Do Macroprudential Policies Affect Non-bank Financial Intermediation?*

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We analyze how macroprudential policies (MaPs), largely applied to banks and to a lesser extent to borrowers, affect non-bank financial intermediation (NBFI). Using data for 24 of the jurisdictions participating in the Financial Stability Board's monitoring exercise over the period 2002–17, we study the effects of MaP actions on bank assets and on those NBFI activities that may involve bank-like financial stability risks (the narrow measure of NBFI). We find that a net tightening of domestic MaPs increases these NBFI activities and decreases bank assets, raising the NBFI share in total financial assets. By contrast, a net tightening of MaPs in foreign jurisdictions leads to a reduction of the NBFI share—as a result of a drop in NBFI activities or an increase in domestic banking assets. Tightening and easing MaPs have largely symmetric effects on NBFI. We find that the effect of MaPs (both domestic and foreign) is economically and statistically significant for all those NBFI economic functions that may pose risks to financial stability.

JEL Codes: G10, G21, O16, O40.

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1. Introduction

The Great Financial Crisis (GFC) of 2007–09 has highlighted the limits of traditional policies (notably microprudential and monetary policy) in addressing the potential negative effects of credit and asset price cycles on financial stability. As a response, central banks and regulators in emerging market economies (EMEs) and advanced economies (AEs) increasingly rely on long-advocated (e.g., Crockett 2000) macroprudential policies (MaPs). MaPs that are addressed at banks include limits on credit growth, caps on loan-to-value (LTV) and debt-service-to-income ratios, and additional liquidity and capital requirements, such as minimum liquidity ratios or countercyclical capital buffers. In addition, MaPs such as loan-to-value limits have targeted risks related to borrowers.

These MaPs have limited the procyclicality of bank credit growth (Cerutti, Claessens, and Laeven 2017; for reviews of macroprudential policies, see Claessens 2015 and Galati and Moessner 2018). Together with the various other reforms implemented since the GFC, including the Basel III framework and the closer supervisory oversight, MaPs have increased the resilience of banking systems around the world. However, two factors may limit their efficacy for overall financial stability.

First is the development of a large non-bank financial intermediation (NBFI) sector, also referred to as the shadow banking system. The NBFI sector represents a potential way through which financial intermediation could circumvent regulation in the core banking system, impairing the effectiveness of various policies, including MaPs, and potentially adding to overall financial stability risks. Indeed, research has found evidence that a tightening of MaPs may shift activities domestically towards the NBFI (Cizel et al. 2019).

Second is the presence of possible spillover effects across jurisdictions. Recent analyses have documented that MaPs can improve financial stability by reducing the impact of global factors (e.g., International Monetary Fund 2020, Takáts and Temesvary 2021). However, it has also been documented that cross-border lending allows financial markets to avoid MaPs and leads to spillover effects from MaPs (Avdjiev et al. 2017, Cerutti and Zhou 2018). This literature has by and large focused on the cross-country effect of MaPs on bank lending only, thus excluding effects on NBFI sector-related

flows, and possibly underestimating total spillovers (Buch and Goldberg 2017). However, this analysis is especially important given the growing role of non-bank financial intermediaries in cross-border capital flows in both AEs and EMEs (the so-called second phase of global liquidity; Shin 2014, Bruno and Shin 2015).

This paper tries to fill this gap by studying how domestic MaPs affect the size of the NBFI assets both domestically and internationally. On the domestic side, we test if a tightening (easing) of MAPs is associated with an increase (decrease) of financial activities in NBFI. And, we test for cross-country spillovers by estimating whether the use of MaPs in foreign countries affects the size of the NBFI domestically.

We focus on data from a subset of jurisdictions participating in the annual monitoring exercise of the Financial Stability Board (FSB), for which a sufficient number of observations are available.[1] For these 24 jurisdictions, we observe yearly data on NBFI over the period 2002–17. In particular, we focus on non-banks that perform economic functions that may give rise to bank-like financial stability risks (what has been called the "narrow measure" of NBFI, hereafter NBFI). The database also includes information on the size of financial sectors based primarily on balance sheet data. Finally, we use the full matrix of cross-country bank claims and liabilities sourced from the Bank for International Settlement (BIS) international banking statistics. The data on MaPs are obtained from three different primary sources: Lim et al. (2011, 2013), Kuttner and Shim (2016), and Cerutti et al. (2017). We classify MaPs under different categories over the period 2000–16 (which is convenient in our case, as we study the impact of lagged MaPs on the size of NBFI over 2002–17). In our baseline model, we estimate the effect of domestic and foreign MaPs (measured over a five-year rolling window) on the size of NBFI. Since foreign MaPs are likely to spill over across countries through financial linkages, we weight foreign countries' MaPs

[1]The jurisdictions are Argentina, Australia, Belgium, Canada, Chile, France, Germany, India, Indonesia, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, Russia, Singapore, South Africa, Spain, Switzerland, Turkey, the United Kingdom, and the United States. We excluded some jurisdictions given the absence of information on the use of macroprudential measures or data gaps in the NBFI components.

according to (beginning-of-period) claims and liabilities towards the country of study.

We find that a net tightening of domestic MaPs causes the share of domestic NBFI assets in total financial assets to increase, driven by both an increase in NBFI assets and a decrease in bank assets. A net tightening of MaPs by foreign countries leads to a reduction in the economy's share of NBFI in total financial assets. When we distinguish between tightening and easing of MaPs, we find that the effects are by and large symmetric. Dividing MaPs into different categories, we find that the effects are stronger for cyclical MaPs (that focus on dampening the financial cycle) than for resilience MaPs (that are intended to directly increase the financial sector's resilience). We also find stronger effects for MaP measures that affect directly borrowers (i.e., loan demand) rather than directly lenders (i.e., loan supply). Moreover, the leakages effects for foreign MaPs are stronger in those jurisdictions with a weaker independence of the supervision authority.

The effect of MaPs (both domestic and foreign) is economically and statistically significant for all components of NBFI assets (i.e., five economic functions as defined by the FSB: for details, see Section 2.1). The spillovers thus appear relevant for financial stability, in particular given the significant effects on collective investment vehicles, such as money market funds (MMFs) and fixed-income funds, with features that make them susceptible to runs.

Our empirical results could be driven by spurious correlations between our dependent variables and domestic and foreign MaPs. To assure the robustness of our results, we implement a variety of tests. First, we perform a Philipps-Perron test to check the stationarity of the variables in our panel and provide evidence against serial correlation of the main variables over time. Second, we test whether omitted variables may be driving our results by implementing the Altonji, Elder, and Taber (2005) selection test on "unobservables based on observables." Here we find that, if anything, omitted variables would bias our results towards zero, i.e., statistically insignificant results. As such, this test reinforces our results.

Our results complement and contribute to the existing literature and policy debates in several ways. First, our results confirm those of Cizel et al. (2019) and Irani et al. (2021), who show that MaPs cause substitution effects towards non-bank credit. We complement those

by distinguishing within NBFI between the five economic functions as defined by the FSB. Second, we extend the evidence on the cross-country spillover effects of MaPs by estimating a direct effect on foreign economies' NBFI. In particular, we show that a domestic net tightening of MaPs may reduce NBFI (including those assets that are more exposed to runs) in foreign jurisdictions. This externality may imply that the domestically optimal MaP stance could be laxer or tighter than what would be optimal from a global point of view. More generally, the presence of cross-country spillovers affecting the NBFI sector calls for international coordination in the implementation of macroprudential policies. Third, and more broadly, we contribute to the growing literature that studies the evolution of global banking and its interaction with financial regulation (e.g., Claessens and van Horen 2016, Buch and Goldberg 2017, Takáts and Temesvary 2021).

Our paper also relates to the discussion on the use of MaPs to address financial stability concerns beyond the banking sector—i.e., in the NBFI sector as well as financial market infrastructures (European Systemic Risk Board 2016, Constâncio 2017). Finally, our paper complements the theoretical literature on the need for international cooperation. Rubio (2020) analyzes the presence of spillovers from domestic macroprudential policies to foreign banks and vice versa and finds that the lack of reciprocity of some macroprudential instruments may result in "leakages." Agenor et al. (2021) find that self-oriented national macroprudential policies imply insufficient subsidies in the long run and wider efficiency gaps in the short run, resulting in substantial gains from cooperation. Our empirical results complement these findings.

The remainder of the paper is structured as follows. Section 2 introduces the data used for the analysis and provides an initial descriptive analysis. Section 3 describes the empirical model and presents the estimation results. Section 4 concludes.

2. Data and Stylized Facts

The analysis in this paper is performed using two main databases. We match jurisdiction-level information on financial assets of the narrow measure of NBFI (hereafter, for simplicity, also referred to as NBFI assets), collected in the FSB annual monitoring exercise,

with data on MaPs enacted by central governments, central banks, and supervisory agencies, collected by several researchers.

2.1 Non-bank Financial Activities

The FSB conducts an annual monitoring exercise to assess global trends and risks in the NBFI sector (the data collected was previously called the "annual monitoring exercise on the global shadow banking system").[2] It adopts a practical two-step approach. First, the monitoring exercise casts the net wide to capture developments in all non-bank financial institutions.[3] The exercise then focuses on a subset of NBFI entities that are involved in certain financial activities to create the "narrow measure of NBFI." This is meant to focus the data collection on those financial activities that may involve bank-like financial stability risks (i.e., maturity/liquidity transformation and/or leverage) and may warrant policy responses. This step is undertaken by classifying a subset of the NBFI entities into five economic functions (EFs).

Five economic functions involving non-bank credit intermediation that may pose risks to financial stability were identified in the FSB's high-level Policy Framework for Strengthening Oversight and Regulation of Shadow Banking Entities (hereafter the FSB Policy Framework) published in 2013.[4] These five EFs, listed also in Table 1, are as follows:

(i) Management of collective investment vehicles (CIVs) with features that make them susceptible to runs (EF1). Typical entity types that are classified include MMFs, fixed-income funds, mixed funds, credit hedge funds, and real estate funds.

(ii) Loan provision that is dependent on short-term funding (EF2). Typical entity types that are classified include finance companies, leasing/factoring companies, and consumer credit companies.

[2]For the most recent results, see FSB (2020b).

[3]The monitoring universe of non-bank financial intermediation (MUNFI) or non-bank financial intermediation (NBFI) sector includes insurance corporations, pension funds, other financial intermediaries (OFIs), and financial auxiliaries.

[4]FSB (2013). See also FSB (2020a).

Table 1. Classification of Non-bank Financial Intermediation by Economic Functions (EFs)

Economic Function	Definition	Typical Entity Types
EF1	Management of collective investment vehicles with features that make them susceptible to runs	MMFs, fixed-income funds, mixed funds, credit hedge funds, real estate funds
EF2	Loan provision that is dependent on short-term funding	Finance companies, leasing/factoring companies, consumer credit companies
EF3	Intermediation of market activities that are dependent on short-term funding or on secured funding of client assets	Broker-dealers, securities finance companies
EF4	Facilitation of credit creation	Credit insurance companies, financial guarantors, monolines
EF5	Securitization-based credit intermediation and funding of financial entities	Securitization vehicles, structured finance vehicles, asset-backed securities

Note: The FSB Policy Framework acknowledges that shadow banking may take different forms across jurisdictions due to different legal and regulatory settings as well as the constant innovation and dynamic nature of the non-bank financial sector. It also enables authorities to capture new structures or innovations that may create financial stability risks from NBFI, by looking through to the underlying economic function and risks of these new innovative structures. Thus, the entity types listed should be taken as typical examples. For details, see FSB (2018, 2020a, 2020b).
Source: FSB.

(iii) Intermediation of market activities that depend on short-term funding or on secured funding of client assets (EF3). For example, broker-dealers and securities finance companies are classified into this EF.

(iv) Facilitation of credit creation (EF4). For example, credit insurance companies, financial guarantors, and monolines are classified into EF4.

(v) Securitization-based credit intermediation and funding of financial entities (EF5). Examples of entity types classified are securitization vehicles, structured finance vehicles, and asset-backed securities.

In this paper, we use the total financial assets data for the so called narrow measure of NBFI[5] (EF1 to EF5) collected from 24 participating jurisdictions in the 2019 FSB monitoring exercise as an indicator for the NBFI size of the relevant jurisdiction.[6] The data are year-end outstanding amounts for the period 2002–17.[7]

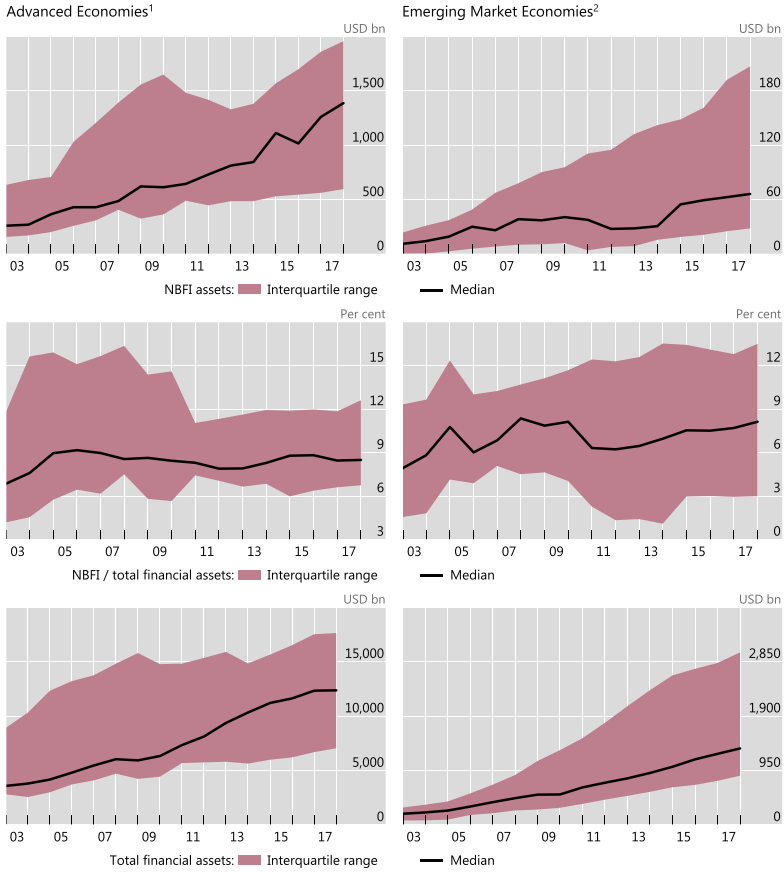
The first row of Figure 1 shows the evolution of NBFI assets for two country groupings: advanced economies and emerging market economies. The black line indicates the median jurisdiction in the sample while the shaded area reports the interquartile range that excludes the first and the last quartile. This shows that NBFI activities have rapidly expanded, especially in the last part of the sample.

[5]The terms "narrow measure of NBFI" and "NBFI assets" are used interchangeably in this paper. This concept differs from the broader measure of total financial assets of the NBFI sector, previously referred to as MUNFI. In 2017, the narrow measure of NBFI represented around 28 percent of the total financial assets of the NBFI sector for all 29 jurisdictions participating in the FSB monitoring exercise.

[6]A total of 29 jurisdictions participate in the FSB annual monitoring exercise. Data from 24 jurisdictions are used, as a sufficient number of observations are available. Thus, the description in this section may differ from the observations in FSB (2020a) using data from all 29 jurisdictions, but they are broadly consistent.

[7]Converted into USD using a year-end exchange rate using a constant exchange rate (from end-2017). Some jurisdictions' narrow measures may be underestimated especially in early years due to gaps in available data. Data reported are based on a conservative assessment by authorities and may be further refined as more granular data become available.

Figure 1. Evolution of Non-bank Financial Intermediation and Total Financial Activities

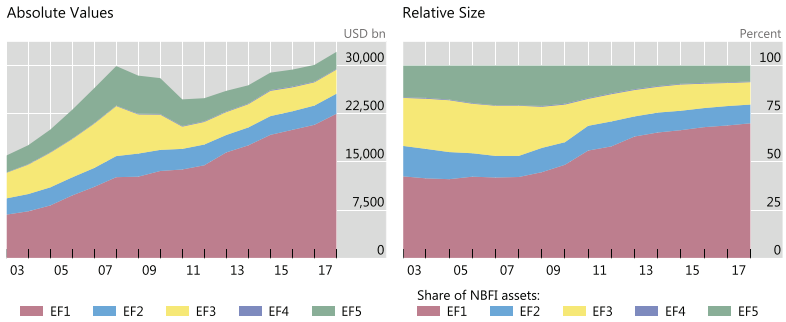


[1]AU, BE, CA, CH, DE, ES, FR, GB, IE, IT, JP, LU, NL, and US. [2]AR, CL, ID, IN, KR, MX, RU, SG, TR, and ZA.
Source: FSB; authors' calculations.

Similar considerations can be drawn looking at the second row of Figure 1, which reports the share of narrow NBFI measured over total financial system assets. Over our 16-year horizon of study, the median share has increased by 2 percentage points to 9 percent in AEs, and by 3 percentage points to 8 percent in EMEs.

The behavior of a share typically resembles that of a stationary variable. We confirm that, for the shares, a Phillips-Perron test

Figure 2. Evolution and Composition of the Narrow Measure of Non-bank Financial Intermediation



Source: FSB; authors' calculations.

always rejects the null hypothesis of unit root against the alternative that the series is stationary. Similar results are obtained considering alternative measures for the variables we use (see next section for details). There are, however, differences in the evolution of NBFI assets across jurisdictions, in general and as a share of total financial assets. The second row of Figure 1, for example, shows that there were some signs of stagnation or very slow growth in the share of NBFI assets in total financial assets in AEs after the GFC, whereas in EMEs the share in general increased.[8]

The left-hand panel of Figure 2 shows the evolution in dollar values of the different components of NBFI over time. Over the period 2002–17, total NBFI activities had an average annual growth rate of 4.7 percent. CIVs with features that make them susceptible to runs (EF1) grew by 8 percent. These EF1 entities represent around two-thirds of the total narrow measure of NBFI in 2017. CIVs in EF1 invest mostly in credit assets (e.g., for fixed-income funds and MMFs, reflecting their business models) and are potentially involved in liquidity transformation.

Non-bank financial intermediaries engaging in loan provision dependent on short-term funding (EF2) grew at an average pace of 1.4 percent over the sample period to account for about 10 percent of the narrow measure in 2017. Finance companies, the entity

[8]This observation is broadly consistent with the assessment using the most recent data for all participating jurisdictions in the monitoring exercise. See FSB (2020a, p. 36).

type most commonly classified into EF2, may employ higher leverage and, in some jurisdictions, a high degree of maturity transformation.

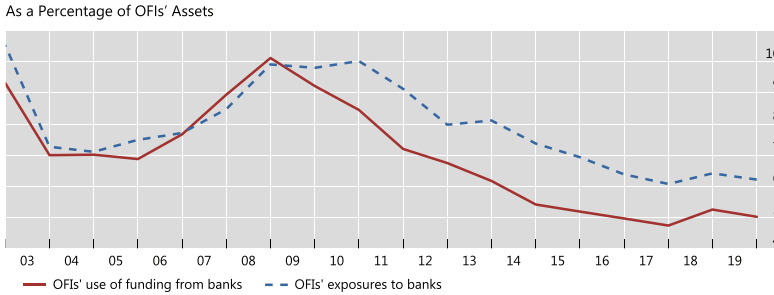
The financial assets of market intermediaries that depend on short-term funding or secured funding of client assets (EF3) shrank significantly during the GFC. This is not necessarily related to the specific evolution of MaPs but could be due to the effect of the crisis. This component represented about 12 percent of the total narrow measure in 2017. Broker-dealers constitute the largest EF3 entity type. Reflecting their business models, broker-dealers in some jurisdictions tend to employ significant leverage, particularly when accounting for off-balance-sheet exposures, although it seems considerably less than prior to the GFC.[9]

Entities involved in the facilitation of credit creation (EF4), such as financial guarantors and credit insurers, grew on average by 4 percent. Their share of NBFI remains very small (0.4 percent of the total in 2017), also due to the difficulty in capturing off-balance-sheet exposures. Finally, securitization-based credit intermediation (EF5) shrank significantly after the GFC and was later influenced by specific regulatory initiatives. For instance, securitization pools were often backed by bank-provided lines of credit (ABCP or warehousing facilities), which incurred significantly higher capital charges post-GFC. This component accounted for 8 percent of the narrow measure in 2017.

The interconnectedness between banks and shadow banking entities is often cited as a key financial stability concern. Abad et al. (2017) document that step-in risk exists for banks when they provide implicit guarantees and sponsor support to securitization conduits, structured investment vehicles, and MMFs. Figure 3 reports two measures of interlinkages between other financial institutions (OFIs) and banks. The red line represents OFIs' use of funding from banks as a share of OFI's assets, while the blue line represents overall OFIs' exposures to banks, measured as OFIs' claims on banks as a share of OFI assets. Both indicators have a similar pattern: linkages between OFIs and banks increased until the GFC and then started a downward trend and were in 2019 at levels lower than prior to 2008. This downward trend in the pre-pandemic period was broad based, with

[9] According to FSB (2018), net repo market funding of broker-dealers increased in 2017, after several years of reduced repo market funding.

Figure 3. Other Financial Intermediaries' Interconnectedness with Banks[1]



[1]Other financial intermediaries' (OFI) use of funding from banks = OFIs' liabilities to banks as a share of OFI assets. OFIs' exposures to banks = OFIs' claims on banks as a share of OFI assets.
Source: FSB (2020b).

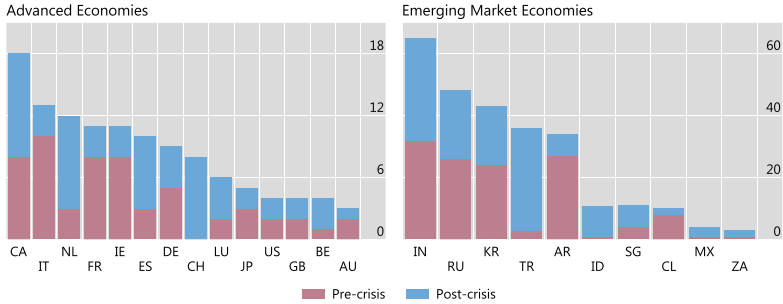
OFI exposure to banks decreasing in around two-thirds of the jurisdictions that are included in the FSB sample. However, Aldasoro, Huang, and Kemp (2020) show that the level of cross-border bank claims on non-bank financial institutions, such as the investment funds and central counterparties, have grown by 63 percent in the period 2015–19. They also show that financial links between banks and NBFIs are mainly denominated in U.S. dollars and concentrated in financial centers and large AEs but have also grown in EMEs.

2.2 Macroprudential Policies

The data on MaPs are gathered from three different sources: Lim et al. (2011, 2013), Kuttner and Shim (2016), and Cerutti et al. (2017).[10] These sources capture MaPs enacted by central governments, supervisory authorities, and central banks. They classify MaPs under 10 categories: credit growth limits, liquidity requirements, maximum debt-service-to-income ratio and other lending criteria, capital requirement/risk weights, provisioning requirement,

[10]These data sets themselves draw on surveys of central banks and regulatory authorities, complemented with a variety of sources including official documents and reports, including financial stability reports and monetary policy bulletins.

Figure 4. Policy Activism Varies between Countries[1]: Number of Policy Actions



[1]The sample covers macroprudential policy actions adopted in 24 countries (14 AEs and 10 EMEs). The database is constructed using information in Lim et al. (2011, 2013), Kuttner and Shim (2016), and Cerutti et al. (2017). Data for the pre-crisis period cover the 1990–2007 period, while the post-crisis period refers to 2008–16.
Source: IMF; BIS; authors' calculations.

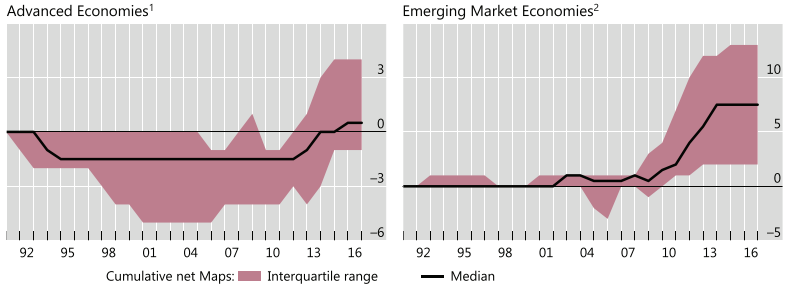
limits on banks' exposure to the housing sector, reserve requirements, maximum loan-to-value ratio, and loan prohibition, limits on net open position, and foreign-currency lending limits. Altogether, these different data sources allow us to build a database of MaPs covering the 24 jurisdictions analyzed in this study over the period 1990–2016.

Figure 4 summarizes these data and highlights the different degree of activism between AEs and EMEs (left- and right-hand panels, respectively), as well as before and after the GFC (red and blue bars, respectively). Macroprudential activism is clearly greater among EMEs across the whole sample than among AEs, but has increased over time across both groups.[11] Figure 4, furthermore, provides clear evidence of a sizable heterogeneity across countries, and also within each group, that does not appear to be simply explained by size, openness, or regional or other factors, a point to which we will return at the end of this paper.

For each category, the MaP policy index can take on three discrete values: −1 for loosening actions, 1 for tightening actions, and

[11]Activism across EMEs displays a marked upward trend, which might have reached its peak around the time of the GFC. See Altunbas, Binici, and Gambacorta (2018) for a more detailed description.

Figure 5. Net Cumulative MaPs: 1990–2016



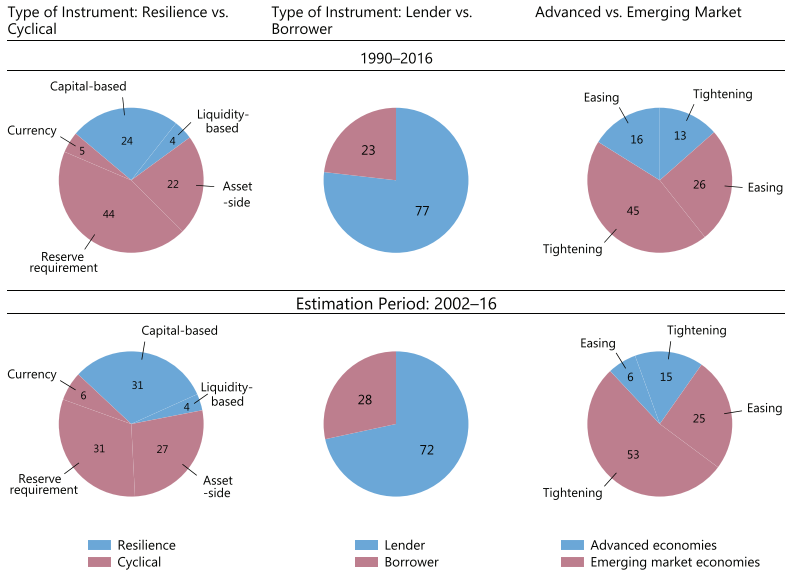
[1]AU, BE, CA, CH, DE, ES, FR, GB, IE, IT, JP, LU, NL, and US. [2]AR, CL, ID, IN, KR, MX, RU, SG, TR, and ZA.
Source: Authors' calculations.

0 for no change. We use these policy actions to construct the aggregated macroprudential index used in the analysis. A shortcoming of this approach is that we treat all MaP actions in the same way and symmetrically. However, we relax this assumption in the following section to consider easing and tightening actions separately and individual categories of MaPs.

We can use the information on the number of interventions aimed at easing/tightening to compute a country's MaP stance. The distribution of the net cumulative index for MaPs is reported in Figure 5. The macroprudential stance for AEs was generally loosening prior to the GFC and tightening after 2011. In EMEs, the MaP stance was neutral until 2001, and subsequently tightened, especially after the GFC.

MaPs can be divided into different categories. Some instruments are intended to increase directly the financial sector's resilience, while others focus on dampening the overall financial cycle. We classify the former as (i) bank capital-based measures (capital requirement/risk weights and provisioning requirements) and (ii) liquidity requirements. Conversely, instruments that aim to smooth the credit cycle include (iii) asset-side instruments (credit growth limits, maximum debt-service-to-income ratios, limits on bank exposures to the housing sector such as maximum loan-to-value ratios); (iv) changes in reserve requirements; and (v) currency mismatches instruments (limits on foreign-currency exchange exposures and net open positions).

Figure 6. Use of Macroprudential Instruments[1] (in percent)



[1]Macroprudential tools for resilience include (i) capital-based instruments (loan loss provisions and risk weights on housing loans) and (ii) liquidity requirements. Cyclical macroprudential tools include (iii) asset-side instruments (limits on banks' exposure to the housing sector, limits on credit growth, maximum debt-service-to-income ratio and other lending criteria, and maximum loan-to-value ratio and loan prohibition); (iv) changes in reserve requirements; and (v) currency instruments (foreign-currency lending limits and limits on net open position). Macroprudential tools for lenders include foreign-currency lending limits, liquidity requirements, loan loss provisions, reserve requirements, and risk weights on housing loans. Borrower macroprudential tools include limits on banks' exposure to the housing sector, limits on credit growth, maximum debt-service-to-income ratio and other lending criteria, and maximum loan-to-value ratio and loan prohibition.
Source: Authors' calculations.

Figure 6 shows that around one-third of MaPs used in the 24 jurisdictions included in our analysis were aimed at directly increasing the financial sector's resilience (Figure 6, left-hand panel). The vast majority of measures were intended to smooth the cycle—i.e., they were used in a countercyclical manner to dampen credit booms or mitigate expected or realized credit crunches. In more than 30 percent of the cases MaPs involved changes in reserve requirements

for banks. Moreover, around three-quarters of the measures were targeted towards lenders (Figure 6, center panel).[12] Overall, 68 percent of the interventions were intended to tighten financial conditions (right-hand panel). Of all the MaPs adopted, around three-quarters were by EMEs (right-hand panel).

We match jurisdiction-level information on NBFI assets with data on MaPs. The final sample is composed of 260 annual observations from 24 jurisdictions. Table 2 shows the descriptive statistics of the variables used for the regression analyses. Table 3 reports non-stationarity tests for the financial asset variables used in the regressions. In particular, we report results of a Phillips-Perron unit-root test. All tests show that variables are stationary, both using a model with one lag and using a model with two lags.

2.3 Identifying Domestic and External Macroprudential Interventions

For each jurisdiction, in each year, we count the number of easing MaPs (MaP^E_{it}) and the number of tightening MaPs (MaP^T_{it}). Following Boar et al. (2017), we take a sum of interventions over a five-year moving window, so that

$$MaP^X_{it} = \sum_{\tau=1}^{5} \widetilde{MaP}^X_{it-\tau} \quad \text{for } X \in \{E, T\}.$$

This index identifies domestic MaPs.

We measure the effect in jurisdiction i of MaPs adopted in another jurisdiction j in year t, MaP^E_{jt} and MaP^T_{jt}, by weighting them by the share of financial claims j has towards i relative to total financial claims to i (w_{ij}) at the beginning of the period.

[12]MaPs that target lenders include credit growth limits, capital-based instruments (countercyclical capital requirements, leverage restrictions, general or dynamic provisioning), liquidity requirements, changes in reserve requirements, variations in limits on foreign-currency exchange mismatches and net open positions, and changes in risk weights. MaPs that affect borrowers include maximum debt-service-to-income ratio and limits to banks' exposures to the housing sector as a maximum loan-to-value ratio. Those affecting banks' ability have some overlap with the ones aimed at increasing resilience, and those affecting households' and firms' ability to borrow have some overlap with those aimed to mitigate the financial cycle, but the overlap is surely not perfect.

Table 2. Descriptive Statistics[1]

Variable	Mean	St. Dev.	Min.	Max.
NBFI / Total Financial Assets	9.77	6.23	0.30	29.54
Log-NBFI Assets[2]	12.30	2.29	5.92	16.50
Log-Banking Assets[2]	14.00	1.91	8.19	16.79
Log-Bank Deposits[2]	13.60	1.38	10.65	16.21
Log-Economic Function EF1[2]	11.78	2.27	5.54	15.77
Log-Economic Function EF2[2]	8.99	2.89	4.26	14.38
Log-Economic Function EF3[2]	8.06	3.33	0.61	15.38
Log-Economic Function EF4–5[2]	9.11	3.45	1.07	15.15
Total Financial Assets / GDP	174.01	107.72	2.62	333.27
MAP	1.13	2.51	–2.00	12.00
MAP^E (Easing)	0.68	1.44	0.00	12.00
MAP^T (Tightening)	1.82	3.05	0.00	18.00
MAP Other – Weighted by Claims	1.14	1.48	–0.64	5.21
$MAP\ Other^E$ (Easing) – Weighted by Claims	0.44	0.22	0.02	1.07
$MAP\ Other^T$ (Tightening) – Weighted by Claims	1.58	1.51	0.05	5.46
MAP Other – Weighted by Liabilities	1.28	1.67	–0.64	6.23
$MAP\ Other^E$ (Easing) – Weighted by Liabilities	0.40	0.21	0.03	0.94
$MAP\ Other^T$ (Tightening) – Weighted by Liabilities	1.67	1.67	0.01	6.39
MAP Other – Weighted by Claims + Liabilities	1.20	1.55	–0.64	5.52
$MAP\ Other^E$ (Easing) – Weighted by Claims + Liabilities	0.42	0.19	0.03	0.89
$MAP\ Other^T$ (Tightening) – Weighted by Claims + Liabilities	1.62	1.57	0.07	5.75
Log GDP	13.69	1.11	10.30	14.92
Lagged Real GDP Growth	2.14	2.38	–9.77	6.12
Inflation	0.03	0.03	–0.02	0.09
Supervisory Authority Protection	0.80	0.41	–1.00	1.00

[1]The number of observations is 260. [2]Corrected for inflation.

Table 3. Non-stationarity Test on the Financial Asset Variables[1,2]

Variable	P-value	
	Lag (1)	Lag (2)
NBFI Assets / Total Financial Assets	0.00	0.00
Log-NBFI Assets	0.00	0.00
Log-Banking Assets	0.00	0.00
Log-Economic Function EF1	0.00	0.00
Log-Economic Function EF2	0.00	0.00
Log-Economic Function EF3	0.00	0.00
Log-Economic Function EF4–5	0.02	0.02
Total Financial Assets / GDP[3]	0.03	0.01

[1]All the variables have been standardized, dividing each variable by its standard deviation. [2]The model considered in column 1 (2) includes one lag (two lags) of the variable and a constant. Each column reports Fisher-type unit-root test for panel data using the Phillips-Perron test. The null hypothesis is the presence of a unit root (stochastic trend). [3]Non-standardized.

The share of financial claim measures the linkage between jurisdiction i and jurisdiction j and underlines the intensity of potential spillover effects. If the two countries have no financial linkages ($w_{ij} = 0$), we can assume that changes in MaPs in one country have no effect on the other. By contrast, if all financial claims to jurisdiction i are with respect to jurisdiction j only, we expect all the external effects of changes in MaPs on the size of NBFI in jurisdiction i to arrive through jurisdiction j ($w_{ij} = 1$).

Formally,

$$MaP\ OTHER_{it}^{E} = \sum_{j} w_{ij} MaP_{jt}^{E} \text{ and}$$

$$MaP\ OTHER_{it}^{T} = \sum_{j} w_{ij} MaP_{jt}^{T},$$

where $w_{ij} = \sum_{T} \frac{Claims_{ijt}}{Claims_{it}}/T$ is the share of financial claims of j towards i, averaged over time.

We also test the robustness of the results to other measures of intercountry linkages. In particular, we present results obtained

using total financial liabilities and the overall intensity of cross-country linkages (claims plus liabilities).[13]

Finally, we compute the net tightening in domestic MaPs:

$$MaP_{it} = MaP_{it}^{T} - MaP_{it}^{E}$$

and the net tightening in foreign MaPs:

$$MaP\ OTHER_{it} = MaP\ OTHER_{it}^{T} - MaP\ OTHER_{it}^{E}.$$

3. Empirical Analysis

The analysis of how MaPs affect NBFI presents many challenges. First, we need to be careful in controlling for unobserved factors, whether across jurisdictions or time varying, that might have an influence on the development of the NBFI not captured by our set of observable variables. And we need to control for possible reverse causality, i.e., that a jurisdiction might choose to implement certain MaPs simply in response to the general state of the financial system or the economy. For example, the development of the NBFI can be associated with stronger economic growth, which in turn may induce authorities to implement MaPs (Boar et al. 2017). This could bias the correlation between MaPs and NBFI. Moreover, the effectiveness of MaPs is reduced in more open economies when firms and households can obtain funds from other financial sources abroad (Cerutti et al. 2017, Cerutti and Zhou 2018). To control for this and other sources of bias, we rely on a panel regression setup.

3.1 The Model

Our baseline model regresses the share of NBFI assets over total financial assets ($\frac{NBFI}{TFA}_{it}$), measured in year t for country i, on the MaPs adopted by the domestic jurisdiction and by other jurisdictions over the previous five years. In our baseline model, MaPs are proxied by the net tightening of MaPs. We enrich the model with

[13] We also used other weights such as exports, imports, or the trade balance (exports minus imports). We also measured the weights using a five-year rolling window, rather than fixing them over time. Results are robust to these alternative weighting methods.

several covariates, to control for alternative explanations of the relationship of interest. First, a larger financial sector is positively correlated with the development of NBFI, and it may induce policymakers to use MaPs: for this reason, we control for the share of total financial assets to GDP. Second, independence of supervisory authorities is a key condition for MaPs to be promptly and effectively adopted and modified, not being constrained by political considerations, and an independent supervisory authority may be better able to monitor the banking system, thus inducing a stronger development of the NBFI: we therefore include an index of supervisory authority independence (Barth, Caprio, and Levine 2004).[14] Additional controls include log GDP per capita, lagged real GDP growth, and inflation. Finally, to account for unobserved factors we use country and time fixed effects.

In particular, we estimate (1):

$$\frac{NBFI}{TFA}_{it} = a_i + b_t + \beta MaP_{it} + \gamma MaP\ OTHER_{it} + \delta_1 \frac{TFA}{GDP}_{it} + \delta_2 SUPERVISION_{it} + controls + \varepsilon_{it}. \quad (1)$$

We normalize both the dependent and the MaP variables to ease the interpretation of the coefficients, their comparability, and evaluation of economic significance across variables. Therefore, the coefficients refer to how many standard deviations a dependent variable will change per standard deviation increase in the predictor variable.

Then, we disentangle the effects of a tightening in MaPs from those of an easing to control for asymmetric effects, if any. The model to be estimated is then

$$\frac{NBFI}{TFA}_{it} = a_i + b_t + \beta_1\ MaP^E_{it} + \beta_2\ MaP^T_{it} + \gamma_1\ MaP\ OTHER^E_{it} + \gamma_2\ MaP\ OTHER^T_{it} + \delta_1\ \frac{TFA}{GDP}_{it} + \delta_2\ SUPERVISION_{it} + controls + \varepsilon_{it}. \quad (2)$$

[14]The index has been interpolated for the missing years and normalized between −1 and 1.

3.2 Baseline Results

Results using OLS are reported in Table 4, with different options to weigh MaPs in foreign countries. Here we focus on our preferred specification (column 1), which closely follows Equation (1), i.e., weighing foreign MaPs by financial claims from domestic institutions.[15]

Consistent with the graphical evidence, we find that tightening of domestic MaPs is associated with an increase in the share of NBFI assets in total financial assets. This result is consistent with Irani et al. (2021), who investigate the connection between capital regulation and non-banks in the U.S. syndicated loan markets. In particular, they find that banks reduce retention (share of syndicated loan) and non-banks fill the void when capital regulation increases. This effect is stronger for banks with (i) lower level of capitalization; and (ii) large Basel III shortfalls. Substitution effects towards non-bank credit are also detected in Cizel et al. (2019), especially in advanced economies. Cizel and co-authors find that quantity restrictions are particularly effective in constraining bank credit, but also cause the strongest substitution effects by non-banks.

Based on the results reported in Table 4, a one-standard-deviation increase in net MaPs tightening is associated with an increase in the share of NBFI assets in total financial assets of around 7 percent of its standard deviation. Results are quite stable using different weighting schemes.

We can read the above results in an alternative way. As the standard deviation of domestic MaPs is 2.51 and that of NBFI to total financial assets (TFA) is 6.23 percentage points, a net tightening of 1 over the five preceding years leads to an increase of the share of NBFI in TFA of around 0.2 percentage point ($0.07 * 6.23 / 2.51 = 0.17$).

Net tightening of MaPs in other countries has an opposite effect: a one-standard-deviation tightening induces a decrease in the share of NBFI assets of 12–18 percent of its standard deviation, depending on the weighting scheme.[16] In this case, as the standard deviation

[15] All tables report heteroskedasticity-robust standard errors. The results are very similar using different cluster procedures (see Tables A.1–A.4 in the appendix).

[16] To account for possible reverse-causality problem, we also used the dynamic generalized method of moments (GMM) panel methodology (see, e.g., Arellano and Bond 1991 and Blundell and Bond 1998). The inclusion of the lagged dependent variable and the use of instruments do not qualitatively change the

Table 4. Baseline Model

Explanatory Variables	(1) Other Countries' MaPs Weighted by Claims	(2) Other Countries' MaPs Weighted by Liabilities	(3) Other Countries' MaPs Weighted by Claims + Liabilities
L1.Net MaP Tightening	0.0786**	0.0724**	0.0686**
	(0.0304)	(0.0319)	(0.0316)
L1.Net MaP Tightening, Other Countries	–0.184***	–0.124***	–0.177***
	(0.0513)	(0.0431)	(0.0513)
Total Financial Assets / GDP	0.107***	0.100***	0.103***
	(0.0170)	(0.0175)	(0.0174)
Supervisory Authority Protection	–0.205**	–0.192**	–0.195**
	(0.0933)	(0.0967)	(0.0964)
Other Controls[1]	Y	Y	Y
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	260	260	260
Adjusted R-squared	0.924	0.923	0.924

[1]Other controls include log GDP, lagged GDP growth, and inflation.
Note: The dependent variable is the share of NBFI assets in total financial assets. All variables are divided by their standard deviation. Robust standard errors in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

of foreign MaPs weighted by our three different measures is between 1.48 and 1.67 and that of NBFI/TFA is 6.23 percentage points, a net tightening of 1 over the five years leads to a decrease in NBFI/TFA of 0.5–0.8 percentage point.

We assess the robustness of these results in three ways.

First, we have re-run the baseline regressions adding two country-specific crisis dummies. The first is a banking crisis dummy that takes the value of 1 in the case of a crisis that involves the banking sector, and 0 elsewhere. This dummy controls for the effects of the GFC. The second is a sovereign debt crisis dummy that takes the value of 1 for those countries involved in the sovereign debt crisis in 2013–4, and 0 elsewhere. The results, reported in Table A.5 in the appendix, are unaffected.

Second, we test for the possible presence of serial correlation in the residuals. Because serial correlation in linear panel-data models biases the standard errors and causes the results to be less efficient, we test for the presence of serial correlation in the idiosyncratic error term in a panel-data model. In particular, we used the fixed-effects one-way models derived by Wooldridge (2002) that can be applied under general conditions and have good size and power properties in reasonably sized samples (Drukker 2003). All tests excluded the presence of serial correlation.

Third, we test for the possible existence of biases in the relationship between MaPs and NBFI assets. While the set of potential covariates and fixed effects that we include is able to explain a large share of the variability in NBFI assets (as is apparent from the adjusted R^2 being generally above 90 percent in Table 4), it may be still possible that unobservables are significantly biasing the estimated relationship between MaPs (domestic and foreign) and NBFI assets. To test for this possibility, we rely on the methodology developed by Altonji, Elder, and Taber (2005) and extended by Oster (2019). The basic idea is to use the relationship between MaPs and their observable covariates to study the relationship between MaPs and unobservables. Omitted-variable bias would then be

results. The results, not reported for the sake of brevity, indicate that both the sign and the size of the coefficients of interest are confirmed, while statistical significance declines due to the reduction of the sample size (a number of observations are used as lagged instruments in the estimation procedure).

proportional to the change in MaPs' coefficients when we move from a restricted model (where we exclude covariates) to an unrestricted one. In order for this change to be informative, coefficient movements need to be scaled by the observed increase in R^2.

In Table 5, we compare, for both domestic and foreign MaPs, the results of our baseline model (Table 4, column 1) with several increasingly less restricted models. This allows us to identify how much our results are robust to the inclusion of additional controls that explain an increasing share of the variance and, thus, how unlikely it is for the remaining part of variance to generate a significant omitted-variable bias. The first row compares the coefficient for net domestic MaP tightening in our baseline unrestricted model with a restricted model that omits time-varying country variables. The second row considers a restricted model that also omits country fixed effects. In all cases, the test on domestic MaPs yields a negative degree of proportionality, meaning that unobservable characteristics are likely to bias the estimated effect towards zero.

The second part of Table 5 provides results of comparing the effect of net foreign MaP tightening across the same sets of restricted and unrestricted models. The degree of proportionality is again negative, implying that omitted variables are biasing results towards zero.[17]

3.3 Tightening vs. Easing of Macroprudential Policies

Table 6 shows the estimates of model (2) that distinguish between the impact of tightening versus easing of MaPs. The three columns report the results for the three different ways to weigh MaPs in foreign countries. All columns show that domestic MaPs have remarkably symmetric effects: coefficients for easing and tightening domestic MaPs are quite similar, both in magnitude and statistical significance. Conversely, the effects of macroprudential interventions in foreign countries on NBFI have the expected sign (negative on tightening and positive on easing), but while the effect of tightening

[17]We have also performed additional tests using the Altonji, Elder, and Taber (2005) framework to consider unrestricted models with country-specific time trends and country-period fixed effects (i.e., interactions between country fixed effects and three period dummies for 2002–06, 2007–12, and 2013–18). Our results are also robust to these additional tests.

Table 5. Test for Omitted-Variable Bias[1,2]

Variable	Restricted			Unrestricted			Degree of Proportionality
	Model	Beta	R-squared	Model	Beta	R-squared	
L1.Net MaP Tightening	No Controls	0.0722	0.92	Baseline	0.0786	0.937	–3.409
	No Controls and Country FEs	0.0611	0.91	Baseline	0.0786	0.937	–2.045
L1.Net MaP Tightening, Other Countries	No Controls	–0.1145	0.92	Baseline	–0.1844	0.937	–0.672
	No Controls and Country FEs	0.0108	0.914	Baseline	–0.1844	0.937	–0.135

[1]All the variables have been standardized, dividing each variable by its standard deviation. [2]The baseline model is the one in column 1 of Table 4. Controls include time-varying country-level variables such as total financial assets over GDP, supervisory authority protection, log GDP, lagged GDP growth, and inflation.

Table 6. Tightening vs. Easing MaPs

Explanatory Variables	(1) Other Countries' MaPs Weighted by Claims	(2) Other Countries' MaPs Weighted by Liabilities	(3) Other Countries' MaPs Weighted by Claims + Liabilities
L1.MaP Easing	–0.114**	–0.158***	–0.142**
	(0.0560)	(0.0585)	(0.0555)
L1.MaP Tightening	0.0885**	0.105**	0.0922**
	(0.0399)	(0.0406)	(0.0393)
L1.MaP Easing, Other Countries	0.108***	0.106***	0.121***
	(0.0318)	(0.0363)	(0.0337)
L1.MaP Tightening, Other Countries	–0.102	–0.048	–0.044
	(0.0793)	(0.0712)	(0.0784)
Total Financial Assets / GDP	0.106***	0.109***	0.106***
	(0.0166)	(0.0177)	(0.0168)
Supervisory Authority Protection	–0.209**	–0.258***	–0.234**
	(0.0898)	(0.0978)	(0.0908)
Other Controls[1]	Y	Y	Y
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	260	260	260
Adjusted R-squared	0.926	0.926	0.927

[1]Other controls include log GDP, lagged GDP growth, and inflation.

Note: The dependent variable is given by the share of NBFI assets in total financial assets. All variables are divided by their standard deviation. Robust standard errors in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

is not significant, that for easing is significant. However, a formal test indicates that the effects of a tightening in foreign MaPs and that of an easing in foreign MaPs are statistically similar for all three weighting schemes.

3.4 Different Types of Macroprudential Policies and Supervisory Strength

The limited number of observations for some types of macroprudential measures makes it difficult to analyze their effectiveness separately. We have therefore grouped MaPs following the traditional distinction between (i) resilience versus cyclical measures; and (ii) lender versus borrower measures (see the first two panels of Figure 6).

In particular, we have modified Equation (1) in the following ways:

$$\begin{aligned}\frac{NBFI}{TFA}_{it} &= a_i + b_t + \beta\ MaP\_Resilience_{it} \\ &\quad + \gamma\ MaP\_Resilience\ OTHER_{it} + \beta^*\ MaP\_Cyclical_{it} \\ &\quad + \gamma^*\ MaP\_Ciclycal\ OTHER_{it} + \delta_1\ \frac{TFA}{GDP}_{it} \\ &\quad + \delta_2\ SUPERVISION_{it} + controls + \varepsilon_{it} \qquad (3)\end{aligned}$$

$$\begin{aligned}\frac{NBFI}{TFA}_{it} &= a_i + b_t + \beta\ MaP\_Lender_{it} \\ &\quad + \gamma\ MaP_{Lender} OTHER_{it} + \beta^*\ MaP_{Borrower_{it}} \\ &\quad + \gamma^*\ MaP_{Borrower} OTHER_{it} + \delta_1\ \frac{TFA}{GDP}_{it} \\ &\quad + \delta_2\ SUPERVISION_{it} + controls + \varepsilon_{it}. \qquad (4)\end{aligned}$$

The results in the first three columns of Table 7 for model (3) do not show a significant effect of MaPs aimed at directly increasing the financial sector's resilience on the share of NBFI assets in total financial assets. While the sign of the coefficients indicates the same types of leakage detected in Table 4, their magnitude is small, and the effects are never statistically significant. By contrast, cyclical MaPs (both domestic and foreign) have a significant impact

Table 7. Effectiveness of Different Types of MaPs Instruments

	Resilience vs. Cyclical MaPs			Lender vs. Borrower MaPs		
Explanatory Variables	**(1) Other Countries' MaPs Weighted by Claims**	**(2) Other Countries' MaPs Weighted by Liabilities**	**(3) Other Countries' MaPs Weighted by Claims + Liabilities**	**(4) Other Countries' MaPs Weighted by Claims**	**(5) Other Countries' MaPs Weighted by Liabilities**	**(6) Other Countries' MaPs Weighted by Claims + Liabilities**
L1.Net MaP Tightening, Resilience/ Lender	0.00345	0.00665	0.00612	0.0111	0.0118	0.0144
	(0.0247)	(0.0243)	(0.0247)	(0.0295)	(0.0303)	(0.0297)
L1.Net MaP Tightening, Resilience/ Lender, Other Countries	–0.0141	–0.0255	–0.008	–0.0189	–0.0219	–0.0188
	(0.0422)	(0.0559)	(0.0530)	(0.0349)	(0.0401)	(0.0390)
L1.Net MaP Tightening, Cyclical/ Borrower	0.0645***	0.0752***	0.0728***	0.0698**	0.0752**	0.0736**
	(0.0223)	(0.0246)	(0.0230)	(0.0308)	(0.0308)	(0.0312)
L1.Net MaP Tightening, Cyclical/ Borrower, Other Countries	–0.107***	–0.0921***	–0.109***	–0.0970***	–0.0917***	–0.101***
	(0.0247)	(0.0211)	(0.0233)	(0.0232)	(0.0221)	(0.0231)
Total Financial Assets / GDP	0.109***	0.0981***	0.104***	0.108***	0.0992***	0.103***
	(0.0167)	(0.0168)	(0.0168)	(0.0171)	(0.0172)	(0.0171)
Supervisory Authority Protection	–0.205**	–0.236**	–0.221**	–0.203**	–0.219**	–0.206**
	(0.100)	(0.105)	(0.102)	(0.0997)	(0.101)	(0.101)
Other Controls[1]	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	260	260	260	260	260	260
Adjusted R-squared	0.925	0.924	0.925	0.925	0.924	0.925

[1]Other controls include log GDP, lagged GDP growth, and inflation.

Note: The dependent variable is the share of NBFI assets in total financial assets. All variables are divided by their standard deviation. Robust standard errors in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively. The definitions of the different types of MaPs instruments are reported in the note of Figure 6.

on the share of NBFI assets in total financial assets. These findings are consistent with the stated goals, where greater resilience does not call for a change in activities, whereas cyclical tools do aim to affect the activities.

The results for model (4) are reported in the last three columns of Table 7. MaPs targeted specifically towards lenders (i.e., loan supply) do not have significant effects on the share of NBFI assets in total financial assets, despite representing 72 percent of MAPs in the sample. By contrast, those MaPs that affect directly borrowers' behavior (28 percent of the measures) have an economically and significant impact on non-bank financial intermediation in the case of both domestic and foreign MaPs.[18] This is consistent with Avdjiev et al. (2017), who find LTV limits to be one of the most effective macroprudential instruments for international bank lending.

The independence of the supervisory authority is an important factor that influences both implementation of MaPs and the development of the NBFI. We have therefore constructed a dummy variable for those jurisdictions with a low level of independence of the supervisory authority and interacted it with the MaPs variables. In particular, the dummy *Low SUPERVISION* takes the value of 1 for those jurisdictions with an index in the lowest quartile of the distribution, and 0 elsewhere). We have modified the baseline equation (1) in the following way:

$$\begin{aligned}\frac{NBFI}{TFA}_{it} = {} & a_i + b_t + \beta\ MaP_{it} + \gamma\ MaP\ OTHER_{it} \\ & + \beta^*\ MaP_{it} * Low\ SUPERVISION_i \\ & + \gamma^*\ MaP_{type} OTHER_{it} * Low\ SUPERVISION_i \\ & + \delta_1\ \frac{TFA}{GDP}_{it} + \delta_2\ SUPERVISION_{it} + controls + \varepsilon_{it}.\end{aligned} \tag{5}$$

[18] Similar results are obtained in a model that divides MaPs measures into three groups (reserve requirements-liquidity-currency versus asset-side versus capital). Also in this case asset-side instruments (credit growth limits, maximum debt-service-to-income ratio, limits to banks' exposures to the housing sector, and maximum loan-to-value ratio) that affect mostly borrowers' behavior have an economically and significant effect on non-bank financial intermediation in the case of both domestic and foreign MaPs. See Tables A.6 and A.7 in the appendix.

In this model, the different effectiveness of the MaPs in jurisdictions with low supervision independence with respect to the other jurisdictions can be directly tested from the statistical significance of the coefficients β^* and γ^*.

The results reported in Table A.8 of the appendix do not highlight significant difference in the effectiveness of domestic MaPs policies in those jurisdictions characterized by low supervisory independence. By contrast, we find a stronger effectiveness of foreign MaPs on NBFI activity in those jurisdictions with a low level of independence of the supervisory authority.

3.5 Impact on the Level of NBFI Assets and Banking Assets

In the analysis conducted so far, we have used as a dependent variable the share of NBFI assets in total financial assets. This share may be affected if MaPs affect either the numerator or the denominator, or both. To identify which of these effects are driving our results, we estimate again Equation (1) using the log of NBFI assets and the log of banking assets as dependent variables.[19]

Table 8 shows that in the case of a net tightening in domestic MaPs, the log of NBFI assets increases significantly. At the same time, as the rationale of the policy would suggest, assets held by banks headquartered in the home jurisdiction decline. So in the case of a domestic MaP, it is both the numerator and denominator that moves, and in opposite direction.

We can also quantify the effects. As the standard deviation of domestic MaPs is 2.51 and that of the log of NBFI assets is 2.29, a net tightening of 1 over the five years leads to a rise in NBFI assets by 5 percent ($0.06 * 2.29/2.51 = 0.05$). By contrast, as the standard deviation of the log of banking financial assets is 1.91 percentage points, a net tightening of 1 over the five years leads to a decrease in banking assets by 2 percent ($-0.024 * 1.91 / 2.51 = 0.02$).

The decrease in banking assets should be mirrored by a corresponding decline on their liabilities. The mechanism could be similar to that detected in the case of a monetary policy shock. For example, Drechsler, Savov, and Schnabl (2017) show that when the federal

[19]We excluded from the analysis assets of the central bank and public financial institutions.

Table 8. Effects of MaPs on the Level of NBFI Assets and Banking Assets

	Logarithm of NBFI Assets			Logarithm of Banking Financial Assets			Logarithm of Bank Deposits		
Explanatory Variables	**(1) Other Countries' MaPs Weighted by Claims**	**(2) Other Countries' MaPs Weighted by Liabilities**	**(3) Other Countries' MaPs Weighted by Claims + Liabilities**	**(4) Other Countries' MaPs Weighted by Claims**	**(5) Other Countries' MaPs Weighted by Liabilities**	**(6) Other Countries' MaPs Weighted by Claims + Liabilities**	**(7) Other Countries' MaPs Weighted by Claims**	**(8) Other Countries' MaPs Weighted by Liabilities**	**(9) Other Countries' MaPs Weighted by Claims + Liabilities**
L1.Net MaP Tightening	0.0602***	0.0580***	0.0562***	–0.0257**	–0.0244**	–0.0231**	–0.0451**	–0.0435**	–0.0408**
	(0.0162)	(0.0163)	(0.0161)	(0.0112)	(0.0108)	(0.0110)	(0.0194)	(0.0186)	(0.0188)
L1.Net MaP Tightening, Other Countries	–0.0689**	–0.0469*	–0.0775***	0.0215	0.0765***	0.0713***	0.0303	0.0901***	0.0899**
	(0.0329)	(0.0247)	(0.0297)	(0.0186)	(0.0149)	(0.0167)	(0.0334)	(0.0300)	(0.0350)
Supervisory Authority Protection	–0.0863***	–0.0823***	–0.0822***	–0.0533***	–0.0603***	–0.0574***	–0.0932***	–0.101***	–0.0983***
	(0.0297)	(0.0300)	(0.0304)	(0.0201)	(0.0212)	(0.0209)	(0.0352)	(0.0332)	(0.0341)
Other Controls[1]	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	260	260	260	260	260	260	259	259	259
Adjusted R-squared	0.989	0.989	0.989	0.996	0.996	0.996	0.989	0.989	0.989

[1]Other controls include log GDP, lagged GDP growth, and inflation.

Note: The dependent variable in columns 1–3 is the natural logarithm of NBFI assets; the dependent variable in columns 4–6 is the natural logarithm of banking financial assets; the dependent variable in columns 7–9 is the natural logarithm of bank deposits. All variables are divided by their standard deviation. Robust standard error in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

funds rate rises, banks widen the markdown they charge on deposits and deposits flow out of the banking system.

Table 8 shows that in the case of a net tightening in domestic MaPs, the log of banks' deposits headquartered in the home jurisdiction declines significantly. As the standard deviation of the log of bank deposits is 1.38 percentage points, a net tightening of 1 over the five years leads to a decrease in bank deposits by 2 percent ($-0.043 * 1.38 / 2.51 = 0.02$).

In the case of a net tightening of MaPs in foreign countries, while NBFI assets domestically decline, we observe an increase in banks' activity. This is in line with our result of a reduction in the share of NBFI assets in total financial assets.

The effects are estimated with less precision with respect to a domestic net tightening. A net tightening of foreign MaPs of 1 over the five years leads to a decrease in NBFI assets of 6–11 percent and a correspondent increase in banking financial assets of 3–9 percent and in bank deposits of 3–8 percent, depending of the measure used to weight the effects of foreign MaPs.[20]

The fact that banks' activity in the domestic jurisdiction increases because of a net tightening abroad is particularly interesting. This result could reflect a shift in the domestic economy of some foreign banking activity that is affected by the MaPs (Nocciola and Żochowski 2019). Indeed, Avdjiev et al. (2017) find that a tightening of loan-to-value limits in the home jurisdiction of banks is associated with higher lending to foreign borrowers, especially in the case of better capitalized and more liquid banks. Using the Avdjev et al. (2017) database and their empirical framework for the 24 destination countries analyzed in our study, we find very similar results.[21] A one-time tightening of LTV limits in our home jurisdictions is associated with a 4.3*** percentage point increase in the growth rate of international claims by foreign banks. At the same time, a

[20]Interestingly, Fong, Sze, and Ho (2021) find that the cross-border linkages between shadow banking systems depend on the level of global liquidity. The linkages are tenuous across borders during tranquil periods, but increase significantly in times of tightening global liquidity. The authors find that these spillover effects can be explained by a small number of economy-specific factors, including capital stringency in the banking sector.

[21]We thank the authors for sharing with us the data and the code to run this test.

tightening of LTV ratios abroad (that limits lending opportunities in foreign countries) induces foreign banks to direct more lending to our home jurisdictions. However, this effect is only marginally significant: the growth rate of international claims increases by 2.8* percentage points. Given the statistical significance of foreign MaPs borrower instruments in Table 7, there is indirect evidence that other measures, such as maximum debt-service-to-income ratio, and other limits to banks' exposure to the housing sectors could be particularly effective.

Aiyar, Calomiris, and Wieladek (2014) analyze the experience for the United Kingdom and find that capital requirements can be circumvented by foreign bank branches that are not affected by regulation, or by the domestic NBFI. The recent multi-study initiative of the International Banking Research Network (Buch and Goldberg 2017) confirms this finding and shows that the effects of prudential instruments sometimes spill across borders through bank lending. And it also shows that such effects have not been large on average. Interestingly, international spillovers vary across prudential instruments and across banks. Bank-specific factors such as balance sheet conditions and business models drive the amplitude and direction of spillovers to lending growth rates, a result highlighted also in Reinhardt and Sowerbutts (2015).

3.6 Disentangling the Effects among Different Components of Non-bank Financial Assets

In this section, we evaluate the effects of MaPs on the different components of NBFI (Table 1). The first component includes management of collective investment vehicles (CIVs) with features that make them susceptible to runs. As seen in Section 2, this component—labeled as EF1—has constantly gained relevance during the sample period and represents 65 percent of total NBFI assets at the end of 2017.[22]

The first three columns of Table 9 show that in the case of a net tightening in domestic MaPs, the log of EF1 assets increases significantly. The economic effects are also sizable. As the standard

[22]For an evaluation of flow versus valuation effects in MMFs, equity funds, and fixed-income funds, see Box 1.1 in FSB (2020b).

Table 9. Effect on Management of Collective Investment Vehicles and on Loan Provision that is Dependent on Short-Term Funding

	Logarithm of EF1 Assets			Logarithm of EF2 Assets		
Explanatory Variables	**(1) Other Countries' MaPs Weighted by Claims**	**(2) Other Countries' MaPs Weighted by Liabilities**	**(3) Other Countries' MaPs Weighted by Claims + Liabilities**	**(4) Other Countries' MaPs Weighted by Claims**	**(5) Other Countries' MaPs Weighted by Liabilities**	**(6) Other Countries' MaPs Weighted by Claims + Liabilities**
L1.Net MaP Tightening	0.0969***	0.0944***	0.0929***	0.153**	0.143**	0.135*
	(0.0259)	(0.0263)	(0.0259)	(0.0736)	(0.0708)	(0.0698)
L1.Net MaP Tightening, Other Countries	–0.0765**	–0.0375*	–0.0675**	–0.247**	–0.410***	–0.416***
	(0.0328)	(0.0225)	(0.0281)	(0.105)	(0.0953)	(0.114)
Supervisory Authority Protection	–0.0846*	–0.0816*	–0.0810*	–0.125	–0.0878	–0.102
	(0.0441)	(0.0451)	(0.0453)	(0.110)	(0.116)	(0.114)
Other Controls[1]	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	258	258	258	260	260	260
Adjusted R-squared	0.986	0.986	0.986	0.833	0.840	0.837

[1]Other controls include log GDP, lagged GDP growth, and inflation.

Note: The dependent variable in columns 1–3 is the natural logarithm of collective investment vehicles (CIVs) with features that make them susceptible to runs (EF1). These assets include MMFs, fixed-income funds, mixed funds, credit hedge funds, real estate funds. The dependent variable in columns 4–6 is the natural logarithm of loan provision that is dependent on short-term funding (EF2). These assets include those of finance companies, leasing/factoring companies, consumer credit companies. All variables are divided by their standard deviation. Robust standard error in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

deviation of domestic MaPs is 2.51 and that of the log of EF1 financial assets is 2.27 percentage points, a net tightening of 1 over the five years leads to an increase of the assets under management of CIVs by 8 percent (0.09 * 2.27 / 2.51 = 0.08). In the case of a net tightening of reserve requirements or liquidity measures, NBFI money creation could significantly expand, especially the MMF component (see Xiao 2020 for a similar mechanism in the case of a monetary tightening). Moreover, when bank capital requirements increase, it becomes more attractive for firms to issue bonds and for CIVs to purchase these. In the case of a net tightening of MaPs in foreign countries, EF1 assets (domestically) decline by 5–12 percent, depending of the different measure used to weight the effects of foreign MaPs.

The second component includes assets of non-bank financial entities engaging in loan provision that is dependent on short-term funding (EF2). These are the assets of finance companies, leasing/factoring companies, and consumer credit companies that are in direct competition with banks. The last three columns of Table 9 show that in the case of a net tightening in domestic MaPs, EF2 assets increase by around 18 percent (0.15 * 2.89 / 2.51 = 0.18). A tightening in bank conditions favors leasing/factoring and other non-bank intermediaries to take over from bank lending. In the case of a net tightening of MaPs in foreign countries, EF2 assets (domestically) decline by 48–78 percent, depending of the different measure used to weight the effects of foreign MaPs.

The third component comprises assets of market intermediaries that depend on short-term funding or secured funding of client assets (EF3). This aggregate includes mainly the assets of broker-dealers and securities finance companies. Even in this case the effects of changes in MaPs are economically relevant. The first three columns of Table 10 indicate that in the case of a net tightening in domestic MaPs, EF3 assets increase by around 23 percent (0.17 * 3.33 / 2.51 = 0.23). In the case of a net tightening of MaPs in foreign countries, EF3 assets (domestically) decline by 50–62 percent, depending on the measure used to weight the effects of foreign MaPs.[23]

[23]This effect can be reinforced by the fact that while broker-dealers can be independent firms, they often form part of banking groups ("dealer banks") and are subject to applicable prudential regulations on a consolidated basis (Aramonte, Schrimpf, and Shin 2023).

Table 10. Effect on Intermediation of Market Activities and on Intermediation on Securitization-Based Credit Intermediation

	Logarithm of EF3 Assets			Logarithm of EF4–5 Assets		
Explanatory Variables	**(1) Other Countries' MaPs Weighted by Claims**	**(2) Other Countries' MaPs Weighted by Liabilities**	**(3) Other Countries' MaPs Weighted by Claims + Liabilities**	**(4) Other Countries' MaPs Weighted by Claims**	**(5) Other Countries' MaPs Weighted by Liabilities**	**(6) Other Countries' MaPs Weighted by Claims + Liabilities**
L1.Net MaP Tightening	0.173**	0.165**	0.159**	0.107*	0.0980	0.0910
	(0.0675)	(0.0653)	(0.0642)	(0.0646)	(0.0659)	(0.0644)
L1.Net MaP Tightening, Other Countries	–0.220**	–0.268***	–0.289***	–0.240**	–0.306***	–0.339***
	(0.102)	(0.0890)	(0.104)	(0.102)	(0.0930)	(0.107)
Supervisory Authority Protection	–0.310***	–0.286***	–0.294***	–0.117	–0.0894	–0.0982
	(0.0946)	(0.0987)	(0.0978)	(0.0949)	(0.0986)	(0.0980)
Other Controls[1]	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	260	260	260	260	260	260
Adjusted R-squared	0.873	0.875	0.874	0.798	0.802	0.801

[1]Other controls include log GDP, lagged GDP growth, and inflation.

Note: The dependent variable in columns 1–3 is the natural logarithm of market activities that is dependent on short-term funding or on secured funding of client assets (EF3). These assets include those of broker-dealers, securities finance companies. The dependent variable in columns 4–6 is the natural logarithm of activities related to the facilitation of credit creation (EF4) and securitization-based credit intermediation and funding of financial entities (EF5). Assets included in EF4 are those of credit insurance companies, financial guarantors, monolines. Assets included in EF5 are those of securitization vehicles, structured finance vehicles and asset-backed securities. All variables are divided by their standard deviation. Robust standard error in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

Given the volatility and relatively scarce weight of the EF4 component (assets of financial guarantors and credit insurers), it was not possible to perform a proper analysis. Regression results were quite unstable, because of the limited number of observations per year and their more volatile behavior. Instead, we chose to pool together the EF4 and EF5 categories. The latter refers to securitization-based credit intermediation and includes assets of securitization vehicles, structured finance vehicles, and asset-backed securities. We will label this joint component EF4–5.

The last three columns of Table 10 show that in the case of a net tightening in domestic MaPs, the log of EF4–5 assets increases significantly. As the standard deviation of domestic MaPs is 2.51 and that of the log of EF4–5 financial assets is 3.45 percentage points, a net tightening of 1 over the five years determines an increase of securitized assets by 15 percent (0.11 * 3.45 / 2.51 = 0.15). In the case of a net tightening of MaPs in foreign countries, EF4–5 assets (domestically) decline by 56–75 percent, depending on the measure used to weight the effects of foreign MaPs.

4. Conclusions

The development of a relatively large non-bank financial sector is a key feature of the last two decades in both AEs and EMEs. This paper provides evidence that one determinant of this growth is the implementation of MaPs in the banking sector, using data from the FSB monitoring exercise over the period 2002–17 and information on MaPs collected by several researchers. Our results suggest that financial intermediaries in the NBFI sector react to regulations aimed at banks. We also show that this is not limited to domestic markets: financial intermediaries in a jurisdiction react to foreign jurisdictions' policy choices.

In particular, we find that a net tightening of domestic MaPs typically leads to an increase of around 0.2 percentage point in the share of domestic NBFI assets in total financial assets. This is driven by both an increase in NBFI assets and a reduction in bank assets. At the same time, tightening MaPs in foreign jurisdictions reduce the share of NBFI assets in total domestic financial assets. All components of NBFI assets react to domestic and foreign changes in the MaP stance.

This evidence shows that financial regulations spill over to other sectors that were not targeted, both within and across borders. The presence of externalities may imply that the domestically optimal MaP stance could be laxer or tighter than what would be optimal from a cross-country point of view. This calls for international coordination in the development and enactment of MaPs in order to better internalize such externalities.

Appendix

The robustness of the results of the paper have been checked in several ways.

A first check was to consider different cluster procedures. All tables in the main text report heteroskedasticity-robust standard errors. However, the results were very similar using different standard error cluster procedures: (i) by year (Table A.1); (ii) by geographical area (Table A.2); (iii) by geographical area and year (Table A.3); (iv) with wild cluster bootstrap procedure (Table A.4).

A second check was to re-run the baseline regressions adding two country-specific crisis dummies. The first was a banking crisis dummy that takes the value of 1 in the case of a crisis that involves the banking sector, and 0 elsewhere. This dummy controls for the effects of the GFC. The second was a sovereign debt crisis dummy that takes the value of 1 for those countries involved in the sovereign debt crisis in 2013–4, and 0 elsewhere. The results, reported in Table A.5, were unaffected.

In a third robustness check, we have divided the MaPs measures into three groups (reserve requirements-liquidity-currency versus asset-side versus capital). This model requires the inclusion of two additional interaction terms and therefore has a lower number of degrees of freedom, reducing the precision of our estimates. The results reported in Table A.6 were very similar to those obtained using the split "lender versus borrower" in the last three columns of Table 10. Also in this case asset-side instruments (credit growth limits, maximum debt-service-to-income ratio, limits to banks' exposures to the housing sector, and maximum loan-to-value ratio) that affect mostly borrowers' behavior have an economically and significant effect on non-bank financial intermediation in the case of both domestic and foreign MaPs. Similar results are obtained when

we consider the effects on subcomponents EF1–EF5. For simplicity, Table A.7 reports the results only when other countries' MaPs are weighted using the overall intensity of cross-country linkages (claims plus liabilities). The effects of MaPs are statistically significant for asset-side MaPs. Interestingly, their effects are significant (but with a lower intensity) also on broker-dealers activities (EF3), that is, on market activities that are dependent on short-term funding or on secured funding of client assets. While broker-dealers can be independent firms, they often form part of banking groups ("dealer banks") and are subject to applicable prudential regulations on a consolidated basis (Aramonte, Schrimpf, and Shin 2023).

In a fourth robustness check we modified the baseline model to control for heterogeneity in the independence of the supervisory authority across jurisdictions. In particular, we have constructed a dummy variable for those jurisdictions with a low level of independence of the supervisory authority and interacted it with the MaPs variables. The dummy *Low SUPERVISION* takes the value of 1 for those jurisdictions with an index in the lowest quartile of the distribution, and 0 elsewhere. The results reported in Table A.8 did not highlight significant difference in the effectiveness of domestic MaPs policies in those jurisdictions characterized by low supervisory independence. By contrast, we found a stronger effectiveness of foreign MaPs on NBFI activity in those jurisdictions with a low level of independence of the supervisory authority.

A complete list of the different MaPs measures adopted in the jurisdictions under analysis is reported in Table A.9.

Table A.1. Baseline Model with Standard Errors Clustered by Year

Explanatory Variables	(1) Other Countries' MaPs Weighted by Claims	(2) Other Countries' MaPs Weighted by Liabilities	(3) Other Countries' MaPs Weighted by Claims + Liabilities
L1.Net MaP Tightening	0.0786***	0.0724**	0.0686**
	(0.0245)	(0.0286)	(0.0274)
L1.Net MaP Tightening, Other Countries	–0.184***	–0.124***	–0.177***
	(0.0521)	(0.0410)	(0.0437)
Total Financial Assets / GDP	0.107***	0.100***	0.103***
	(0.0169)	(0.0151)	(0.0157)
Supervisory Authority Protection	–0.205**	–0.192**	–0.195**
	(0.0832)	(0.0856)	(0.0860)
Other Controls[1]	Y	Y	Y
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	260	260	260
Adjusted R-squared	0.924	0.923	0.924

[1]Other controls include log GDP, lagged GDP growth, and inflation.
Note: The dependent variable is given by the share of NBFI assets in total financial assets. All variables are divided by their standard deviation. Standard errors clustered by year in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

Table A.2. Baseline Model with Standard Errors Clustered by Geographical Areas[1]

Explanatory Variables	(1) Other Countries' MaPs Weighted by Claims	(2) Other Countries' MaPs Weighted by Liabilities	(3) Other Countries' MaPs Weighted by Claims + Liabilities
L1.Net MaP Tightening	0.0786**	0.0724*	0.0686*
	(0.0274)	(0.0321)	(0.0279)
L1.Net MaP Tightening, Other Countries	–0.184**	–0.124**	–0.177**
	(0.0649)	(0.0355)	(0.0562)
Total Financial Assets / GDP	0.107**	0.998**	0.103**
	(0.0273)	(0.0285)	(0.0278)
Supervisory Authority Protection	–0.205	–0.192	–0.195
	(0.219)	(0.231)	(0.231)
Other Controls[2]	Y	Y	Y
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	260	260	260
Adjusted R-squared	0.924	0.923	0.924

[1]The sample has been divided into five geographical areas: Africa, Asia and Oceania, Europe, Latin America, and North America.
[2]Other controls include log GDP, lagged GDP growth, and inflation.
Note: The dependent variable is given by the share of NBFI assets on total financial assets. All variables are divided by their standard deviation. Standard errors clustered by geographical area in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

Table A.3. Baseline Model with Standard Errors Clustered by Geographical Area and Year[1]

Explanatory Variables	(1) Other Countries' MaPs Weighted by Claims	(2) Other Countries' MaPs Weighted by Liabilities	(3) Other Countries' MaPs Weighted by Claims + Liabilities
L1.Net MaP Tightening	0.0786**	0.0724*	0.0686*
	(0.0280)	(0.0318)	(0.0295)
L1.Net MaP Tightening, Other Countries	–0.184**	–0.124**	–0.177**
	(0.0656)	(0.403)	(0.0539)
Total Financial Assets / GDP	0.107**	0.998**	0.103**
	(0.0274)	(0.0277)	(0.0274)
Supervisory Authority Protection	–0.205	–0.192	–0.195
	(0.211)	(0.222)	(0.222)
Other Controls[2]	Y	Y	Y
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	260	260	260
Adjusted R-squared	0.924	0.923	0.924

[1]The sample has been divided into five geographical areas: Africa, Asia and Oceania, Europe, Latin America, and North America.
[2]Other controls include log GDP, lagged GDP growth, and inflation.
Note: The dependent variable is given by the share of NBFI assets in total financial assets. All variables are divided by their standard deviation. Standard errors clustered by geographical area and year in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

Table A.4. Baseline Model with Wild Cluster Bootstrap Procedure Standard Errors[1]

Explanatory Variables	**(1) Other Countries' MaPs Weighted by Claims**	**(2) Other Countries' MaPs Weighted by Liabilities**	**(3) Other Countries' MaPs Weighted by Claims + Liabilities**
L1.Net MaP Tightening	[0.0278; 0.1441]	[0.0035; 0.155]	[0.0118; 0.1374]
	(0.0352)	(0.0872)	(0.0653)
L1.Net MaP Tightening, Other Countries	[–0.3523; 0.0129]	[–0.2194; –0.0289]	[–0.3106; –0.0339]
	(0.1134)	(0.0645)	(0.0710)
Total Financial Assets / GDP	[0.0457; 0.1911]	[0.0392; 0.183]	[0.0457; 0.1846]
	(0.0404)	(0.0300)	(0.0278)
Supervisory Authority Protection	[–1.002; 0.2024]	[–1.051; 0.1804]	[–1.041; 0.2383]
	(0.4764)	(0.6156)	(0.5628)
Other Controls[2]	Y	Y	Y
Country FE	Y	Y	Y
Observations	260	260	260

[1]The sample has been divided into five geographical areas: Africa, Asia and Oceania, Europe, Latin America, and North America.
[2]Other controls include log GDP, lagged GDP growth, and inflation.
Note: The dependent variable is given by the share of NBFI assets on total financial assets. All variables are divided by their standard deviation. The table shows 90 percent confidence intervals of the coefficients (in squared brackets) and p-values (in rounded brackets) resulting from wild cluster bootstrapping tests on regressions estimated using standard errors clustered by geographical area and year. The application of this algorithm does not produce standard errors, and the Stata command boottest does not attempt to compute them. Instead, inference is based on P-values and confidence sets. As explained in Roodman et al. (2018), one could compute the standard deviation of the bootstrap distribution of β and then use it for inference in several ways. However, this approach relies heavily on the asymptotic normality of $\beta\hat{}$ in a case where large-sample theory may not apply.

Table A.5. Baseline Model with Banking Crisis and Sovereign Debt Crisis Dummies

Explanatory Variables	(1) Other Countries' MaPs Weighted by Claims	(2) Other Countries' MaPs Weighted by Liabilities	(3) Other Countries' MaPs Weighted by Claims + Liabilities
L1.Net MaP Tightening	0.078**	0.072**	0.068**
	(0.031)	(0.032)	(0.032)
L1.Net MaP Tightening, Other Countries	–0.185***	–0.122***	–0.175***
	(0.052)	(0.044)	(0.052)
Total Financial Assets / GDP	0.108***	0.100***	0.103***
	(0.017)	(0.018)	(0.017)
Supervisory Authority Protection	–0.205**	–0.193**	–0.195**
	(0.093)	(0.097)	(0.097)
Banking Crisis Dummy	–0.026	–0.019	–0.019
	(0.112)	(0.114)	(0.113)
Sovereign Debt Crisis Dummy	–0.146*	–0.106	–0.118
	(0.088)	(0.074)	(0.076)
Other Controls[1]	Y	Y	Y
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	260	260	260
Adjusted R-squared	0.924	0.923	0.924

[1]Other controls include log GDP, lagged GDP growth, and inflation.
Note: The dependent variable is the share of NBFI assets in total financial assets. All variables are divided by their standard deviation. Robust standard errors in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

Table A.6. Reserve Requirements/Liquidity/Currency vs. Asset-Side vs. Capital MaPs: Baseline Model

Explanatory Variables	(1) Other Countries' MaPs Weighted by Claims	(2) Other Countries' MaPs Weighted by Liabilities	(3) Other Countries' MaPs Weighted by Claims + Liabilities
L1.Net MaP Tightening, Reserve Requirements/Liquidity/Currency	0.014	0.001	0.009
	(0.035)	(0.036)	(0.035)
L1.Net MaP Tightening, Reserve Req./Liquidity/Currency, Other Countries	–0.037	–0.040	–0.042
	(0.046)	(0.028)	(0.041)
L1.Net MaP Tightening, Asset	0.056**	0.061**	0.060**
	(0.026)	(0.026)	(0.026)
L1.Net MaP Tightening, Asset, Other Countries	–0.101***	–0.093***	–0.106***
	(0.028)	(0.023)	(0.027)
L1.Net MaP Tightening, Capital	0.010	0.018	0.015
	(0.028)	(0.027)	(0.028)
L1.Net MaP Tightening, Capital, Other Countries	–0.039	–0.002	–0.033
	(0.042)	(0.052)	(0.051)
Total Financial Assets / GDP	0.103***	0.099***	0.099***
	(0.019)	(0.018)	(0.019)
Supervisory Authority Protection	–0.196*	–0.193*	–0.189*
	(0.100)	(0.105)	(0.104)
Other Controls[2]	Y	Y	Y
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	260	260	260
Adjusted R-squared	0.924	0.924	0.925

[1]P-values on the null hypothesis. [2]Other controls include log GDP, lagged GDP growth, and inflation.
Note: The dependent variable is the share of NBFI assets in total financial assets. All variables are divided by their standard deviation. Robust standard errors in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

Table A.7. Reserve Requirements/Liquidity/Currency vs. Asset-Side vs. Capital MaPs: Effect on Subcomponents

Explanatory Variables	(1) Logarithm of EF1 Assets	(2) Logarithm of EF2 Assets	(3) Logarithm of EF3 Assets	(4) Logarithm of EF4–5 Assets
	Other Countries' MaPs Weighted by Claims + Liabilities			
L1.Net MaP Tightening, Reserve Requirements/Liquidity/Currency	0.018	0.085	0.023	0.090
	(0.025)	(0.061)	(0.077)	(0.060)
L1.Net MaP Tightening, Reserve Req./ Liquidity/Currency, Other Countries	–0.009	–0.022	–0.012	–0.212
	(0.022)	(0.075)	(0.073)	(0.075)
L1.Net MaP Tightening, Asset	0.100***	0.230***	0.098**	0.056
	(0.026)	(0.056)	(0.049)	(0.045)
L1.Net MaP Tightening, Asset, Other Countries	–0.045***	–0.245***	–0.092**	–0.209***
	(0.016)	(0.050)	(0.044)	(0.051)
L1.Net MaP Tightening, Capital	0.011	0.020	0.006	0.072**
	(0.012)	(0.039)	(0.036)	(0.033)
L1.Net MaP Tightening, Capital, Other Countries	–0.017	–0.172**	–0.057	–0.048
	(0.024)	(0.085)	(0.076)	(0.077)
Supervisory Authority Protection	–0.101**	–0.076	–0.303***	–0.089
	(0.047)	(0.130)	(0.109)	(0.117)
Other Controls[1]	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	258	260	260	260
Adjusted R-squared	0.987	0.848	0.869	0.807

[1]Other controls include log GDP, lagged GDP growth, and inflation.

Note: The dependent variable in column 1 is the natural logarithm of collective investment vehicles (CIVs) with features that make them susceptible to runs (EF1). These assets include MMFs, fixed-income funds, mixed funds, credit hedge funds, real estate funds. The dependent variable in column 2 is the natural logarithm of loan provision that is dependent on short-term funding (EF2). These assets include those of finance companies, leasing/factoring companies, consumer credit companies. The dependent variable in column 3 is the natural logarithm of market activities that is dependent on short-term funding or on secured funding of client assets (EF3). These assets include those of broker-dealers, securities finance companies. The dependent variable in column 4 is the natural logarithm of activities related to the facilitation of credit creation (EF4) and securitization-based credit intermediation and funding of financial entities (EF5). Assets included in EF4 are those of credit insurance companies, financial guarantor, monolines. Assets included in EF5 are those of securitization vehicles, structured finance vehicles, and asset-backed securities. All variables are divided by their standard deviation. Robust standard errors in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

Table A.8. Different MaPs' Effectiveness in Jurisdictions with Low Supervisory Authority Protection

Explanatory Variables	(1) Other Countries' MaPs Weighted by Claims	(2) Other Countries' MaPs Weighted by Liabilities	(3) Other Countries' MaPs Weighted by Claims + Liabilities
L1.Net MaP Tightening	0.075**	0.060*	0.058*
	(0.034)	(0.036)	(0.035)
L1.Net MaP Tightening * Dummy Low Supervision	–0.049	–0.025	–0.030
	(0.071)	(0.092)	(0.086)
L1.Net MaP Tightening, Other Countries	–0.163***	–0.164***	–0.194***
	(0.054)	(0.049)	(0.055)
L1.Net MaP Tightening Other * Dummy Low Supervision	–0.079*	–0.152**	–0.109**
	(0.047)	(0.064)	(0.050)
Total Financial Assets / GDP	0.110***	0.103***	0.106***
	(0.017)	(0.018)	(0.018)
Supervisory Authority Protection	–0.259**	–0.274***	–0.261**
	(0.101)	(0.102)	(0.102)
Other Controls[1]	Y	Y	Y
Country FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	260	260	260
Adjusted R-squared	0.925	0.925	0.926

[1]Other controls include log GDP, lagged GDP growth, and inflation.

Note: The dependent variable is the share of NBFI assets in total financial assets. All variables are divided by their standard deviation. The dummy Low Supervision takes the value of 1 for those jurisdictions with a value of the Supervisory Authority protection index in the lowest quartile of the distribution and 0 elsewhere. Robust standard errors in parentheses; ***, **, and * denote results significant at the 1 percent, 5 percent, and 10 percent level, respectively.

Table A.9. Total Number of MaPs by Jurisdiction

Jurisdiction	Asset Side				Reserve Requirements	Liquidity Requirements	Currency		Capital Based	
	Limits on Credit Growth	Max. Debt-Service-to-Income Ratio and Other Lending Criteria	Limits on Banks' Exposure to the Housing Sector	Max. Loan-to-Value Ratio and Loan Prohibition			Foreign-Currency Lending Limits	Limits on Net Open Position	Risk Weights on Housing Loans	Loan Loss Provisions
Argentina	0	0	0	1	7	1	1	4	8	0
Australia	0	0	0	0	0	0	0	0	2	0
Belgium	0	0	0	0	1	0	0	0	1	0
Canada	1	2	0	7	0	0	0	0	1	0
Chile	0	0	0	1	1	0	0	0	0	0
France	0	0	0	0	1	1	0	0	1	0
Germany	0	0	0	0	1	0	0	0	1	0
India	1	0	0	3	23	4	0	0	6	7
Indonesia	2	0	0	1	5	0	0	0	0	0
Ireland	0	0	0	0	1	0	0	0	2	0
Italy	0	0	0	0	1	0	0	0	2	0
Japan	0	0	0	0	0	0	0	0	1	0
Korea	0	10	0	11	2	0	3	4	3	4
Luxembourg	0	0	0	1	1	1	0	0	0	0
Mexico	0	0	0	0	0	0	0	0	1	2
Netherlands	0	1	0	6	1	1	0	0	3	0
Russia	0	0	0	0	13	0	0	1	4	2
Singapore	0	0	0	5	0	0	0	0	1	0
South Africa	0	0	0	0	0	0	0	0	1	0
Spain	2	0	0	1	1	0	0	0	2	1
Switzerland	0	0	1	0	0	0	0	0	2	1
Turkey	1	0	0	1	9	0	1	0	4	4
United Kingdom	0	0	0	0	0	0	0	0	1	0
United States	0	0	0	0	0	0	0	0	0	0
Advanced Economies	3	3	1	15	8	3	0	0	19	2
Emerging Market Economies	4	10	0	23	60	5	5	9	28	19
% of Total	3.2%	6.0%	0.5%	17.5%	31.3%	3.7%	2.3%	4.1%	21.7%	9.7%

Note: The table reports the total number of MaPs by country over the period 2002–16.

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