then, from the perspective of each economy i , we compute the policy of the ROW " $-i$ " as a weighted average of the policies of the remaining countries:

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

Ideally the weights should reflect the financial links between economies, which we approximate based on data from the Coordinated Portfolio Investment Survey from the IMF as follows:

$$\omega_{s,t} = \frac{\text{Portfolio Investments of country } s \text{ on country } i \text{ at } t}{\text{Total foreign portfolio investments on country } i \text{ at period } t}$$

The survey provides the investment positions at an annual frequency meaning we can update the financial weights every year in our sample.

3.2 Baseline estimation

We will use a Local Projection approach following [Jordà \(2005\)](#) to model the co-movement between the macroprudential policies in a panel estimation. Our baseline estimation follows also the structure of [Richter, Schularick, and Shim \(2019\)](#) although our variable of interest is the macroprudential policy stance of a country i and the explanatory variable is the policy stance of the rest of the world:

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

for $h = 0, 1, \dots, H$ and with $\Delta_h MaPP_{i,t} = MaPP_{i,t+h} - MaPP_{i,t-1}$

As a very initial exploration, we use a basic fixed effects panel framework (i.e. $h = 0$) to test several set ups and choose our baseline. The results of these regressions can be seen in table 2.

Clearly, this estimation can be subject to improvements, however for now we are just arriving to the combination of controls we will use. We would like to include as many meaningful controls as possible without compromising our sample size too much. For that, we start with a estimation without controls and add controls by type until we arrive to our baseline (model (5)).

Table 2: 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	Yes	Yes
Global Financial Controls				Yes	Yes	Yes	Yes
Extra Domestic Financial Controls					Yes	Yes	Yes
n	5135	4135	4135	4135	4135	3917	3858
R^2	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

This baseline includes the following set of controls:

- *Domestic Economic Controls*: Real GDP growth, yoy CPI inflation, change in monetary policy rate (or shadow rate for zero lower bound cases)
- *Domestic Financial Controls*: Financial Development Index, annual depreciation of the nominal exchange rate.
- *Global Economic Controls*: Global growth (first principal component of growth of US, UK and Japan), global interest rate (first principal component of US, EU, UK).
- *Global Financial Controls*: VIX, TED spread

All the variables are included in changes (first difference) unless a particular variation (e.g. annual) is mentioned above.

We base the selection of controls on other empirical papers in the international finance literature such as [Aizenman et al. \(2017a\)](#), [Aizenman et al. \(2020\)](#) and [Richter et al. \(2019\)](#). The approximation of global controls based on principal components is based on [Aizenman et al. \(2017b\)](#).

Additionally, we consider other potential controls (Extra Domestic Financial Controls in table 2) such as Credit-to-GDP, Capital inflows to GDP, as well as an additional estimation with the capital openness index of [Aizenman et al. \(2017b\)](#). However, we decided against including additional controls beyond the listed above because of the cost in terms of sample size due to missing data (particularly in credit) while the results were virtually the same as in our baseline regression.

3.2.1 Identification Strategy and Baseline Formulation

Ideally, we would count with a series of orthogonal foreign policy shocks that we could include in the right hand side instead of the foreign policies themselves as these could be affected by the policy of country i too. However, at the moment there is not any available series of shocks that accounts for all of these instruments.

Because of this limitation most of the literature instrumentalize the macroprudential policy indicator, by using the first lag directly (or in an analogous IV regression). The main idea behind this choice is that the policy of the rest of the world of previous periods is unlikely to be affected by future policy decisions in our dependent variable. Clearly, this is a less than ideal strategy, since it could also be argued that the (lag) instrument may not work completely as intended given the forward-looking nature of financial markets (and ROW regulators).

Other papers in the literature such as [Richter, Schularick, and Shim \(2019\)](#) have created measures of prudential policy shocks based on filtering the data on the LTV requirement. However, we cannot use a similar measure since we are interested in the changes of the rest of instruments, whose levels are not available, but that more closely resemble the regulation of the banking sector in these economies.

Finally, it should be mentioned that even after finding a series of identified policy shocks, we likely would have to trade-off the possibility of analyzing different types of instruments as we do here. Because of that, even as it becomes available, we think of this exercise as complementary (particularly sections for disaggregated policy instruments).

Then, our actual specification for the generation of the impulse responses is:

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

For $h = 0, 1, \dots, H$. We pick $H = 15$ when generating the estimation results.

Here $MaPP_{-i,t-1}$ is the policy indicator one period before. The controls will be defined as mentioned (economic and financial, domestic and global). Additionally α_i represents a country specific fixed effect. The estimation also adjusts the errors using robust clustered errors at the country level. This level of clustering acknowledges that the country is the level at which the policies are implemented.

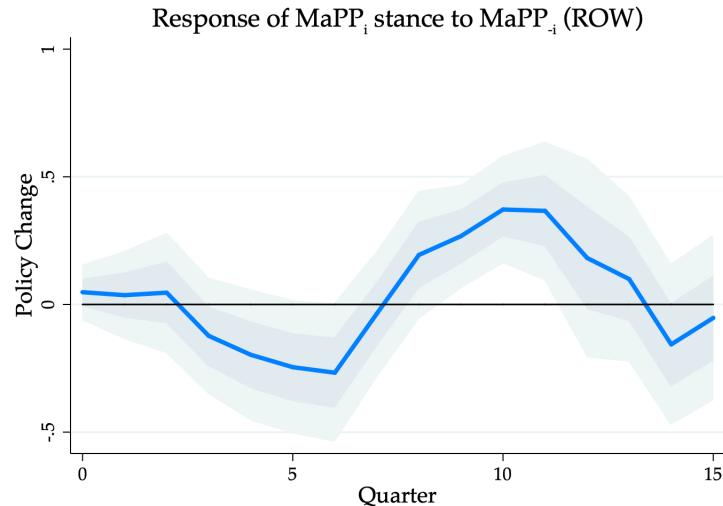
4 Results

We start by generating the Impulse Response Function results for our baseline estimation in figure 3. The response displayed indicates the policy reaction in the average economy to a positive policy change made (or tightening) by the rest of the world (ROW), where the foreign ROW country comprises every type of economy (emerging and advanced). Additionally, the policy indicator considered aggregates the policy stance reflected in every instrument (17 in total).

The result indicates that there is a delayed positive response, approximately equivalent to one half of a tightening. In other words, domestically, we would see a full macro-prudential tightening in the presence of a two tightenings abroad (e.g., a simultaneous tightening in two policy instruments).

The positive response persists for several quarters which is expected given the nature of the policy indicator (annual accumulated macroprudential stance) that reflects any policy change during four quarters.⁴

Figure 3: Response of Local MaP policies to policy changes in the rest of the world

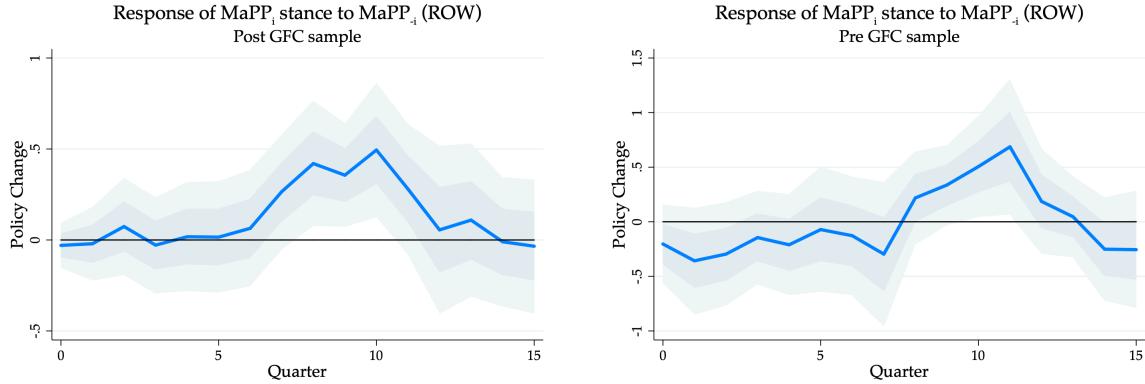


Note: Impulse Response Function from a local projection based on equation 1. The MaPP indicator comprises the information for all the 17 instruments. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q1-2018Q4

At the same time, we calculate this result on different estimations that consider the sub-periods after and before the Global Financial Crisis and show the result in figure 4. We see that the positive response is more representative of the post crisis period.

⁴See figure 18 in appendix B for an conceptual plot explaining how to read the Linear Projection IRF results in the case of the annual accumulated policy.

Figure 4: Response of Local MaP policies to policy changes in the rest of the world, after the global financial crisis (left panel) and before (right panel).



Note: the figure displays Impulse Response Function from a local projection based on equation 1. Where the MaPP indicator comprises the information for all the 17 instruments. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 2008Q4-2018Q4 (left panel), 1999Q1-2008Q3 (right panel).

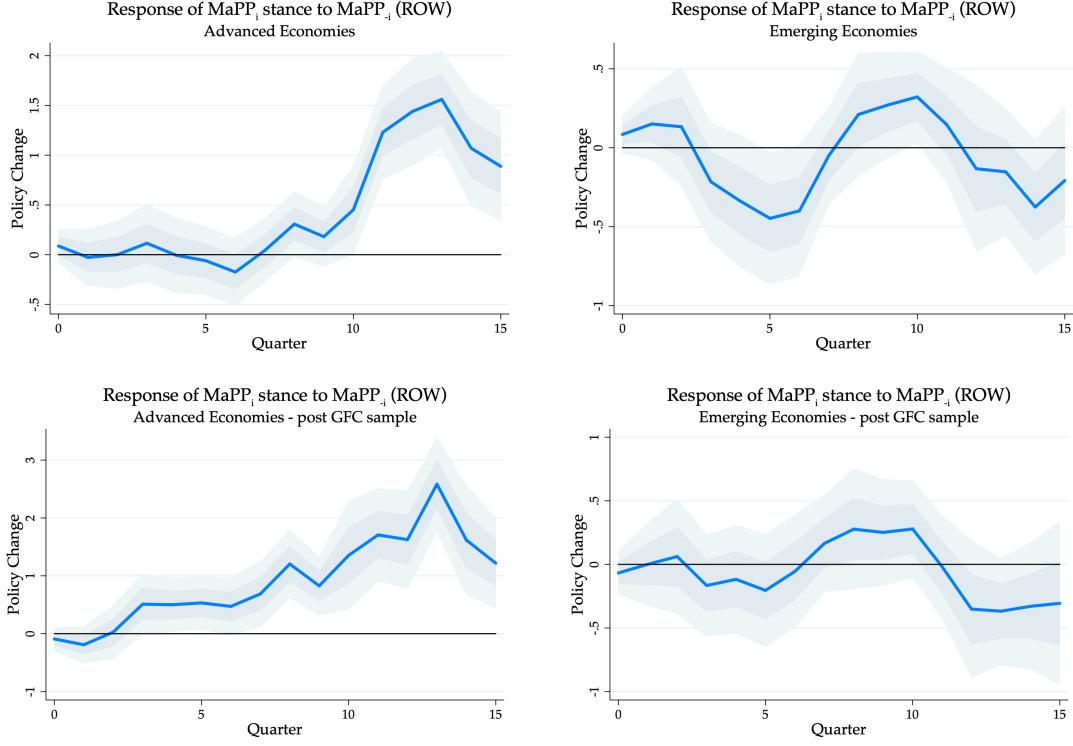
Similarly, it is plausible that the policy response implemented by advanced and emerging economies differ. To verify this, we compute the baseline estimation for subsamples considering only countries in each category (one model for 23 advanced economies and another for 32 emerging). The results are shown in figure 5. In this case, we see that the positive policy reaction is more resembling of the behavior of regulators in the advanced economies. At the same time when estimating models by types of economy we also have that the response is stronger (and even subject to less uncertainty) in the post-crisis period.⁵

The interpretation is similar, a policy tightening abroad is followed by delayed tightening adjustments domestically. This effect takes place mainly in advanced economies and has strengthened after the Global Financial Crisis.

Notice, we are making conservative statements about these effects. That is the case because this result corresponds only to the average effect across all instruments and in presence of a policy action taken by an aggregation all types of countries in the ROW. It is worthy to examine if this average result describes the general nature of the policy interactions between countries, or if instead, it corresponds to the net policy effect, after off-setting responses across types of instruments and countries take place.

⁵For additional linear projection results not shown here see the appendix B.

Figure 5: Response of MaP policies to policy changes in the rest of the world. Model for Advanced Economies (left panel) and for Emerging Economies (right panel).



Note: the figure displays Impulse Response Function from a local projection based on equation 1. Where the MaPP indicator comprises the information for all the 17 instruments. Left panel: estimation for Advanced Economies (complete sample and post-GFC sample), Right panel: estimation for Emerging Economies (all sample and post-GFC sample). Units: Policy Change (+1: tightenings, -1: loosening). Sample periods: complete sample: 1999Q4-2018Q4, post-GFC sample: 2008Q4-2018Q4.

4.1 Splitting the Effects by Type of Foreign Country

To understand the origin of the relevant policy actions abroad for the domestic policy stance we perform an estimation where we split the foreign or ROW policies as follow,

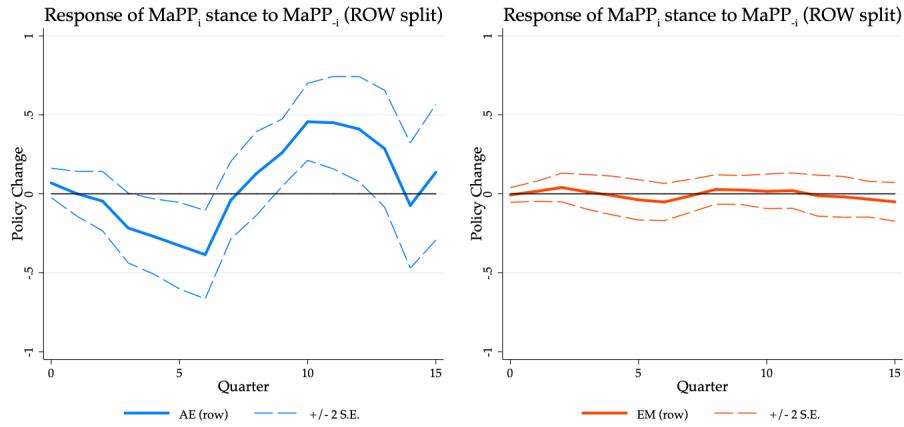
$$MaPP_{i,t+h} - MaPP_{i,t-1} = \alpha_i^{(h)} + \beta_1^{(h)} \Delta MaPP_{-i,t-1}^{\text{AE}} + \beta_2^{(h)} \Delta MaPP_{-i,t-1}^{\text{EM}} + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h} \quad (2)$$

The coefficients $\beta_1^{(h)}$ and $\beta_2^{(h)}$ represent the IRF for periods $h = 1, \dots, 15$, to the policy changes implemented in the ROW by advanced economies and emerging, respectively. As with the foreign policy indicator for the totality of the ROW, we construct each policy indicator by taking a weighted average of the policy actions of each group of economies, and analogously, the weights are based on the bilateral portfolio investment positions (as

a total of the investments of each group of economies). The estimation procedure and controls used are identical to the baseline specification described before.

The associated responses can be seen in 6. We can see that the foreign policy actions that countries are responding to on average are those of the advanced economies (AE). In contrast, the average domestic country is not reacting to the policies enacted in emerging economies at any horizon.

Figure 6: Response of MaP policies to policy changes in the rest of the world. Model for Advanced Economies (left panel) and for Emerging Economies (right panel).

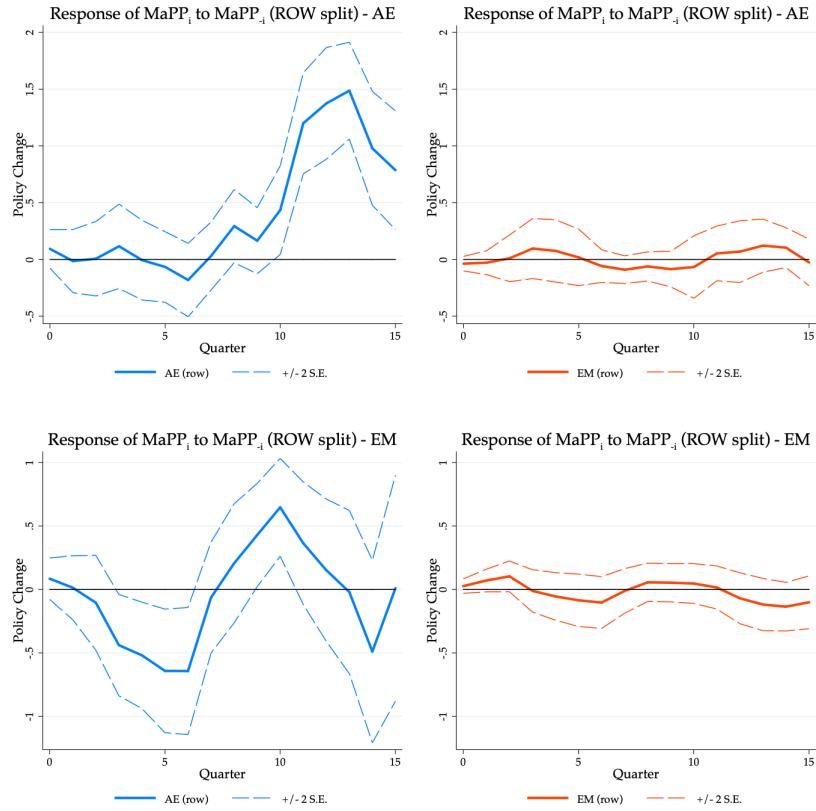


Note: the figure displays the Impulse Response Function from a local projection based on equation (2). Where the MaPP indicator comprises the information for all the 17 instruments. Left panel: Domestic Response to Change in Foreign policy in Advanced Economies, Right panel: Domestic Response to Change in Foreign policy in Emerging Economies. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4

The result of models for each type of economy point to the same conclusion. Both advanced, and emerging are reacting mostly to the policies implemented in the advanced economies. In particular, the delayed positive reaction is better capture by the response of AE policies to that of other advanced economies, although it is also partly reflected in the responses of emerging regulators.

In summary, the lesson we get for the analysis of a policy indicator that comprises the dynamics of all instruments is that, there is a delayed positive policy reaction to the policy tightenings implemented abroad. At the same time, the foreign tightenings that the regulators are reacting to are those of advanced economies. This result holds for both the responses made by advanced and emerging economies. Finally, the positive policy response has strengthened after the Global Financial Crisis episode.

Figure 7: Response of MaP policies to policy changes in the rest of the world. Model for Advanced Economies (top panels) and for Emerging Economies (bottom panels).



Note: the figure displays the Impulse Response Function from a local projection based on equation (2). Where the MaPP indicator comprises the information for all the 17 instruments. Top, left: AE policy response to Foreign AE policies; Top, right: AE policy response to Foreign EM policies; Bottom, left: EM policy response to Foreign AE policies; Top, right: EM policy response to Foreign EM policies. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4

As for the intuition behind this response, there are several hypotheses we can formulate. On one hand, a tightening abroad, i.e. stricter foreign banking regulations will likely elicit an regulation arbitrage effort by banks with cross-border activities (or balance sheet links) looking to circumvent the new (and more constraining) policy stipulations. That intuition aligns with the findings of [Aiyar et al. \(2014\)](#), and is consistent with the global nature of the banking business and the difficulties it implies for policymakers attempting to enforce a regulation at the local economy level.

As a result, the policy abroad may have destabilizing domestic effects in the financial sector, i.e., more financial institutions trying to increase the scale of their activities to compensate for the hindered activities in foreign locations. The local regulators will acknowledge this and tighten their own policies to prevent it.

Another complementary interpretation to this story relates to the dynamics of the

international portfolio flows. These investment flows can be destabilizing and sometimes an economy is interested in repelling them (and prioritize more stable flows such as FDI). It is also plausible, that a country repelling these flows abroad may imply a higher threat for the domestic economy that may try to implement a tightening to in order to shield itself from a potential intake of these flows and the waves of the global financial cycle.

4.2 Effects by Type of Instrument

So far we have analyzed the average policy reaction of an economy in the presence of foreign macroprudential policy changes. By average, we refer to the overall policy stance accounting for an aggregation across all 17 policy instruments.

However, it is plausible that different cross-country policy considerations apply to different types of policy instruments. Here we explore if that is the case. We do it by splitting the policy indicator according to two typical macroprudential policy tools classifications used in the literature:

1. Borrower and Lending (fin. institutions) tools ([Cerutti, Claessens, and Laeven, 2017](#))

Borrower: Loan-to-value (LTV), Debt-Service-to-Income (DSTI)

Financial Institutions (Lender): The rest of instruments.

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

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.

In principle, by making these separations we are able to either indicate what type of instrument is more relevant for driving the positive strategic policy interaction we find on aggregate. Or we can even check whether there are certain types of instruments for which the opposite relationship holds.

4.2.1 First Classification: Borrower and Lender Related Instruments

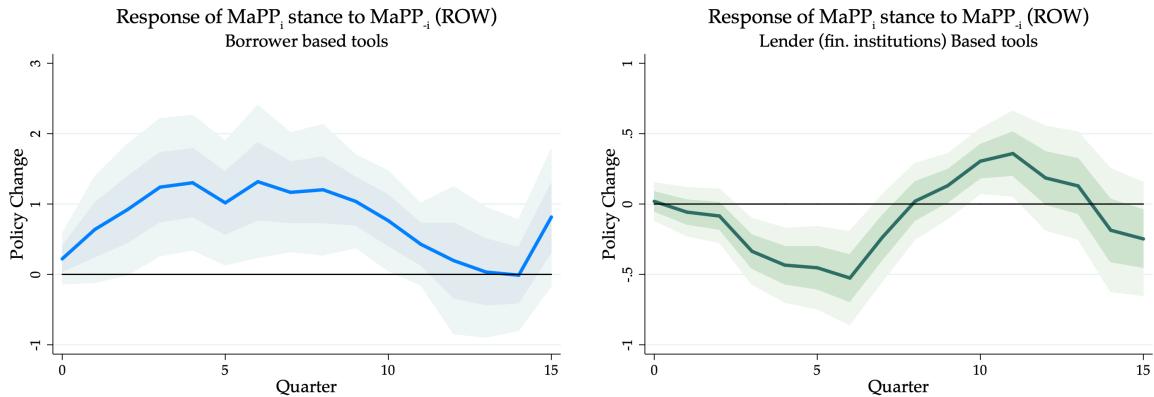
We divide the policy stance variable into two separate variables, according to the instrument types in the first classification. The first index $MaPP_{-i,t}^{Borrow}$ is an aggregate of the policy stance indicator of borrower targeted tools (LTV, DSTI), and $MaPP_{-i,t}^{Lender}$ is an aggregate of the stance captured by the rest of instruments that target the (lenders) financial institutions. We estimate the following equation:

$$\begin{aligned}\Delta MaPP_{i,t+h} = & \alpha_i^{(h)} + \beta_1^{(h)} \Delta MaPP_{-i,t-1}^{Borrow} + \beta_2^{(h)} \Delta MaPP_{-i,t-1}^{Lender} \\ & + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h}\end{aligned}\quad (3)$$

The policy response to each type of policy action is shown in the figure 8. In the left panel we see the domestic policy reaction to a tightening in the foreign borrower targeted tools. This reaction is positive and is implemented with a small delay (about 2-3 quarters), and amounts to approximately a full tightening. In that sense, the response is analogous to what we found on average for the aggregate prudential stance indicator.

On the other hand, the right panel depicts the policy response to a tightening in the foreign lender tools. In this case, we see a negative response, although with a weaker magnitude. This contrasts with the rest of our findings until now, which in itself can be interesting as it may denote potential free-riding incentives by the national regulators. Still, we disentangle these before making additional interpretations.

Figure 8: Response of MaP policies to policy changes in the Rest Of the World. Response to Borrower instruments (left panel) and to Lender based policies (right panel).



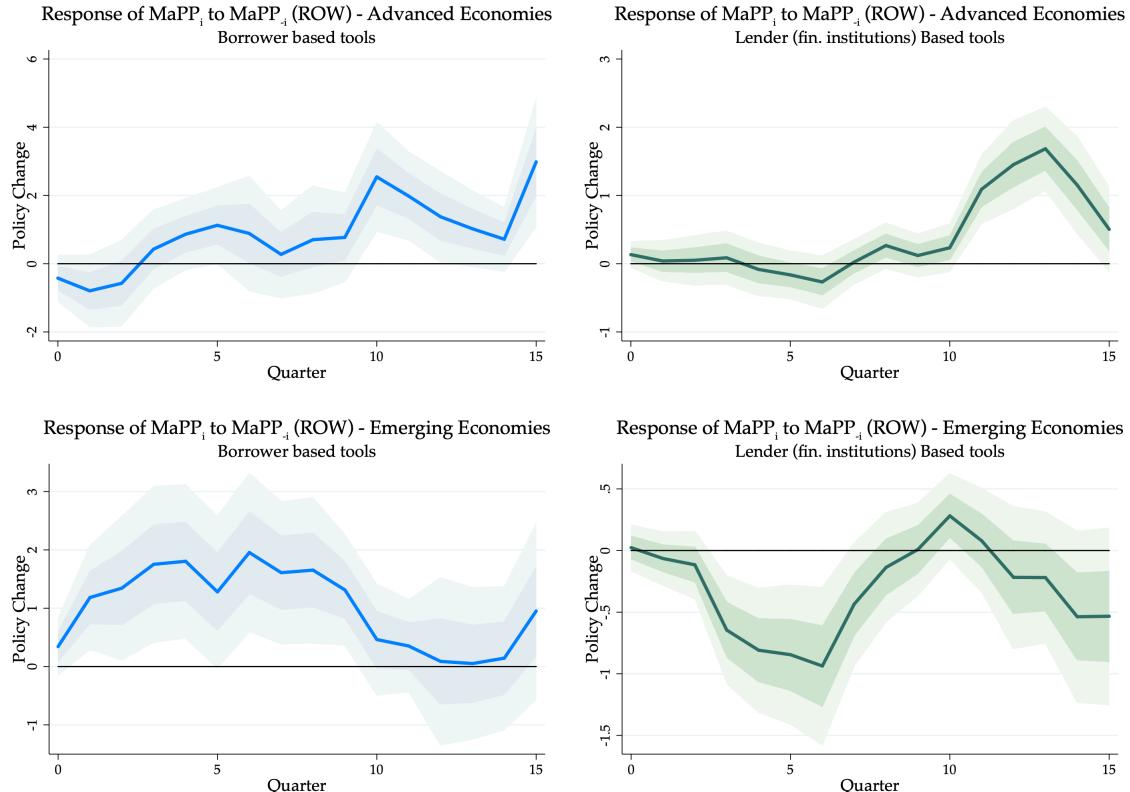
Note: the figure displays the Impulse Response Function from a local projection based on equation (3). The foreign MaPP indicator includes Borrower tools (response shown in left panel) and Lender tools (right panel) separately as explanatory variables. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4.

We obtained these effects in separate models for advanced economies (AE) and emerging economies (EM) respectively and plot the results in the figure 9. To begin, we see that the policy responses in advanced economies goes along the same line as our baseline results: there is a positive reaction (tightenings) made in response to policy tightenings abroad. This holds for any type of instrument.

Conversely, for the emerging economies we see that there is a positive policy reaction to foreign policy tightenings only for borrower instruments. Thus, we can track down the negative policy reaction to these countries, and in response to changes in foreign policy tools targeting the banking sector.

Here, similar to the baseline result for the aggregation of instruments, the response to policy changes in each type of foreign tool is explained only by the post crisis (GFC) data (figure 22 in the appendix B). The same pattern holds for estimations by type of country.

Figure 9: Response of MaP policies to policy changes in the Rest Of the World. Response to Borrower instruments (left panel) and to Lender instruments (right panel). Model for Advanced Economies (top), and for Emerging Economies (bottom)



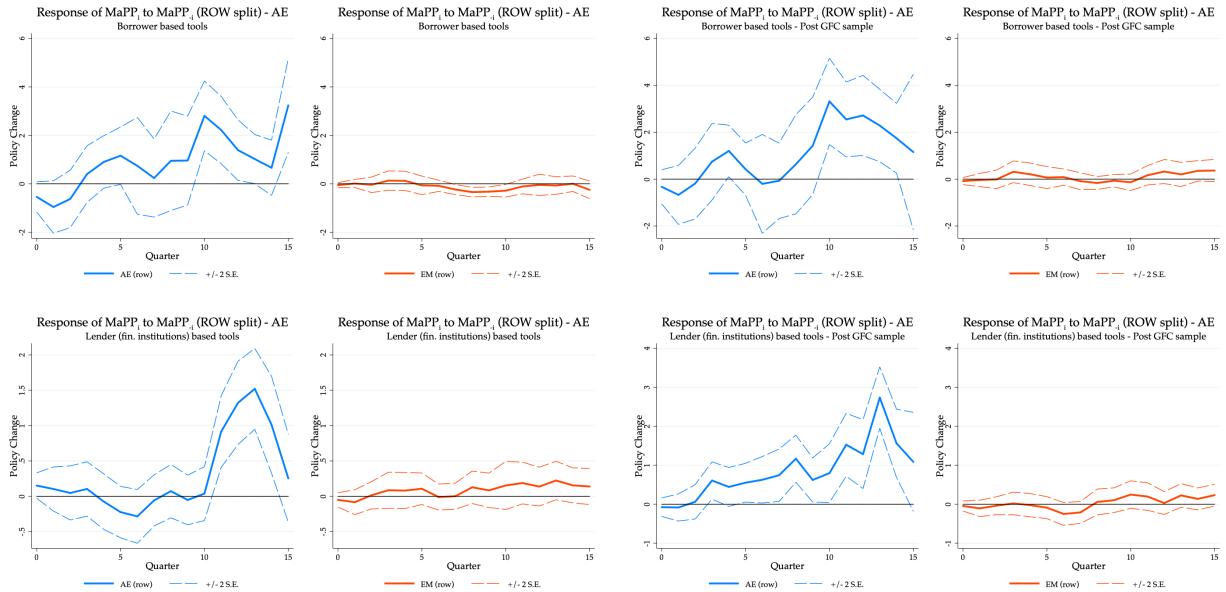
Note: the figure displays the Impulse Response Function from a local projection based on equation (3). The foreign MaPP indicator includes Borrower tools (left panel) and Lender tools (right panel). The figure shows result from the estimation for Advanced Economies (top panel), and Emerging Economies (bottom). Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4.

Similar to the case of the aggregate policy indicator, we can split the effects by type of foreign country. In that case we carry out an estimation based on the following equation,

$$\begin{aligned} \Delta MaPP_{i,t+h} = & \alpha_i^{(h)} + \beta_1^{(h)} \Delta MaPP_{-i,t-1}^{\text{Borrow}, \text{AE}} + \beta_2^{(h)} \Delta MaPP_{-i,t-1}^{\text{Lender}, \text{AE}} \\ & + \beta_3^{(h)} \Delta MaPP_{-i,t-1}^{\text{Borrow}, \text{EM}} + \beta_4^{(h)} \Delta MaPP_{-i,t-1}^{\text{Lender}, \text{EM}} \\ & + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h} \end{aligned} \quad (4)$$

The figure 10 shows response for the model estimated for the advanced economies (AE). We can see that the positive reaction to changes in each type of instrument correspond to responses to the policies implemented in foreign advanced economies. Also, the result is driven by the post crisis reactions as expected by now.

Figure 10: Response of MaP policies to policy changes in the rest of the world. Model for Advanced Economies.



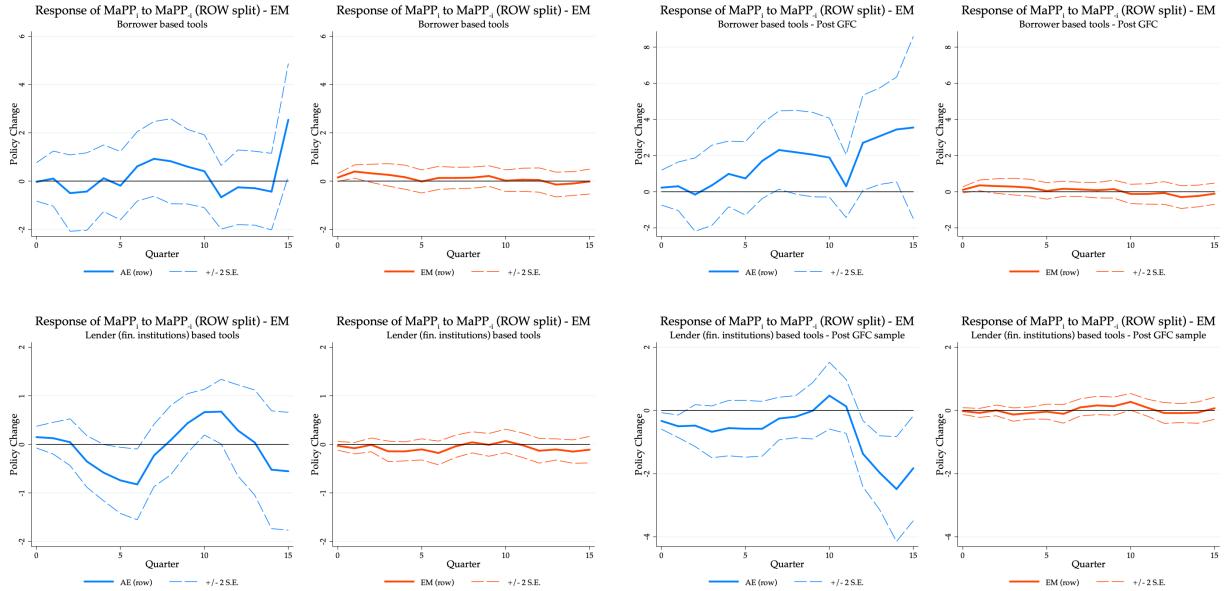
Note: the figure displays the Impulse Response Function from a local projection based on equation (2). Where the MaPP indicator comprises the information for all the 17 instruments. Top, left: AE policy response to Foreign AE policies; Top, right: AE policy response to Foreign EM policies; Bottom, left: EM policy response to Foreign AE policies; Top, right: EM policy response to Foreign EM policies. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4

The responses for the emerging economies is shown in the figure 11. In that case we see that a positive response to foreign borrower tools' changes regardless of the origin (AE or EM). However, the response to the policies in advanced economies has a higher order of magnitude, i.e., one or more tightenings in response. Whereas the response to the policy changes in advanced economies is much lower (1/10 to 2/10 of a tightening).

On the other hand, we obtain that the negative policy response to changes in financial institutions' tools by emerging countries is driven by the reactions to the policy changes originated in advanced economies only. That is, the domestic policy relaxation in presence of stricter foreign policies only follows after policy tightenings in advanced economies.

This is an interesting finding, basically the emerging regulators are internalizing potential positive welfare spillovers from the stricter policies in financial centers that may be strong enough to allow them to relax their own domestic regulations. This aligns with the findings of [Tripathy \(2020\)](#), where policy effects targeting banks in the Spanish financial sector eventually leaked to the Mexican financial sector through Spanish banks' franchises (e.g. BBVA) operating in Mexico, thereby generating financial stability gains outside the intended scope of the original regulation.

Figure 11: Response of MaPP policies to policy changes in the rest of the world. Model for Emerging Economies.



Note: the figure displays the Impulse Response Function from a local projection based on equation (2). Where the MaPP indicator comprises the information for all the 17 instruments. Top, left: AE policy response to Foreign AE policies; Top, right: AE policy response to Foreign EM policies; Bottom, left: EM policy response to Foreign AE policies; Top, right: EM policy response to Foreign EM policies. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4.

The results for this first classification is summarized in the table 3. It depicts the sign of the impulse response for the possible estimations we have analyzed separately and others not shown (see appendix for the additional responses).

In a nutshell, the positive policy reaction is explained by the reaction to borrower instruments while a negative response emerges for reactions to foreign lender tools.

Table 3: Sub-sample results for Classification 1: Borrower and Lender tools (summary)

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
Full Sample									
Borrower	+	+	+	+	+	-	+	+	+
Lender	-	+,- net 0		+	+		-	-,+	+
Post GFC									
Borrower	+	+	+	+	+		+	+	+
Lender	-			+	+		-	-	
Pre GFC									
Borrower					+				
Lender				+	+	-		+	

Note: Sign of the IRF of each subcase for the Classification 1 of the policy tools. Units: Policy Change (+: tightenings, -: loosening).

When performing separate estimations for different countries, we see that for advanced economies, there is a positive response in any type of tool as expected. In contrast, the negative response can be tracked to the response of emerging regulators to financial institutions targeted tools' tightenings in advanced economies.

Additionally, both type of economies (AE, EM) are reacting to the policy changes made in foreign advanced economies. But only emerging economies react to the foreign policies made in other emerging markets.

Finally, the responses are explained mostly by post-GFC behavior. In fact, the reactions in the post-crisis sample estimations have the same signs as the whole sample, but with a stronger effects.

4.2.2 Second Classification: Capital, Asset-side and Liquidity instruments

It can be argued that the borrower and lender tools categories are too broad, particularly the lender related tools, since it still aggregates 15 out of the 17 instruments. In that vein, it can be important to disentangle the effects of foreign policies that target the financial institutions. It is possible, that by accounting for more specific categories we discover more meaningful effects.

With that in mind, we analyze the second classification, as proposed by Cabral et al. (2019) (ECB) and BIS (2012). This classification is also widely used in the literature. On one hand it pools Capital related tools, that are meant to affect the resiliency of the financial sector, then it considers the Asset-side tools that are more related to the Global Financial Cycle and asset prices fluctuations, and finally it includes Liquidity and Foreign

Currency related tools that are meant to mitigate the liquidity and insolvency risk (in local or foreign currency).

$$\begin{aligned}\Delta MaPP_{i,t+h} = & \alpha_i^{(h)} + \beta_1^{(h)} \Delta MaPP_{-i,t-1}^{Capital} + \beta_2^{(h)} \Delta MaPP_{-i,t-1}^{Asset} + \beta_3^{(h)} \Delta MaPP_{-i,t-1}^{Liquidity} \\ & + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h}\end{aligned}\quad (5)$$

The first two types of tool target types of risk that have been well identified since Basel I, while the liquidity tools target a source of risk that became relevant after the onset of the Global Financial Crisis. On the other hand, the Asset-type tools, relate to credit, income and asset prices and hence are associated to the global financial cycle. The dynamic domestic response to foreign policy changes in each of these type of tools is estimated based on the equation (5).

We show the results in the figure 12. The response to capital tools' changes is hard to interpret as it displays a short term negative reaction and the opposite sign at the end. It is likely that this is reflecting opposite reactions by types of economies. This type of dynamics is the reason why we analyze different subsamples as well as the dynamic effect. On the other hand, the response to foreign changes in asset-side tools and liquidity tools is positive and delayed. This is consistent with the baseline results and most of the sub-sample estimates.

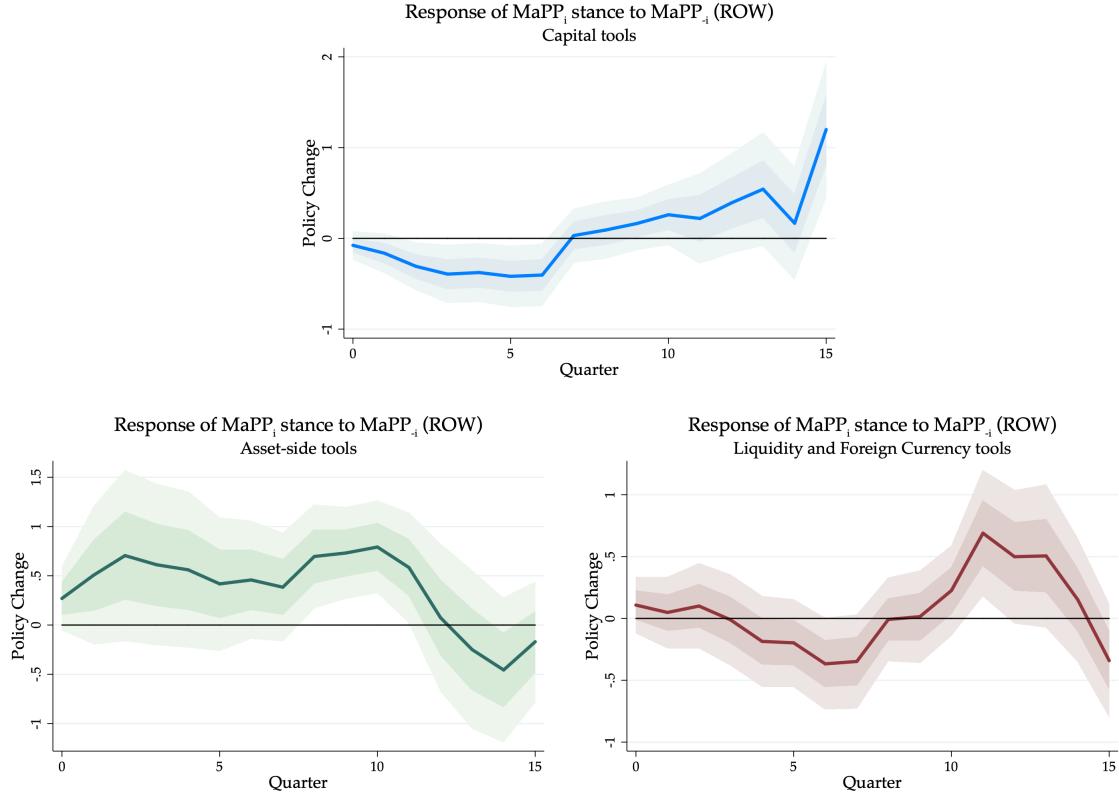
To understand better these effects, we estimate the effects for this classification separately for each type of economy (AE, EM). The results are shown in figure 13. We can see that the response in the Advanced Economies is positive as in the baseline result and first classification (i.e. a tightening is implemented in response to foreign tightenings). This positive reaction holds for each type of instrument with similar magnitudes, about two tightenings are applies in response to a single foreign tightening.

On the other hand, in the model for Emerging Economies we can obtain the negative reponse in capital tools we see in the model for all countries in the initial periods. This means that it is the emerging regulators those that relax their capital related instruments in response to tightenings in capitla instruments abroad. At the same time, the relation with respect to the asset tools is positive as in the baseline and non-significant for the liquidity tools.

This means that for emerging regulators, tighter capital requirements abroad allow them to relax their own requirements, while asset-side tightenings, more closely related to the global financial cycle, does not provide the scope for this. Instead they tighten their asset and credit requirements in response. Lastly, the liquidity tools spillovers may be

less concerning for these economies, and then reacting in response is not as necessary.

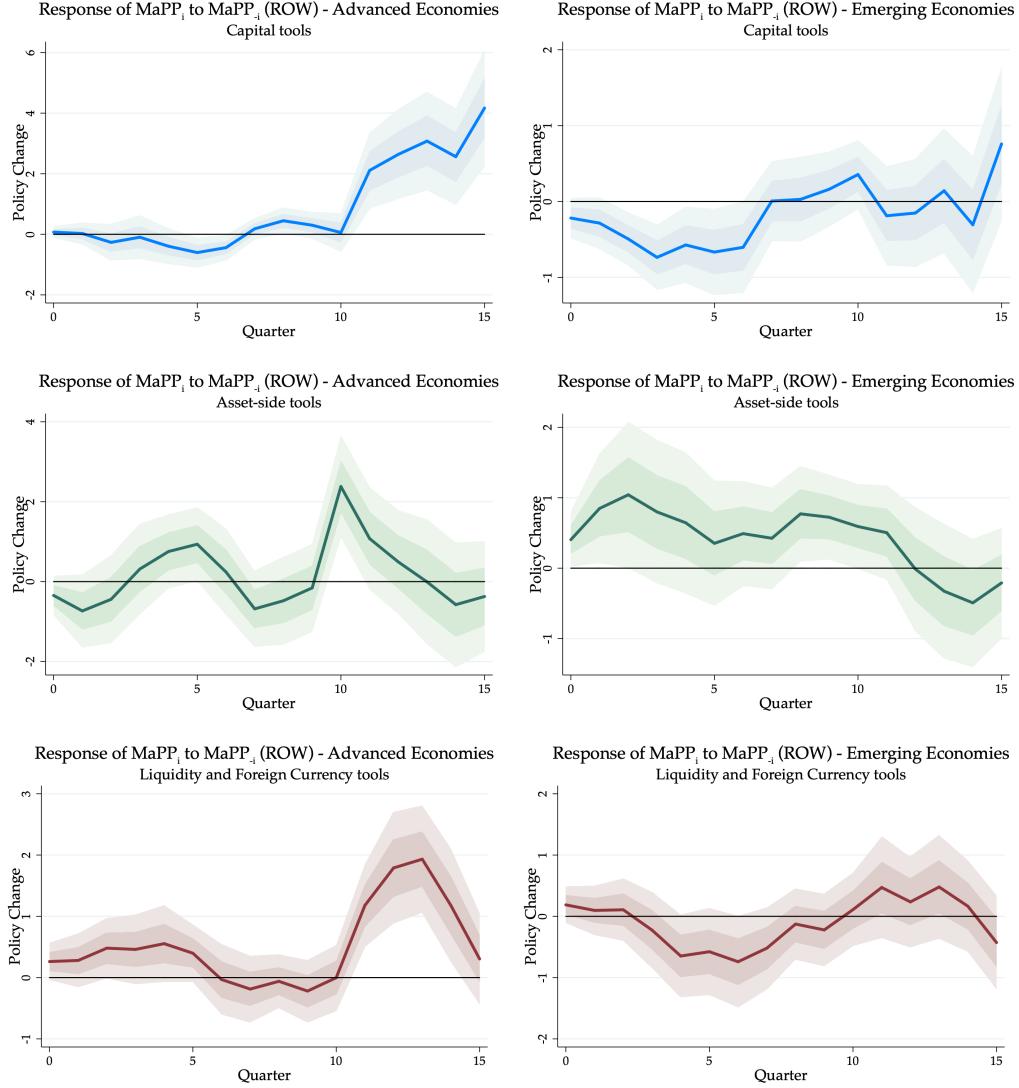
Figure 12: Response of MaP policies to policy changes in the Rest Of the World. Response to Capital instruments, Asset, and to Liquidity and FX flows based policies.



Note: the figure displays the Impulse Response Function from a local projection based on equation (5). The foreign MaPP indicator includes Capital tools (response shown in top panel), Asset-side tools (bottom, left), and Liquidity and Foreign Currency tools (bottom, right) separately as explanatory variables. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4.

When we estimate these results by sub-periods (after and before the financial crisis) we obtain that the responses in all cases, for both advanced and emerging economies become significant only in the post-crisis estimation. In the advanced, for all tools as in the full sample counterpart, and for emerging for capital and asset tools. The full sample signs of these responses are also captured by the post-crisis sample in all cases (see figure 23 in the appendix B).

Figure 13: Response of MaP policies to policy changes in the Rest of the World. Response to Capital instruments, Asset, and to Liquidity and FX flows based policies. Model for Advanced Economies (left) and for Emerging Economies (right)



Note: the figure displays the Impulse Response Function from a local projection based on equation (5) estimated separately for Advanced (left panel plots) and Emerging Economies (right panel plots). The foreign MaPP indicator includes Capital tools (first row), Asset-side tools (second row), and Liquidity and Foreign Currency tools (third row) separately as explanatory variables. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4.

As with the first classification we generated more results than what is shown in the paper or appendix. We provide a summary of these in the table 4. The conclusions are similar, the policy response in advanced economies is largely positive for all instruments, and specially in reaction to foreign policy changes originating in other advanced economies. The policy response of emerging economies is negative for capital tools, and in particular to those implemented in advanced economies, while the response to policies in other emerging countries is positive for instruments related to the global financial cycle.

Finally, the ubiquitous result at this point follows here too: the policy reactions dynamics are driven by post-GFC effects. Some responses for models with the rest of the world split in advanced and emerging economies are also shown in the figures 24 and 25 in the appendix B.

Table 4: Sub-sample results for Classification 2: Capital, Asset and liquidity tools (summary)

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

Note: Sign of the IRF of each subcase for the Classification 2 of the policy tools. Units: Policy Change (+: tightenings, -: loosening).

4.3 Accounting the Intensity of the Policy Changes

There have been substantial improvements in terms of the availability, coverage, and informativeness of the macroprudential policies data at the cross-country level. To make an idea of this, a few years ago the data available and used by some seminal studies such as Cerutti et al. (2017) consisted on indicator variables denoting only the use of a policy instruments rather than the policy stance as in this work. Additionally, the number of tools available (only 12), and countries with information were lower too. This changed with the contribution of Alam et al. (2019) (integrated MAP database). We have certainly benefited from this new database that generated instruments and country specific indicators capturing the policy stance (tightenings or loosening of tools).

However, as Richter, Schularick, and Shim (2019) mentions, these policy indicators still fail to capture the intensity of the policy change. That is, in the "stance" indicator used until now, a small or a substantial increase in the capital requirements yields the same value of the policy variable. This is certainly a shortcoming, of the available data.

Despite this, the integrated database we use tries to fill this void by generating data on the Loan-to-Value ratio for a smaller number of economies (52 out of the 65 in our sample). We use this information and repeated our exercise. The baseline estimation is similar to (2) but now the policy variables on the equation is the LTV ratio.

The results (shown in the appendix C) are not as conclusive as in the rest of the paper. We obtain a similar positive cross-country complementarity effects in presence of foreign tightenings using the full sample. However, unlike in the rest of our exercises, neither subsample (period, splitting the rest of the world policies, or estimating separate models for advanced and emerging economies) estimation supports this result strongly.

We see this as an issue generated by the data limitation. Perhaps, if the same type of variable would be available for more instruments and countries we could use the actual level for our baseline exercises rather than the indicators. However, for now we consider more appropriately to stick to the conventional approach and use the indicator.

It should be noted that the outcome of this intensity-inclusive estimation is consistent with the rest of our results, although it is still limited as it ignores almost all of the macroprudential policy toolkit, and every instrument targeted at the financial institutions.

5 Policy Implications and the Scope for International Co-ordination

We obtain a number of important results on the evidence of cross-country co-movements between macroprudential regulations. On average, we find that these policies react to their foreign counterparts and usually in the same direction of the policy change abroad. This is the case, even after controlling for the potential external (domestic and global) variables that these instruments react to.

We also obtained that for some instruments and sub-cases (e.g. the reaction of EM regulators to foreign capital tools in AE economies) the opposite relation holds, there is a local relaxation in presence of a foreign tightening. Both of these effects, a complementarity of these policies or a potential substitution are aligned with the findings of empirical studies in the literature (Aiyar et al. (2014) for the positive, Tripathy (2020) for the negative), and the overall comovement is also consistent with the evidence indicating the policy leakages and international spillovers of these instruments.

Our initial motivation was to test whether these instruments are set with any strategic

considerations in mind, after the regulators internalized the international dimension of these policies, and the results indicate that it is the case indeed. These tools seem to be implemented not only in response to local and global fundamentals, but also as part of an international policy interaction game.

We see these results as indicative of a potential scope for policy improvements in the form of internationally coordinated cooperative regulations.

This is consistent with the theoretical literature prudential policy interactions and coordination. On one hand, we have a potential positive strategic complementarity between these instruments, that could generate welfare losses due to excessive regulatory interventions (see [Korinek \(2020\)](#), [Davis and Devereux \(2019\)](#), among others). On the other, a negative relationship may indicate a free riding incentive that could lead to issues of suboptimal levels of regulation ([Kara, 2016](#)).

Of course, we cannot guarantee there is such a scope from this empirical study as the significant cross-country effects may also be indicative of an efficient adjustment mechanism prompted by domestic policymakers after internalizing the global effect of these policies. However, we find repeated evidence that these cross-country policy-to-policy effects exist (and not only policy-to-fundamentals as in other studies), which in itself makes it worthwhile to explore under which conditions they also imply the possibility of welfare improvements from centralized policies (global or regional). This particular topic is explored in [Granados \(2021\)](#) where it is also explained under which conditions the coordination initiatives can become beneficial or counterproductive.

6 Conclusions

We study the empirical policy interactions between macroprudential regulators at the cross-country level. Our objective is to determine whether regulators set their policies with strategic considerations in mind, after internalizing the spillovers of foreign regulations in their economies, and not only as a function of local and global economic conditions. For that purpose, we exploit a recently available dataset on instrument-specific policy stance indicators in a panel of 65 economies. We generate an indicator of the policy of the rest of the world from the perspective of each economy and analyze the cross-border interactions using a panel linear projection approach.

Our findings suggest that domestic regulators do react in response to foreign policy changes, and on average will tighten their policy instruments after witnessing a prudential

tightening abroad. We also find that this behavior has gained traction after the onset of the Global Financial Crisis. To disentangle this effect, we implement a number of different specifications by type of local economy, foreign economy, sample period (pre and post-GFC), and type of foreign policy revision. This allows us to find additional case-specific effects that were less evident in the full-sample estimation, namely: (i) domestic regulators react mainly to the policy changes in advanced economies, (ii) the countries reacting more strongly are the advanced economies, (iii) the response to policies originated in emerging countries is not significant in most cases, when it is, the magnitude is about 5 times lower than that of the response to policies in advanced economies.

Similarly, the exercises by type of instrument changing abroad reveal additional insights, for both classifications (borrower vs. lender targeted tools, and capital, asset-side, and liquidity tools), we find the same positive response in most cases, but also some instances where there are signs of negative policy reactions, i.e., a policy loosening after a tightening abroad. Further exercises show us that this negative response is driven by the behavior of emerging economies' regulators: these behave in the usual way when reacting to tools related to the Global Financial Cycle (borrower and asset-side), in contrast, they will adjust their policies in the opposite direction (or not at all) when reacting to other foreign policy regulations. This implies that the emerging economies regulators deem it more necessary to protect their financial system from the effects of the global cycle when other economies are doing the same, while for other types of effects they see scope for relaxing their policies and instead free-ride on the spillovers of the stricter global regulations.

We relate both types of effects to related findings in the literature and explain that each is a reasonable reaction to the potential policy leakages stemming from foreign policies. A positive one (to tighten) can be reasonable if the regulators perceive negative policy spillovers from abroad, for example, if they think a foreign tightening would threaten their local financial stability once the affected financial institutions attempt to circumvent the stricter regulations by increasing their intermediation in the local economy. On the other hand, a policy relaxation can be reasonable if a regulator thinks that the stabilizing effects of some foreign policies leak to the local economy, for example through the activities of foreign branches of regulated global banks operating locally.

More importantly, either effect, i.e., the ubiquitous positive or the occasional negative (by emerging regulators) can indicate the potential scope for policy improvements through the implementation of coordinated policy frameworks. After all, the banking business has a global nature while the nationally oriented policies have only a local scope.

In the case of positive reactions, coordination could prevent issues of excessive policy interventions (race to the bottom and regulatory wars), and in the case of the negative emerging reaction, situations of sub-optimal level or interventions or too unequal sharing of the burden of regulation could be mitigated.

Clearly, the determination of the viability and welfare gains of international cooperation goes beyond the scope of this study, and we leave it for future or separate work⁶. At the same time and on the empirical front, we leave for future work to carry out this analysis with data on the actual level of the tools rather than policy stance indicators.

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⁶See [Granados \(2021\)](#) for a study on this topic

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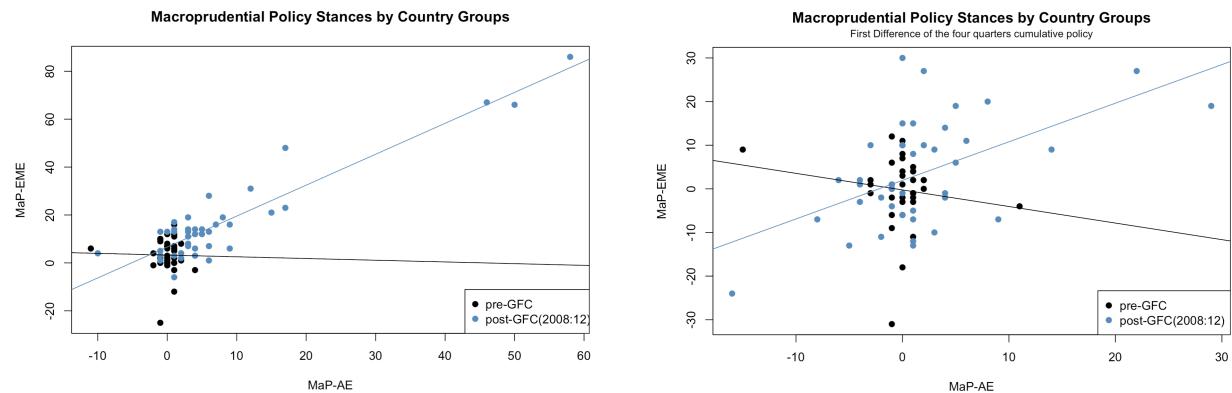
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A Additional descriptive data

Co-movement of policy stances between country groups:

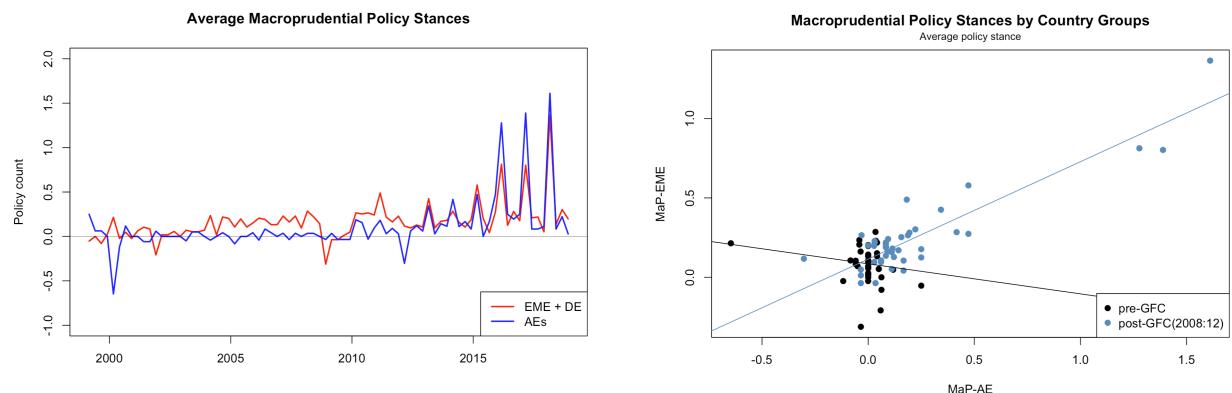
Figure 14: Macroprudential Policies in AE vs. EM, 1999-2018



Note: scatterplot and regression line between the macroprudential policy stance of AE and EM. In the left panel we use the quarterly level of the policy indicator, in the right panel we report the first difference of the annual policy stance given the annual stance itself becomes non-stationary.

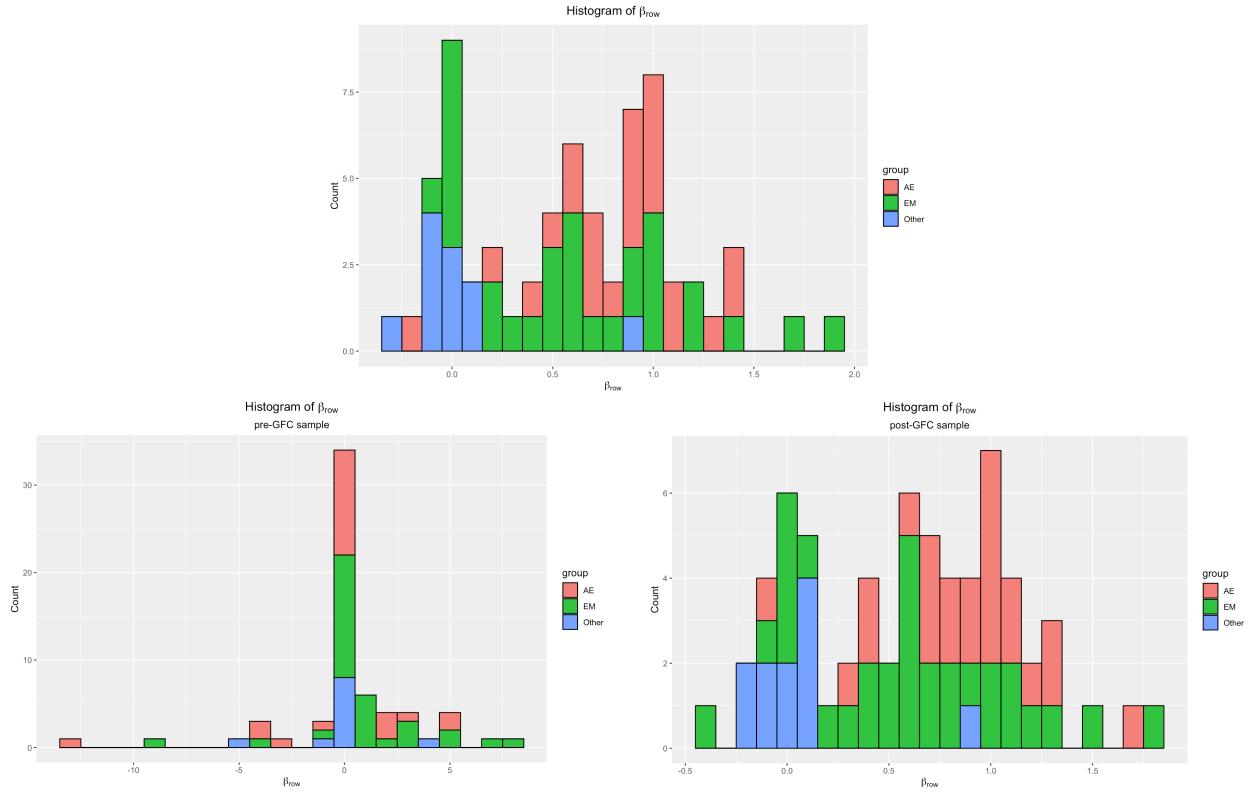
There is a co-movement between country groups' policies after the crisis. The correlations between policies in the AE and EM shown in the plots are -0.021 for the quarterly and 0.298 for the annual policies and become 0.925 and 0.862 in the post-crisis sample.

Figure 15: Average Macroprudential Policies in AE vs. EM, 1999-2018



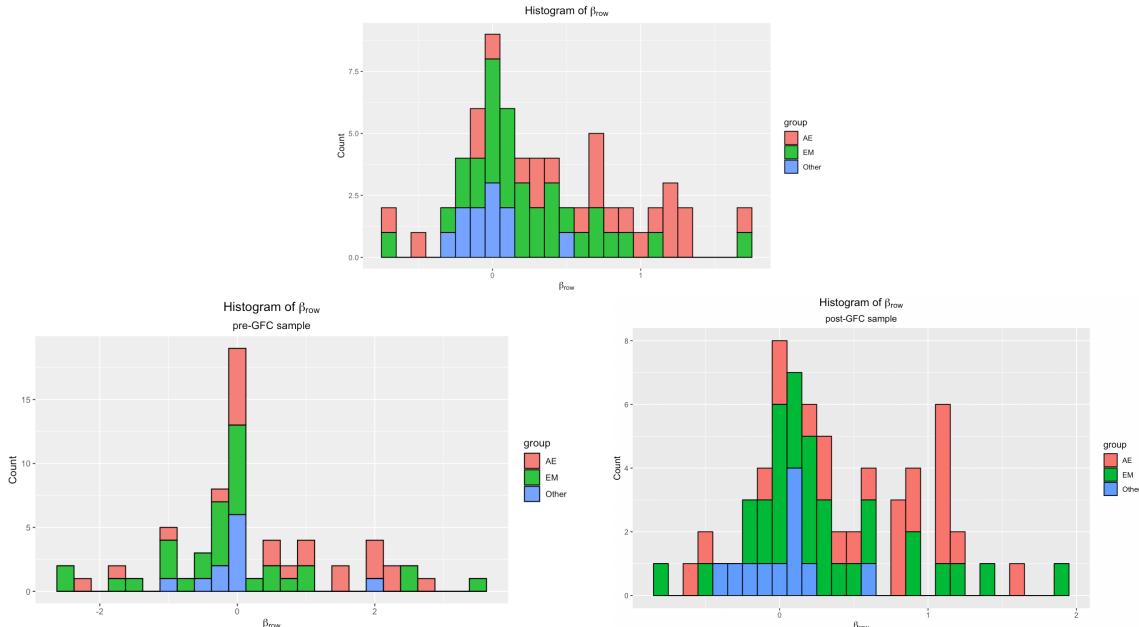
Note: left panel: average macroprudential policy indicator by country group. We divide the level of the policy indicator in levels by the number of countries reporting an active use of these instruments. Right panel: scatterplot and regression line between the average macroprudential policy stance of AE and EM. The correlation between the average policies in AE and EM before the GFC is 0.221 , for the post-GFC period it becomes 0.812 .

Figure 16: Histogram for the coefficient of country-wise regressions for the policy vs. policy in the rest of the world (ROW)



Note: the figure displays the histogram for the $MaPP_{i,t} = \alpha_i + \beta_{row} MaPP_{-i,t} + \epsilon_{i,t}$. Sample periods: Full sample: 1999Q1-2018Q4; pre-GFC: 1999Q1-2008Q3; post-GFC: 2008Q4-2018Q4.

Figure 17: Histogram for the coefficient of country-wise regressions for the change in the annual policy vs. change in annual policy in the rest of the world (ROW)



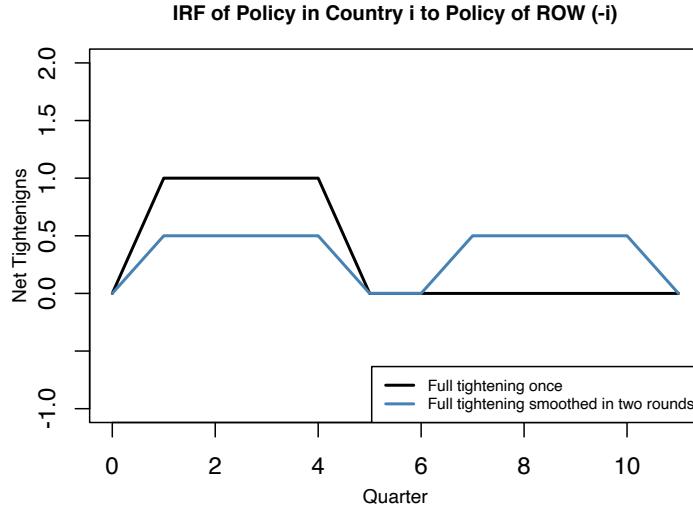
Note: the figure displays the histogram for the $MaPP_{i,t} = \alpha_i + \beta_{row} MaPP_{-i,t} + \epsilon_{i,t}$.

Table 5: Countries included in the sample

Advanced Economies	Emerging Economies	Other
Austria	Argentina	Albania
Australia	Azerbaijan	Armenia
Belgium	Bulgaria	Cape Verde
Canada	Brazil	Georgia
Switzerland	Belarus	Jamaina
Germany	Chile	Kyrgyzstan
Denmark	China	Moldova
Spain	Colombia	Mongolia
Finland	Costa Rica	Mauritius
France	Cyprus	Nigeria
United Kingdom	Czechia	Paraguay
Greece	Dominican Republic	
Ireland	Hong Kong	
Iceland	Hungary	
Italy	Indonesia	
Japan	Israel	
Luxembourg	India	
Netherlands	South Korea	
Norway	Mexico	
New Zealand	Malaysia	
Portugal	Peru	
Sweden	Phillipines	
United States	Poland	
	Romaria	
	Russia	
	Singapore	
	Thailand	
	Turkey	
	Ukraine	
	Uruguay	
	South Africa	

B Additional Linear Projection Results

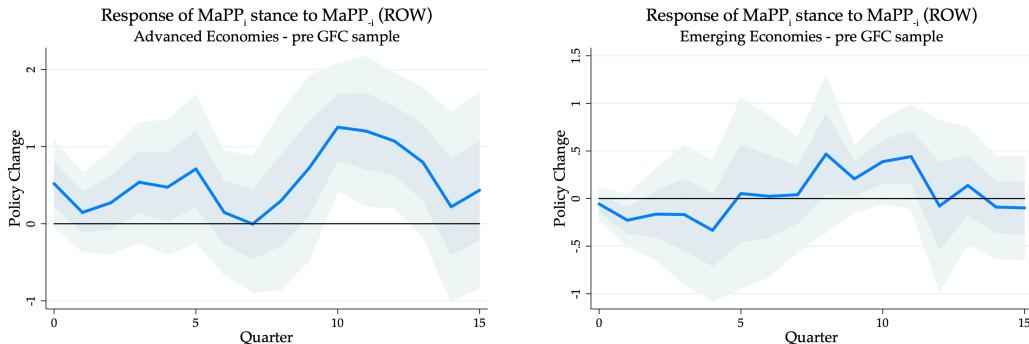
Figure 18: Conceptual LP-IRF for Annual Macroprudential Indicator



Note: The figure depicts conceptually a positive policy response in the annual policy indicator. In black the tightening is applied in period 1. In blue the tightening is applies in two rounds, half in period 1, the other in period 7.

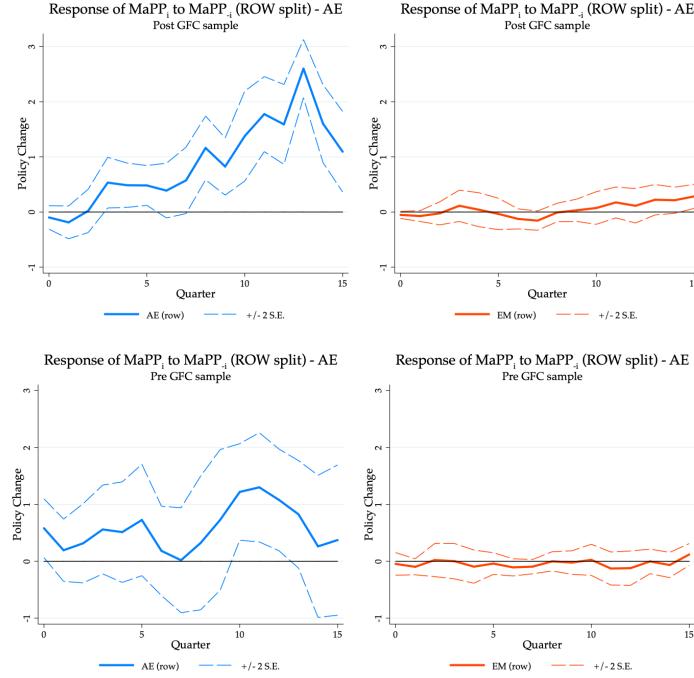
The figure 18 shows a hypothetical positive policy response after a policy tightening abroad. It shows how a single policy change (or reaction) implemented in a single quarter persists in the annual policy indicator. A tightening in period one will be reflected in a higher policy indicator (hence a positive response) until period 4. In absence of additional policy changes the response would look like the black line.

Figure 19: Response of MaPP policies to policy changes in the rest of the world. Model for Advanced Economies (left panel) and for Emerging Economies (right panel).



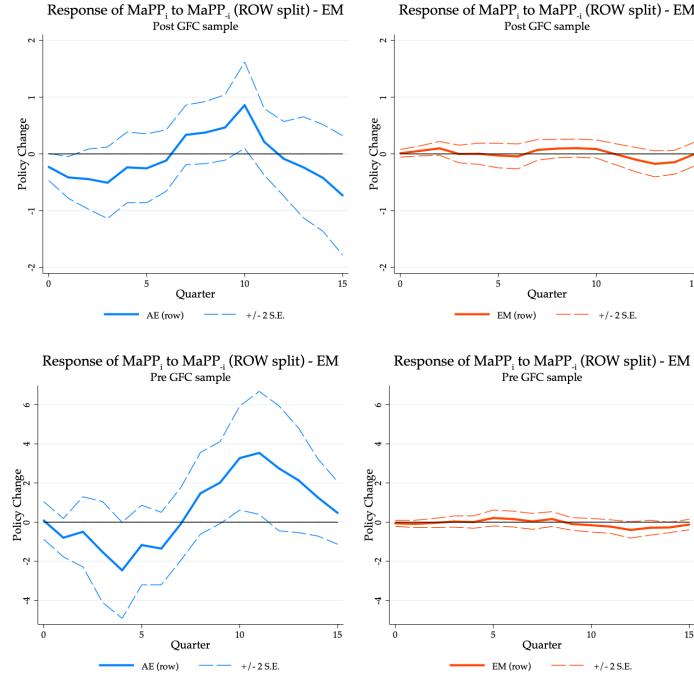
Note: Impulse Response Function from a local projection based on equation (1). Where the MaPP indicator comprises the information for all the 17 instruments. Left panel: estimation for Advanced Economies, Right panel: estimation for Emerging Economies. Units: Policy Change (+1: tightenings, -1: loosening). Sample periods: complete sample: pre-GFC sample: 1999Q1:2008Q3

Figure 20: Response of MaP policies to policy changes in the ROW. Model for Advanced Economies.



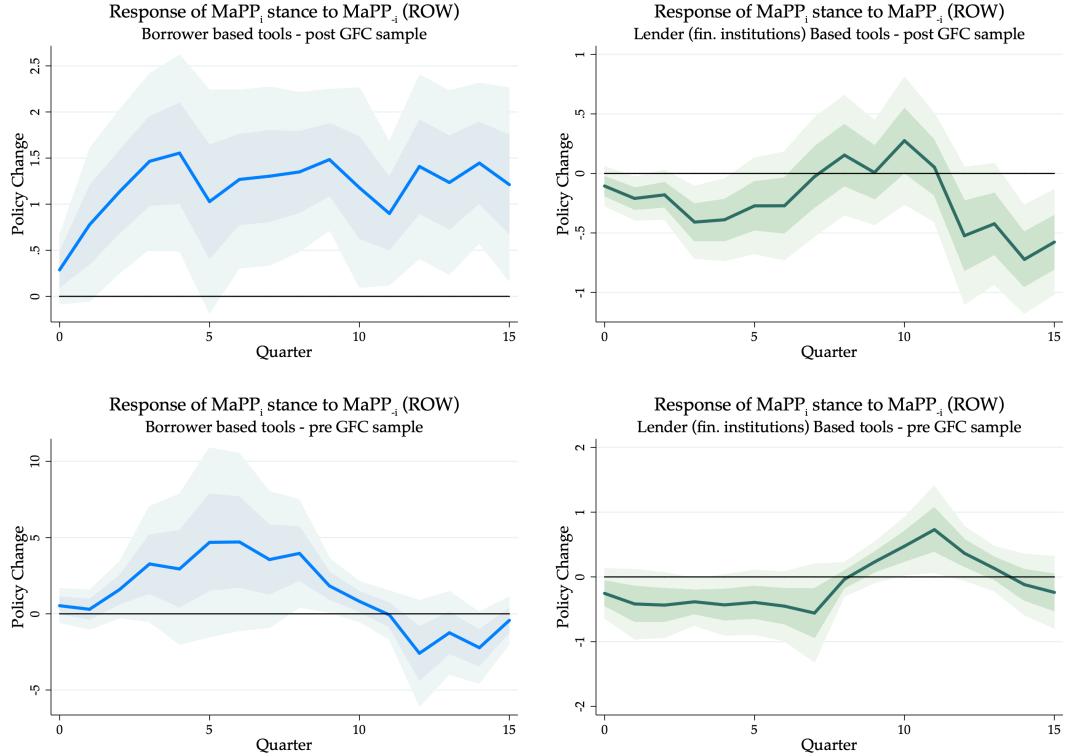
Note: Impulse Response Function from a local projection based on equation (2). MaPP Indicator: All 17 instruments. Top, left: AE policy response to Foreign AE policies; Top, right: AE policy response to Foreign EM policies; Bottom, left: EM policy response to Foreign AE policies; Top, right: EM policy response to Foreign EM policies. Units: Policy Change (+1: tightenings, -1: loosening). Sample periods: post-GFC sample: 2008Q4-2018Q4, pre-GFC sample: 1999Q1-2008Q3.

Figure 21: Response of MaP policies to policy changes in the ROW. Model for Emerging Economies.



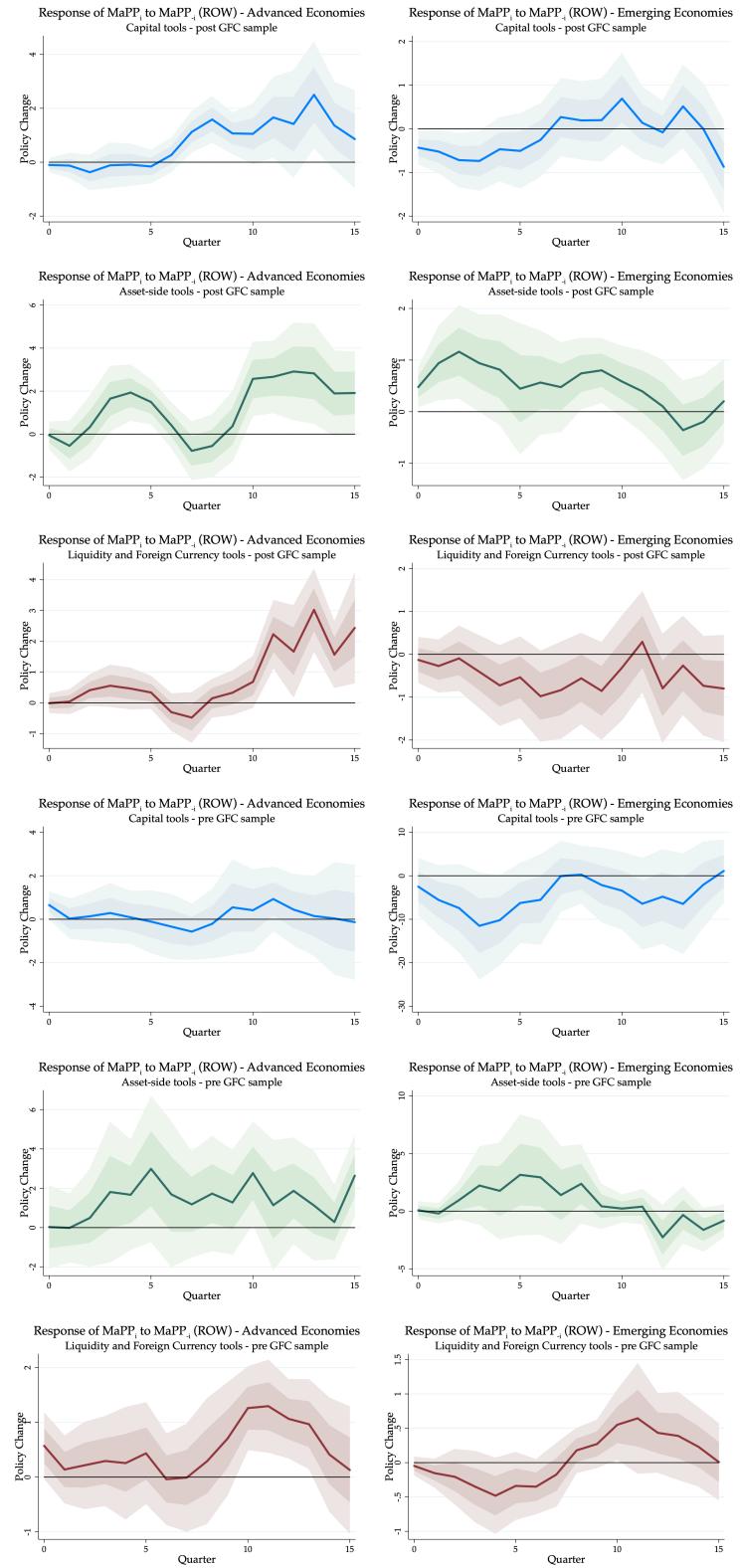
Note: Impulse Response Function from a local projection based on equation (2). MaPP indicator: All 17 instruments. Top, left: AE policy response to Foreign AE policies; Top, right: AE policy response to Foreign EM policies; Bottom, left: EM policy response to Foreign AE policies; Top, right: EM policy response to Foreign EM policies. Units: Policy Change (+1: tightenings, -1: loosening). Sample periods: post-GFC sample: 2008Q4-2018Q4, pre-GFC sample: 1999Q1-2008Q3.

Figure 22: Response of MaP policies to policy changes in the Rest Of the World. Response to Borrower instruments (left panel) and to Lender based policies (right panel).



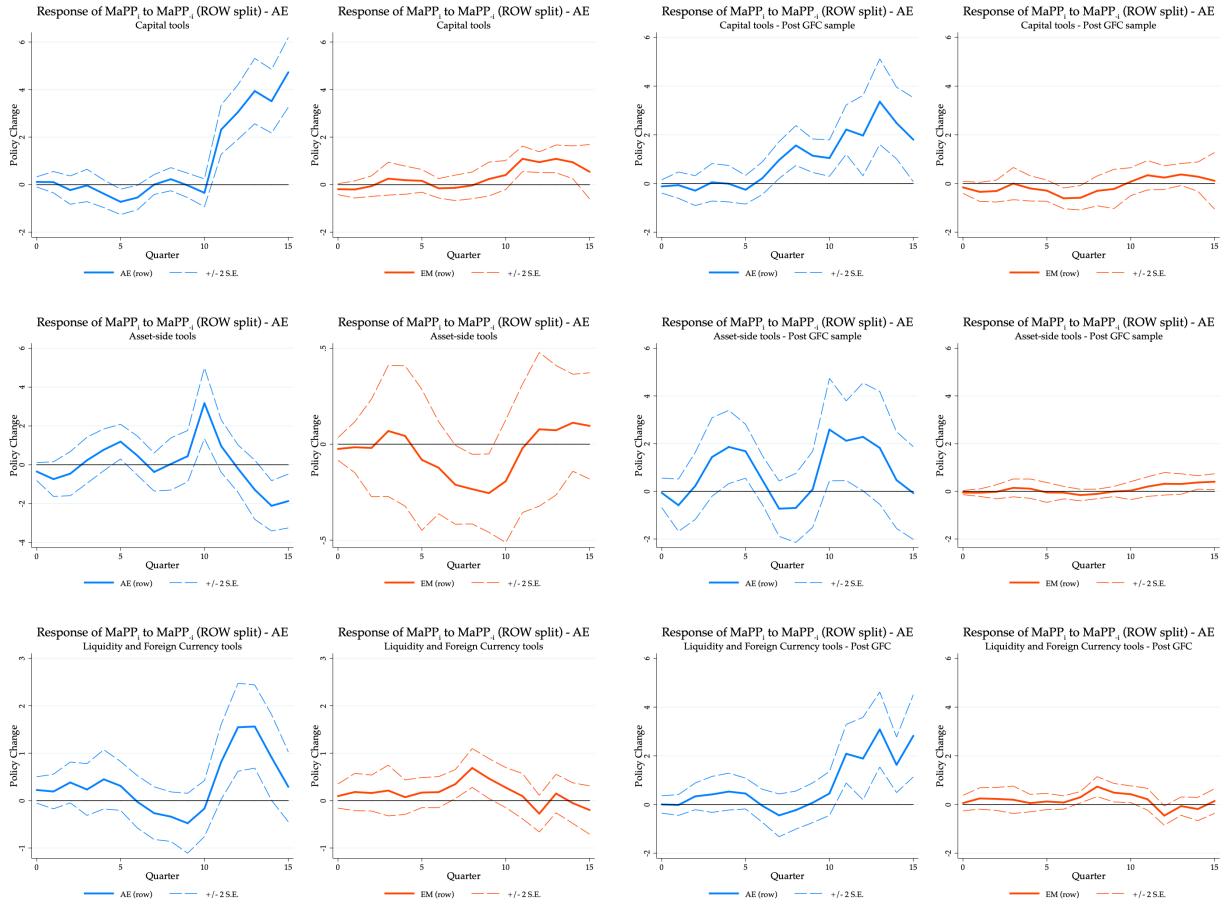
Note: the figure displays the Impulse Response Function from a local projection based on equation (3). The foreign MaPP indicator includes Borrower tools (response shown in left panel) and Lender tools (right panel) separately as explanatory variables. Units: Policy Change (+1: tightenings, -1: loosening). Sample periods: post-GFC sample: 2008Q4-2018Q4; pre-GFC: 1999Q1-2008Q3,

Figure 23: MaPP Response to Capital, Asset, and to Liquidity policies. Model for Advanced Economies (left) and for Emerging Economies (right). Subsample periods.



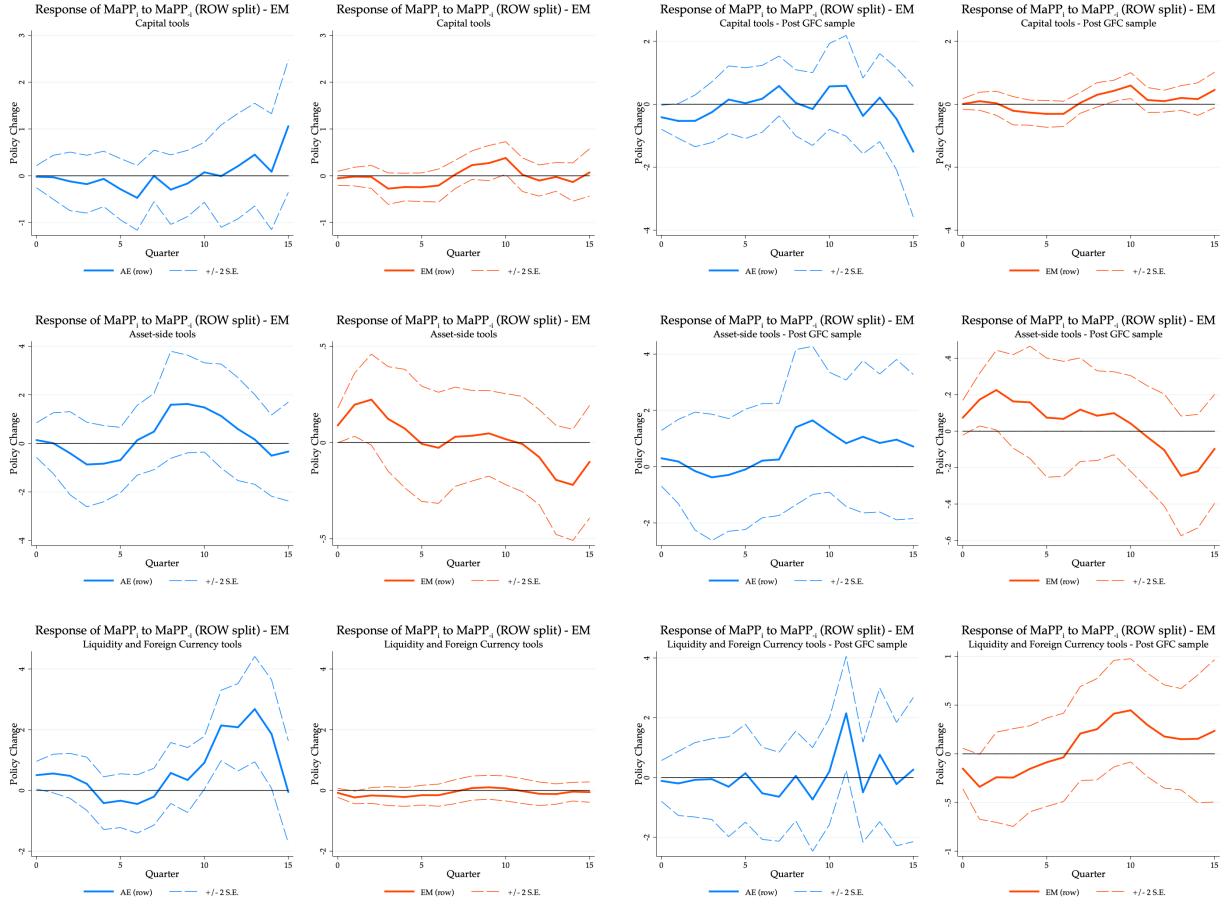
Note: Impulse Response from a local projection based on equation (5) estimated separately for Advanced (left panel plots) and Emerging Economies (right panel plots). The foreign MaPP includes Capital tools (first row), Asset-side tools (second row), and Liquidity and Foreign Currency tools (third row) separately as explanatory variables. Units: Policy Change (+1: tightenings, -1: loosening). Sample periods: complete: 1999Q4-2018Q4, post-GFC sample: 2008Q4-2018Q4, pre-GFC sample: 1999Q1-2008Q3.

Figure 24: Response of MaP policies to policy changes in the rest of the world. Capital, Asset-side, and Liquidity tools. Model for Emerging Economies.



Note: the figure displays the Impulse Response Function from a local projection based on equation (2). Where the MaPP indicator comprises the information for all the 17 instruments. Top, left: AE policy response to Foreign AE policies; Top, right: AE policy response to Foreign EM policies; Bottom, left: EM policy response to Foreign AE policies; Top, right: EM policy response to Foreign EM policies. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4

Figure 25: Response of MaPP policies to policy changes in the rest of the world. Capital, Asset-side, and Liquidity tools. Model for Emerging Economies.



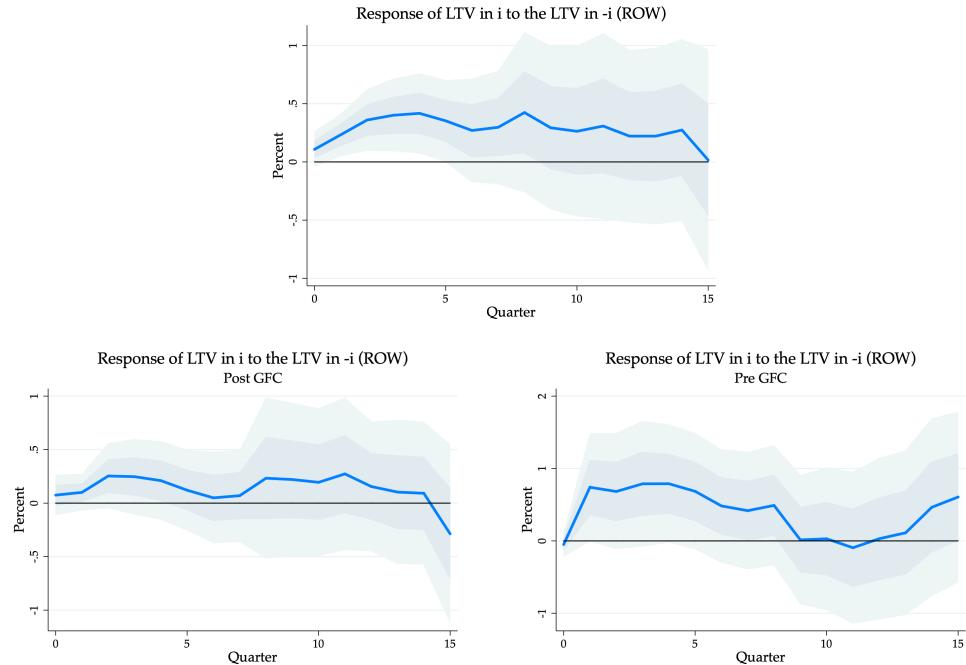
Note: the figure displays the Impulse Response Function from a local projection based on equation (2). Where the MaPP indicator comprises the information for all the 17 instruments. Top, left: AE policy response to Foreign AE policies; Top, right: AE policy response to Foreign EM policies; Bottom, left: EM policy response to Foreign AE policies; Top, right: EM policy response to Foreign EM policies. Units: Policy Change (+1: tightenings, -1: loosening). Sample period: 1999Q4-2018Q4

C Loan-to-Value Ratio Linear Projection Results

Estimation Equation for Loan-to-Value instrument:

$$\Delta_h LTV_{\mathbf{i},t} = \alpha_i^{(h)} + \beta^{(h)} \Delta LTV_{-\mathbf{i},t-1} + \varepsilon_{i,t+h} + \sum_{k=0}^4 \phi_k^{(h)} X_{i,t-k} + \sum_{k=0}^4 \gamma_k^{(h)} G_{t-k} + \varepsilon_{i,t+h} \quad (6)$$

Figure 26: Response of Local LTV MaP policies to policy changes in the LTV in rest of the world.



Note: the figure displays Impulse Response Function from a local projection based on equation 1. Where the MaPP indicator comprises the information for all the 17 instruments. Units: percentage. Sample period: 2008Q4-2018Q4 (left panel), 1999Q1-2008Q3 (right panel).

Table 6: Summary of Sub-sample results for local LTV responses to foreign LTV changes

Coefficient for $\Delta MaPP_{-i,t}$	All Countries			Advanced Econ.			Emerging Econ.		
	ROW	ROW (split)		ROW	ROW (split)		ROW	ROW (split)	
		All	AE		All	AE		All	AE
Full Sample	+						+	+	
Post GFC	-						-		-
Pre GFC							+		