Macroprudential Policies, Capital Flows, and the Structure of the Banking Sector

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Abstract

Using a large sample of advanced and emerging market economies over the period 1999-2012, we examine the effectiveness of macroprudential policies (MPPs) in managing cross-border bank flows. Conditioning on the structure of the banking sector in the MPP-implementing country, we find that higher regulatory quality and a higher credit-to-deposit ratio increase the effectiveness of MPPs, while a higher cost-to-income ratio has the opposite effect. If all three financial variables are evaluated at the median, the marginal effect of our preferred MPP measure leads to a reduction of international bank inflows in percent of GDP by around half a percentage point and is only marginally significant. However, when the more favorable 25^{th} percentiles of their respective distributions are considered, we observe, as a response to the same MPP measure, a reduction of bank inflows by 3.44 percentage points that is highly statistically and economically significant. The size of this effect even increases to a reduction of 5.39 percentage points when the 10^{th} percentiles are used for the evaluation. Additionally, we find that the structure of the domestic banking sector determines asset class spillovers from MPPs within countries, while geographical spillovers from MPPs are a function of banking sector conditions both at home and abroad.

Key Words: macroprudential policies, international capital flows, banking sector

JEL Classification: F3, F5, G11, G21

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1 Introduction

The global financial crisis has forcefully demonstrated the wide spectrum of adverse consequences that can emerge from an uncontrolled build-up and an eventual materialization of systemic risks – such as a potential collapse of the financial system and in particular the banking system – for the entire economy. Systemic risks increase in the presence of financial vulnerabilities, which range from a strong pro-cyclicality of credit growth and leverage growth to a high interconnectedness among financial institutions. At the same time, international capital flows, and especially international bank flows, provide a key link in the transmission of systemic risks and their underlying vulnerabilities across countries (e.g., Cetorelli and Goldberg, 2012a and 2012b; Bruno and Shin, 2015a and 2015b; Lane and McQuade, 2014). Facing these challenges, policy makers around the world have not only invested a substantial amount of resources into designing policies that reduce the presence of domestic financial vulnerabilities but also into limiting the transmission of financial vulnerabilities across countries that is facilitated through the widespread use of wholesale funding or foreign currency borrowing. These policies are known as macroprudential policies (MPPs).[1]

Building on a fast growing literature that assesses the effectiveness of macroprudential policies, in this paper we examine the link between MPPs and international bank flows with a particular focus on the role of the banking system, where bank flows are intermediated and MPPs are applied. Using data on international bank flows for 66 advanced and emerging market economies over the period 1999 to 2012, we conduct our analysis in a cross-country panel. Our empirical measures of MPPs build on earlier work by Ostry et al. (2012) and comprise "financial sector capital controls" and "foreign currency-related prudential measures" – both are MPPs in a broader sense that are targeted to reduce the inflows of foreign capital into the domestic financial system with the intention to mitigate systemic risks.[2] We make the following two contributions to the literature.

Our first contribution is to show robustly in a cross-country setting that the structure of the domestic banking sector matters for the effectiveness of MPPs in managing international bank flows. We specifically find that higher regulatory quality and a higher credit-to-deposit ratio in the MPP-implementing country increase the effectiveness of MPPs, while a higher cost-to-income ratio has the opposite effect. If all three financial variables are evaluated at their most favorable 25^{th} (10^{th}) percentile, we observe a highly significant marginal effect of our preferred MPP measure that leads to a reduction of bank inflows in percent of GDP by 3.44 (5.39) percentage points. The corresponding effect with an evaluation at the median of their distributions, however, amounts to only a reduction by 0.53 percentage points. This difference is of substantial economic significance.

While there is growing evidence that MPPs have generally been effective in reducing domestic financial stability risks,[3] the literature lacks convincing evidence of their impact on international

[1] MPPs are frequently characterized by three defining elements (see Lim et al., 2011): i) an objective to limit the risk of widespread disruptions to the provision of financial services [...]. ii) a focus on the financial system as a whole as opposed to individual components or institutions; and iii) instruments that primarily consist of prudential tools that have been designed and calibrated to target systemic risk.

[2] While the notion of capital flow management measures/policies/tools is often used as synonym for several of these policies, it lacks the focus on reducing systemic risks and includes capital controls outside of the financial sector. An earlier version of this paper included also MPPs with a purely domestic focus (e.g., loan-to-value or debt-to-income ratios) to which Ostry et al. (2012) refer to as "domestic prudential regulations." However, because of the purely domestic focus and coverage of these specific policies, their link to international capital flows is generally weak.

[3] Examples of recent studies with a focus of MPPs on domestic financial stability risks are Kuttner and Shim (2013),

capital flows so far, in particular when the assessment takes place in a cross-country setting. The most prominent studies that have systemically examined the effectiveness of MPPs on capital flows in large cross-country panels are Lim et al. (2011), Ostry et al. (2012) and Forbes et al. (2015).

Lim et al. (2011) assess the effectiveness of eight different MPPs across 49 countries in reducing the ratio of foreign liabilities to foreign assets and find that only limits to net open positions in foreign currency have a mitigating effect, while all other MPPs turn out to be ineffective in this setting. Ostry et al. (2012) examine the effectiveness of a broad set of capital flow management tools and MPPs that includes capital controls to the financial sector, foreign currency-related prudential measures and domestic prudential regulation for 51 emerging market economies. The authors find evidence that foreign currency-related prudential measures reduce the share of a country's foreign currency credit to total credit but not the share of debt to total external liabilities. Further, the impact of financial sector capital controls and domestic prudential policies on both response variables is largely insignificant. Finally, Forbes et al. (2015) examine the effectiveness of capital flow management measures and MPPs using a self-constructed database at the weekly frequency for 60 countries over the period from 2009 to 2011. Their findings indicate that MPPs can reduce financial fragility but are not successful in affecting capital inflows.

However, other studies, supported by a region-specific focus, have been more successful in providing evidence for the effectiveness of MPPs on capital flows. Examining MPPs and capital flow measures in a sample of 46 countries, Zhang and Zoli (2014) find a small negative average effect on the equity-inflows-to-GDP ratio for the entire country sample but no effect for Asian economies. Focusing on international bank and bond inflows instead, Bruno, Shim, Shin (2015), assess the effectiveness of MPPs and capital flow management policies for 12 economies in the Asia-Pacific region. The authors find that banking sector and bond market capital flow management policies are indeed effective in slowing down international capital flows.

Our main finding that the structure of the domestic banking sector matters for the effectiveness of MPPs helps reconciling the mixed evidence from previous studies that points to a lower effectiveness of MPPs in cross-country studies with large samples and a higher effectiveness of MPPs in regionally more homogeneous samples.

Our second contribution documents the presence of potential externalities of MPPs. When subsequently assessing the presence of spillover effects as a function of banking sector conditions at home and abroad, we find that spillovers to closely related asset classes in the MPP-implementing country respond to domestic banking sector conditions in the same way. Moreover, we find that especially for advanced economies, the banking sector structure both at home and in other MPP-implementing countries of the same geographical region are important determinants of cross-country spillovers from MPPs.

For a long time, the literature has largely ignored potential spillover effects of MPPs and capital management measures. One of the first studies that went beyond assessing the effectiveness of capital flow management tools only for the introducing country is Forbes et al. (2011). The authors examine the introduction of a tax on foreign debt investments in Brazil from 2006 to 2011.[4] Using bond and equity fund flow data, their approach differentiates between effects on the portfolio

Vandenbussche et al. (2015), and Akinci and Olmstead-Rumsey (2015). See also Cerutti, Claessens and Laeven (2015) and their introduction for additional references on micro-level evidence from individual countries.

[4]Lambert et al. (2011) examine the same event and also find spillovers to other countries in the region.

allocation of investment fund flows to Brazil and spillover effects to other countries. The authors find that spillovers are heterogeneous across countries: countries that are perceived as likely to implement capital controls in the near future receive lower portfolio weights, while countries that are located in the same region, that are of similar weight in the benchmark index, and that benefit from growth in China, are likely to receive higher portfolio weights. More recently, Giordani et al. (2014) show for a sample of 78 developing countries that capital controls deflect capital flows to other borrowing countries with similar macroeconomic characteristics. Using bilateral data on cross-border bank flows from 31 source countries to 76 recipient countries, Ghosh et al. (2014) find that capital controls and MPPs imposed by countries are associated with larger flows to other countries. Pasricha et al. (2015) find that a net inflow tightening in Brazil, Russia, India, China and South Africa increases net capital inflows in other emerging market economies, especially in connection with cross-border bank lending. Finally, Bruno, Shim, Shin (2015) show that bank inflow controls are positively associated with an increase in international debt securities in their sample of 12 Asia-Pacific economies, suggesting the presence of spillovers across asset classes.

The spillover analysis in our paper differs from these papers by considering the following three dimensions at the same time: (i) by making a distinction between spillovers across asset classes and spillovers across countries (geographical spillovers), we assess two frequently encountered forms of spillovers in the same study; (ii) we show that both types of spillovers occur conditionally on the banking sector structure and thus provide evidence that there is no one-fits-all approach to identifying the direction of spillovers; and (iii) we conduct our analysis for a large sample of countries that includes both advanced and emerging market economies allowing for more general conclusions.[5]

The remainder of this paper is organized as follows. Section 2 describes how the banking sector structure matters for the use of MPPs. Section 3 presents the methodology for the empirical effectiveness assessment of MPPs. Section 4 presents the corresponding results and a rich set of robustness checks. Section 5 provides an assessment of related spillovers and Section 6 concludes.

2 Macroprudential Policy Effectiveness and the Banking Sector

This section discusses the role of the banking sector structure and its potential implications for the effectiveness of MPPs with respect to cross-border bank flows. We have derived our measures of MPPs from the work of Ostry et al. (2012), whereby we focus on measures aimed at reducing systemic risk in the domestic financial system (see Section 3 and Appendix A for a detailed account of how our MPP measures are constructed). Given that MPPs are aimed at reducing systemic risk across the entire financial system, it follows that the structure of the financial system, and particularly the structure of the banking sector, should play a key role in determining the effectiveness of MPPs. We consider the following set of financial variables that characterise the structure of the banking sector and highlight their associated channels:

- **Regulatory Quality:** A better set of regulatory rules can make MPPs more effective. In a narrow definition, the degree of regulatory quality could proxy for the strength of financial regulation and supervision directly. The argument being that banks in a better regulated

[5]The exception being Ghosh et al. (2014), who focus on 76 recipient countries and include both advanced and emerging market economies in their analysis.

and supervised financial system comply more with the regulation. However, there could also be a broader channel at work that relies on arguments from the literature in development economics. Here, it is argued that better institutions in general lead to a more efficient use of foreign capital (e.g. Abiad et al., 2009). In this paper, we measure regulatory quality with the regulatory quality index (henceforth also referred to as *RQ index*) from the World Bank's Worldwide Governance Indicators 2014. The regulatory quality index is defined as follows: "[it] reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development."

- **Profitability of the Banking System:** A second variable that characterises the structure of the banking sector is the level of profitability. The impact of profitability on the effectiveness of MPPs relates closely to the standard transmission channels of monetary policy. Both, the risk-taking and the risk-shifting channel of monetary policy rely on a connection between the interest rate and financial stability outcomes.[6] The risk-taking channel, on the one hand, highlights the fact that in an environment of low interest rates (and thus low income/low profits), investors and financial institutions take on more risks in order to generate sufficient returns (see Ioannidou et al., 2009; Jiménez et al., 2014). The risk-shifting channel, on the other hand, argues that for financial institutions, which already have balance sheet problems, an increase in the interest rate (and thus high costs/low profits) can lead to the accumulation of additional risks with the intention to "gamble for resurrection" (see Gan, 2004; Landier et al., 2011, for the risk-shifting channel and Baldursson and Portes, 2013, for resurrection gambling in the case of Iceland). Given this documented relationship between profitability and risk-taking behavior, it is equally plausible that in an environment of low profitability not only more financial risks but also more "regulatory risks" are being taken. This alternative notion of risk-taking could capture the effort of investors and financial institutions to circumvent MPPs that are currently in place. We would expect such efforts to increase in banking systems with a lower profitability. In this paper, we measure the profitability of the banking sector with the cost-to-income ratio, obtained from the World Bank's Financial Development and Structure Dataset 2013 compiled by Beck et al. (2000). The cost-to-income ratio is defined as "total costs as a share of total income of all commercial banks."

- **Intermediation Behavior:** A third variable that describes the structure of the banking sector is the intermediation behavior of banks. This notion includes both sides of the balance sheet, the allocation of credit to the economy and the associated funding structure of banks. From an operative perspective, banks that have more assets are generally larger and benefit from higher returns to scale that go along with a wider geographical coverage of the bank's activities, more diversified risks, and a better reputation. All these factors can have an impact on the effectiveness of MPPs. From a funding perspective, banks that rely in their funding activities on international wholesale funding and are less dependent on domestic deposits have to comply promptly with all policies that relate to the inflow of foreign capital. Hence, we would expect such policies to be more effective in countries where banks extend more credit relative to their domestic deposit base. In our analysis, we measure this relationship in form

[6] The list of references in this paragraph heavily draws on IMF (2013), where the relationship between the interest rate and financial stability is discussed in more detail.

of the credit-to-deposit ratio. In particular, we take the credit-to-deposit ratio from the World Bank's Financial Development and Structure Dataset 2013, which is defined as "private credit by deposit money banks as a share of demand, time and saving deposits in deposit money banks."

- **Banking Concentration:** The effect of banking concentration or competitiveness on bank behavior, and especially financial stability, has been examined extensively in the past (e.g., Caminal and Matutes, 2002; Allen and Gale, 2004; Boyd and De Nicoló, 2005; De Nicoló and Lucchetta, 2011). While the impact of concentration on financial stability is not straightforward to assess and often depends on other factors, most arguments in the literature work through the cost-to-income ratio as a proxy for the profitability channel.[7] Since we separately include the profitability channel in the empirical analysis, we are assessing whether there is an *additional* effect of banking concentration over and above the one of the previous variables, in particular, profitability. A potential additional channel that has these characteristics could relate to the speed and the intensity with which MPPs become effective. The outcomes could significantly differ in the case of a monopolistic bank that has substantial bargaining power with respect to the policy-implementing authorities; in case of an oligopolistic banking sector, where players could potentially engage in collusion behavior; or a perfectly competitive banking system, where idiosyncratic deviation is less likely. We measure banking concentration as the "assets of three largest banks as a share of assets of all commercial banks," a measure taken from the World Bank's Financial Development and Structure Dataset 2013.

- **Share of Foreign Banks:** Research has documented that foreign banks have different characteristics and subsequently display different behavior than domestic banks. Claessens and van Horen (2014), for example, find that foreign and domestic banks differ in key balance sheet variables, such as foreign banks having higher capital and more liquidity, but also lower profitability. In addition, Claessens and van Horen (2013) show that foreign banks tend to outperform domestic banks in developing countries and in countries with weak institutions. A key difference between foreign and domestic banks is also the role of parent banks. De Haas and van Lelyveld (2010), for example, provide evidence on the existence of internal capital markets for multinational banks. As a consequence, bank subsidiaries with financially strong parent banks are able to expand their lending faster and have more stable credit supply during a financial crisis. Since we already control for profitability and the funding structure of the banking sector, we assess with this variable whether the presence of foreign banks has an *additional* impact on the effectiveness of MPPs. A potential additional channel could relate to internal capital markets that allow the circumvention of policies that restrict international transactions for example.[8] We measure the presence of foreign banks as the (number) share of foreign banks to all banks in a banking sector based on data taken from Claessens and van Horen (2014).

[7] In particular, it has been argued that a highly concentrated banking sector can be conducive to financial stability given uncertainty about the costs of concentration as well as the perceived negative relation between competition and financial stability (e.g., Allen and Gale, 2004). However, it can also increase financial fragility as a more concentrated system may be more prone to engaging in risky practices (e.g., Boyd and De Nicoló, 2005).

[8] In addition, and despite ongoing efforts at the global level to harmonise regulation, foreign bank branches can be subject to differences in regulatory and supervisory jurisdiction, e.g., a foreign bank branch may increase lending following the implementation of regulatory actions toward domestic banks (Aiyar et al., 2014).

3 Methodology

In order to assess the impact of MPPs on international bank flows, we estimate the following equation:

$$k_{i,t} = \alpha + \alpha_t + \delta DMPP_{i,t} + \beta X_{i,t-1} + \lambda DMPP_{i,t} \times X_{i,t-1} + \epsilon_{i,t} \tag{1}$$

where $k_{i,t}$ measures international gross bank flows into country i in percent of its GDP at time t, henceforth also referred to as "bank inflows" and $DMPP_{i,t}$ is an indicator variable that measures the macroprudential policy stance.[9] $X_{i,t}$ is a vector of financial and macroeconomic control variables, which includes the previously introduced set of variables that describe the structure of the banking sector. In order to reduce endogeneity concerns, we let all control variables enter the specification with a one-year lag.[10] The core element of this equation is the interaction of the macroprudential policy measure with the vector of financial and macroeconomic variables, $DMPP_{i,t} \times X_{i,t-1}$, whose impact on international bank flows is measured by the coefficient λ. In Equation (1), λ indicates the differential impact of a macroprudential policy depending on the value of the (interacted) financial and macroeconomic variables that are included in vector $X_{i,t}$. The overall impact of the MPP measure on international bank flows is then evaluated using the marginal effect that depends on the value of the financial and macroeconomic control variables as well. The marginal effect of $DMPP_{i,t}$ takes the following form:

$$\frac{\partial k_{i,t}}{\partial DMPP_{i,t}} = \delta + \lambda X_{i,t-1} \tag{2}$$

We use the following data to estimate Equation (1). The left-hand-side variable, bank inflows in percent of GDP, is obtained from the Locational Statistics of the BIS. We rely on Table 6 that contains the "external positions" of BIS reporting banks and use the subset of the table where data are expresses as "estimated exchange rate adjusted changes." While the BIS provides only data from the perspective of BIS reporting banks, we make use of the mirror image in the Locational Statistics and the fact that assets of BIS reporting banks correspond to liabilities from the viewpoint of the rest of the world. Unless otherwise noted, we rely on these gross liabilities (in percent of GDP) as our measure of international capital flows. Finally, the BIS does not explicitly report flows to the banking sector. Here, we follow Bruno and Shin (2015a) by measuring international banking sector flows as the difference between the "all borrowers" and "non-bank borrowers" concept in the BIS statistics. This way, we obtain a left-hand-side variable that captures bank inflows into the domestic banking sector. Our resulting bank inflows variable is then normalized by GDP and winsorized at the 1% level to reduce the impact of outliers.

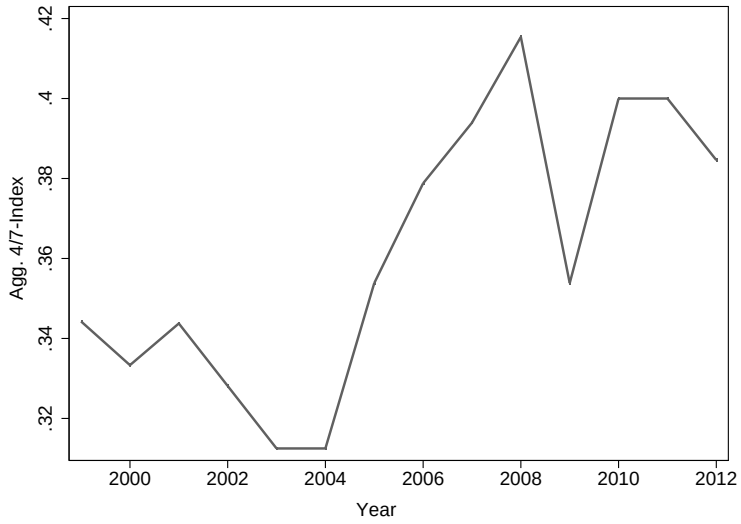
We derive our measure of MPPs from earlier work conducted by Ostry et al. (2012) and extend their sample to advanced economies. In our analysis, we focus exclusively on the measures of financial sector capital controls and foreign currency-related prudential policies that the authors construct from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions

[9] Correspondingly, coefficient δ captures the *direct* effect of the MPP measure on bank inflows (i.e., the effect on bank inflows that persists even when all interaction terms of the specification are equal to zero).

[10] Since there could be a concern that MPPs are generally ineffective and capital flows revert naturally to the mean in the next period, we include the control variables also contemporaneously in the specification. However, even in this case, the results of Table 1 are virtually the same.

(AREAER).[11] While the main intention behind both measures is to reduce systemic risk in the domestic banking sector – and thus both fulfill the standard definition of a macroprudential policy – there is an additional focus on the international dimension that makes these measures more likely to have an impact on international capital flows. While we use the original indices from Ostry et al. (2012) to confirm the robustness of our results, we base the core of our analysis on a self-constructed aggregated MPP index, which we term "Agg. 4/7-Index."[12] This index aggregates the information contained in the original indices into a single but representative indicator variable and thus operationalizes $DMPP_{i,t}$ in Equation (1). Figure 1 displays the dynamics of the Agg. 4/7-Index over time. The detailed construction of this MPP measure and the set of alternative MPP indices that we use for robustness checks in Section 4.2 is explained in Appendix A.

Figure 1: Dynamics of the Sample Average of the Agg. 4/7-Index over Time



Note: This figure presents the sample average of the MPP measure Agg. 4/7-Index over time. The Agg. 4/7-Index is an indicator variable that takes on the value of 1 when four or more out of seven subcomponents, on which the *Fincont1/2* and *Fxreg1/2* indices from Ostry et al. (2012) are based, are equal to 1; and zero otherwise.

The vector of financial variables corresponds to the five variables that have been described in the previous subsection. We include the first three variables, regulatory quality, and profitability of the banking sector and intermediation behavior, in all specifications. The last two variables, banking concentration and the share of foreign banks, are included selectively. The vector of macroeconomic variables consists of the following variables from the World Economic Outlook (WEO) database.

[11] The IMF's AREAER database comprises data on restrictions to the financial account of a country and is available for most countries in the world. While the overall database has been exploited extensively to compute *de jure* measures of financial openness, and therefore a concept closely related to the definition of capital controls in the past (e.g., Chinn and Ito, 2008), the main contribution of Ostry et al. (2012) is to identify those categories that apply to the financial sector. A significant advantage of working with the AREAER database in this case is that it contains reliable information on the introduction and termination dates of all incidents so that the resulting MPP measures are derived in a systematic way across countries and time. Often, this is not the case for data on domestic prudential measures that are derived based on anecdotal evidence.

[12] "Agg." stands for the aggregation of information from the capital controls to the financial sector measures and the foreign currency-related prudential measures from Ostry et al. (2012) into a single variable. "4/7" indicates that we require four or more out of the seven AREAER database subcategories, on which the original indices are based, to be "restricted" for our indicator variable to take on the value of 1 (and 0 otherwise).

The growth rate of real GDP to capture the real side of the business cycle, the (logarithm) of the inflation rate to capture the nominal side of the business cycle,[13] the level of purchasing power parity (PPP) adjusted GDP per capita as a measure of economic development and finally, trade integration, defined as imports plus exports in percent of GDP, as a measure of openness. As with the left-hand-side variable, the financial and macroeconomic variables are winsorized at the 1% level to reduce the impact of outliers.

We also include a set of fixed effects in the specifications. In all specifications, with the exception of one robustness check, we rely on time fixed effects to control for standard "push factors" of international bank flows. The importance of "push" factors have been discussed extensively in the literature since at least Calvo, Leiderman and Reinhart (1993) and comprise, for example, the U.S. business cycle, the U.S. monetary policy stance, and global risk appetite. Further, in two of the robustness checks, we re-estimate Equation (1) using country fixed effects in addition to identify the impact of MPPs on international bank flows within countries over time instead of across countries.

We estimate Equation (1) by ordinary least squares with heteroskedasticity-robust standard errors, clustered at the country level. Our initial sample comprises all advanced and emerging market economies for which we have annual data on the key variables over the period 1999 to 2012.[14] The starting date is limited by the availability of data on MPPs and the ending date is limited by the availability of the financial variables, which stops in 2011. The availability of the foreign bank number share variable is even more restricted and goes only until 2010. In all regressions, we set a minimum threshold for data availability and require countries to have at least seven years of non-missing data. In order to obtain meaningful policy conclusions, we generally exclude small countries, the largest oil exporters and the main development aid receivers.[15] Overall, for our main specifications, we obtain a sample 66 countries that include both advanced and emerging market economies. The largest robustness check contains up to 75 countries.[16]

4 Effectiveness Results

This results section consists of two parts. The first subsection presents the main result of the paper. We show that the effectiveness of MPPs is highly dependent on the structure of the domestic banking sector. The second subsection then generalizes this finding to a broader set of financial variables and alternative definitions of the macroprudential policy indices. It also includes a set of additional specifications that confirm the robustness of the main result.

[13] Although a measure of the short-term interest rate would be preferable in this context, we use the inflation rate, since it is available in a harmonized way for all the sample countries.

[14] The lagged values of the control variables in 1999 are taken from 1998. Hence, the time dimension of the sample consists of 14 years.

[15] i) Small countries, often islands, have highly volatile financial accounts because of their small GDP levels, serve occasionally as tax heavens, and/or are subject to a very specialized economy. We define small countries as those that have less than 25.000 square km of surface area (which is slightly smaller than the size of the Former Yugoslavian Republic of Macedonia); ii) Commodity and especially oil exporters usually have large current account surpluses and thus very different capital flow dynamics than non-commodity exporters. We define the largest oil exporters as countries that have oil exports of more than 10 percent of GDP; iii) Development aid flows are not market-based flows and thus respond to different drivers than private capital flows. We define the main development aid receivers as those countries that receive aid above 10 percent of Gross National Income.

[16] See Appendix B for the list of included countries in both cases.

4.1 The Role of the Banking Sector

We present the results from estimating Equation (1) for our sample of 66 advanced and emerging market economies on a step-by-step basis in Table 1. Each of the nine specifications relies on the Agg. 4/7-Index as our preferred MPP measure, time fixed effects to account for global factors and includes both, a full set of macro variables[17] and the following set of financial variables: the regulatory quality index, the cost-to-income ratio, and the credit-to-deposit ratio. We proceed by discussing the key coefficients of the nine specifications in detail (p-values are in parentheses).

Specification (1) does not contain any interactions. The associated coefficient of the MPP measure amounts to -0.292 and is statistically insignificant.[18] This observation replicates previous findings in the literature that suggest that, on average, MPPs do not have a significant impact on international bank flows.

Specification (2) then adds the interaction of the MPP measure with the first financial variable, the index of regulatory quality, to the specification. The coefficient on the interaction term is highly significant, amounting to -2.483, and thus suggests that a better regulatory environment implies a stronger impact of the MPP measure on bank inflows. The left top panel in Figure 2 displays the resulting marginal effect of the MPP measure on bank inflows (left axis) as a function of the index of regulatory quality (bottom axis). It turns out that for degrees of regulatory quality above the sample mean (indicated by the vertical line) the MPP measure has a clearly mitigating effect on international bank flows (shown by the downward sloping solid line and the 95% confidence bands, represented as dashed lines, around it). This especially applies for high levels of regulatory quality that according to the distribution function of the regulatory quality variable (indicated by the dotted line in the background) occur fairly frequently in the sample. Next, Specification (3) allows for additional interactions of the MPP measure with all four macro variables. Interestingly, a resulting coefficient of -2.656, which is larger in absolute terms and equally significant at the 1% level, indicates that adding the macro interactions to the specification increases the importance of the regulatory environment for determining the effectiveness of MPPs even further.

Specification (4) presents the interaction of the MPP measure with the cost-to-income ratio that serves as a proxy for the profitability of the domestic banking system. The interaction term amounts to 0.105 and is significant at the 1% level. This suggests that the implementation of MPPs with respect to international bank flows is more effective in banking sectors that are characterized by a lower cost-to-income ratio. The right top panel in Figure 2 displays the corresponding marginal effect of the MPP measure on international bank flows as a function of the cost-to-income ratio. This time, the marginal effect is characterised by an upward sloping line.

[17] Due to space constraints, the direct effects and potential interactions of the macro variables are not displayed.

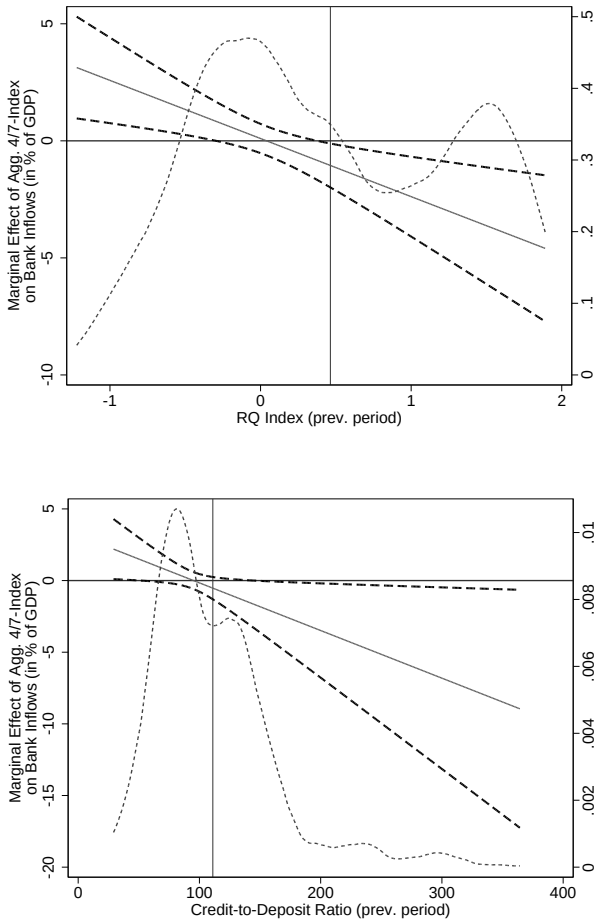
[18] The *direct* effects of all variables turn out as expected. For the financial variables: a higher degree of regulatory quality and a higher credit-to-deposit ratio lead to stronger bank inflows, a higher cost-to-income ratio to lower inflows. For the macro variables: a higher growth rate of real GDP suggests high returns and thus an increase in bank inflows. A higher level of PPP-GDP per capita and more trade integration are most likely capturing the impact of economic development and hence lead to higher bank inflows. Finally, a higher (log) inflation rate in the previous period increases bank inflows. While here, also the opposite sign could be expected, it should be noted that we do not explicitly control for interest rates in the empirical specification (as discussed in Section 3), and due to their high correlation, the inflation variable proxies for a positive interest rate impact. However, in the remainder of the paper, we do not separately interpret the direct effects for the financial and macro variables. Instead, it is more useful to examine the marginal effect depending on the entire distribution of these variables.

Table 1: Main Results

LHS: Bank Inflows (in % of GDP)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$DMPP_{i,t}$	-0.292	0.100	4.262*	-6.571***	0.211	3.164**	7.695***	-2.833	2.339
	(0.413)	(0.749)	(0.069)	(0.005)	(0.930)	(0.035)	(0.004)	(0.149)	(0.297)
$DMPP_{i,t}$ x RQ $Index_{i,t-1}$		-2.483***	-2.656***					-1.641***	-1.949**
		(0.004)	(0.001)					(0.006)	(0.024)
$DMPP_{i,t}$ x $Cost\text{-}to\text{-}Income_{i,t-1}$				0.105***	0.076**			0.088***	0.066**
				(0.004)	(0.012)			(0.003)	(0.020)
$DMPP_{i,t}$t x $Credit\text{-}to\text{-}Dep._{i,t-1}$						-0.033**	-0.027**	-0.024*	-0.022*
						(0.033)	(0.038)	(0.090)	(0.098)
RQ $Index_{i,t-1}$	0.747	2.268***	2.049***	0.838*	0.843*	0.728*	0.656	1.814***	1.689**
	(0.120)	(0.003)	(0.008)	(0.060)	(0.097)	(0.062)	(0.139)	(0.005)	(0.022)
$Cost\text{-}to\text{-}Income_{i,t-1}$	-0.065***	-0.068***	-0.065***	-0.096***	-0.085***	-0.064***	-0.062***	-0.093***	-0.084***
	(0.004)	(0.003)	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.001)
$Credit\text{-}to\text{-}Dep._{i,t-1}$	0.011*	0.010	0.012*	0.011*	0.013**	0.024**	0.023**	0.020*	0.020*
	(0.096)	(0.135)	(0.063)	(0.069)	(0.042)	(0.027)	(0.024)	(0.057)	(0.053)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Variables Inter.	No	No	Yes	No	Yes	No	Yes	No	Yes
Observations	862	862	862	862	862	862	862	862	862
R-squared	0.26	0.27	0.29	0.27	0.29	0.28	0.30	0.29	0.31
Countries	66	66	66	66	66	66	66	66	66

Notes: The left-hand-side (LHS) variable "Bank Inflows" is defined as "Changes in Gross Total Liabilities to Foreign Countries by Domestic Banks." In this table, $DMPP_{i,t}$ corresponds to the Agg. 4/7-Index. The Agg. 4/7-Index is an indicator variable that takes on the value of 1 when four or more out of the seven subcomponents of Fincont1/2 and Fxreg1/2 are equal to 1; and zero otherwise. Time fixed effects are annual dummies over the sample period with the exclusion of the year 1999. The macro variables inclusion row indicates whether Real GDP $Growth_{i,t-1}$, $Inflation_{i,t-1}$ (in logs), PPP GDP per $capita_{i,t-1}$ (in 1,000), and Trade $Integration_{i,t-1}$ are included in the specification. The macro variable interaction indicates whether all four macro variables are additionally interacted with $DMPP_{i,t}$. We refer to Specification (8) as the "baseline specification." A constant is included in all specifications but not reported. Standard errors are heteroskedasticity-robust and clustered by country. P-values are shown in parentheses (***=p<0.01; **=p<0.05; *=p<0.1).

Figure 2: Marginal Effects of the MPP Measure Depending on the Structure of the Banking Sector



Note: This figure presents the marginal effects of $DMPP_{i,t}$ on Bank Inflows (in % of GDP), depending on the value of the Regulatory Quality (RQ) index (left top panel), the Cost-to-Income Ratio (right top panel), and the Credit-to-Deposit Ratio (left bottom panel). The corresponding coefficients are taken from Specifications (2), (4), and (6) in Table 1. The marginal effects (left vertical axis) are bordered by two confidence bands at the 95% level. The dotted distribution line (right vertical axis) describes the sample distribution of the lagged and winsorized values of the three financial variables.

While for the average value of the cost-to-income ratio, there is no significant impact of the MPP measure on international bank flows, we indeed observe such an impact for lower cost-to-income ratios. As before, Specification (5) then shows that the results also hold when the MPP measure is interacted with all four macro variables at the same time. While the coefficient on the cost-to-income ratio becomes slightly smaller and now amounts to 0.076, it is still positive and significant (at the 5% level now) supporting the previous evidence.

Turning next to Specification (6), which shows the interaction of the MPP measure with the credit-to-deposit ratio, we observe a coefficient of -0.033 on the interaction term, significant at the 5% level. Hence, the introduction of MPPs is more effective when the domestic banking sector is characterised by a higher credit-to-deposit ratio. The left bottom panel in Figure 2 depicts the marginal effect of the MPP measure as a function of the credit-to-deposit ratio. Since the confidence bands are substantially wider this time, the results are somewhat weaker than in the case of the first two variables. The figure indicates that a credit-to-deposit ratio at the sample mean implies no impact of the MPP measure on international bank flows. However, when the credit-to-deposit ratio takes on higher values, we indeed observe a small but statistically significant effect of the MPP measure on international bank flows. In the next step, Specification (7) adds the full set of macro

interactions to the specification. The coefficient on the interaction term now amounts to -0.027 and still remains significant at the 5% level.

Specifications (2) to (7) have been characterised by individual interactions of the financial variables with the MPP measure (as well as by the additional interaction of all macro variables in the odd-numbered specifications). While all individual effects were highly significant, there could still be the possibility that the three financial variables are highly correlated with each other and capture one and the same underlying effect.

In order to rule out this possibility, we estimate Specification (8), where we include all interactions of the MPP measure with the three financial variables at the same time. In the remainder of this paper, we refer to this specification as our "baseline specification." The results of this specification indicate that all three interaction terms are still individually significant and have the same sign as in the previous cases. This finding suggests that the structure of the banking sector, represented by the three financial variables, is indeed a key determinant for the effectiveness of MPPs with respect to bank inflows. The potential banking sector channel through which the effectiveness of MPPs may be determined, described earlier in Section 2, would appear to be fully validated as regards the role played by regulatory quality, banking sector profitability and intermediation efficiency. Finally, and analogously to the individual specifications, we allow for all possible interactions of the MPP measure with both, the three financial and the four macro variables. The outcome is shown in Specification (9) and confirms that the baseline specification is robust to the additional interaction of all macro variables. Hence, in this section, we have learned that the effectiveness of MPPs is a function of the domestic banking sector structure and we can exclude that this observation is simply measuring structural macroeconomic trends, such as PPP-GDP per capita or trade integration, or cyclical macroeconomic factors, such as real GDP growth or inflation dynamics.[19]

Next, we discuss the statistical and economic significance of our results. While Table 1 has provided the size, sign and significance of the interaction terms, eventually, we are interested in the same characteristics for the marginal effects. The top part of Table 2 shows the size of the marginal effect of the MPP measure on bank inflows for different combinations of the underlying financial variables. The first three number-columns of the table mirror the coefficients and variable distributions for Specifications (2), (4), and (6), where the financial variables were interacted individually. In most cases, we do not observe a significant or only a small impact of the MPP measure on bank inflows, when the financial variables take on the mean or the median value.[20] This again represents the previously discussed finding from the literature that, on average, MPPs are largely ineffective in dealing with international capital flows. The picture changes, however, when more "favorable" values of the financial variables are considered (i.e., the 75^{th} or the 90^{th} percentile for the index of regulatory quality and the credit-to-deposit ratio as well as the 25^{th} or the 10^{th} percentile for the cost-to-income ratio). For both favorable percentile sets, the marginal effects of the MPP measure for the individually included financial variables are all negative, highly significant and point to a reduction of international bank flows (in % of GDP) by 1.11 to 2.93 percentage points.

[19]Most of the interactions of the macro variables with the MPP are insignificant. The only exception is the interaction with real GDP growth that is negative and significant at the 1% level, suggesting that MPPs are also more effective in the presence of a higher real GDP growth rate.

[20]The only significant variable is the index of regulatory quality. When individually interacted, its interaction term becomes significant at the sample mean and marginally significant at the sample median.

Table 2: Statistical and Economic Significance

Distribution Measure	RQ Index	Cost-to-Inc.	Cre.-to-Dep.	All Three Jointly
Statistical Significance				
Mean				
Marg. Effect	-1.02	-0.30	-0.52	-0.95
P-value	0.03	0.39	0.18	0.02
Memo: Value of Fin. Var.	0.45	59.63	110.93	all three
Median				
Marg. Effect	-0.69	-0.38	-0.15	-0.53
P-value	0.08	0.29	0.63	0.09
Memo: Value of Fin. Var.	0.32	58.86	99.54	all three
25th/75th (in favor)				
Marg. Effect	-2.93	-1.11	-1.29	-3.44
P-value	0.01	0.03	0.06	0.00
Memo: Value of Fin. Var.	1.22	51.87	134.07	all three
10th/90th (in favor)				
Marg. Effect	-3.92	-1.81	-2.28	-5.39
P-value	0.00	0.01	0.04	0.00
Memo: Value of Fin. Var.	1.62	45.20	163.71	all three
Economic Significance				
Local Mean				
Share of Marg. Eff. to LHS Mean [in %]	-87.65	-65.92	-68.73	-57.74
Memo: Decile of Fin. Var.	8	3	8	all three
Memo: Local Marg. Effect	-2.92	-1.09	-1.30	-3.70
Memo: Corresponding p-value	0.01	0.03	0.06	0.001
Memo: Local Mean of LHS Var.	3.34	1.66	1.89	6.41

Note: The Statistical Significance section reports three values. First, the marginal effect of the MPP measure on Bank Inflows, second, the corresponding p-value and third, the financial variable value at which the marginal effect is evaluated. The financial variable values are taken from different parts of the distribution and are evaluated at: the mean, the median, the $25^{th}/75^{th}$ percentile, and the $10^{th}/90^{th}$ percentile. "In favor" means that the marginal-effect-minimizing value of the pair is selected. The Economic Significance section reports five values. First, the share of the local marginal effect to the local mean of the left-hand-side variable, second, the decile of the financial variable distribution that determines the "local" environment, third, the local marginal effect, fourth, the corresponding p-value, and fifth, the local mean of the left-hand-side variable.

These findings are confirmed by the last column of Table 2. It presents the marginal effect of the MPP measure as a function of different value combinations for all three financial variables (using coefficients from Specification (8)). As in the individual cases, there is only a weak impact of MPPs on bank inflows, when all three financial variables are equal to their sample median (i.e., the joint marginal effect amounts to -0.53 and is marginally significant) or their sample mean (i.e., the joint marginal effect amounts to -0.95 and is significant at the 5% level). When more favorable values of the distribution are considered, the size of the joint marginal effect increases substantially.

In particular, the introduction of the same set of MPPs in a country with an index of regulatory quality and a credit-to-deposit ratio at the 75th percentile of the sample distribution as well as a cost-to-income ratio at the 25th percentile leads to a reduction in bank inflows in percent of GDP by 3.44 percentage points. When the cost-to-income ratio is evaluated at the 10th percentile of the sample distribution and the other two variables at the 90th percentile, instead, the above mentioned MPPs lead to a reduction of international bank flows in percent of GDP by 5.39 percentage points.

Finally, in the bottom part of Table 2, we assess the economic significance of our findings. The evaluation is conducted by relating the local marginal effect of the MPP measure at different parts of the distribution of the three financial variables to the local mean of the left-hand-side variable. The local marginal effects and the local means are obtained from conditioning the financial variables on similar values of the distribution that have been used to compute the marginal effects in the previous paragraph. The first row of the bottom part shows how the local marginal effects relate to the local means. The result is expressed as a share.[21] When the individual cases are considered, the shares imply a reduction in international bank flows (relative to the local mean of these flows) ranging from 87.65 percent in the case of favorable values in the regulatory quality index to 65.92 percent in the case of favorable values of the cost-to-income ratio. When all three variables are jointly included and take on favorable values, the share of the marginal effect to the local mean amounts to a reduction in international bank flows by 57.74 percent.

Hence, a reduction of bank inflows by almost 60 percent relative to their long-term average implies a strong economic significance of our results. Overall, this exercise has shown that the structure of the banking sector is a key determinant for the effectiveness of MPPs and that under certain banking sector conditions, MPPs are indeed effective in reducing the inflow of foreign capital into the domestic banking sector. The effects are both statistically and economically significant with the introduction of MPPs creating a reduction in bank inflows (in percent of GDP) by 3.70 percentage points or by 57.74 percent of the local left-hand-side variable mean, respectively, when the conservative 25th percentiles and 3rd deciles from each side of the distribution of the financial variables are chosen. The effects become even stronger when tail values are selected.

4.2 Robustness and Sensitivity Analysis

We now assess the extent to which these results can be generalised, as well as the robustness of our main result. In the first part of this subsection, we examine how alternative financial variables, that also characterize the structure of the domestic banking sector, relate to our current variable choice. In the second part, we vary the definitions of the MPP-index to capture different levels of intensity. The third part then displays a set of additional robustness checks that confirm our main result.

[21] Rows two to five describe the steps required to compute the corresponding share. The second row indicates the decile where each of the financial variables have been evaluated at – for the local marginal effect and for the determination of the local mean of the left-hand-side variable. The 3rd and the 8th decile have been selected to match the 25th and the 75th percentile in the evaluation of the statistical significance in the top part of the table. Subsequently, the local marginal effects in the third row (with corresponding p-values in the fourth row) are very close to the those in the top part of the table. The fifth row displays the local mean of the left-hand-side variable, bank inflows in percent of GDP. The local mean varies between 1.66 and 3.34 percent across the individual specifications and amounts to 6.41 percent for the joint specification.

4.2.1 Alternative Financial Variables

Our main result is based on a set of three financial variables. In this subsection, we decompose two of them, the cost-to-income ratio and the credit-to-deposit ratio, into their individual components and investigate if the remaining variables from Section 2, the degree of banking concentration and the share of foreign banks in the economy, determine the effectiveness of MPPs as well.[22] The results of both exercises are contained in Table 4 in Appendix C.[23]

First, in Specification (2), the cost-to-income ratio is replaced by a cost measure and an income measure that are both scaled by asset size.[24] In this way, we separate the impact of the cost side from the income side. The corresponding cost measure is represented by "overhead costs as a share of total assets" and the corresponding income measure by "net income as a share of total assets," which is also referred to as the "return on assets." The results indicate that both components are significant and carry the expected sign. A higher level of overhead costs reduces the impact of MPPs on international bank flows and a higher return to assets increases their impact accordingly. Specification (3) then adds the cost-to-income ratio back into the specification. Thus, we investigate if the two components can explain away the effect of the cost-to-income ratio. However, it turns out that both, the cost-to-income ratio and its two components are still statistically significant. Two possible explanations emerge. First, there might be an incomplete overlap between the total cost measure in the cost-to-income ratio and the separately included overhead cost measure, which mainly measures indirect costs or operating costs, and thus suggests that the directly attributable part of total costs is not sufficiently accounted for. Alternatively, the relationship between costs and income, i.e., the profitability of the banking sector, is an important determinant.

Second, we repeat this exercise with the credit-to-deposit ratio. Specification (4) includes the two components of the credit-to-deposit ratio as separate regressors, each time scaled by GDP. The credit measure is represented by the "deposit money bank assets as a share of GDP," which mainly captures loans provided, and the deposit measure is replaced by "bank deposits as a share of GDP," which indicates the funding source. Again, after replacing the credit-to-deposit ratio with both components, the results show significant coefficients that carry the expected sign for both components. Hence, a larger asset side increases and a more deposit-based funding structure decreases the effectiveness of MPPs. Specification (5) then adds the credit-to-deposit ratio back into the specification. Interestingly, this time, the credit-to-deposit becomes insignificant and suggests that its two components are sufficiently characterizing the impact on the effectiveness of MPPs.

Third, Specifications (6)-(9) add the measure of banking concentration, that was introduced in Section 2, to our baseline specification. We test whether a higher concentration of banks in the domestic banking sector impacts the effectiveness of MPPs over and above the three previously tested channels (and especially the cost-to-income channel). Specification (6) shows the results. While the coefficients on the first three financial variables remain very similar in terms of sign, size and significance, the coefficient on the interaction with banking concentration turns out to be insignificant. This suggests that there is no effect of the banking concentration measure over

[22] Unless otherwise stated elsewhere in the text, all financial variables used in this subsection stem from the World Bank's Financial Development and Structure Dataset 2013. The variation in the number of observations across specifications comes from the fact that some of the additional variables start at a later date than those from the baseline specification.

[23] Specification (1) contains the results of the baseline specification for comparison.

[24] The substitution implies that also the level term of the cost-to-income ratio is replaced by its components.

and above the three previously tested channels.[25] The reason is shown in Specification (8), that contains an extremely loose, and Specification (9), that contains an extremely strict definition of the MPP measure.[26] While the very loose definition of the MPP measure implies that a higher banking concentration increases the effectiveness of MPPs, the very strict definition indicates that more banking concentration yields less effective MPPs. A potential explanation for these findings could be that these two extremes represent policies in very different country groups. While the first case covers the majority of sample countries, only very few countries entertain so many restrictions that they fall under the very strict definition. In such an environment, which most likely occurs in countries with already weak domestic fundamentals and institutions, a lower degree of banking concentration will not create sufficient competition pressure to increase the effectiveness of MPPs.

Fourth, Specifications (10)-(12) include the share of foreign banks variable that was introduced in Section 2. Analogously to the previous exercise, we first include the number share of foreign banks in the baseline specification (see Specification (10)).[27] Because also here, the coefficient on the interaction term is insignificant, we include the measure in Specification (11) individually. Together, the last two specifications suggest that also the share of foreign banks does neither have an effect over and above the three financial variables from the baseline specification nor on its own. Investigating further under which MPP-definition the interaction term becomes significant, it turns out that again only the combination with a very strict MPP measure delivers a significant result.[28] In this case, a higher share of foreign banks in the banking sector increases the effectiveness of MPPs. A potential mechanism could build on the same explanation as in the banking concentration case. If domestic fundamentals and institutions are relatively weak, the presence of foreign banks might bring additional managerial skills, corporate governance improvements or other factors to the country that enhance the effectiveness of MPPs.

4.2.2 Alternative Definitions of the MPP-Index

So far, all of our results have been derived using our preferred Agg. 4/7-Index as a measure of the MPP stance. We now expand our MPP measure to the set of all 19 MPP indices that are described in Appendix A. Table 5 in Appendix C shows the results.[29] We start with the top part of the table that presents the alternative definitions of the aggregated index based on seven subcomponents. Specifications (2), (6), (10) and (11) are equivalent to the baseline specification but include instead of the Agg. 4/7-Index the Agg. 2/7-, the Agg. 3/7-, the Agg. 5/7- and the Agg. 6/7-Index, respectively. In addition, Specifications (3)-(5) contain the individually included financial variables of the baseline specification for the Agg. 3/7-Index and Specifications (7)-(9)

[25] However, also the inclusion of banking concentration as the only financial interaction variable in Specification (7) reveals that concentration is not even significant on its own.

[26] Instead of using the Agg. 4/7-Index, Specification (8) relies on the Agg. 1/7-Index and Specification (9) relies on the Agg. 7/7-Index. These two indices were the only ones from the range of Agg. 1/7 to Agg. 7/7 that turned out significant. However, both carry an opposing sign. Being located between the two extremes, the median value of the MPP measure, represented by the Agg. 4/7-Index, does not show a significant effect.

[27] Since the share of foreign banks variable lacks the two most recent years, the sample size in this specification is smaller than before.

[28] Again represented by the Agg. 7/7-Index. No other definitions were significant.

[29] Specification (1) represents the baseline specification for comparison again. The specifications where the MPP measure is represented by the more extreme Agg. 1/7-Index or its Agg. 7/7-counterpart do not contain significant interaction terms and are not included in the table.

include the corresponding setup for the Agg. 5/7-Index.[30] Irrespective of the specification, we observe in all cases the same pattern as in the baseline specification. A higher level of regulatory quality and a higher credit-to-deposit ratio increase the effectiveness of MPPs and a higher cost-to-income ratio decreases it. In particular, all additional 18 interaction term coefficients in the top part of Table 5, i.e., Specifications (2)-(11), carry the same sign as in the baseline specification, and 15 out of 18 interaction term coefficients are statistically significant. It also turns out that the interaction term on the credit-to-deposit ratio, the financial variable that shows the weakest significance level in the baseline specification, becomes more significant for stricter definitions of the MPP measure.

The bottom part of Table 5 goes even further and assesses the role of MPP definitions beyond the measures based on the seven subcomponents. The results for the original indices[31] from Ostry et al. (2012) are presented in Specifications (12)-(15), the outcomes for the corresponding low and high value indicator variables are shown in Specifications (16)-(19) and the results for the aggregated indices based on the subcomponents of Fincont1 and Fxreg1 are shown in Specifications (20)-(23). The results are striking. All 36 interaction terms of the bottom part of Table 5 have the same sign as in the baseline specification and in 30 out of 36 cases, the interaction term coefficient is significant. It should also be noted that the number of countries in the sample increases up to 75, when other MPP measures are considered.[32] The fact that our results are confirmed in a larger sample of countries lends additional support to our findings. Finally, we find that there are no significant differences between different MPP-types, i.e., between the two Fincont- and the two Fxreg-types, which validates our approach of combining their information into an aggregated MPP measure.

4.2.3 Additional Robustness Checks

In this subsection, we present an additional set of robustness checks that support our main result. The outcome is shown in Table 6 in Appendix C and will be discussed briefly.[33] Answering a research question as the one of this paper with country-level data has the advantage that the findings can be generalized to a large number of countries. At the same time, a country-level approach places restrictions on the degree to which we can establish causality between the implementation of MPPs and the reaction of capital flows. However, as already pointed out by Ostry et al. (2012), the endogeneity problem in this setup works against us. The presence of reverse causality from capital inflows to the introduction of an MPP should create an upward-bias, resulting in a coefficient estimate that is closer to zero, and thus making it more difficult for us to detect an inflow decreasing effect. Hence, using our approach, we rather understate than overestimate the effectiveness of MPPs. Nevertheless, we allow the MPP measure in Specification (2) to enter with a one-year lag in order to minimize concerns that come from a contemporaneous correlation. As expected, coefficients and significance levels remain very similar.

[30] The findings for the individually included variables with the Agg. 2/7-Index and the Agg. 6/7-Index are very similar and only not shown for space reasons.

[31] The indices are included in the order Fincont1, Fincont2, Fxreg1 and Fxreg2. The four original indices enter in continuous terms and not as an indicator variable, which is the case for all other MPP definitions.

[32] Since we do not want to confound missing values and zero observations when computing the Agg. 4/7-Index (and all other indices based on the seven subcategories), we can only use information from countries that have non-missing values in all seven dimensions. The sample in this case amounts to the 66 countries used in our baseline specification.

[33] Specification (1) corresponds to the baseline specification and is included for comparison again.

Another problem could be that our results are driven by crises periods. Specification (3) therefore includes an indicator variable that takes on the value of 1 if a country was in a banking crisis and zero otherwise.[34] Again the results are not affected. Following the use of alternative financial variables in Section 4.2.1, where we did not substitute another variable for the index of regulatory quality, we now examine its robustness as follows. In Specification (4), we replace the index for regulatory quality with an index that captures the rule of law instead. However, also this measure of institutional quality gives very similar results.

So far, all specifications included time fixed effects. While this seems to us the most robust way to control for push factors, we show in Specification (5) that the results are not driven by this decision. Further, the baseline specification did not include country fixed effects. In Specification (6), we now add country fixed effects to the baseline specification and exploit the variation in the MPP stance within countries over time.[35] While the coefficients of all interaction terms keep their signs and the index of regulatory quality and the cost-to-income ratio remain significant, it appears that the credit-to-deposit ratio does not impact the effectiveness of MPPs anymore. A potential reason for this finding is that there is a positive relationship between the credit-to-deposit ratio and the level of economic development of a country, with more advanced economies having higher ratios.[36] Thus, when the data are purged from all time-invariant differences between countries through the inclusion of country fixed effects, also the credit-to-deposit ratio gives up a significant part of its variation.[37] In addition, Specification (7) confirms that the interactions with the index of regulatory quality and the cost-to-income ratio keep their signs and significance levels when also the four macro variables are interacted with the MPP.[38]

Since the last exercise has shown that cross-country differences in economic development could potentially affect the results, we split up the baseline specification into an advanced economy and an emerging market economy sample.[39] Specification (8) presents the results for emerging market economies and Specification (9) those for advanced economies. For the emerging market economy sample, the interactions with the cost-to-income ratio and especially the index of regulatory quality are important drivers of MPP effectiveness. For advanced economies, the interaction with the credit-to-deposit ratio seems to account for most of the differences in their effectiveness. Since the average value of MPPs is substantially lower in advanced economies, we replace the Agg. 4/7-Index from the baseline specification with the less strict Agg. 3/7-Index.[40] Specification (10) then shows that

[34] We take the information on banking crises from Reinhart and Rogoff (2011), who provide data until 2010. We add to this data from Laeven and Valencia (2012) that contains information on banking crises until 2011. Our results are also robust to an exclusion of the global financial crisis period (i.e., the years 2008 and 2009).

[35] The equivalent to Specification (1) in Table 1 with country fixed effects indicates as well that, on average, there is no significant effect from the MPP on bank inflows.

[36] In our empirical analysis, we control for differences in the level of economic development between countries by additionally including PPP-GDP per capita as a direct effect in all specifications and as an additional interaction with the MPP measure in the odd-numbered specifications in Table 1.

[37] The argument is supported by the following summary statistics. The *between variance* of the credit-to-deposit ratio in our sample is substantially larger than its *within variance* (the ratio of the two variances amounts to 2.04), whereas for the cost-to-income ratio, the two variances take on largely similar values (with a ratio of 0.95). With differences in the credit-to-deposit ratio being more pronounced across countries than within countries, the within estimator has less variation to exploit and the bar to identify significant effects is higher.

[38] Due to the insignificance of both, the direct effect and the interaction term, we exclude the credit-to-deposit ratio entirely from this specification.

[39] We define the two subsamples based on whether a country is above (i.e., advanced economy sample) or below (i.e., emerging market economy sample) the sample mean of GDP per capita in each year.

[40] The Agg. 4/7-Index is the most strictly defined MPP measure in our sample of advanced economies. A potential

for more moderately defined MPP measures in the advanced economy sample, the cost-to-income ratio returns as a determinant of MPP effectiveness. Hence, this exercise has shown that our results do not only apply to a mixed sample of advanced and emerging market economies but also appear, especially when adjusted for the level of average restrictions, within both country groups.

Finally, we test two alternative definitions of the left-hand-side variable. Following up on the previous robustness check, the literature has shown that net capital flow dynamics are traditionally more important for emerging market economies and gross flow dynamics are more important for advanced economies. Specification (11) therefore replaces the gross bank inflow measure with a measure of net flows (we define net flows as gross bank outflows minus gross bank inflows and thus we expect the opposite sign for all coefficients in this specification). We indeed find the opposite sign for all three interaction coefficients with those capturing the impact of the index of regulatory quality and the credit-to-deposit ratio being significant at the 5% level. We do not observe an impact of the cost-to-income ratio for net flows. Eventually, in Specification (12), we change the left-hand-side variable of the baseline specification that is based on the broader definition of the bank balance sheet ("external positions") to a more narrow one ("external loans and deposits"); we also return to gross bank inflows. Again, the results of the baseline specification are confirmed by significant interaction terms and coefficients with anticipated signs for all three financial variables. Overall, this subsection has shown that the baseline specification passes various additional robustness checks.

5 Spillover Analysis

The analysis so far has shown that – depending on the structure of the domestic banking sector – MPPs can indeed be effective in reducing the inflow of foreign capital into the domestic banking sector. This result has important implications. In particular, whenever MPPs are effective, we would expect capital to be directed somewhere else instead. Hence, this section examines the role of spillover effects from MPPs. We specifically assess the presence of spillovers in terms of inflows into other asset classes within the MPP-implementing country (asset class spillovers) and in terms of bank flows into other countries (geographical spillovers). In the same way as before, each time, we condition the response of capital flows on the structure of the banking sector.[41] Next, we discuss potential channels through which MPPs can redirect capital inflows. Following the introduction of an MPP, investors make their decision on whether or not to reallocate their portfolios based on the state of the financial and the macroeconomic environment. In case investors decide to reallocate, there are three additional options. Overall, this yields four distinct scenarios with different testable implications:

First, in a scenario where international investors maintain their portfolio allocation following the introduction of an MPP, we would subsequently observe no (or only a very small) reduction of bank flows. Hence, the coefficients of MPPs and their associated interaction terms would be insignificant throughout. While we saw that this pattern is true for our sample of countries on average, it is not the case for countries with a certain structure of the domestic banking sector, i.e., countries whose banking sectors are characterized by a high level of regulatory quality, a low cost-to-income and

indication of limited cross-country variation for this measure is its already large direct effect in Specification (9).

[41] In the case of asset class spillovers, we condition on the domestic banking sector, whereas in the case of geographical spillovers, we condition on both the domestic and the foreign banking sector.

a high credit-to-deposit ratio. In the remainder of our analysis, we will therefore investigate the behavior of capital flows from countries with these characteristics.

Second, investors could stick to the same country but reallocate their capital across observed asset classes. Taking the example of international bank flows, foreign capital could alternatively flow into domestic debt or equity markets. While in this example, the dependence of asset class spillovers on the domestic banking sector seems obvious (i.e., inflows to other asset classes should respond to banking sector conditions with the opposite sign), in practice, the direction of the response is less clear cut. If investors expect other asset classes in the MPP-implementing country to be affected by the policy as well, we would see a synchronized dependence on domestic banking sector conditions across various asset classes instead.

Third, investors could stick to the same asset class, in our case international bank flows, but reallocate their funds geographically. In this case, we would observe that bank flows toward the MPP-implementing country decrease and flows into related countries change as well. This time, however, the effect would be dependent on the structure of the *foreign* banking sector as well. While in theory, we would expect an inverse dependence of domestic inflows on foreign banking sector conditions, in practice, the eventual direction of such an effect is not evident either.

Fourth, the spillovers could not be observable to us. Investors could replace their investments in the banking sector with investments that are not measurable for us (e.g., investing in derivatives, holding their money temporarily in cash). In such cases, we do observe a reduction in bank inflows for the MPP-implementing country but no dependence of capital flows to banking sector conditions along the geographical or the asset class dimension. Another possibility for the inability to detect spillovers could relate to the fact that we measure flows as a share of domestic GDP. If the spillovers occur from a small market (e.g., country or asset class) to a larger one, these inflows will hardly matter for the larger market.

We now turn to an empirical test that is primarily concerned with the identification of the second and third case, i.e., spillovers across asset classes and along the geographical dimension. We start by assessing the presence of the former. By replacing the left-hand-side variable in the baseline specification with inflows into other asset classes, we can determine whether MPPs have an impact on other asset classes as well and if so, how this impact depends on the structure of the domestic banking sector. In all cases, we rely for comparability purposes on the same set of control variables that was selected to characterise the determinants of bank inflows. Table 3 shows the result.[42] Specifications (2)-(5) present the impact of domestic MPPs on alternative asset classes as a function of domestic banking sector conditions.

Specification (2) broadens the measure of bank flows into the domestic banking sector to bank flows into all sectors of the domestic economy.[43] Again, the direct effect of the MPP measure on foreign inflows is insignificant and the structure of the domestic banking sector seems to matter as before. Both the index for regulatory quality and the cost-to-income ratio have significant coefficients on their interaction terms. In addition, the signs of the coefficients for all three financial variables point in the same direction as in the more narrowly defined measure of international bank inflows.

[42]Specification (1) displays the baseline specification for comparison again.

[43]We obtain this variable by using the "all borrowers" concept in the Locational Statistics of the BIS. The resulting variable is scaled by GDP as well.

Table 3: Assessment of Spillovers across Asset Classes and across Countries

LHS: Varies (see Note)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DMPP_{i,t}$	-2.833	-4.406	-0.741	-10.168	-5.154*	-2.905	-0.721	8.813
	(0.149)	(0.223)	(0.842)	(0.233)	(0.077)	(0.168)	(0.550)	(0.188)
$DMPP_{i,t}$ x RQ $Index_{i,t-1}$	-1.641***	-1.811*	-1.670**	-0.077	1.772	-1.408**	-0.808	-2.836
	(0.006)	(0.056)	(0.049)	(0.942)	(0.144)	(0.019)	(0.147)	(0.314)
$DMPP_{i,t}$ x Cost-to-$Income_{i,t-1}$	0.088***	0.130***	0.057*	0.202	0.027	0.091***	0.036*	0.131*
	(0.003)	(0.009)	(0.100)	(0.203)	(0.486)	(0.004)	(0.091)	(0.089)
$DMPP_{i,t}$ x Credit-to-$Dep._{i,t-1}$	-0.024*	-0.039	-0.017	-0.011	0.005	-0.022	-0.015**	-0.121***
	(0.090)	(0.107)	(0.405)	(0.353)	(0.686)	(0.142)	(0.041)	(0.000)
$DMPPINT_{i,t}$						1.196	-0.260	-2.464
						(0.622)	(0.921)	(0.793)
$DMPPINT_{i,t}$ x INT RQ $Index_{i,t-1}$						-1.098**	-1.104*	21.876***
						(0.035)	(0.079)	(0.010)
$DMPPINT_{i,t}$ x INT Cost-to-$Income_{i,t-1}$						0.032	-0.015	-0.632***
						(0.472)	(0.588)	(0.002)
$DMPPINT_{i,t}$ x INT Credit-to-$Dep._{i,t-1}$						-0.034**	0.010	0.177***
						(0.045)	(0.524)	(0.005)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dom. Macro Var. Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dom. Fin. Var. Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Foreign Fin. Var. Incl.	No	No	No	No	No	Yes	Yes	Yes
Observations	862	872	579	600	617	862	571	291
R-squared	0.29	0.29	0.25	0.27	0.41	0.30	0.27	0.45
Countries	66	67	45	46	47	66	45	25

Note: For a description of the variables, see Table 1. Specification (1) corresponds to the baseline specification (i.e., Specification (8) in Table 1) and is added for comparison. Specifications (2)-(5) analyse spillovers from $DMPP_{i,t}$, across different asset classes within a country. Specifications (6)-(8) assess spillovers from $DMPP_{i,t}$ on bank flows (i.e., the same asset class) across countries. In particular, Specification (2) broadens our previous measure of bank inflows to a measure of bank inflows to all sectors of the economy, Specification (3) uses portfolio debt inflows, Specification (4) uses portfolio equity inflows and Specification (5) foreign direct investment inflows as the left-hand-side variable. Specification (6) shows the impact of $DMPPINT_{i,t}$ on bank inflows, where $MPPINT_{i,t}$ is a measure of the GDP-weighted average policy stance in countries nearby and $DMPPINT_{i,t}$ is an indicator variable that takes on the value of 1 when $MPPINT_{i,t}$ is above the sample average; and 0 otherwise. Finally, Specification (7) shows the corresponding effect for emerging market economies and Specification (8) for advanced economies.

Specification (3), where the left-hand-side variable is represented by portfolio debt flows in percent of GDP.[44] A higher level of regulatory quality and a lower cost-to-income ratio make MPPs more likely to reduce portfolio debt inflows. This suggests that spillovers in these related asset classes are dependent on the domestic banking sector structure in the same way as actual bank inflows and investors expect MPPs to have a broad effect. Hence, we find evidence that under certain banking sector conditions, MPPs are not only able to affect the composition but also the volume of capital flows. Next, we examine the consequences for more distant asset classes, such as portfolio equity flows or FDI flows. Specification (4) presents the result for equity flows, where we do not observe an impact of MPPs on portfolio equity flows, even when conditioning on the structure of the domestic banking sector.[45] Finally, Specification (5) uses FDI inflows in percent of GDP as the left-hand-side variable. Again, we find that most coefficients are insignificant, with the only exception being the direct effect of the MPP measure on FDI flows. A potential explanation for this finding could be that investors planning to engage in long-term projects (such as in the case of FDI flows) are more sensitive to the introduction or the announcement of MPPs than investors with, possibly more flexible, portfolio investments.

Next, we examine the presence of geographical spillovers. In particular, we return to the baseline specification with bank inflows as the left-hand side variable and add a set of "international" variables to its right-hand side. International variables are calculated as the GDP-weighted average of the values from 10 geographical regions.[46] We construct an international dimension for the following four variables: the MPP measure, the index of regulatory quality, the cost-to-income ratio, and the credit-to-deposit ratio. The international MPP measure is further converted into the indicator variable $DMPPINT_{i,t}$ that takes on the value of 1 when its continuous counterpart is above the sample average (and zero otherwise). We now re-estimate our baseline specification by adding $DMPPINT_{i,t}$, the international versions of the three banking sector variables, contained in $XINT_{i,t-1}$, and their respective interactions terms, contained in $DMPPINT_{i,t} \times XINT_{i,t-1}$. All "domestic" variables are included in the specification in the same way as before. The corresponding equation reads as follows:

$$\begin{aligned} k_{i,t} = \alpha + \alpha_t + \delta DMPP_{i,t} + \mu DMPPINT_{i,t} + \beta X_{i,t-1} + \theta XINT_{i,t-1} \\ + \lambda DMPP_{i,t} \times X_{i,t-1} + \eta DMPPINT_{i,t} \times XINT_{i,t-1} + \epsilon_{i,t} \end{aligned} \tag{3}$$

Specification (6) in Table 3 presents the results. While the direct effects of the domestic and the international MPP measures are insignificant, we do observe for the index of regulatory quality and the credit-to-deposit ratio an additional dependence of geographical spillovers on the banking sector structure abroad.[47] Further, these results suggest that the presence of geographical spillovers in

[44] The data on portfolio debt flows (as well as the data on portfolio equity and on FDI flows that are used in the next specifications) are taken from the International Financial Statistics (IFS) database of the International Monetary Fund and represent the liability side of the financial account.

[45] As mentioned earlier, the set of control variables might be less appropriate for equity flows than for bank flows since none of the control variables in this specification is significant.

[46] The regions are Western Europe, Eastern Europe, Caucasus and CIS, Emerging Asia, Other Asia, South America, Central America and Caribbean, Central and Southern Africa, Middle East, North and Western Africa. The last category is Other Advanced and includes Australia, Canada, Japan, New Zealand, and the United States.

[47] In addition, it should be noted that the effects of the domestic variables remain largely significant and the international terms are not simply measuring omitted domestic effects.

the full sample depends on the banking sector structure of nearby countries in the same way as on the domestic banking sector structure. However, because of the previously discussed implications of scaling capital flows by GDP, we next split up the specification into one for emerging market economies and one for advanced economies to account for potential differences in the dependence on the banking sector structure. The emerging market sample in Specification (7) shows almost no evidence of geographical spillover effects. In the advanced economy sample in Specification (8), however, it turns out that all three international interaction terms are highly significant and have the exact opposite sign of the domestic ones. Hence, when MPPs are introduced abroad, an increase in the *foreign* level of regulatory quality, a decrease in the *foreign* cost-to-income ratio and an increase in the *foreign* credit to GDP ratio lead to *higher* bank flows into the domestic economy – a fact that is highly consistent with the findings in Section 4.1, where we found that the same behavior of these three variables in the *domestic* banking sector lead to *lower* bank flows into the domestic economy following the introduction of domestic MPPs.

6 Conclusion

This paper has examined the effectiveness and externalities of MPPs in affecting international capital flows, specifically cross-border bank flows. Besides using MPPs as a tool to reduce excessive capital inflows, policy-makers might also be interested to understand whether MPPs targeted at domestic objectives have unexpected side effects on international capital flows. We have contributed to the literature in two ways. First, by assessing the conditions of the domestic banking sector that are required for MPPs to be effective, and second, by accounting in our empirical analysis for the presence of potential spillover effects – both across asset classes and across countries. Our empirical analysis then relies on a panel-data approach and examines the impact of MPPs on bank flows in a sample of 66 countries over the period 1999 to 2012.

Our results indicate that the structure of the domestic banking sector matters for the effectiveness of MPPs. We specifically find that higher regulatory quality and a higher credit-to-deposit ratio in the MPP-implementing country increase the effectiveness of MPPs, while a higher cost-to-income ratio has the opposite effect. If all three financial variables are evaluated at the median, the marginal effect of our preferred MPP measure leads to a reduction of international bank inflows in percent of GDP by around half a percentage point and is only marginally significant. However, when the more favorable 25^{th} percentiles of their respective distributions are considered, we observe, as a response to the same MPP measure, a reduction of bank inflows by 3.44 percentage points that is highly statistically and economically significant. The size of this effect even increases to a reduction of 5.39 percentage points when the 10^{th} percentiles are used for the evaluation.

Consequently, we also assess the existence of spillover effects from such policies as a function of banking sector conditions at home and abroad. We find that spillovers to closely related asset classes in the MPP-implementing country respond to domestic banking sector conditions in a very similar way. Moreover, we find that especially for advanced economies, the banking sector structure both at home and in other MPP-implementing countries of the same geographical region are important determinants of spillovers from bank flows.

Eventually, the main findings of our paper – that under certain banking sector structures, MPPs are effective in addressing strong capital inflows but can create spillovers – have important policy implications. First, especially in turbulent times, when capital flows are specifically volatile and countries want potentially to rely on MPPs to mitigate such flows, it is important to maintain a stable financial system with a high degree of regulatory quality and a profitable banking sector. Second, the assessment and categorization of spillovers following the introduction of MPPs is a function of domestic and international financial sector conditions and therefore complex. Third, in light of the first two observations, it will be difficult to devise a macroprudential policy framework at the global level. Since the nature of spillovers is difficult to assess and can change in response to financial sector developments, it will be difficult to agree on a clear code of conduct in a multilateral context. Hence, a potential policy option would be to promote and foster the existence of well-regulated and healthy banking sectors that allow sufficient room for maneuver when such policies should be used. Going forward on the research agenda, more effort should be dedicated to developing high-frequency measures of MPPs over an extended period. This in turn would allow the use of at least quarterly or potentially even monthly data in the empirical analysis and thus enable researchers to get a clearer picture of the behavior of capital flows immediately after the introduction of MPPs.

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Appendices

Appendix A Measurement of Macroprudential Policies

Ostry et al. (2012) derive two types of measures from the AREAER database: financial sector capital controls and foreign currency-related prudential policies. The financial sector capital controls measure is a hybrid concept between MPPs and traditional capital controls and comes in two variants (i.e., *Fincont1* and *Fincont2*). *Fincont1* is defined as the average of two indicator variables that represent restrictions on "borrowing abroad" and a "differential treatment of deposit accounts held by non-residents." *Fincont2* is computed as the average over three indicator variables, the same two subcomponents as above, plus a third variable that captures restrictions on the "maintenance of accounts abroad." The foreign currency-related prudential measure relates to restrictions on the use of foreign currency and comes in two variants as well (i.e., *Fxreg1* and *Fxreg2*). *Fxreg1* is the average of two indicator variables that capture restrictions on "lending locally in foreign exchange" and a "differential treatment of deposit accounts in foreign exchange." Finally, *Fxreg2* is based on the average of four indicator variables that, besides the subcomponents of *Fxreg1*, additionally capture restrictions to "purchase of locally issued securities denominated in foreign exchange" and limits to "open foreign exchange positions."[48] While Ostry et al. (2012) compute their four indices for a sample of 51 emerging market economies, we extend the coverage to all advanced and emerging market economies that have data available in the AREAER database.[49]

Based on these "original indices," we compute three sets of additional MPP measures that make use of the information contained in some or in all of the underlying subcomponents of the AREAER database:[50]

- The first set of additionally defined indices converts *Fincont1* and *Fxreg1* into indicator variables. While linear measures, such as the original indices, can serve as simple proxies for the intensity of MPPs, they come at the disadvantage that restrictions in, say, two subcomponents may not be exactly twice as strong as restrictions in only a single subcomponent. We therefore compute four indicator variables. The first two indicate a low level of restrictions and take on the value of 1 when *Fincont1* takes on a value of 0.5 or higher (i.e., *Low Level of Fincont1*) and when *Fxreg1* takes on a value of 0.5 or higher (i.e., *Low Level of Fxreg1*), respectively. The other two indicator variables take on a value 1 when *Fincont1* takes on a value of 1 (i.e., *High Level of Fincont1*) and when *Fxreg1* takes on a value of 1 (i.e., *High Level of Fxreg1*), respectively. In all other cases, the four indicator variables take on a value of zero.

- The second set of additionally defined indices aggregates the information from *Fincont1* and *Fxreg1*. While this step does not allow identifying differences between policies anymore, it

[48] Subsequently, the four measures can take on the following values: *Fincont1* = 0, 0.5, 1; *Fincont2* = 0, 1/3, 2/3, 1; *Fxreg1* = 0, 0.5, 1; *Fxreg1* = 0, 0.25, 0.5, 0.75, 1.

[49] When comparing the index values for the set of overlapping country and time-observations from our sample with the Ostry et al. (2012) sample, we obtain very high correlation coefficients between 0.99-1.00 based on the panel dataset that is available under http://conference.nber.org/confer/2011/GFC11/summary.html.

[50] The full list of subcomponents comprises "borrowing abroad," "differential treatment of deposit accounts held by non-residents," "maintenance of accounts abroad," "lending locally in foreign exchange" and a "differential treatment of deposit accounts in foreign exchange," "purchase of locally issued securities denominated in foreign exchange" and limits to "open foreign exchange positions."

takes into account the fact that the presence of different MPPs at the same time can yield stronger effects. We therefore compute four aggregated (*Agg.*) indicator variables that take on the value of 1 (and zero otherwise), when the sum of *Fincont1* and *Fxreg1* is equal to 0.5 or higher (i.e., *Agg. 1/4-Index*), to 1 or higher (i.e., *Agg. 2/4-Index*), to 1.5 or higher (i.e., *Agg. 3/4-Index*) and finally, equal to 2 (i.e., *Agg. 4/4-Index*).

- Eventually, we compute a third set of additionally defined indices using the information from all seven subcategories that the original measures are based on. We obtain a set of seven aggregated indicator variables, ranging from the weakest one that takes on the value of 1 (and zero otherwise), when one or more out of the seven subcategories are restricted (i.e., *Agg. 1/7-Index*) to the strongest one (i.e., *Agg. 7/7-Index*), when all seven subcategories are restricted.

Table 7 in Appendix C presents the summary statistics for the four original indices and the three sets of additional indices (i.e., 19 indices in total) in our country sample over the period 1999 to 2012.[51] In particular, the last set of indices shows that the share of country-time observations that indicate the presence of MPPs varies substantially across the cut-off values. While under the Agg. 1/7-Index definition, with 77%, most country-time observations are subject to MPPs, the Agg. 7/7-Index indicates the presence of MPPs in only about 5% of the cases. In order to find a middle ground between these two extremes, we opt for the median cut-off value, the Agg. 4/7-Index, as the core measure of MPPs in this paper. However, we use all other definitions, including the original indices, to demonstrate the generality of our choice in Section 4.2. Further, the Agg. 4/7-Index has very similar properties as the average of the four original indices. While the indices from Ostry et al. (2012) have sample means between 0.29 and 0.48 (with an unweighted average of 0.39), the corresponding mean of the Agg. 4/7-Index amounts to 0.38.

Appendix B List of Sample Countries

The following list describes the set of countries in the specification with the largest country coverage (i.e., Fxreg1). Countries with a star (*) are not included of the baseline specification (i.e., Agg. 4/7-Index):

Albania, Argentina, Armenia, Australia, Austria, Bangladesh, Belgium, Benin, Bolivia, Bosnia and Herzegovina, Bulgaria, Cambodia*, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Dominican Republic, Egypt, Estonia, FYR Macedonia, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Honduras, Hungary, Iceland, India*, Indonesia, Ireland, Italy, Japan, Jordan, Kenya, South Korea, Latvia, Malaysia*, Mexico, Moldova, Morocco, Nepal*, Netherlands, New Zealand, Pakistan*, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania*, Senegal, Slovak Republic*, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Togo, Tunisia, Turkey, Ukraine, United States, Uruguay, and Vietnam*.*

[51] For details on the sample composition, see Appendix B.

Appendix C Tables

Table 4: Alternative Financial Variables

LHS: Bank Inflows (in % of GDP)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$MPP_{i,t}$	-2.833	-1.902**	-5.843**	0.717	0.951	-4.123*	-0.568	3.776**	-3.335**	-3.261*	-0.868	1.815*
	(0.149)	(0.043)	(0.018)	(0.306)	(0.520)	(0.086)	(0.673)	(0.037)	(0.041)	(0.097)	(0.553)	(0.090)
$DMPP_{i,t}$ x RQ $Index_{i,t-1}$	-1.641***					-1.738***				-1.081		
	(0.006)					(0.004)				(0.140)		
$DMPP_{i,t}$ x Cost-to-$Income_{i,t-1}$	0.088***		0.079**			0.079**				0.106***		
	(0.003)		(0.038)			(0.013)				(0.002)		
$DMPP_{i,t}$ x Credit-to-Dep.$_{i,t-1}$	-0.024*				-0.004	-0.010*				-0.032**		
	(0.090)				(0.749)	(0.094)				(0.028)		
$DMPP_{i,t}$ x Overhead $Costs_{i,t-1}$		0.567***	0.327*									
		(0.010)	(0.091)									
$DMPP_{i,t}$ x Return on $Assets_{i,t-1}$		-0.701**	-0.442*									
		(0.018)	(0.096)									
$DMPP_{i,t}$ x Bank Deposit-to-$GDP_{i,t-1}$				0.069*	0.095**							
				(0.068)	(0.035)							
$DMPP_{i,t}$ x Bank Assets-to-$GDP_{i,t-1}$				-0.068*	-0.088**							
				(0.065)	(0.030)							
$DMPP_{i,t}$ x $Concentration_{i,t-1}$						0.008	0.008	-0.063**	0.064**			
						(0.658)	(0.710)	(0.026)	(0.043)			
$DMPP_{i,t}$ x Foreign $Banks_{i,t-1}$										-0.003	0.014	-0.055*
										(0.895)	(0.650)	(0.059)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	862	807	806	837	837	810	810	810	810	727	727	727
R-squared	0.29	0.27	0.28	0.27	0.30	0.27	0.26	0.27	0.26	0.36	0.33	0.33
Countries	66	66	66	65	65	64	64	64	64	63	63	63

Note: For a description of the variables, see Table 1. Specification (1) corresponds to the baseline specification (i.e., Specification (8) in Table 1) and is added for comparison. Specifications (2)-(12) contain alternative sets of financial variables that are listed on the left. In addition, Specifications (8), (9) and (12) have different $DMPP_{i,t}$ measures. Specification (8) relies on the Agg. 1/7-Index and Specifications (9) and (12) on the Agg. 7/7-Index. The financial variables included row ("Financial Variables Incl.") indicates whether the level terms/direct effects of the financial variables are included in the specification. A constant is included in all specifications but not reported. P-values are in parentheses.

Table 5: Alternative MPP Measures

LHS: Bank Inflows (% of GDP)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
$DMPP_{i,t}$	-2.833	-3.618	0.506	-5.705**	3.090**	-1.925	-0.187	-6.482**	3.414**	-2.332	-1.621
	(0.149)	(0.177)	(0.245)	(0.037)	(0.035)	(0.409)	(0.642)	(0.010)	(0.024)	(0.219)	(0.351)
$DMPP_{i,t}$ x RQ $Index_{i,t-1}$	-1.641***	-1.673*	-2.778***			-2.041***	-2.217**			-1.076*	-0.342
	(0.006)	(0.061)	(0.004)			(0.006)	(0.028)			(0.077)	(0.416)
$DMPP_{i,t}$ x Cost-to-$Income_{i,t-1}$	0.088***	0.106**		0.089**		0.078**		0.107***		0.086***	0.067**
	(0.003)	(0.018)		(0.037)		(0.032)		(0.008)		(0.007)	(0.027)
$DMPP_{i,t}$ x Credit-to-$Dep._{i,t-1}$	-0.024*	-0.022			-0.034**	-0.023			-0.034**	-0.028**	-0.022***
	(0.090)	(0.143)			(0.038)	(0.122)			(0.032)	(0.046)	(0.006)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	862	862	862	862	862	862	862	862	862	862	862
R-squared	0.29	0.29	0.28	0.27	0.28	0.29	0.27	0.27	0.28	0.28	0.27
Countries	66	66	66	66	66	66	66	66	66	66	66

LHS: Bank Inflows (% of GDP)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
$DMPP_{i,t}$	-2.373	-3.828	-4.465*	-4.559	-1.553	-2.396	-4.447*	-2.059	-4.576*	-1.454	-2.805*	-2.972
	(0.373)	(0.167)	(0.060)	(0.181)	(0.449)	(0.167)	(0.060)	(0.193)	(0.071)	(0.465)	(0.092)	(0.122)
$DMPP_{i,t}$ x RQ $Index_{i,t-1}$	-1.952**	-2.227**	-1.746***	-2.133**	-1.344***	-1.046	-1.322**	-1.302***	-1.280**	-1.609***	-1.224***	-1.332
	(0.018)	(0.011)	(0.008)	(0.048)	(0.008)	(0.161)	(0.033)	(0.004)	(0.046)	(0.002)	(0.008)	(0.102)
$DMPP_{i,t}$ x Cost-to-$Income_{i,t-1}$	0.090**	0.114**	0.107***	0.122**	0.062*	0.050*	0.104***	0.069**	0.104***	0.066**	0.080***	0.058*
	(0.030)	(0.012)	(0.006)	(0.019)	(0.053)	(0.052)	(0.006)	(0.011)	(0.007)	(0.040)	(0.003)	(0.068)
$DMPP_{i,t}$ x Credit-to-$Dep._{i,t-1}$	-0.034*	-0.033*	-0.020**	-0.021	-0.023*	-0.005	-0.021*	-0.017***	-0.020	-0.023*	-0.018**	-0.006
	(0.093)	(0.069)	(0.033)	(0.134)	(0.072)	(0.610)	(0.057)	(0.008)	(0.127)	(0.069)	(0.018)	(0.540)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	955	955	994	891	955	955	994	994	949	949	949	949
R-squared	0.27	0.28	0.27	0.28	0.27	0.25	0.28	0.26	0.28	0.28	0.26	0.25
Countries	72	72	75	68	72	72	75	75	72	72	72	72

Note: For a variable description, see Table 1. Specification (1) corresponds to the baseline specification and relies on the Agg. 4/7-Index as $DMPP_{i,t}$ measure. In Specifications (2)-(11), $DMPP_{i,t}$ is computed based on the same methodology as in Specification (1) but with different cut-off values. In Specification (12)-(15), $DMPP_{i,t}$ is based on the original indices from Ostry et al. (2012). In Specifications (16)-(19), $DMPP_{i,t}$ is based on the corresponding indicator variables that indicate a low or a high value for Fincont1 or Fxreg1, respectively. In Specifications (20)-(23), $DMPP_{i,t}$ is based on an index that combines information of both, Fincont1 and Fxreg1. In particular: Specification (1) = Agg. 4/7-Index (2) = Agg. 2/7-Index; (3)-(6) = Agg. 3/7-Index; (7)-(10) = Agg. 5/7-Index; (11) = Agg. 6/7-Index; (12) = Fincont1; (13) = Fincont2; (14) = Fxreg1; (15) = Fxreg2; (16) = Low Fincont1; (17) = High Fincont1; (18) = Low Fxreg1; (19) = High Fxreg1; (20) = Agg. 1/4-Index; (21) = Agg. 2/4-Index; (22) = Agg. 3/4-Index; and (23) = Agg. 4/4-Index. A constant is included. P-values in parentheses.

Table 6: Additional Robustness Checks

LHS: Varies (see Note)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$DMPP_{i,t}$	-2.833	-4.915**	-3.466*	-2.834	-3.087	-3.598	-1.712	-1.369	12.260**	1.135	-1.727	-2.739*
	(0.149)	(0.032)	(0.098)	(0.150)	(0.125)	(0.263)	(0.677)	(0.267)	(0.015)	(0.818)	(0.369)	(0.072)
$DMPP_{i,t}$ x RQ $Index_{i,t-1}$	-1.641***	-1.402**	-1.139*		-2.076***	-1.641*	-2.155*	-1.199**	2.178	-0.044	1.261**	-1.245**
	(0.006)	(0.025)	(0.066)		(0.003)	(0.069)	(0.058)	(0.049)	(0.289)	(0.979)	(0.029)	(0.013)
$DMPP_{i,t}$ x $Cost\text{-}to\text{-}Income_{i,t-1}$	0.088***	0.110***	0.098***	0.084***	0.100***	0.089*	0.076*	0.039*	0.043	0.172**	-0.004	0.071***
	(0.003)	(0.005)	(0.006)	(0.004)	(0.002)	(0.054)	(0.079)	(0.080)	(0.492)	(0.013)	(0.878)	(0.003)
$DMPP_{i,t}$ x $Credit\text{-}to\text{-}Dep._{i,t-1}$	-0.024*	-0.018**	-0.026*	-0.027*	-0.029*	-0.018		-0.011	-0.141***	-0.107***	0.016**	-0.015*
	(0.090)	(0.029)	(0.064)	(0.053)	(0.056)	(0.639)		(0.137)	(0.000)	(0.007)	(0.049)	(0.084)
$DBanking\ Crises_{i,t}$			-3.541***									
			(0.000)									
$DMPP_{i,t}$ x RL $Index_{i,t-1}$				-0.906*								
				(0.057)								
Time Fixed Effects	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	No	No	No	Yes	Yes	No	No	No	No	No
Macro Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro Variables Inter.	No	No	No	No	No	No	Yes	No	No	No	No	No
Financial Variables Incl.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	862	803	783	862	862	862	917	571	291	291	875	863
R-squared	0.29	0.29	0.35	0.28	0.20	0.23	0.26	0.25	0.43	0.43	0.09	0.25
Countries	66	65	64	66	66	66	68	45	25	25	67	66

Note: For a description of the variables, see Table 1. Specification (1) corresponds to the baseline specification (i.e., Specification (8) in Table 1) and is added for comparison. Specification (2) replicates the baseline specification with a one-year lag of $DMPP_{i,t}$. The corresponding measure is the Agg. 4/7-Index. Specification (3) adds an indicator variable for banking crises to the baseline specification. Specification (4) replaces the regulatory quality (RQ) index in the baseline specification with a rule of law (RL) index. Specification (5) corresponds to the baseline specification without time fixed effects. Specification (6) is the baseline specification with country fixed effects. Specification (7) equals Specification (6) but includes all macro interactions and omits the insignificant level and interaction terms of the credit-to-deposit ratio. Specification (8)-(10) estimate the baseline specification separately for emerging market economies (Specification 8) and advanced economies (Specification 9). Specification (10) corresponds to Specification (9) but uses the Agg. 3/7-Index as the $DMPP_{i,t}$ measure. Specification (11) replicates the baseline specification with net flows on the left-hand side. Net flows are defined as outflows – inflows and thus, we expect the opposite signs on all coefficients. Finally, Specification (12) corresponds to the baseline specification but uses a measure of loans instead of total liabilities on the left hand side.

Table 7: Summary Statistics

Variable	Obs.	Mean	Std.	Min	Max
LHS Variables (changes over the period):					
Bank Inflows (gross, in % of GDP)$_{i,t}$	994	1.24	5.44	-17.16	28.23
Bank Inflows (loan flows only, in % of GDP)$_{i,t}$	992	0.86	4.50	-14.48	21.75
Bank Inflows (net, in % of GDP)$_{i,t}$	994	-0.01	4.48	-15.34	16.94
All Inflows (bank and non-bank, in % of GDP)$_{i,t}$	991	2.24	8.21	-20.64	46.96
PF Debt Inflows (in % of GDP)$_{i,t}$	652	2.32	5.38	-14.41	31.11
PF Equity Inflows (in % of GDP)$_{i,t}$	675	1.34	6.47	-3.83	51.32
FDI Inflows (in % of GDP)$_{i,t}$	702	4.49	5.14	-3.15	28.81
Macro Controls:					
Real GDP Growth$_{i,t-1}$	994	3.85	3.43	-7.72	13.09
Inflation$_{i,t-1}$ (in logs)	994	1.79	0.66	-0.18	3.98
PPP GDP per capita$_{i,t-1}$ (in 1,000)	994	14.57	12.66	1.01	46.91
Trade Integration$_{i,t-1}$	994	63.84	33.29	17.83	172.71
Financial Controls:					
Regulatory Quality (RQ) Index$_{i,t-1}$	994	0.38	0.82	-1.22	1.89
Cost-to-Income$_{i,t-1}$	994	58.81	12.90	22.41	95.77
Credit-to-Dep.$_{i,t-1}$	994	113.39	65.52	29.18	472.49
Overhead Costs$_{i,t-1}$	927	3.42	2.37	0.22	14.43
Return on Assets$_{i,t-1}$	927	1.12	1.41	-4.37	7.06
Bank Deposit-to-GDP$_{i,t-1}$	963	52.04	35.26	5.74	190.22
Bank Assets-to-GDP$_{i,t-1}$	964	68.19	48.68	6.86	221.09
Concentration$_{i,t-1}$	946	66.40	18.64	28.67	100.00
Foreign Banks$_{i,t-1}$	850	34.21	23.65	0.00	87.50
Rule of Law (RL) Index$_{i,t-1}$	994	0.20	0.97	-1.54	1.96
MPP Indices: DMPP$_{i,t}$					
Agg. 1/7-Index, b.o. all Subcomp.	892	0.77	0.42	0	1
Agg. 2/7-Index, b.o. all Subcomp.	892	0.62	0.48	0	1
Agg. 3/7-Index, b.o. all Subcomp.	892	0.51	0.50	0	1
Agg. 4/7-Index, b.o. all Subcomp.	892	0.38	0.48	0	1
Agg. 5/7-Index, b.o. all Subcomp.	892	0.28	0.45	0	1
Agg. 6/7-Index, b.o. all Subcomp.	892	0.15	0.36	0	1
Agg. 7/7-Index, b.o. all Subcomp.	892	0.05	0.21	0	1
Original Index, Fincont1	959	0.29	0.36	0	1
Original Index, Fincont2	959	0.29	0.34	0	1
Original Index, Fxreg1	994	0.48	0.43	0	1
Original Index, Fxreg2	916	0.48	0.36	0	1
Low Level of Fincont1	959	0.45	0.50	0	1
High Level of Fincont1	959	0.13	0.34	0	1
Low Level of Fxreg1	994	0.61	0.49	0	1
High Level of Fxreg1	994	0.35	0.48	0	1
Agg. 1/4-Index, b.o. Fincont1 and Fxreg1	959	0.63	0.48	0	1
Agg. 2/4-Index, b.o. Fincont1 and Fxreg1	959	0.49	0.50	0	1
Agg. 3/4-Index, b.o. Fincont1 and Fxreg1	959	0.29	0.46	0	1
Agg. 4/4-Index, b.o. Fincont1 and Fxreg1	959	0.11	0.31	0	1
Int'l Variables: DMPPINT$_{i,t}$ and controls					
INT Agg. 4/7-Index, b.o. all Subcomp.	892	0.36	0.48	0	1
INT RQ Index$_{i,t-1}$	994	0.36	0.75	-1.63	1.72
INT Cost-to-Income$_{i,t-1}$	994	59.27	8.27	40.34	84.16
INT Credit-to-Dep.$_{i,t-1}$	994	110.31	39.65	58.12	241.00

Note: The sample size in this table is based on the specification that use Fxreg1 as the measure for DMPP$_{i,t}$. With 994 observations, this is the specification with most observations in the analysis. "b.o." stands for "based on."