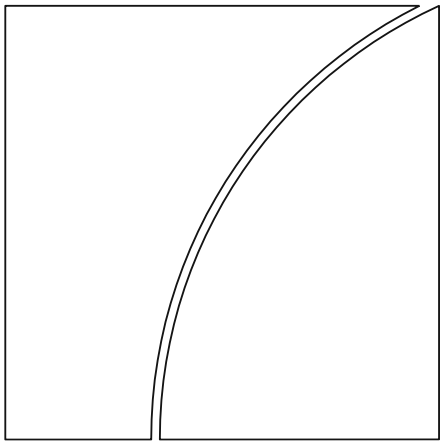


BIS Working Papers
No 1158

Financial development and the effectiveness of macroprudential and capital flow management measures

by Yusuf Soner Başkaya, Ilhyock Shim, Philip Turner

Monetary and Economic Department

January 2024

JEL classification: F34, G15, G28

Keywords: bank lending, capital flow management measures, cross-border capital flows, financial development, macroprudential policy

BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The papers are on subjects of topical interest and are technical in character. The views expressed in them are those of their authors and not necessarily the views of the BIS.

This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

Financial development and the effectiveness of macroprudential and capital flow management measures[1]

Yusuf Soner Başkaya[2] Ilhyock Shim[3] Philip Turner[4]

13 December 2023

Abstract

Using quarterly data on macroprudential policy (MaPP) measures and capital flow management measures (CFMs) taken by 39 economies in 2000–2013, we analyse how domestic credit and cross-border capital flows respond to such measures. In doing so, we take a granular approach by considering price-based and quantity-based MaPP measures and CFMs, and also examine if the level of financial development matters in explaining policy effectiveness. We find that quantity-based MaPP measures significantly affect total credit and its components such as domestic bank credit, corporate credit and housing credit, but that the effects fade away beyond a certain level of financial development, suggesting that highly developed financial markets provide opportunities to circumvent MaPP measures imposed on banks. We also find that both price- and quantity-based CFMs are effective in slowing down bank inflows with the former effective at all levels of financial development and the latter effective at relatively high levels. Finally, we find some evidence on the existence of leakage effects. For example, tighter overall MaPP measures are associated with larger bond inflows, and tighter quantity-based MaPP measures with larger bank inflows.

Keywords: bank lending, capital flow management measures, cross-border capital flows, financial development, macroprudential policy

JEL codes: F34, G15, G28

[1] The authors are grateful for the research assistance by Jimmy Shek. The views expressed in this paper are those of the authors and do not necessarily represent the views of the Bank for International Settlements.

[2] University of Glasgow, Adam Smith Business School, Gilbert Scott Building, G128QQ, United Kingdom. E-mail: soner.baskaya@glasgow.ac.uk.

[3] Bank for International Settlements, Representative Office for Asia and the Pacific, 78th floor, Two International Finance Centre, 8 Finance Street, Central, Hong Kong SAR, China. E-mail: ilhyock.shim@bis.org.

[4] University of Basel, Faculty of Business and Economics, Financial Markets, Peter Merian-Weg 6, CH-4002 Basel, Switzerland. E-mail: philip.turner@unibas.ch.

1. Introduction

After the Global Financial Crisis (GFC) in 2007–09, a large number of central banks and financial regulators in both advanced economies (AEs) and emerging market economies (EMEs) acknowledged the importance of macroprudential policy (MaPP) in securing both domestic financial stability and external stability. In particular, the role of the macroprudential policy has been characterised as increasing the financial system's resilience by identifying the sources of systemic risk and taking appropriate policy actions. In addition, many central banks and other financial authorities in EMEs paid attention to capital flow management measures (CFMs) to mitigate the adverse effects of excessive capital flow or exchange rate volatility and secure external stability, as recognised at the G20 meeting of Finance Ministers and Central Bank Governors held in October 2010. Since then, significant progress has been made in designing and implementing MaPP by both AEs and EMEs. Some EMEs continued to use various types of CFM to reduce the volatility of capital flows or exchange rates.

The increased use of MaPP measures and CFMs since the GFC naturally brought in the question of whether such policy measures were effective in taming excessive growth in credit, asset prices and capital inflows. However, we think that there are still important gaps in research on this question for several reasons. First, many countries implement MaPP measures, in addition to CFMs, which aim at taming excessive capital flows as well as at excessive growth in credit and asset prices. In contrast, the general approach in the literature is to estimate the effectiveness of MaPP measures on financial stability-related outcomes such as credit growth and asset prices without considering the potential effects of CFMs. This, however, potentially generates omitted variable bias for the effects of MaPP measures. Second, despite the acknowledgement of the potential implications of excessive capital flows for financial instability and the potential use of MaPP to mitigate such financial instability risks, the number of studies assessing the effectiveness of MaPP measures is limited. More importantly, such studies usually do not account for different types of CFM, which potentially provides a limited view on the potential effects of such policies.

In this paper, using a very detailed cross-country dataset on MaPP measures and CFMs at quarterly frequency, we analyse the effectiveness of such policies on capital inflows and the volume of credit. In particular, we consider how domestic credit variables (such as total credit to the private non-financial sector, domestic bank credit, total corporate credit, household loans, housing loans and consumer loans) and capital flow variables (such as cross-border bank inflows, bond inflows and offshore issuance of debt securities) respond to MaPP measures and CFMs. This contrasts with the general practice in the literature which focuses on the policy impact on *either* the dynamics of domestic credit *or* those of capital flows.

Our approach differs from the rest of the literature in that our empirical model simultaneously accounts for the effect of MaPP measures and CFMs on credit dynamics and capital inflows, which is guided by the policy practice, especially in many EMEs. In particular, there are the following few merits of identifying the effect of MaPP measures and CFMs on credit growth and capital flows in model that controls for both types of policies. First, both MaPP measures and CFMs affect total credit, defined as the sum of credit extended by domestic financial intermediaries in the form of loans and bonds and cross-border borrowing also in the form of loans and debt securities, as well as the domestic financial conditions of an economy, often measured by the cost of credit such as loan rates or long-term bond yields.

Therefore, any analysis considering the effectiveness of one type of policy without considering the other has a potential to produce biased results on the effect of policies on total credit, domestic bank credit and different types of loans, such as lending to corporates and households. Second, when we only consider the effect of CFMs on capital inflows without considering the potential effects of MaPP measures, we may obtain biased results especially for countries which use MaPP to deal with challenges from too much capital inflows or outflows by affecting domestic asset prices or the amount of domestic credit. Finally, although this is an indirect channel, CFMs are often used to moderate the volatility of exchange rates which not only affects capital inflows by non-residents but also indirectly affect domestic credit because change in exchange rates tend to affect domestic financial conditions such as long-term bond yields. All these suggest that a more accurate approach on identifying the effect of CFMs and MaPP measures on credit growth and capital flows requires including both type of policies simultaneously in the regressions. In contrast, in our best knowledge, except Bruno, Shim and Shin (2017) and Das, Kalemli-Ozcan and Gopinath (2022) who focus on different outcomes and/or mechanisms from our analysis, the papers in the literature evaluate the effectiveness of CFMs without considering MaPP measures, or the effectiveness of MaPP measures without considering CFMs.

We also differ from most studies in the literature in the sense that in our preferred specification, we look at the effectiveness of price-based and quantity-based MaPP measures and CFMs, rather than considering jointly all MaPP measures and CFMs. While the potential differences in the effectiveness of price-based and quantity-based measures, to our knowledge, very few papers have investigated the issue of the relative effectiveness of price-based and quantity-based measures. Regarding the desirability of price- versus quantity-based tools, Shin (2012) points out that a levy on wholesale/FX-denominated liabilities have the advantage of a price-based measure, but a leverage cap has the drawback of being not price-based and thus being open to circumvention. Recently, Cizel et al (2019) find that quantity-based macroprudential measures have stronger cross-sector substitution effects (from bank to non-bank credit) in AEs.

Finally, we also account for potential differences in the effectiveness of CFMs and MaPP measures with respect to the level of financial development of countries. As we later show empirically in this paper, this is an important margin that needs to be considered for assessing the effectiveness of different policies. As low levels of financial development as typically characterised with a dominant role of the banking sector in the financial system and few alternative ways of finance, one may expect that policies aiming at slowing down credit growth may be more effective compared to a case with higher levels of financial development. In contrast, high levels of financial development may be associated with alternative ways of finance, as a result of which MaPP measures may be circumvented and therefore become ineffective in taming credit growth. Moreover, tighter macroprudential policies can also trigger capital inflows in economies with higher financial development and financial openness. Therefore, given the possibility that a higher level of financial development increases the likelihood of MaPP measures being ineffective because domestic bank credit is substituted with alternative sources of finance, it is important to document whether and how the effectiveness of CFMs and MaPP measures change with the degree of financial development.

Our key findings can be summarised as follows. First, the overall MaPP measures (that is, combined measures including both price- and quantity-based MaPP measures) are ineffective in slowing down credit growth for all levels of financial development, whereas the overall CFMs

(that is, combined measures including both price- and quantity-based CFMs) are effective on slowing down banking inflows when the level of financial development is higher than the median. Second, when we consider the impact on credit growth of price- and quantity-based measures separately, we find that tightening quantity-based MaPP measures slows down growth in total credit, domestic bank credit, total credit to the non-financial corporates and housing credit in economies with relatively low financial development, while price-based MaPP are ineffective in moderating the credit growth. In contrast, price-based CFMs are effective in slowing down total credit and total credit to the non-financial corporate sector in economies with high levels of financial development, mainly via its effect on non-domestic bank credit. Third, regarding the impact on capital inflows, both price- and quantity-based CFMs are effective in slowing down bank inflows. However, while the effect of the former is independent from the level of financial development, the latter is effective in slowing down bank inflows in economies with relatively high levels of financial development. We further find that the price-based CFMs slow down capital inflows due to offshore issuance of debt securities, yet only if the level of financial development is high. Finally, we find some evidence of policy leakages. In particular, tightening the overall MaPP measures increases bond inflows when the level of financial development is high. This is possibly because a higher degree of financial development is associated with the utilisation of alternative ways of finance, including access to bond financing from abroad which can allow for substituting for domestic credit during times of tighter MaPP measures. In addition, tightening quantity-based MaPP measures leads to larger bank inflows, which suggests that domestic credit and credit from non-resident banks may have some degree of substitutability.

The rest of the paper is organised as follows. In the next section, we summarise the related literature. In section 3, we present our empirical framework and the data. Section 4 presents the main results and discussions. Section 5 concludes.

2. Literature

This paper is related to four strands of literature on MaPP and CFMs: (1) the effectiveness of various types of MaPP on credit growth and capital flows; (2) the effectiveness of various types of CFMs on capital flows; (3) differential effects of price- and quantity-based policy measures; and (4) the differential effects of financial development on the effectiveness of these policies.

First, a large number of papers consider the effectiveness of MaPP measures on domestic bank credit, using a large cross-country sample.[5] In particular, Borio and Shim (2007) conduct an event-study analysis on MaPP actions taken by 18 Asian and European economies, and find that such actions reduce domestic bank credit growth in the years after their introduction. Lim et al (2011) consider 40 economies that took MaPP measures. Using a panel regression analysis, they find that reserve requirements and dynamic provisioning have been effective in reducing private sector real credit growth during booms, and that loan-to-value (LTV) and debt-service-to-income (DSTI) limits, dynamic provisioning and reserve requirements reduce the procyclicality of credit growth. Kuttner and Shim (2013) consider 60 economies that took MaPP actions affecting housing markets and find that a typical tightening of DSTI limits slows real housing credit growth by 5–6 percentage points over the subsequent year. Claessens et

[5] See Ostry et al (2012), Cerutti et al (2017), Bruno et al (2017) and Akinci and Olmstead-Rumsey (2018).

al (2013) show that MaPP measures such as limits on LTV and DSTI ratios and limits on foreign currency lending are effective in reducing the growth in bank-level leverage and assets during booms. Cerutti et al (2017) also find that MaPP measures overall are effective in reducing real domestic bank credit growth and that borrower-based measures such as LTV and DSTI limits are very effective through their effects on household credit.[6]

Second, our paper is related to studies analysing the effectiveness of various policy tools on reducing volatility of capital flows. As documented by early studies, such as Cetorelli and Goldberg (2012) and Bruno and Shin (2015), international banking flows have the potential to transmit financial stability risks across borders, and therefore deserve attention from the perspective of optimal pre-emptive policies. The period in the aftermath of the GFC witnessed an increasing number of theoretical and empirical studies exploring the role of CFMs in mitigating such risks.[7] In contrast, there are few papers empirically analysing the effectiveness of CFMs on domestic credit and capital flows at the same time.[8] This possibly reflects the fact that granular datasets on CFMs are relatively recent and scarce. Therefore, we believe that our analysis provides new insights into the effectiveness of CFMs on both credit aggregates and cross-border capital flows.

Third, we analyse the effectiveness of quantity- and price-based measures, rather than aggregate indicators of CFMs and MaPP measures which include both quantity- and price-based measures. In this sense, Cizel et al (2019) is one of the closest studies to this paper. While we highlight differences in the effectiveness of price- and quantity-based measures, we also show the potential differences in the policy implications of the results obtained with aggregate CFMs and MaPP measures and of those obtained with quantity- and price-based CFMs and MaPP measures.

Finally, a small number of papers explicitly consider the relationship between a country's level of financial development and the choice/effectiveness of MaPP measures using a large cross-country sample. Lim et al (2011) point out that the stage of economic/financial development affects the choice of MaPP instruments, and consider dummies for the exchange rate regime in their regression analyses. Cerutti et al (2017) also consider institutional variables such as the exchange rate regime, de factor financial openness, the log of per capita GDP (as a proxy for the level of economic development), the level of credit relative to GDP, and the ICRG index of institutional quality. They find that (1) MaPP measures are more effective for a sample of relatively (de-facto financially) closed economies than for relatively open economies; (2) MaPP measures are less effective in countries with more flexible exchange rates; (3) the level of economic development and the quality of institutions do not explain the effectiveness of MaPP measures; and (4) economies with a higher credit-to-GDP ratio have more difficulty in lowering credit growth through MaPP measures when they consider a sample of low-income developing economies or a sample of relatively (de-facto financially) closed economies. Finally,

---

6 Elliott, Feldberg and Lehnert (2013) consider macroprudential tools the Federal Reserve and other US agencies have used since the First World War and find that macroprudential policies designed to tighten credit availability, especially tools such as underwriting standards, have a significant effect, but that macroprudential policies designed to ease credit availability have little effect on of credit.

7 For example, see Korinek and Sandri (2016), Bianchi et al (2012), Mendoza (2016), Farhi and Werning (2016) and Basu et al (2020).

8 See Forbes et al (2015) and Das et al (2022) for examples of studies empirically exploring the effectiveness of CFMs on mitigating systemic risks. Relatedly, there are a number of studies that analyse whether macroprudential measures have the potential to curb excessive capital flows. See Beirne and Friedrich (2017).

Baskaya et al (2016) consider price-based and quantity-based MaPP measures separately together with the level of financial development and find that quantity-based MaPP measures are effective in moderating credit cycles almost irrespective of the level of financial development, but that price-based MaPP measures effectively curb excess variations in total credit in relatively more developed financial markets.

3. Data

We use quarterly data mainly from the Bank for International Settlements for a sample of 37 economies over the period from Q1 2000 to Q4 2011. The 37 economies include 20 AEs and 17 EMEs, with 10 economies from Asia-Pacific, five from central and eastern Europe, one from the Middle East and Africa, three from Latin America, 16 from western Europe and two from North America. The data used in this paper consist of five blocks: (1) credit and capital flows; (2) MaPP measures; (3) CFMs; (4) index on the level of financial development; and (5) macroeconomic controls.

3.1 Credit and capital inflows

We focus on the impact of various types of MaPP measure and CFM on private non-financial sector credit growth, that is, the increase in borrowing by households and corporates in an economy in the form of loans or bonds and from domestic financial institutions or foreign lenders/investors. In particular, we consider four credit variables capturing domestic credit (ie, credit extended by domestic financial institutions), three credit variables capturing foreign credit (ie credit extended by non-residents) and two credit variables capturing the sum of the two (ie total credit from all sources).

The first set of dependent variables are credit aggregates. We consider the following six credit variables in this paper: (1) total credit to the private non-financial sector consisting of borrowing by domestic households and corporates from both domestic and foreign sources in the form of loans and debt securities, which is obtained from the BIS credit statistics; (2) total credit to private non-financial corporates including borrowing by domestic corporates from all domestic and foreign sources in the form of loans and debt securities, obtained from the BIS credit statistics; (3) domestic bank credit to the private non-financial sector, obtained from IMF International Financial Statistics[9]; (4) domestic banks' lending to households, obtained from various national sources and commercial databases; (5) domestic banks' lending to households who purchase houses; and (6) domestic bank lending to consumers either from national sources or calculated as domestic banks' loans to households which are not used to purchase houses (i.e. the difference between (4) and (5)). In this paper, we call them total credit, total corporate credit, domestic bank credit, household loans, housing loans and consumer loans, respectively.

Our second set of dependent variables are credit extended by non-residents. We consider the following three capital inflow variables: (1) non-resident banks' lending to all residents in

[9] Domestic credit to private sector by banks refers to financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks), such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries, these claims include credit to public enterprises.

an economy, measured as the amount outstanding of external claims (only in the form of loans) in US dollars of BIS-reporting country banks on each economy by residency obtained from the BIS locational banking statistics; (2) the amount outstanding of domestic debt securities in US dollars purchased by non-residents obtained from the IMP BOP and IIP statistics; and (3) The amount outstanding in US dollars of international debt securities issued by banks and corporations residing in an economy, obtained from the BIS international debt securities statistics. In this paper, we call them bank inflows. bond inflows and offshore bond issuances, respectively.

3.2 Macroprudential policy (MaPP) measures

Domestic MaPP measures are obtained from the database in Shim et al (2013). In the database, each tightening action is assigned value "+1", each loosening action value "–1", and no action value zero. The eight types of policy action recorded in the database can be classified into price-based and quantity-based measures. In particular, reserve requirements (RR), liquidity requirements (Liq) risk weights (RW) and provisioning requirements (Prov) are price-based measures, while credit growth limits (CRg), LTV limits (Ltv), DSTI limits and other lending criteria (Dstilc) and exposure limits (Expo) are quantity-based measures. We can define an indicator for all price-based MaPP measures (PriceMaPP) as the sum of the indicators for the four price-based tools, and an indicator for all quantity-based MaPP measures (QuantMaPP) as the sum of the indicators for the four quantity-based tools. PriceMaPP takes the values of -3, -2, -1, 0, 1, 2, 3 and 4, while QuantMaPP the values of –2, -2, 0, 1, 2 and 3. Table 1 shows the number of policy actions for the aggregate indicators as well as the number of tightening and loosening policy actions taken by 39 economies.[10] Table A1 in the annex shows the distribution of PriceMaPP, QuantMaPP, PriceCFM and QuantCFM.

Between 2003 and 2008, there were more tightening actions than loosening actions. After a sharp increase in loosening actions during the peak of the global financial crisis, these economies overall took more tightening actions than loosening ones after 2009 (Graphs 1 and 2). By contrast, the 39 economies overall had taken more tightening quantity-based measures than loosening measures from 1990 to 2012, except two brief periods of more loosening actions immediately after the Asian financial crisis of 1997 and during the peak of the GFC.

3.3 Capital flow management measures (CFMs)

CFMs taken by 39 economies (consisting of 21 AEs and 18 EMEs) between Q1 2002 and Q4 2012 are obtained partly from the CFM database on Asia-Pacific economies by Chantapacdepong and Shim (2016) and the authors' collection of CFM data from various sources including IMF Annual Reports on Exchange Arrangements and Exchange Restrictions (AREAERs). Since we are interested in credit provided by non-residents, we focus on CFMs targeting resident banks' borrowing from abroad and non-residents' investment in local or foreign currency bonds issued by residents. Table 2 shows the number of banking inflow management measures or bank CFMs (eg, prudential measures on domestic banks which

[10] It should be noted that the correlation of all price-based measure indicators (+1, 0, –1) and all quantity-based measure indicators over 1990–2012 is 0.15, and the correlation of cumulative indicators of all price-based measures and cumulative indicators of all quantity-based measures is 0.44. Also, the two measures were used at the same time during 1990-2012 in 17 out of 2782 country-quarter observations, at the same time in the same direction in 4 (loosen) and 13 (tighten) country-quarters. That is, we have zero observation with two types of policy action taken in the opposition directions.

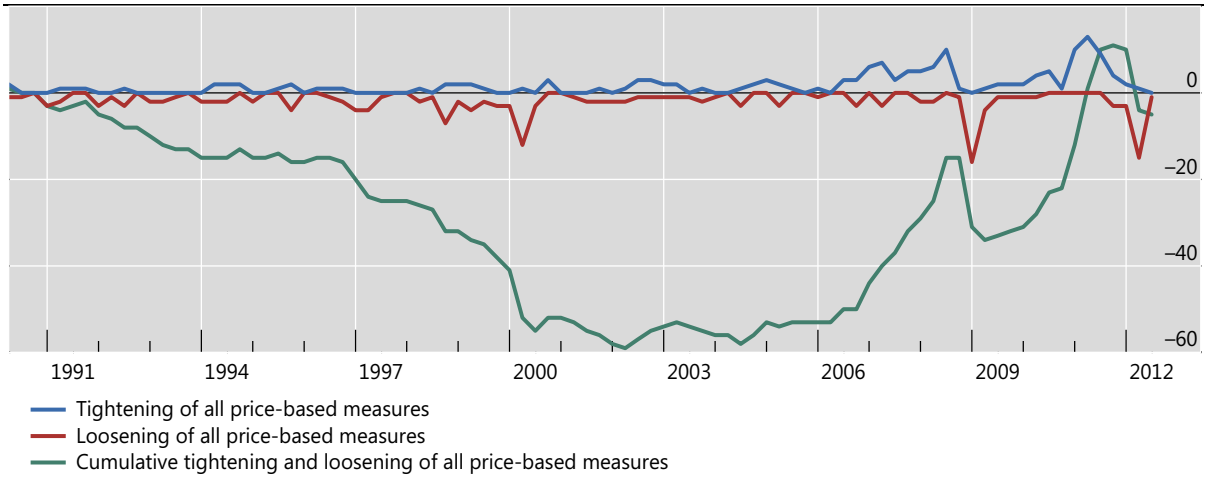
affect the domestic banks' borrowing from abroad in foreign currency) and bond inflow management measures or bond CFMs (eg, policy actions affecting non-residents' investment in local or foreign currency bonds issued by a country's entities) used in the paper.

Number of macroprudential policy measures taken over Q1 1990–Q2 2012 Table 1

Economy	Price-based MaPP measures			Quantity-based MaPP measures			All MaPP measures
	Total	Tightening	Loosening	Total	Tightening	Loosening	Total
AU	2	2	0	0	0	0	2
CN	44	35	9	23	21	2	67
HK	0	0	0	16	10	6	16
IN	42	25	17	2	2	0	44
ID	4	3	1	1	1	0	5
JP	1	0	1	2	1	1	3
KR	10	7	3	21	15	6	31
MY	21	14	7	8	4	4	29
SG	0	0	0	9	7	2	9
TH	6	4	2	2	1	1	8
CZ	8	2	6	0	0	0	8
HU	4	0	4	4	3	1	8
PL	5	3	2	3	3	0	8
RU	22	15	7	0	0	0	22
TR	19	11	8	3	3	0	22
AR	11	3	8	0	0	0	11
BR	39	17	22	0	0	0	39
MX	1	1	0	0	0	0	1
SA	6	4	2	0	0	0	6
ZA	1	1	0	0	0	0	1
AT	2	0	2	0	0	0	2
BE	2	0	2	0	0	0	2
CH	1	1	0	1	1	0	2
DE	6	0	6	0	0	0	6
DK	0	0	0	4	2	2	4
ES	5	2	3	3	1	2	8
FI	5	0	5	0	0	0	5
FR	10	3	7	0	0	0	10
GB	2	0	2	0	0	0	2
GR	3	0	3	4	3	1	7
IE	7	1	6	1	1	0	8
IT	10	2	8	1	0	1	11
LU	2	0	2	2	1	1	4
NL	2	0	2	3	3	0	5
NO	8	2	6	3	3	0	11
PT	3	0	3	2	1	1	5
SE	0	0	0	2	2	0	2
CA	5	0	5	6	6	0	11
US	2	0	2	0	0	0	2
Total	321	158	163	126	95	31	447

Use of price-based macroprudential measures over time

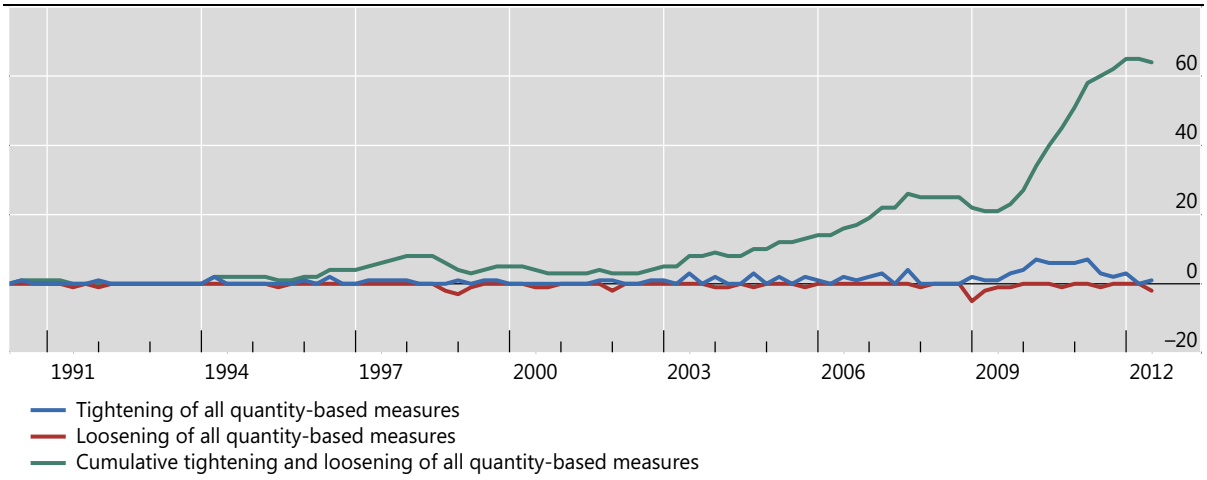
Number of policy actions — Graph 1



Sources: Shim et al (2013); authors' calculations.

Use of quantity-based macroprudential measures over time

Number of policy actions — Graph 2



Sources: Shim et al (2013); authors' calculations.

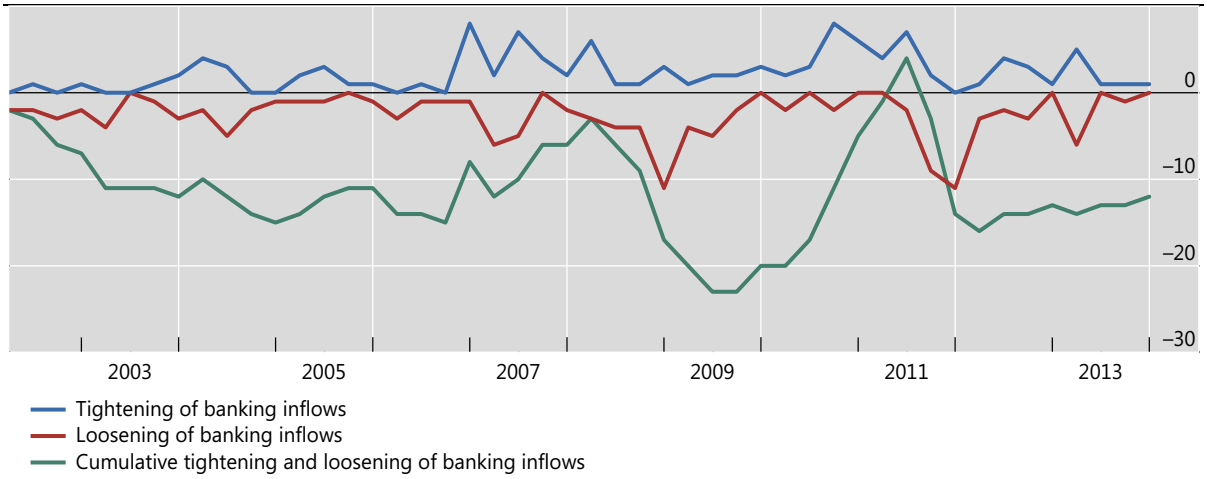
Number of capital inflow management measures taken over 2002–2012 Table 2

Economy	Bank CFMs			Bond CFMs			All CFMs
	Total	Tightening	Loosening	Total	Tightening	Loosening	Total
AU	3	3	0	0	0	0	3
CN	17	14	3	13	0	13	30
HK	1	0	1	0	0	0	1
IN	38	11	27	12	0	12	50
ID	6	4	2	3	3	0	9
JP	0	0	0	0	0	0	0
KR	25	17	8	5	1	4	30
MY	17	1	16	4	0	4	21
SG	0	0	0	0	0	0	0
TH	14	7	7	4	1	3	18
CZ	0	0	0	0	0	0	0
HU	11	4	7	0	0	0	11
PL	3	2	1	2	0	2	5
RU	15	9	6	5	2	3	20
TR	20	10	10	0	0	0	20
AR	20	5	15	8	5	3	28
BR	21	16	5	17	11	6	38
MX	4	1	3	0	0	0	4
SA	0	0	0	0	0	0	0
ZA	7	1	6	0	0	0	7
AT	4	4	0	0	0	0	4
BE	0	0	0	0	0	0	0
CH	0	0	0	1	0	1	1
DE	0	0	0	0	0	0	0
DK	0	0	0	0	0	0	0
ES	0	0	0	0	0	0	0
FI	0	0	0	0	0	0	0
FR	0	0	0	0	0	0	0
GB	2	1	1	0	0	0	2
GR	0	0	0	0	0	0	0
IE	0	0	0	0	0	0	0
IT	0	0	0	0	0	0	0
LU	0	0	0	0	0	0	0
NL	0	0	0	0	0	0	0
NO	0	0	0	0	0	0	0
PT	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
CA	0	0	0	0	0	0	0
US	0	0	0	0	0	0	0
Total	228	110	118	74	23	51	302

In the quarterly CFM dataset, each tightening action is assigned value +1, each loosening action value –1, and no action value zero (Graphs 3 and 4). The cumulative tightening and loosening of bank CFMs tend to follow global cycles of risk-on and risk-off phases (Graph 3, green line). By contrast, the cumulative tightening and loosening of bond CFMs tend to show a general trend of loosening over the sample period (with ups and downs reflecting global risk-on risk-off cycles) mainly due to the continuous efforts of domestic bond market liberalization by several emerging market economies such as Argentina, Brazil, China, India, Korea, Malaysia and Thailand (Graph 4, green line).

Capital flow management measures targeting bank inflows

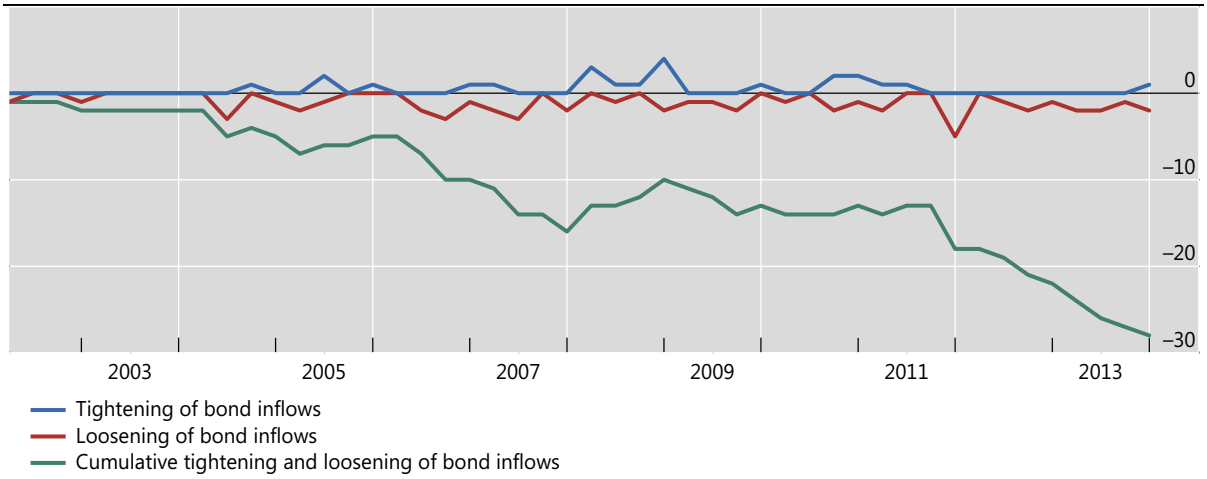
Number of policy actions — Graph 3



Sources: Ahmed et al (2015); Chantapacdepong and Shim (2016); IMF Annual Reports on Exchange Arrangements and Exchange Restrictions; national data; authors' calculations.

Capital flow management measures targeting bond inflows

Number of policy actions — Graph 4



Sources: Ahmed et al (2015); Chantapacdepong and Shim (2016); IMF Annual Reports on Exchange Arrangements and Exchange Restrictions; national data; authors' calculations.

The four types of bank CFMs can be classified into price-based and quantity-based bank CFMs. In particular, quantitative bank CFMs and qualitative bank CFMs are quantity-based

measures, while tax-style bank CFMs and holding period-style requirements on bank borrowing are price-based measures. Similarly, the four types of bond CFMs can be classified into price-based and quantity-based bond CFMs. Quantitative bond CFMs and qualitative bond CFMs are quantity-based measures, while tax-style bond CFMs and holding period-style requirements on bonds are price-based measures. When we sum up the indicators for price-based bank CFMs and price-based bond CFMs, we obtain an indicator for all price-based CFMs. Similarly, when we sum up the indicators for quantity-based bank CFMs and quantity-based bond CFMs, we obtain an indicator for quantity-based CFMs.

3.4. Financial development indicators

To measure a country's level of financial development in a comprehensive way, we construct our own composite financial development indicators. We first normalise 13 World Bank Financial Development indicators by subtracting mean and dividing by the standard deviation, and then take first principal components. We consider the following ten ratios capturing the depth of a country's financial system: (i) (private credit by banks)/GDP, (ii) (bank assets)/GDP, (iii) (bank assets)/(bank assets and central bank assets), (iv) (liquid liabilities)/GDP, (v) (central bank assets)/GDP, (vi) (financial system deposits)/GDP, (vii) (private credit by banks and other financial institutions)/GDP, (viii) (domestic credit to private sector)/GDP, (ix) (stock market cap)/GDP, and (x) (stock market total value traded)/GDP. We also include the following two ratios proxying the efficiency of a financial system: (i) (credit to government and state-owned enterprises)/GDP, and (ii) stock market turnover ratio. Finally, we use the ratio of bank credit to bank deposits as a measure of the stability of a financial system. We consider all three categories, ie, depth, efficiency and stability, and construct a composite variable for the level of financial development (FinDev).[11] However, it is worth noting that, while our index is a comprehensive measure capturing the common variation in a wide range of measures in country, it does not intend to measure the institutional or legal aspect of financial development.

3.5. Other Control Variables

We use standard macroeconomic variables as controls. In particular, we use short-term interest rates, real GDP growth, per capita GDP, CPI inflation and the ratio of current account to GDP in each economy. Finally, we also consider two crisis dummies, one for banking crises and the other for currency crises, in Laeven and Valencia (2012).

4. Empirical Analysis

In this section, we present our empirical specifications and estimation results. In particular, we start with a basic model which allows us to estimate the effect of tighter MaPP measures and CFMs on credit growth and capital flows. Then, we first move towards a more granular account

[11] In addition to using the principal component method to construct a composite index for the level of financial development, we also calculated the simple average of the 13 indicators after normalising each of them. We also calculated the average level for each of the three categories and then calculated the average over the three categories. These two indexes have relatively high levels of correlation with the composite index from the principal component method (0.6 and 0.8. respectively).

of MaPP measures and CFMs by distinguishing between price-based and quantity-based measures. We then introduce a specification which allows for the heterogenous effects of these policies with respect to the level of financial development. This way, we show step by step that (1) the effect of price-based and quantity-based measures on credit and capital inflow variables may be different; (2) MaPP measures and CFMs have different effects on credit growth and capital inflows; and (3) the degree of financial development is one of the key factors determining the effectiveness of MaPP measures and CFMs on credit growth and capital inflows.

4.1 Effect of MaPP measures and CFMs: a first pass without considering various heterogeneities

We first show the results based on a specification which does not allow for two key heterogeneities that we later consider. In particular, we estimate the effectiveness of MaPP measures and CFMs on credit growth and capital flows using:

$$\Delta y_{i,t} = \sum_{j=1}^{4} \alpha_{1j} (MaPP)_{i,t-j} + \sum_{j=1}^{4} \alpha_{2j} (CFM)_{i,t-j} + \alpha_3 \, Controls_{i,t-1} + \mu_i + \mu_t + \varepsilon_{it} \quad (1)$$

In Equation (1), the outcome variable of interest, denoted by $\Delta y_{i,t}$, is the quarter-on-quarter change in various credit and capital inflow variables. Regarding credit, we use (1) total credit, (2) total corporate credit, (3) domestic bank credit, (4) household loans, (5) housing loans and (6) consumer loans, which have been defined in detail in Section 3.1. Likewise, the outcome variables of interest capturing capital inflows are bank inflows, bond inflows and offshore bond issuances, as described in detail in Section 3.1. The terms *MaPP* and *CFM* in Equation (1) stand for all MaPP measures and all CFMs, respectively, without differentiating between price-based and quantity-based policies. We consider four lags of policy variables to capture the policy effect over one year after implementation. Therefore, the terms denoted by $\sum_{j=1}^{4} \alpha_{1j}$ and $\sum_{j=1}^{4} \alpha_{2j}$in Equation (1) correspond to the cumulative effect of MaPP measures and CFMs, respectively, over the next four quarters. All other explanatory variables, which include the control variables such as the quarterly GDP growth, inflation rates, the ratio of current account balance to GDP and banking crises dummies, are lagged by one quarter.[12] We also use the one quarter lagged value of the policy interest rates which is regarded as a policy measure for general credit and beyond as it "gets in all the cracks in the economy". Finally, time fixed effects and country fixed effects are denoted by μ_t and μ_i respectively.

Table 3 shows the impact of all MaPP measures and all CFMs on various credit variables. First, column 1 shows that MaPP tightening measures significantly reduce the size of increases in the total credit-to-GDP ratio, over the next four quarters. In terms of lag structure, we observe that the effect is strongest with the 4-quarter lag, although the coefficient on the 4-quarter lagged MaPP measures is marginally significant. In contrast, tightening CFMs (without differentiating between price-based and quantity-based measures) does not lead to a significant slow-down in the increase in the ratio of total credit to GDP. We find similar results on the impact of MaPP measures and CFMs on domestic bank credit. Now the coefficient on

[12] While the results reported in the empirical section are using only the 1-quarter lag of these control variables, the results are robust to the utilisation of different lag structures as well.

the 4-quarter lagged MaPP measures is statistically significant. Columns 3-6 show similar findings for credit to specific sectors or bank loans households for specific purposes. In particular, MaPP tightening measures significantly reduce the size of increases in the total corporate credit-to-GDP ratio, the ratio of bank lending to households to GDP, the ratio of bank lending to households to purchase houses to GDP and the ratio of bank lending to households for consumption to GDP, respectively, over the next four quarters.

Effect of macroprudential measures and CFMs on credit growth

In quarterly percentage point change in the credit-to-GDP ratio Table 3

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Total Credit	Domestic Bank Credit	Corporate Credit	Households Loans	Housing Loans	Consumer Loans
$MaPP_{t-1}$	0.00207	0.00227	0.00305	0.00245	0.00291	0.00299
	(0.00395)	(0.00407)	(0.00446)	(0.00899)	(0.00867)	(0.0181)
$MaPP_{t-2}$	-0.00297	-0.00383	-0.00345	-0.0179**	-0.0153	-0.0136
	(0.00393)	(0.00426)	(0.00458)	(0.00817)	(0.00907)	(0.0111)
$MaPP_{t-3}$	-0.00512	-0.00527	-0.00626	-0.0105	-0.0119	-0.00548
	(0.00424)	(0.00438)	(0.00436)	(0.00985)	(0.00955)	(0.0143)
$MaPP_{t-4}$	-0.00512*	-0.0054**	-0.00654*	-0.0128	-0.0178*	-0.0221**
	(0.00257)	(0.00252)	(0.00340)	(0.0109)	(0.0104)	(0.0107)
CFM_{t-1}	-0.00272	-0.00379	-0.00499	-0.0118	-0.0133	-0.00891
	(0.00559)	(0.00536)	(0.00664)	(0.0150)	(0.0132)	(0.0138)
CFM_{t-2}	0.00244	0.00283	0.00373	0.00798	0.0106	0.0132
	(0.00456)	(0.00487)	(0.00529)	(0.0154)	(0.0151)	(0.0116)
CFM_{t-3}	0.00164	0.00282	0.00206	0.00923	0.00948	0.00351
	(0.00344)	(0.00385)	(0.00386)	(0.00852)	(0.0105)	(0.00779)
CFM_{t-4}	-0.00278	-0.00352	-0.00343	-0.0105	-0.0105	-0.00537
	(0.00339)	(0.00345)	(0.00385)	(0.00775)	(0.00691)	(0.00662)
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{1j} = 0$	0.031**	0.037**	0.036**	0.052*	0.040**	0.020**
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{2j} = 0$	0.556	0.397	0.346	0.300	0.653	0.665
No of Obs	1,214	1,214	1,149	1,149	1,181	952
R-squared	0.625	0.616	0.593	0.397	0.405	0.62

Robust standard errors clustered at country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Table 4, we show how various capital inflow variables respond to the same MaPP measures and CFMs. The results suggest that all CFMs significantly reduce bank inflows (measured by increases in the ratio of the amount outstanding of domestic banks' borrowing from non-resident banks to GDP, over the next four quarters. In terms of lag structure, we observe that the effect is strongest with the 3-quarter lag, However, all CFMs do not have significant effects on bond inflows or offshore bond issuances. MaPP tightening measures does not lead to a significant change in bank flows or offshore bond issuances. In contrast, we find that tighter MaPP results in an *increase* in bond inflows, suggesting that tighter MaPP measures aiming to reduce domestic bank credit are associated with a leakage such that domestic financial institutions and non-financial corporates may try to substitute bank loans with cross-border borrowing through local currency bond markets.

Effect of macroprudential measures and CFMs on capital inflows

In quarterly percentage change in current US dollar value Table 4

	(1)	(2)	(3)
Variables	Bank Inflows	Bond Inflows	Offshore Bond Issuance
$MaPP_{t-1}$	0.00181	0.00289	0.000149
	(0.00659)	(0.00305)	(0.00485)
$MaPP_{t-2}$	0.00408	0.00302	-0.00499*
	(0.00746)	(0.00325)	(0.00274)
$MaPP_{t-3}$	0.00624	-0.00149	-0.00089
	(0.00466)	(0.00236)	(0.00306)
$MaPP_{t-4}$	0.00217	0.0117***	0.00539
	(0.00735)	(0.00410)	(0.00431)
CFM_{t-1}	-0.00704	0.00254	0.000482
	(0.00497)	(0.00310)	(0.00361)
CFM_{t-2}	0.000532	-0.00062	0.00384
	(0.00395)	(0.00205)	(0.00265)
CFM_{t-3}	-0.0129**	0.000672	-0.00495*
	(0.00582)	(0.00279)	(0.00279)
CFM_{t-4}	-0.00264	0.000701	0.00351
	(0.00610)	(0.00363)	(0.00256)
Macroeconomic Controls	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
P-Value for H_o: $\sum_{j=1}^{4}\alpha_{1j}=0$	0.407	0.017**	0.952
P-Value for H_o: $\sum_{j=1}^{4}\alpha_{2j}=0$	0.034**	0.616	0.631
Number of Observations	1,214	1,206	1,180
R-squared	0.266	0.304	0.274

Robust standard errors clustered at country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

4.2 Effectiveness of price- and quantity-based MaPP measures and CFMs

We then analyse the effectiveness of policies by distinguishing between price-based and quantity-based measures, rather than using policy measures corresponding to the sum of all CFM and MaPP policies. In particular, we estimate:

$$\Delta y_{i,t} = \sum_{j=1}^{4}\alpha_{1j}(PriceMaPP)_{i,t-j} + \sum_{j=1}^{4}\alpha_{2j}(QuantMaPP)_{i,t-j} + \sum_{j=1}^{4}\alpha_{3j}(PriceCFM)_{i,t-j} + \sum_{j=1}^{4}\alpha_{4j}(QuantCFM)_{i,t-j} + \alpha_{5}Controls_{i,t-1} + \mu_i + \mu_t + \varepsilon_{it} \quad (2)$$

In this specification, $\sum_{j=1}^{4}\alpha_{1j}$ and $\sum_{j=1}^{4}\alpha_{2j}$ correspond, respectively, to the cumulative effect of price-based MaPP measures and quantity-based MaPP measures, over the next four quarters. In a similar fashion, $\sum_{j=1}^{4}\alpha_{3j}$ and $\sum_{j=1}^{4}\alpha_{4j}$ represent the cumulative effects of price-based CFMs and quantity-based CFMs, respectively.

The results presented in Table 5 show that price-based and quantity-based MaPP measures and CFMs do not have a significant effect on credit growth. This is mainly because the standard error of the coefficients on price-based and quantity-based MaPP measures are generally much larger than that of the coefficients on all MaPP measures.

Effect of price-based and quantity-based macroprudential measures and CFMs on credit growth

In quarterly percentage point change in the credit-to-GDP ratio

Table 5

Variables	(1) Total Credit	(2) Domestic Bank Credit	(3) Corporate Credit	(4) Households Loans	(5) Housing Loans	(6) Consumer Loans
$PriceMAPP_{t-1}$	0.0147	0.0109	0.0181	0.0409	0.0362	0.0508
	'(0.0114)	'(0.0120)	'(0.0161)	'(0.0413)	'(0.0354)	'(0.0370)
$PriceMAPP_{t-2}$	-0.0112	-0.0131	-0.0198	-0.0785	-0.0565	-0.0753
	'(0.0211)	'(0.0226)	'(0.0293)	'(0.0746)	'(0.0575)	'(0.0682)
$PriceMAPP_{t-3}$	-0.00057	-0.00061	-0.00323	0.00882	0.0122	0.0297
	'(0.0146)	'(0.0155)	'(0.0174)	'(0.0489)	'(0.0445)	'(0.0647)
$PriceMAPP_{t-4}$	-0.00484	-0.00167	-0.00045	0.0176	0.0105	0.00526
	'(0.0196)	'(0.0204)	'(0.0223)	'(0.0531)	'(0.0435)	'(0.0342)
$QuantityMAPP_{t-1}$	-0.00108	-0.00049	-0.00019	0.00651	-0.00335	-0.0155
	'(0.00453)	'(0.00447)	'(0.00472)	'(0.0168)	'(0.00966)	'(0.0112)
$QuantityMAPP_{t-2}$	-0.00837	-0.0078	-0.0104	-0.0148	-0.0153	0.00585
	'(0.0100)	'(0.0104)	'(0.0116)	'(0.0229)	'(0.0183)	'(0.0127)
$QuantityMAPP_{t-3}$	-0.00239	-0.00179	-0.00069	0.00382	0.0034	0.00968
	'(0.00798)	'(0.00868)	'(0.00905)	'(0.0117)	'(0.0129)	'(0.00818)
$QuantityMAPP_{t-4}$	0.00271	0.00344	0.000744	0.00185	0.00907	-0.012
	'(0.00650)	'(0.00551)	'(0.00775)	'(0.0147)	'(0.0147)	'(0.0104)
$PriceCFM_{t-1}$	-0.0224	-0.0239	-0.0247	-0.0739*	-0.0716*	-0.044
	'(0.0165)	'(0.0160)	'(0.0201)	'(0.0431)	'(0.0408)	'(0.0332)
$PriceCFM_{t-2}$	0.0121	0.0128	0.0143	0.0408	0.0368	0.0286*
	'(0.00887)	'(0.00976)	'(0.00966)	'(0.0256)	'(0.0285)	'(0.0144)
$PriceCFM_{t-3}$	0.00943	0.0126	0.0107	0.0398	0.0418	0.0303
	'(0.0101)	'(0.00978)	'(0.0119)	'(0.0254)	'(0.0287)	'(0.0189)
$PriceCFM_{t-4}$	-0.00513	-0.00502	-0.00637	-0.017	-0.0155	-0.00949
	'(0.00975)	'(0.0102)	'(0.0114)	'(0.0215)	'(0.0225)	'(0.0202)
$QuantityCFM_{t-1}$	0.00846	0.00723	0.00663	0.0238	0.0178	0.017
	'(0.00589)	'(0.00592)	'(0.00742)	'(0.0181)	'(0.0139)	'(0.0179)
$QuantityCFM_{t-2}$	-0.00642	-0.00657	-0.00722	-0.0254*	-0.0164	-0.0097
	'(0.00620)	'(0.00600)	'(0.00740)	'(0.0142)	'(0.0116)	'(0.00963)
$QuantityCFM_{t-3}$	-0.00044	-0.00063	0.000185	0.000632	-0.00347	-0.0156
	'(0.00559)	'(0.00559)	'(0.00689)	'(0.0134)	'(0.0108)	'(0.0135)
$QuantityCFM_{t-4}$	0.000853	-0.00018	0.00036	0.00203	0.00159	0.0118
	'(0.00522)	'(0.00514)	'(0.00650)	'(0.0108)	'(0.0100)	'(0.0108)
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{1j} = 0$	0.929	0.848	0.835	0.902	0.966	0.851
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{2j} = 0$	0.357	0.353	0.395	0.907	0.549	0.537
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{3j} = 0$	0.808	0.895	0.824	0.850	0.870	0.855
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{4j} = 0$	0.632	0.979	0.994	0.942	0.969	0.853
No of Obs	1214	1214	1149	1149	1181	952
R-squared	0.63	0.622	0.599	0.415	0.42	0.633

Robust standard errors clustered at country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6 shows the response of capital flows to tightening of CFMs and MaPP measures, based on Equation (2), which does not allow for the effects to differ with respect to the level of financial development. As in the case for credit growth, we find that neither price-based nor quantity-based MaPP measures do not affect capital flows. We also observe that the quantity-based CFM measures do not affect capital flows as well.

Effect of price-based and quantity-based macroprudential measures and CFMs on capital flows

In quarterly percentage change in current US dollar value — Table 6

	(1)	(2)	(3)
Variables	Bank Inflows	Bond Inflows	Off-Shore Bond Issuance
$PriceMAPP_{t-1}$	-0.0596***	0.000942	0.033
	'(0.0186)	'(0.00947)	'(0.0201)
$PriceMAPP_{t-2}$	0.0167	-0.006	-0.0191*
	'(0.0257)	'(0.0100)	'(0.00970)
$PriceMAPP_{t-3}$	-0.0143	-0.0156*	-0.0105
	'(0.0226)	'(0.00892)	'(0.0177)
$PriceMAPP_{t-4}$	0.0242	0.0168	0.0125
	'(0.0177)	'(0.0192)	'(0.0180)
$QuantityMAPP_{t-1}$	0.0261**	0.0118*	-0.00902
	'(0.0115)	'(0.00654)	'(0.00769)
$QuantityMAPP_{t-2}$	-0.00185	0.00417	-0.00759
	'(0.0116)	'(0.0103)	'(0.00730)
$QuantityMAPP_{t-3}$	0.00402	0.00289	-0.00183
	'(0.00783)	'(0.00629)	'(0.00713)
$QuantityMAPP_{t-4}$	0.0107	0.0192**	0.00176
	'(0.0153)	'(0.00778)	'(0.00591)
$PriceCFM_{t-1}$	-0.00527	0.00444	-0.00362
	'(0.0100)	'(0.00269)	'(0.00609)
$PriceCFM_{t-2}$	-0.00498	0.00253	0.00304
	'(0.00627)	'(0.00446)	'(0.00685)
$PriceCFM_{t-3}$	-0.0114	-0.00114	-0.00668*
	'(0.00879)	'(0.00445)	'(0.00356)
$PriceCFM_{t-4}$	-0.00973	0.00418	0.00789
	'(0.0104)	'(0.00387)	'(0.00535)
$QuantityCFM_{t-1}$	-0.00566	0.00137	0.00309
	'(0.00772)	'(0.00596)	'(0.00369)
$QuantityCFM_{t-2}$	0.00321	-0.00201	0.00378
	'(0.00538)	'(0.00313)	'(0.00326)
$QuantityCFM_{t-3}$	-0.0148*	0.00218	-0.00315
	'(0.00824)	'(0.00411)	'(0.00472)
$QuantityCFM_{t-4}$	0.00306	-0.00339	0.000568
	'(0.00500)	'(0.00454)	'(0.00276)
Macroeconomic Controls	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{1j} = 0$	0.407	0.017**	0.952
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{2j} = 0$	0.034**	0.616	0.631
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{3j} = 0$	0.407	0.017**	0.952
P-Value for H_o: $\sum_{j=1}^{4} \alpha_{4j} = 0$	0.034**	0.616	0.631
Number of Observations	1214	1149	1149
R-squared	0.627	0.596	0.400

Robust standard errors clustered at country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The only effective type of policy measure in slowing down capital flows is price-based CFMs. In particular, we find that tightening price-based CFMs leads to a slowdown in cross border bank inflows.

4.3 The effect of MaPP and CFM measures considering financial development

We next analyse whether the level of financial development matters for the effectiveness of MaPP measures and CFMs on credit and capital flow variables. In particular, we estimate the augmented version of Equation (1), which allows for the differential effects of MaPP measures and CFMs with respect to the level of financial development:

$$\Delta y_{i,t} = \sum_{j=1}^{4} \beta_{1j}(MaPP)_{i,t-j} + \sum_{j=1}^{4} \beta_{2j}(CFM)_{i,t-j} + \sum_{j=1}^{4} \beta_{3j}(FinDev)_{it}(MaPP)_{i,t-j} + \sum_{j=1}^{4} \beta_{4j}(FinDev)_{it}(CFM)_{i,t-j} + \beta_5 Controls_{i,t-1} + \mu_i + \mu_t + \varepsilon_{it} \quad (3)$$

In Equation (3), the overall effect of MaPP measures and CFMs deployed at time *t-j* on the quarter-on-quarter change in credit and capital flow variables can be stated, respectively, as:

$$\frac{\partial \Delta y_{i,t}}{\partial (MaPP)_{i,t-j}} = \sum_{j=1}^{4} \beta_{1j} + \sum_{j=1}^{4} \beta_{3j}(FinDev)_{it} \quad (4)$$

$$\frac{\partial \Delta y_{i,t}}{\partial (CFM)_{i,t-j}} = \sum_{j=1}^{4} \beta_{2j} + \sum_{j=1}^{4} \beta_{4j}(FinDev)_{it} \quad (5)$$

In this specification, $\sum_{j=1}^{4} \beta_{1j}$ and $\sum_{j=1}^{4} \beta_{2j}$ correspond to the cumulative effect of MaPP measures and CFMs, respectively, on $\Delta y_{i,t}$ over the next four quarters for a case where the financial development indicator is equal to the zero, corresponding to the lowest possible level of financial development in our sample. Regarding the differential effects, $\sum_{j=1}^{4} \beta_{3j} \neq 0$ in Equation (4) implies that the effects of MaPP measures vary with the level of financial development. In a similar manner, $\sum_{j=1}^{4} \beta_{4j} \neq 0$ corresponds to the differential effect of CFMs with respect to the level of financial development. Significantly negative values for $\sum_{j=1}^{4} \beta_{3j}$ and $\sum_{j=1}^{4} \beta_{4j}$ suggest that tightening (loosening) MaPP measures or CFMs effectively slows (accelerates) credit growth or capital inflows for higher levels of financial development. Finally, we assess the effectiveness of these policy actions by testing whether the expressions given in Equations (4) and (5) are negative and statistically significant at different levels of financial development.

While we present the estimation results for this specification for credit in Table 7 and for capital flows in Table 8, we mainly use Graphs 5–8 to show how the effectiveness of MaPP measures and CFMs vary with the level of financial development. The results in Graph 5 suggest that for any values of financial development between 0.3 and 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, the overall MaPP measures are ineffective. By contrast, we observe significantly positive effects of MaPP tightening measures on bond inflows, when countries have the level of financial development at or above 0.6 (Graph 7.B). This result possibly suggests that higher levels of financial development are associated with leakages, as the potential borrowers can substitute bank credit with other sources of financing such as bonds.

Financial development and the effect of macroprudential measures and CFMs on credit growth

In quarterly percentage point change in the credit-to-GDP ratio

Table 7

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Total Credit	Domestic Bank Credit	Corporate Credit	Households Loans	Housing Loans	Consumer Loans
$MaPP_{t-1}$	-0.00422	-0.00564	-0.00304	-0.0231	-0.0322	0.00521
	(0.0114)	(0.0110)	(0.0136)	(0.0278)	(0.0277)	(0.0733)
$MaPP_{t-2}$	0.0003	-0.0024	-0.00229	-0.0377	-0.0288	-0.0716
	(0.0104)	(0.0123)	(0.0136)	(0.0290)	(0.0241)	(0.0445)
$MaPP_{t-3}$	-0.00672	-0.00864	-0.0146	-0.00716	-0.00565	-0.00927
	(0.0105)	(0.0108)	(0.0116)	(0.0181)	(0.0172)	(0.0483)
$MaPP_{t-4}$	-0.00937	-0.0112	-0.00765	-0.0182	-0.0246	-0.0432
	(0.00758)	(0.00722)	(0.0120)	(0.0199)	(0.0158)	(0.0451)
CFM_{t-1}	0.0285*	0.0268*	0.0352**	0.0516	0.0379	0.0457
	(0.0145)	(0.0141)	(0.0172)	(0.0388)	(0.0352)	(0.0413)
CFM_{t-2}	-0.0109	-0.0117	-0.0135	-0.0308	-0.0314	0.00542
	(0.0118)	(0.0120)	(0.0140)	(0.0264)	(0.0285)	(0.0139)
CFM_{t-3}	-0.000807	-0.000231	-0.00524	-0.00027	-0.00965	-0.00524
	(0.00922)	(0.0102)	(0.0105)	(0.0209)	(0.0226)	(0.0195)
CFM_{t-4}	-0.00485	-0.0116	-0.00476	-0.00953	-0.0218	0.0186
	(0.00929)	(0.00962)	(0.0117)	(0.0208)	(0.0207)	(0.0193)
$MaPP_{t-1} \times FinDev_{t-1}$	0.0122	0.0157	0.0118	0.0466	0.0669	-0.00449
	(0.0207)	(0.0202)	(0.0241)	(0.0554)	(0.0606)	(0.0987)
$MaPP_{t-2} \times FinDev_{t-2}$	-0.00687	-0.00338	-0.00352	0.0326	0.023	0.0843
	(0.0151)	(0.0191)	(0.0201)	(0.0417)	(0.0329)	(0.0612)
$MaPP_{t-3} \times FinDev_{t-3}$	0.00122	0.00442	0.0128	-0.0103	-0.0155	0.00855
	(0.0162)	(0.0167)	(0.0174)	(0.0312)	(0.0362)	(0.0624)
$MaPP_{t-4} \times FinDev_{t-4}$	0.00888	0.0114	0.00291	0.011	0.0145	0.0325
	(0.0137)	(0.0133)	(0.0197)	(0.0309)	(0.0303)	(0.0620)
$CFM_{t-1} \times FinDev_{t-1}$	-0.0586*	-0.0575*	-0.0744*	-0.118	-0.0967	-0.0921
	(0.0331)	(0.0319)	(0.0388)	(0.0922)	(0.0836)	(0.0775)
$CFM_{t-2} \times FinDev_{t-2}$	0.0259	0.0281	0.033	0.0737	0.0803	0.0157
	(0.0233)	(0.0239)	(0.0274)	(0.0618)	(0.0681)	(0.0360)
$CFM_{t-3} \times FinDev_{t-3}$	0.00487	0.00598	0.0146	0.0198	0.0382	0.017
	(0.0199)	(0.0228)	(0.0215)	(0.0492)	(0.0594)	(0.0428)
$CFM_{t-4} \times FinDev_{t-4}$	0.00447	0.0165	0.0031	-0.000392	0.0243	-0.0422
	(0.0152)	(0.0154)	(0.0184)	(0.0346)	(0.0343)	(0.0295)
Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
No of Obs	1214	1214	1149	1149	1181	952
R-squared	0.627	0.619	0.596	0.400	0.408	0.622

Robust standard errors clustered at country level in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Financial development and the effect of macroprudential measures and CFMs on capital flows

In quarterly percentage change in current US dollar value Table 8

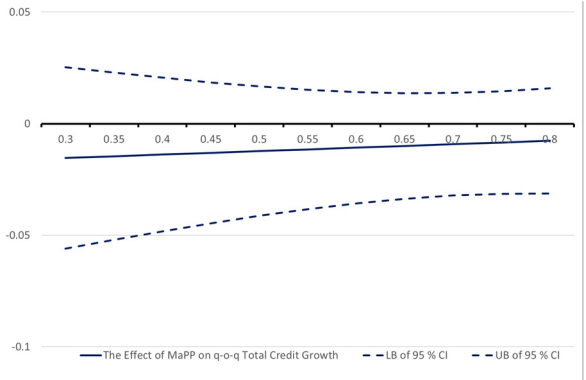
	(1)	(2)	(3)
Variables	Bank Inflows	Bond Inflows	Offshore Bond Issuance
$MaPP_{t-1}$	-0.0347***	-0.0162	-0.0012
	(0.0120)	(0.0124)	(0.0112)
$MaPP_{t-2}$	0.0225	-0.0212**	-0.016
	(0.0344)	(0.00874)	(0.0112)
$MaPP_{t-3}$	-0.00397	-0.00447	0.00179
	(0.0244)	(0.00640)	(0.00845)
$MaPP_{t-4}$	-0.0047	0.0139	0.0187
	(0.0202)	(0.0156)	(0.0121)
CFM_{t-1}	0.0118	0.0156*	0.0168*
	(0.0205)	(0.00771)	(0.00871)
CFM_{t-2}	0.00294	0.00731*	0.0222**
	(0.0118)	(0.00416)	(0.00880)
CFM_{t-3}	0.00854	-0.00151	-0.00568
	(0.0133)	(0.0110)	(0.0118)
CFM_{t-4}	0.00538	-0.025***	-0.0116
	(0.0153)	(0.00541)	(0.00694)
$MaPP_{t-1} \times FinDev_{t-1}$	0.0646***	0.0367*	0.00414
	(0.0199)	(0.0207)	(0.0128)
$MaPP_{t-2} \times FinDev_{t-2}$	-0.0355	0.0441**	0.0205
	(0.0544)	(0.0174)	(0.0179)
$MaPP_{t-3} \times FinDev_{t-3}$	0.0174	0.00342	-0.00627
	(0.0389)	(0.0115)	(0.0126)
$MaPP_{t-4} \times FinDev_{t-4}$	0.0119	-0.00667	-0.0258
	(0.0321)	(0.0242)	(0.0185)
$CFM_{t-1} \times FinDev_{t-1}$	-0.0347	-0.0245	-0.0305**
	(0.0325)	(0.0155)	(0.0143)
$CFM_{t-2} \times FinDev_{t-2}$	-0.00288	-0.0147**	-0.0348**
	(0.0186)	(0.00698)	(0.0152)
$CFM_{t-3} \times FinDev_{t-3}$	-0.0416*	0.00466	0.00173
	(0.0243)	(0.0206)	(0.0198)
$CFM_{t-4} \times FinDev_{t-4}$	-0.0143	0.0525***	0.0311**
	(0.0337)	(0.0104)	(0.0135)
Macroeconomic Controls	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Number of Observations	1214	1149	1149
R-squared	0.627	0.596	0.4

Robust standard errors clustered at country level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

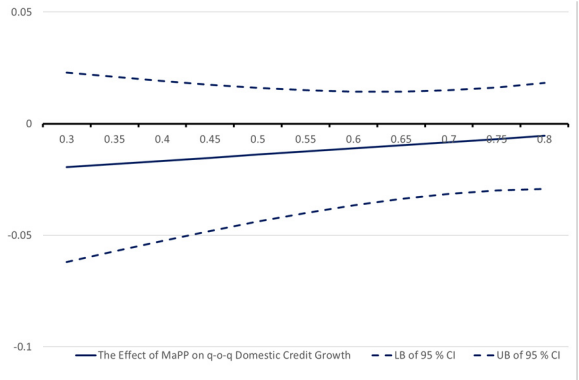
Financial development and the effect of macroprudential tightening on Q-o-Q credit growth

Graph 5

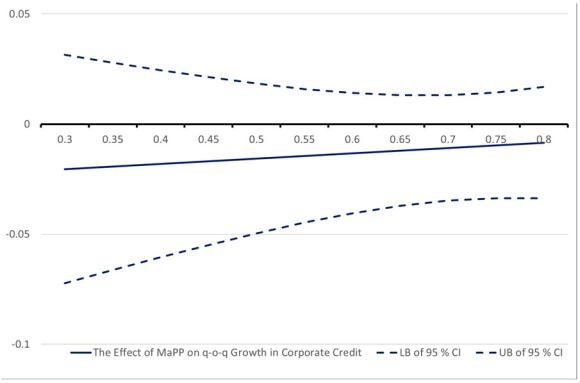
A. Effect on Total Credit Growth



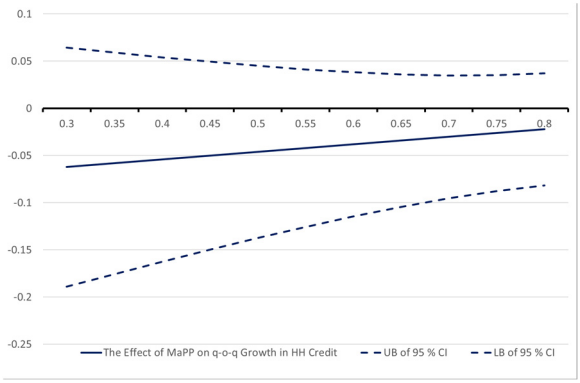
B. Effect on Domestic Bank Credit Growth



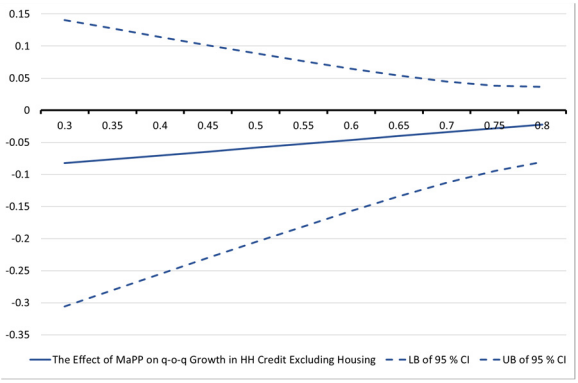
C. Effect on Corporate Credit



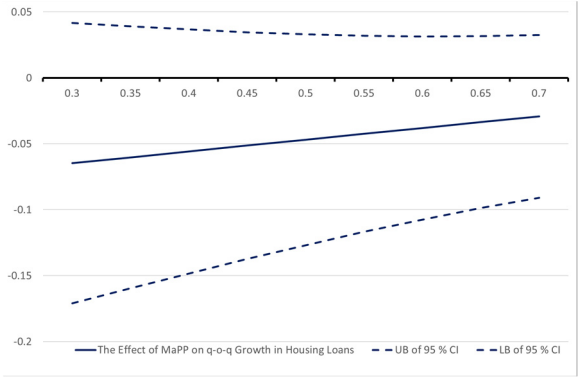
D. Effect on Household Credit



E. Effect on Household Credit excluding Housing Credit



F. Effect on Housing Credit

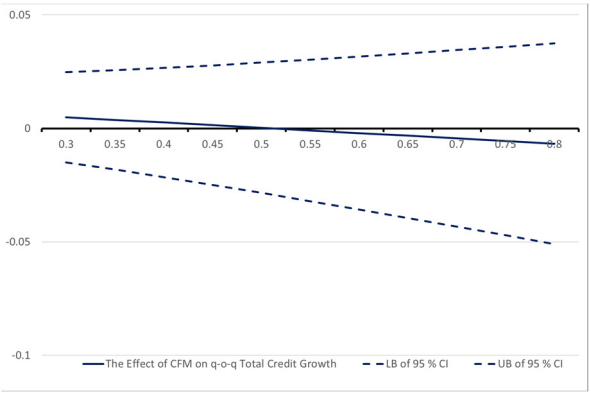


This graph shows the marginal effect of MaPP tightening on corresponding credit measures, based on Equations (3) and (4). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (4) and the dashed lines are the 95th percent confidence intervals.

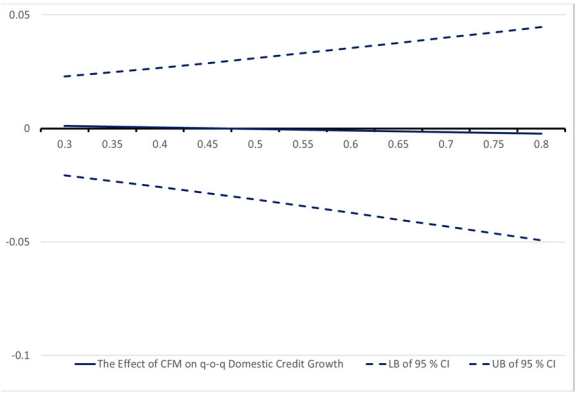
Financial development and the effect of CFM tightening on Q-o-Q credit growth

Graph 6

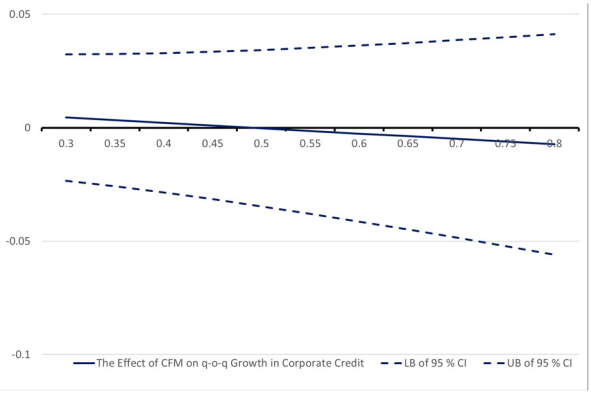
A. Effect on Total Credit Growth



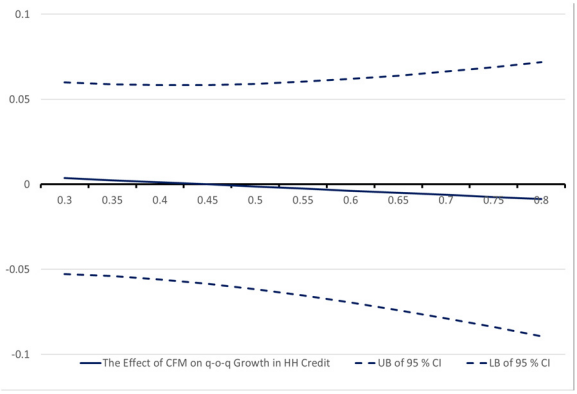
B. Effect on Domestic Bank Credit Growth



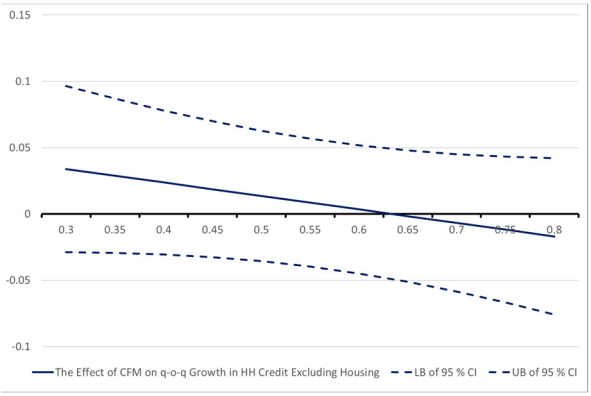
C. Effect on Corporate Credit



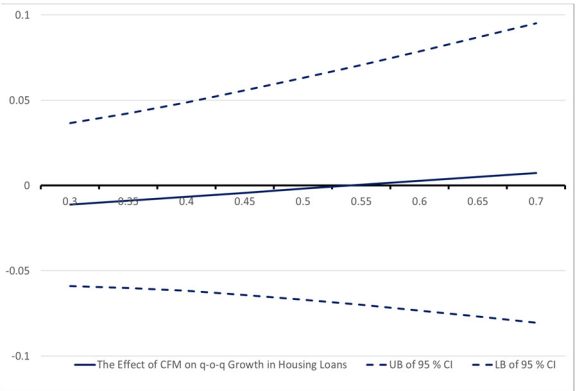
D. Effect on Household Credit



E. Effect on Household Credit excluding Housing Credit



F. Effect on Housing Credit

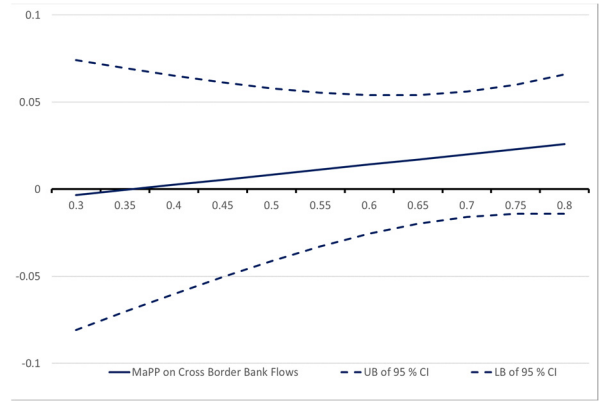


This graph shows the marginal effect of CFM tightening on corresponding credit measures, based on Equations (3) and (5). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (5) and the dashed lines are the 95th percent confidence intervals.

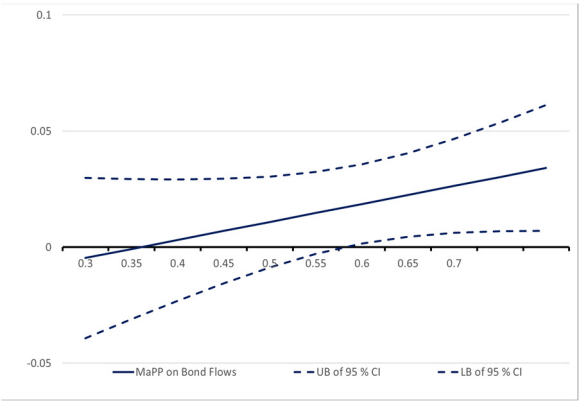
Financial development and the effect of macroprudential tightening on Q-o-Q growth in capital inflows

Graph 7

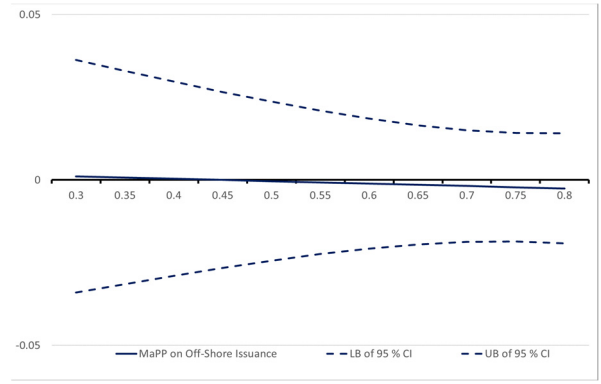
A. Effect on Bank Inflows



B. Effect on Bond Inflows



C. Effect on Offshore Bond Issuance



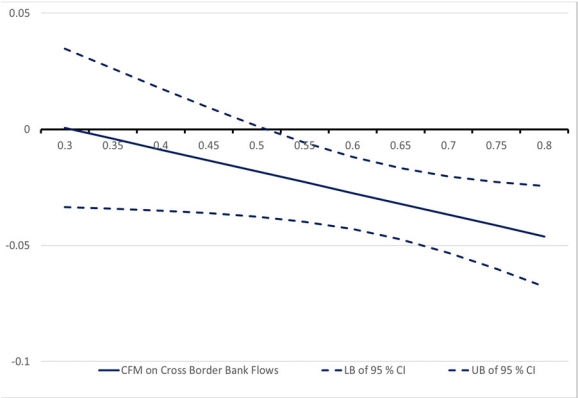
This graph shows the marginal effect of MaPP tightening on corresponding capital inflow measures, based on Equations (3) and (4). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (4) and the dashed lines are the 95th percent confidence intervals.

Graphs 6 and 8 show how the effects of CFMs on credit and capital flows differ with respect to financial development. We first observe that a tightening in the overall CFM measures used in this specification, i.e., the sum of all price- and quantity-based measures, does not lead to a significant change in the credit growth rate (Graph 6). By contrast, tighter CFMs lead to a slowdown in the growth rate of cross-border bank loans in economies with above-median levels of financial development (Graph 8.A). Finally, tighter CFMs do not influence bond inflows or offshore bond issuance at any levels of financial development (Graphs 8.A and 8.B).

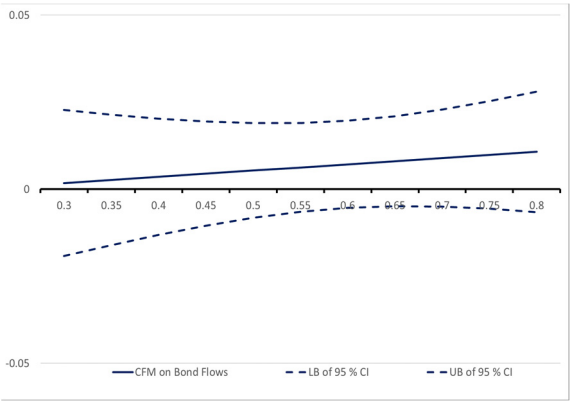
Financial development and the effect of CFM tightening on Q-o-Q growth in capital inflows

Graph 8

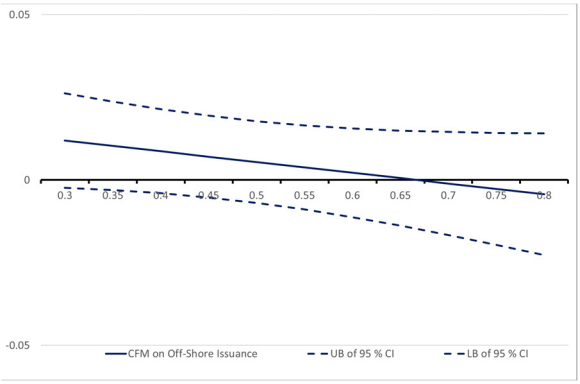
A. Effect on Bank Inflows



B. Effect on Bond Inflows



C. Effect on Offshore Bond Issuance



This graph shows the marginal effect of MaPP tightening on corresponding capital inflow measures, based on Equations (3) and (5). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (5) and the dashed lines are the 95th percent confidence intervals.

4.4 The effect of price- vs quantity-based MaPP measures and CFMs considering financial development

Finally, as one of the main innovations of this paper, we assess the effectiveness of price- and quantity-based MaPP measures and CFMs depending on the level of financial development. In particular, we estimate:

$$\begin{aligned}\Delta y_{i,t} = &\sum_{j=1}^{4}\gamma_{1j}(PriceMaPP)_{i,t-j} + \sum_{j=1}^{4}\gamma_{2j}(QuantMaPP)_{i,t-j} + \sum_{j=1}^{4}\gamma_{3j}(PriceCFM)_{i,t-j} \\ &+ \sum_{j=1}^{4}\gamma_{4j}(QuantCFM)_{i,t-j} + \sum_{j=1}^{4}\gamma_{5j}(FinDev)_{it}(PriceMaPP)_{i,t-j} \\ &+ \sum_{j=1}^{4}\gamma_{6j}(FinDev)_{it}(QuantMaPP)_{i,t-j} + \sum_{j=1}^{4}\gamma_{7j}(FinDev)_{it}(PriceCFM)_{i,t-j} \\ &+ \sum_{j=1}^{4}\gamma_{8j}(FinDev)_{it}(QuantCFM)_{i,t-j} + \gamma_9 Controls_{i,t-1} + \mu_i + \mu_t + \varepsilon_{it} \qquad (6)\end{aligned}$$

In this specification, the effect of price-based MaPP measures (PriceMaPP), quantity-based MaPP measures (QuantMaPP), price-based CFMs (PriceCFM) and quantity-based CFMs (QuantCFM) are, respectively, given by:

$$\frac{\partial \Delta y_{i,t}}{\partial (PriceMaPP)_{i,t-j}} = \sum_{j=1}^{4} \gamma_{1j} + \sum_{j=1}^{4} \gamma_{5j} (FinDev)_{it} \quad (7)$$

$$\frac{\partial \Delta y_{i,t}}{\partial (QuantMaPP)_{i,t-j}} = \sum_{j=1}^{4} \gamma_{2j} + \sum_{j=1}^{4} \gamma_{6j} (FinDev)_{it} \quad (8)$$

$$\frac{\partial \Delta y_{i,t}}{\partial (PriceCFM)_{i,t-j}} = \sum_{j=1}^{4} \gamma_{3j} + \sum_{j=1}^{4} \gamma_{7j} (FinDev)_{it} \quad (9)$$

$$\frac{\partial \Delta y_{i,t}}{\partial (QuantCFM)_{i,t-j}} = \sum_{j=1}^{4} \gamma_{4j} + \sum_{j=1}^{4} \gamma_{8j} (FinDev)_{it} \quad (10)$$

In order to assess the effectiveness of tightening or loosening each policy tool on the outcome variable $\Delta y_{i,t}$, we test if the partial derivatives in Equations (7)–(10) are negative and significantly different from zero for different values of financial development.

We present the results under this specification in Graphs 9–17. The panels A, B, C and D of Graph 9 present the results for the total credit. While the price-based MaPP measures and quantity-based CFMs are not effective on total credit, we find that that quantity-based MaPP measures are effective when financial development is low and that the price-based CFMs are effective when financial development is high. We obtain a similar result also for total corporate credit. These results possibly reflect the fact that total credit and total corporate credit include both domestic lending and cross-border lending, and therefore both MaPP measures and CFMs are effective, albeit for different levels of financial development.

We next analyse the effectiveness of CFMs and MaPP measures on domestic bank lending. Our results suggest that only quantity-based MaPP measures are effective in slowing down domestic bank credit in economies with low financial development. For economies with financial development above median, the quantity-based MaPP measures also become ineffective in slowing down domestic credit growth.

In Graph 12, we present the results on how domestic total credit to households respond to changes in MaPP measures and CFMs. Our results suggest that the total domestic credit to households are insensitive to changes in these policies. However, when we further analyse by the components of credit to households, we identify an important heterogeneity. In particular, the responses of housing credit and non-housing credit to households to the MaPP and CFM measures are quite different from each other. While the non-housing credits are not sensitive to the policy, we find that the tightening in the quantity-based MaPP measures are effective in slowing down the growth of housing credit in economies with low financial development.

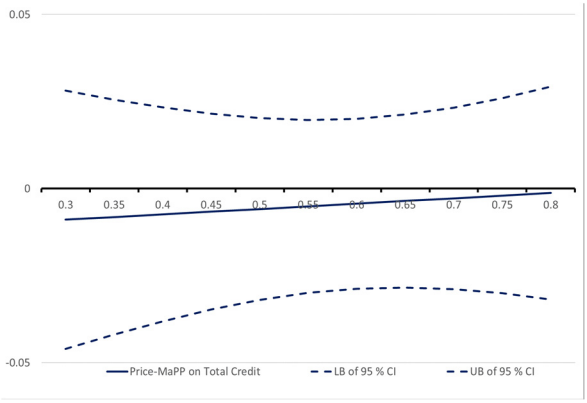
In Graphs 15–17, we analyse the effectiveness of the policies on capital inflows. The results in panel A of Graph 15 suggest that tighter quantity-based MaPP measures can speed up cross-border bank inflows, possibly reflecting some degree of substitutability between the domestic and foreign credit to the non-financial corporate sector. In contrast, for economies with low financial development, tightening price-based MaPP measures leads to a slowdown in cross-border capital inflows as well. Another result that emerges from this specification is that MaPP tightening measures are not effective in slowing down the bond inflows or offshore bond issuance. On the contrary, we find that tightening quantity-based MaPP measures can lead to an increase in bond inflows.

For the effectiveness of various policies on bank inflows, we show that tightening price-based CFMs is effective in slowing down bank inflows, regardless of the level of financial development. This result is consistent with Table 6 as well. However, quantity-based CFMs affect bank inflows if the level of financial development is high enough. Finally, we also find that both price-based and quantity-based MaPP measures affect bank inflows, but in opposite directions. While tightening price-based MaPP measures slows down bank inflows, policy tightening via quantity-Based MaPP measures possibly results in a leakage of prudential regulation. Finally, CFMs and MaPP measures are mostly ineffective in slowing down bond flows or capital flows due to offshore bond issuance (see Graphs 16 and 17). The key exception is the negative effect of tightening via price-based CFMs on the growth rate of offshore bond issuances.

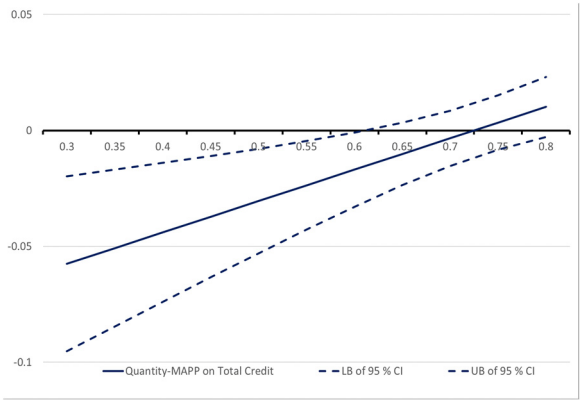
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q total credit growth

Graph 9

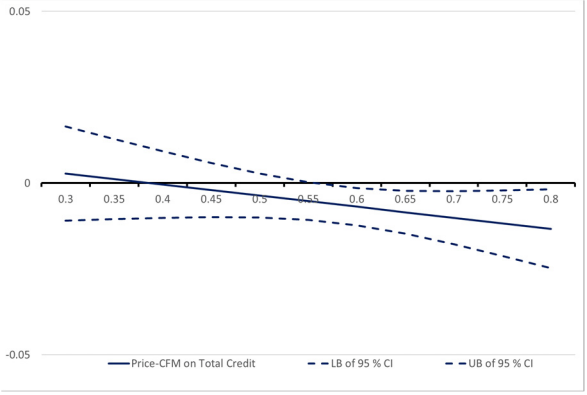
A. Effect of price-based MaPP measures



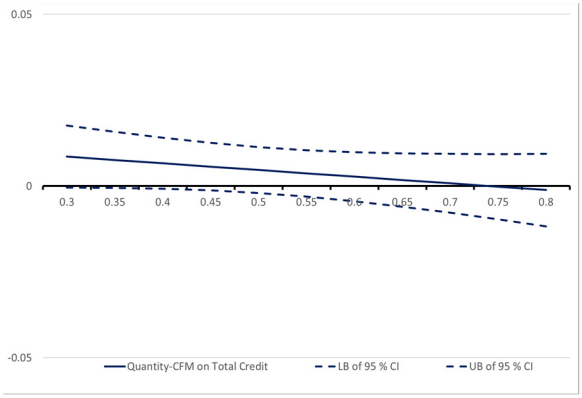
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs

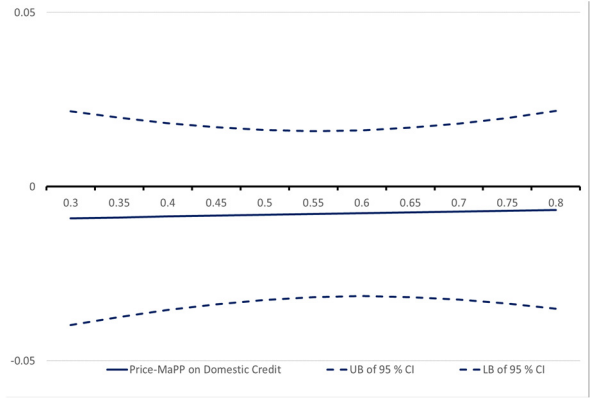


This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on total credit growth, based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

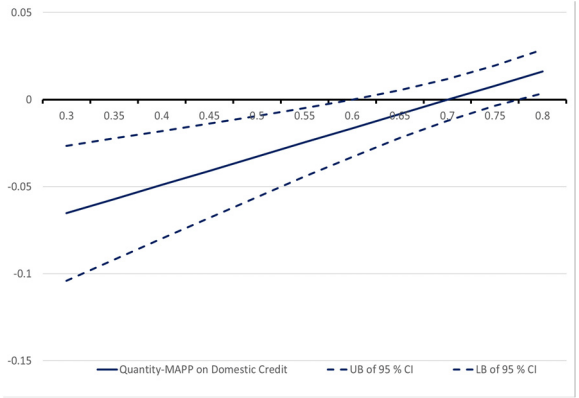
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q domestic bank credit growth

Graph 10

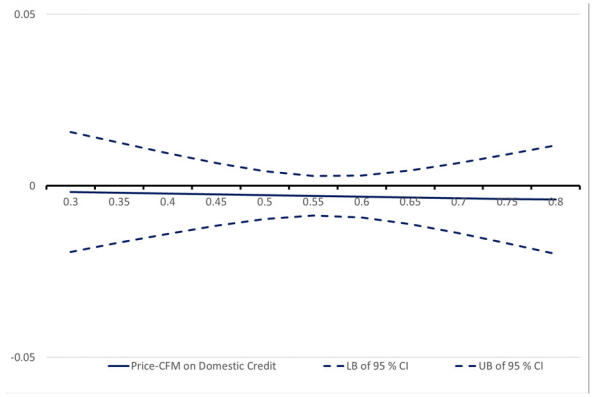
A. Effect of price-based MaPP measures



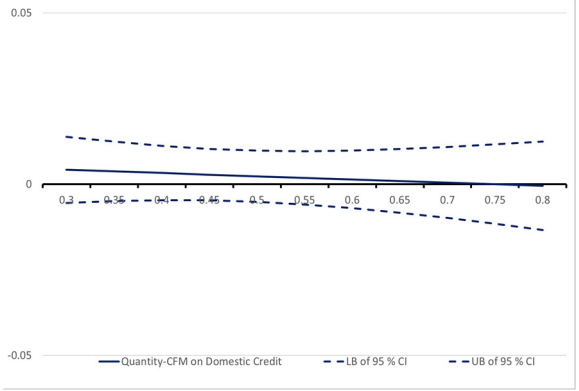
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs

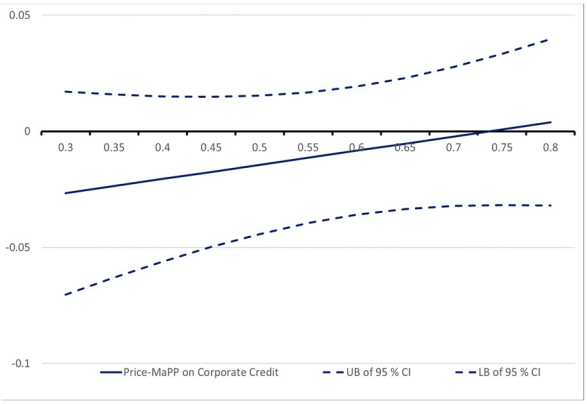


This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on domestic bank credit growth, based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

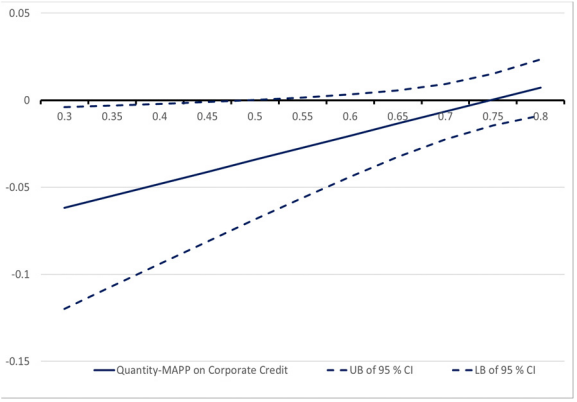
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q corporate credit growth

Graph 11

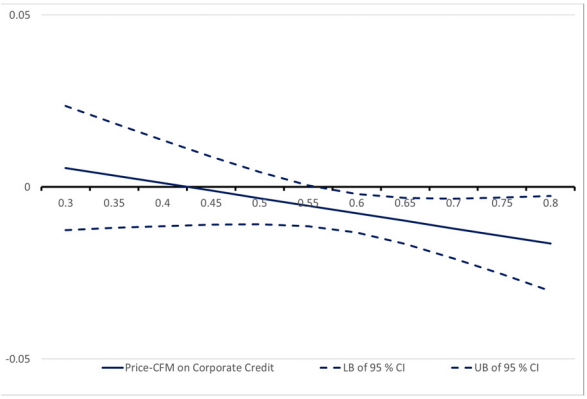
A. Effect of price-based MaPP measures



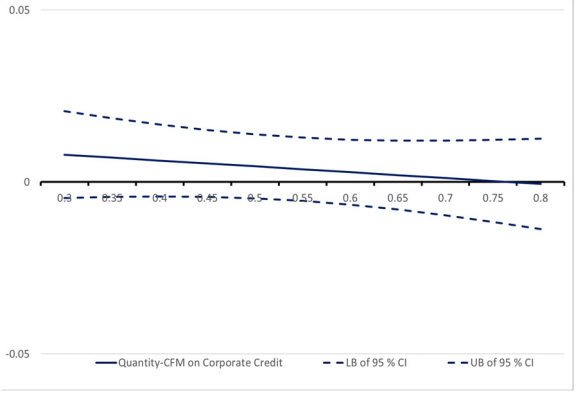
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs

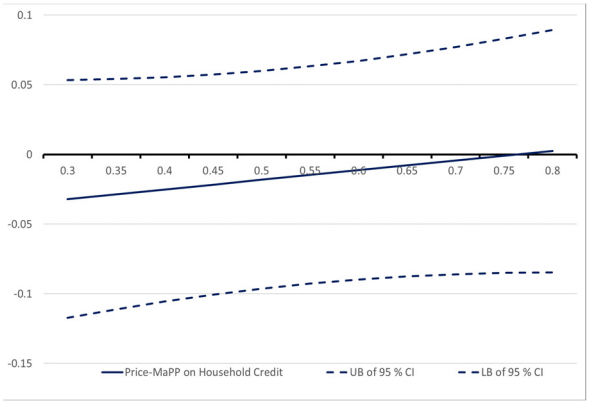


This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on corporate credit growth, based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

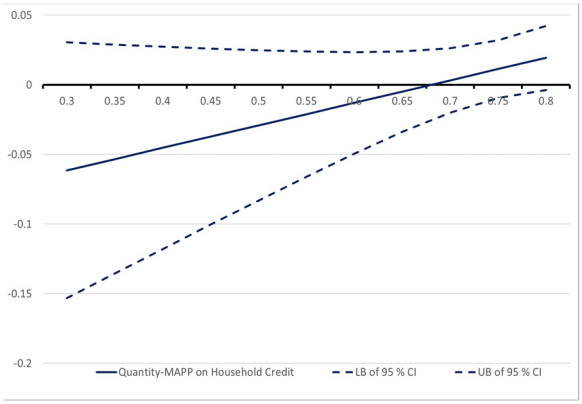
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q growth in domestic bank credit to households

Graph 12

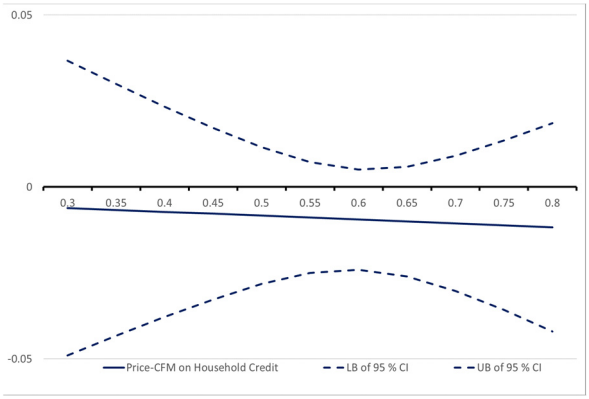
A. Effect of price-based MaPP measures



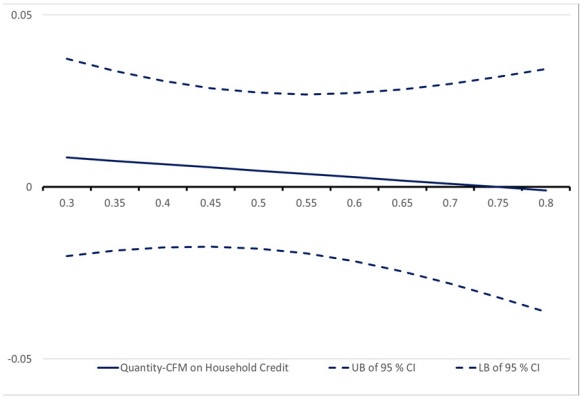
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs

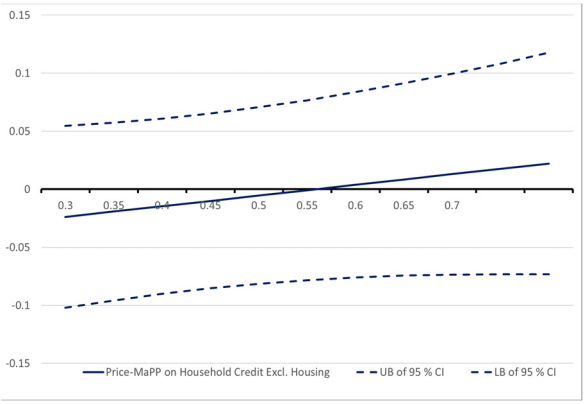


This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on growth in domestic bank credit to households, based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

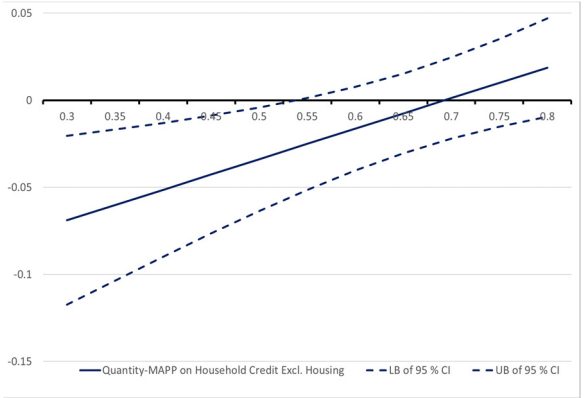
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q growth in housing loans by domestic banks

Graph 13

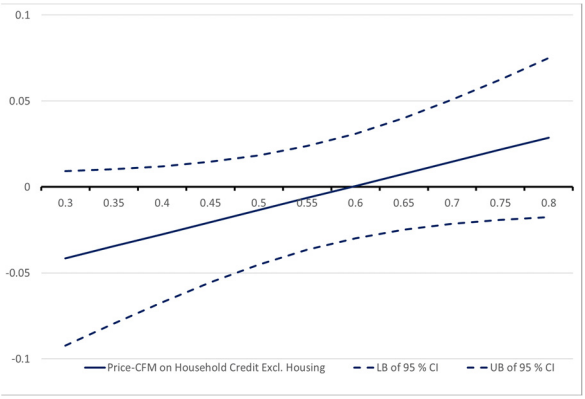
A. Effect of price-based MaPP measures



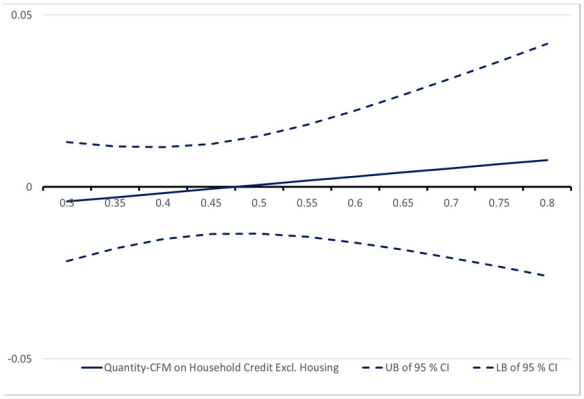
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs

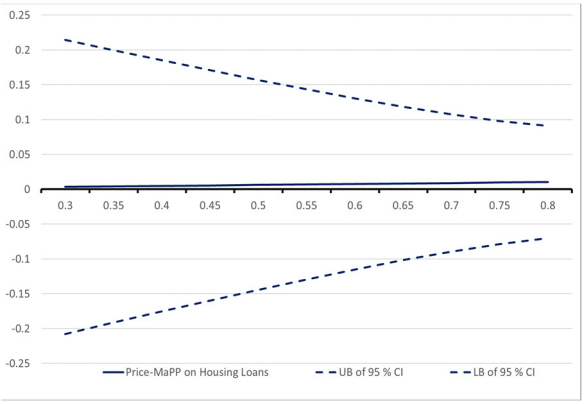


This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on growth in domestic bank lending for housing purchases, based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

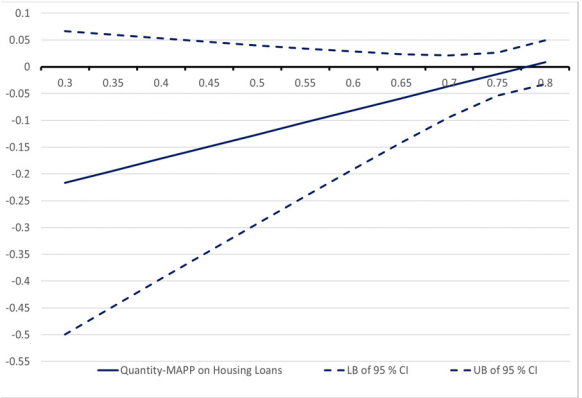
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q growth in consumer loans by domestic banks

Graph 14

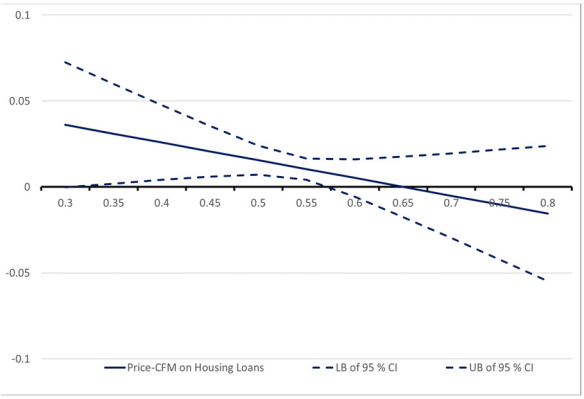
A. Effect of price-based MaPP measures



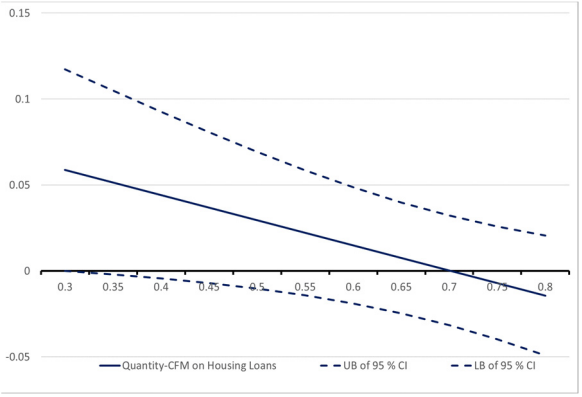
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs

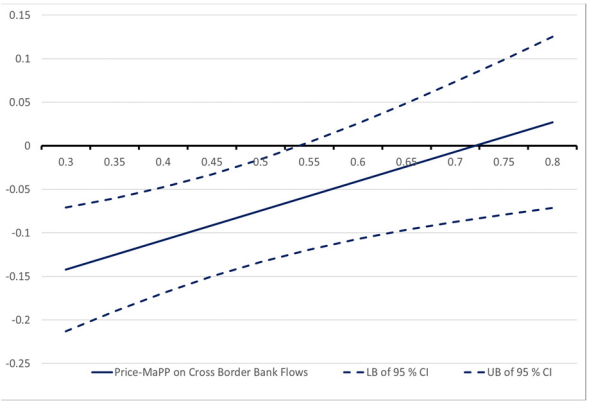


This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on growth in domestic bank lending to households not for housing purchases (ie consumer loans), based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

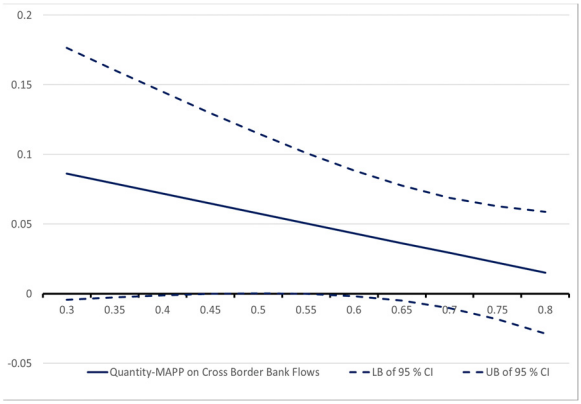
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q growth in cross-border bank loans

Graph 15

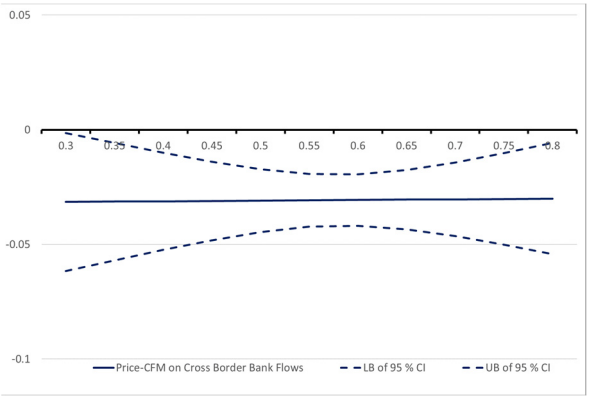
A. Effect of price-based MaPP measures



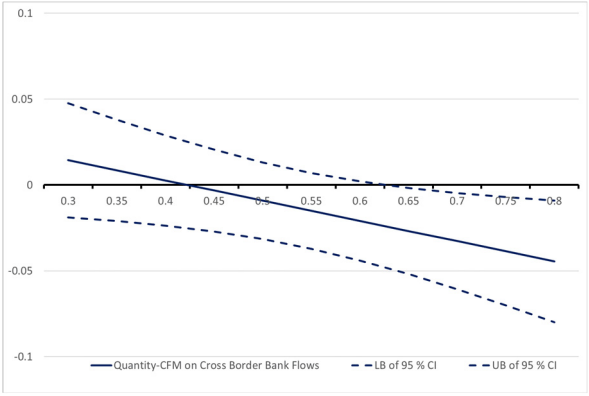
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs

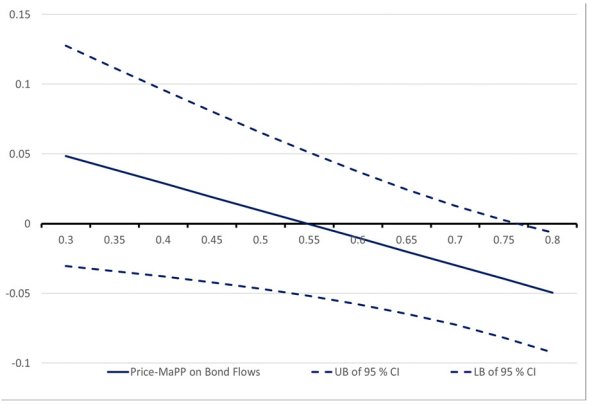


This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on growth in cross-border bank inflows, based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

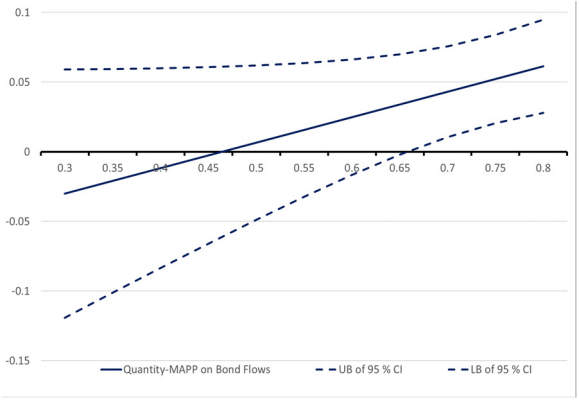
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q growth in bond inflows

Graph 16

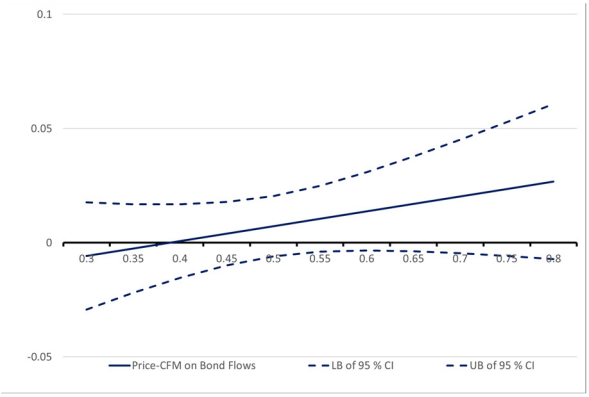
A. Effect of price-based MaPP measures



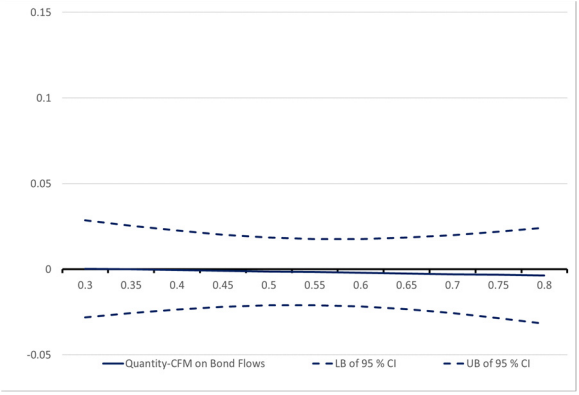
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs

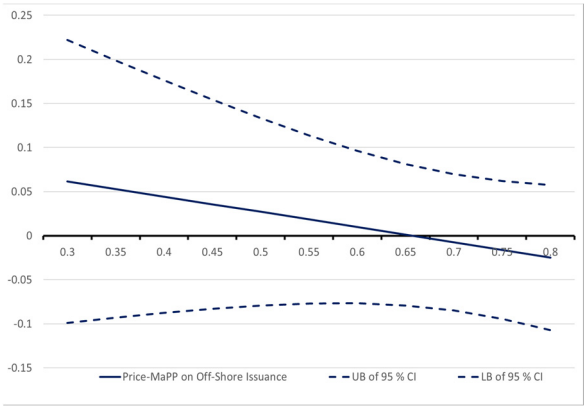


This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on growth in bond inflows, based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

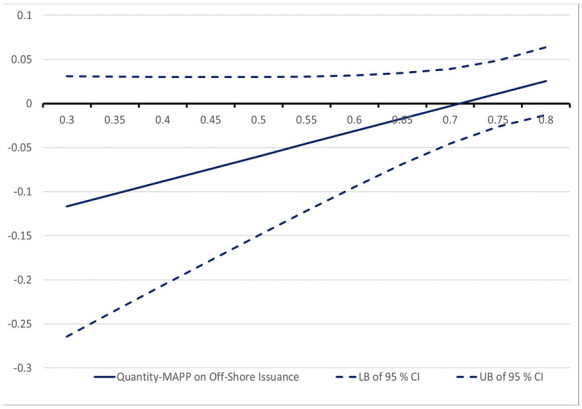
Financial development and the effect of price- and quantity-based MaPP measures and CFMs on Q-o-Q growth in offshore bond issuance

Graph 17

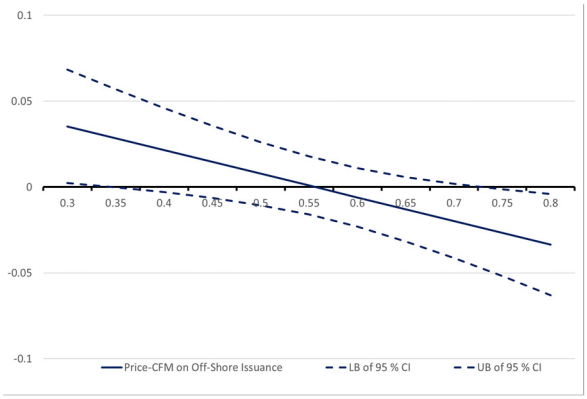
A. Effect of price-based MaPP measures



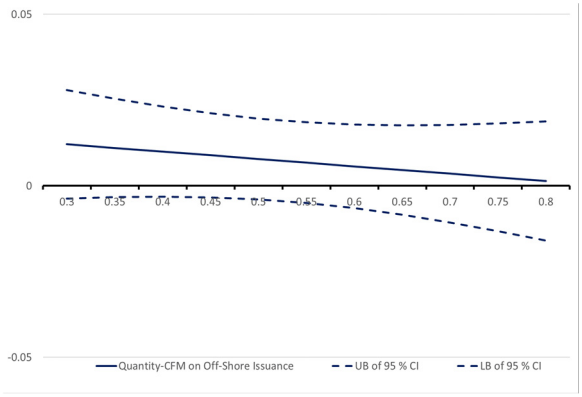
B. Effect of quantity-based MaPP measures



C. Effect of price-based CFMs



D. Effect of quantity-based CFMs



This graph shows the marginal effect of price-based MaPP measures, quantity-based MaPP measures, price-based CFMs and quantity-based CFMs on growth in offshore bond issuance, based on Equations (6)–(10). The horizontal axis gives the values of financial development from 0.3 to 0.8, which correspond to the 10th and 86th percentiles of the financial development distribution, respectively. The solid line gives the marginal effect based on Equation (7)–(10) and the dashed lines are the 95th percent confidence intervals.

All these results suggest that there is a contrast between the effectiveness of MaPP measures and CFMs with respect to the level of financial development: while MaPP measures are effective in economies with low financial development, CFMs are effective in economies with high financial development.

4.5 Robustness

The empirical results reported so far depend on a specific lag structure, ie, the effects of MaPP measures and CFMs are measured over four quarters after their implementation. As a robustness check, we allow for different lag structures for both the policy variables and the control variables and reach similar conclusions with respect to the effectiveness of MaPP measures and CFMs.

We also test the robustness of our results with respect to alternative indicators of financial development, such as the degree of financial institutions-based development and that of financial markets-based development and find that the results are robust to the utilisation of

different metrics of financial development. We also check the robustness of our results with respect to a possible omission of unobserved heterogeneity across countries. For this, we include both lagged dependent variables, which controls for the slow-moving time-varying unobserved factors affecting credit and capital flows, and the country-specific linear trends in credit growth rates and capital flows. Again, we find similar results to those summarised in Sections 4.1 to 4.4.

5. Conclusion

In this paper, we investigate if MaPP measures and CFMs are effective in slowing down credit growth and capital inflows. Our analysis relies on multiple dimensions, such as the nature of MaPP measures and CFMs (ie price-based versus quantity-based), the type of credit and capital inflow variables, and the structural characteristics of a country with respect to financial development and reveals a number of heterogeneities which are not captured when we look at the overall MaPP measures and CFMs.

Regarding credit variables, we show that tightening quantity-based MaPP measures slows down growth in total credit, domestic bank credit, total credit to the non-financial corporates and housing credit in economies with relatively low financial development, whereas the price-based MaPP are ineffective in moderating the credit growth. In contrast, price-based CFMs are effective in slowing down total credit and total credit to the non-financial corporate sector in economies with high levels of financial development, mainly via its effect on non-domestic bank credit. This result is also consistent with the fact that price-based CFMs are effective in slowing down the bank inflows. Finally, we find that consumer loans (ie household loans excluding housing loans) are not sensitive to the variations in MaPP measures and CFMs.

Regarding capital inflows, the results are less generalisable than the ones for the credit growth. While tighter CFMs slow down capital inflows, the effect is different with respect to the type of policy and capital flows. For bank inflows, both price-based and quantity-based CFMs are effective. However, while the effect of the former is independent from the level of financial development in an economy, the latter is effective in slowing down bank inflows in economies with relatively high levels of financial development. We further find that the price-based CFMs slow down capital inflows due to offshore issuance of debt securities, yet only if the level of financial development is high. Finally, we find that bond inflows are not sensitive to the CFMs.

When compared with the effects of CFMs, the effects of MaPP measures show more heterogeneity. We find that tighter price-based MaPP measures slow down bank inflows. This result can arise in cases associated with complementarities between domestic loans and cross-border credit. For example, if a bank located in a country borrows from a non-resident bank when lending to the non-financial sector, then any policy, such as MaPP measures, aiming at slowing the credit growth can also have implications for the bank inflows. In contrast, tightening quantity-based MaPP measures leads to larger bank inflows, suggesting that domestic credit and credit from non-resident banks may have some degree of substitutability. Finally, we find that tighter quantity-based MaPP measures are associated with greater bond inflows in economies with high levels of financial development.

All in all, our results have several important policy implications. First, we assess the effect of MaPP measures and CFMs simultaneously on a range of outcomes related to credit and capital flows and carefully characterise the differences in the effectiveness of these policies. Second, this paper highlights the merits of taking more granular approach to MaPP measures and CFMs by separating them into price- and quantity-based measures, rather than taking them as a whole. For example, while an aggregate MaPP indicator which combines both price- and quantity-base MaPP measures has an insignificant effect on bank inflows, price-based and quantity-based MaPP measures have totally different effects on bank inflows. Finally, our results suggest the importance of considering the level of financial development in deploying different policy tools.

References

Ahmed, Shaghil, Stephanie Curcuru, Francis Warnock and Andrei Zlate (2015): "The two components of international capital flows", manuscript.

Akinci, Ozge and Jane Olmstead-Rumsey (2018): "How effective are macroprudential policies? An empirical investigation", *Journal of Financial Intermediation*, vol 33, pp 33–57.

Başkaya, Yusuf Soner, Turalay Kenç, Ilhyock Shim and Philip Turner (2016): "Financial development and the effectiveness of macroprudential measures", *BIS Papers*, no 86, pp 103–116.

Basu, Suman, Emine Boz, Gita Gopinath, Francisco Roch and Filiz Unsal (2020): "A conceptual model for the integrated policy framework", *IMF Working Papers*, no 20/121, July.

Bianchi, Javier, Emine Boz and Enrique Gabriel Mendoza (2012): "Macroprudential policy in a Fisherian model of financial innovation", *IMF Economic Review*, vol 60(2), pp 223–269.

Beirne, John and Christian Friedrich (2017): "Macroprudential policies, capital flows, and the structure of the banking sector", *Journal of International Money and Finance*, vol 75, pp 47–68.

Borio, Claudio and Ilhyock Shim (2007): "What can (macro-)prudential policy do to support monetary policy?" *BIS Working Papers*, no 242.

Bruno, Valentina and Hyun Song Shin (2015): "Cross-border banking and global liquidity", *Review of Economic Studies*, vol 82(2), pp 535–564.

Bruno, Valentina, Ilhyock Shim and Hyun Song Shin (2017): "Comparative assessment of macroprudential policies", *Journal of Financial Stability*, vol 28(C), pp 183–202.

Cerutti, Eugenio, Stijn Claessens and Luc Laeven (2017): "The use and effectiveness of macroprudential policies: new evidence", *Journal of Financial Stability*, vol 28(C), pp 203–224.

Cetorelli, Nicola and Linda Goldberg (2012): "Banking globalization and monetary transmission", *Journal of Finance*, vol 67(5), pp 1811–1843.

Chantapacdepong, Pornpinun and Ilhyock Shim (2016): "Correlations across Asia-Pacific bond markets and the impact of capital flow measures", *BIS Working Papers*, no 472.

Cizel Janko, Jon Frost, Aerdt Houben and Peter Wierts (2019): "Effective macroprudential policy: cross-sector substitution from price and quantity measures", *Journal of Money, Credit and Banking*, vol 51(5), pp 1209–1235, August.

Claessens, Stijn, Swati R Ghosh and Roxana Mihet (2013): "Macro-prudential policies to mitigate financial system vulnerabilities", *Journal of International Money and Finance*, vol 39(C), pp 153–185.

Das, Mitali, Gita Gopinath and Sebnem Kalemli-Ozcan (2022): "Pre-emptive policies and risk-off shocks in emerging markets", *IMF Working Papers*, no 22/003.

Elliott, Douglas J, Greg Feldberg and Andreas Lehnert (2013): "The history of cyclical macroprudential policy in the United States", Federal Reserve Board, *Finance and Economics Discussion Series*, no 2013-39.

Farhi, Emmanuel and Ivan Werning (2016): "A theory of macroprudential policies in the presence of nominal rigidities", *Econometrica*, vol 84(5), pp 1645–1704.

Fernández, Andrés, Michael Klein, Alessandro Rebucci, Martin Schindler and Martín Uribe (2016): "Capital control measures: a new dataset", *IMF Economic Review*, vol 64(3), pp 548–574, August.

Forbes, Kristin, Marcel Fratzscher and Roland Straub (2015): "Capital-flow management measures: What are they good for?" *Journal of International Economics*, vol 96(S1), pp S76-S97.

Korinek, Anton and Damiano Sandri (2016): "Capital controls or macroprudential regulation?" *Journal of International Economics*, vol 99, pp S27–S42.

Kuttner, Kenneth N and Ilhyock Shim (2013): "Can non-interest rate policies stabilise housing markets? Evidence from a panel of 57 economies", *BIS Working Papers*, no 433.

Laeven, Luc and Fabian Valencia (2013): "Systemic banking crises database", *IMF Economic Review*, vol 61(2), pp 225–270, June.

Lim, Cheng Hoon, Francesco Columba, Alejo Costa, Piyabha Kongsamut, Akira Otani, Mustafa Saiyid, Torsten Wezel, and Xiaoyong Wu (2011): "Macroprudential policy: what instruments and how to use them? Lessons from country experiences", *IMF Working Papers*, no 11/238.

Mendoza, Enrique G (2016): "Macroprudential policy: promise and challenges", *NBER Working Papers*, no 22868, November.

Ostry, Jonathan D, Atish R Ghosh, Marcos Chamon and Mahvash S Qureshi (2012): "Tools for managing financial-stability risks from capital inflows", *Journal of International Economics*, vol 88(2), pp 407-421.

Shim, Ilhyock, Bilyana Bogdanova, Jimmy Shek and Agne Subelyte (2013): "Database for policy actions on housing markets", *BIS Quarterly Review*, September, pp 83–95.

Shin, Hyun Song (2012): "Adapting macroprudential policies to global liquidity conditions", *Central Bank of Chile Working Papers*, no 671, July.

Annex

Distribution of price- and quantity-based MaPP measure and CFM aggregate indicators

Number of country-quarter observations — Table A1

Value	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5	+6	+7
PriceMaPP	0	0	0	0	0	0	0	4	3	33	1209	51	16	7	2	0	0	0
QuantMaPP	0	0	0	0	0	0	0	0	2	12	1254	41	14	2	0	0	0	0
PriceCFM	0	0	0	0	0	1	0	2	5	16	1268	21	8	0	1	0	2	1
QuantCFM	1	1	0	0	1	0	1	1	15	39	1228	30	6	0	0	1	1	0

Previous volumes in this series

1157 December	Fintech vs bank credit: How do they react to monetary policy?	Giulio Cornelli, Fiorella De Fiore, Leonardo Gambacorta and Cristina Manea
1156 December	Monetary policy frameworks away from the ELB	Fiorella De Fiore, Benoit Mojon, Daniel Rees, Damiano Sandri
1155 December	Monetary Tightening, Inflation Drivers and Financial Stress	Frederic Boissay, Fabrice Collard, Cristina Manea, Adam Shapiro
1154 December	Foreign investor feedback trading in an emerging financial market	Ingomar Krohn, Vladyslav Sushko, Witit Synsatayakul
1153 December	Foreign institutional investors, monetary policy, and reaching for yield	Ahmed Ahmed, Boris Hofmann, Martin Schmitz
1152 December	The Heterogeneous Impact of Inflation on Households' Balance Sheets	Clodomiro Ferreira, José Miguel Leiva, Galo Nuño, Álvaro Ortiz, Tomasa Rodrigo, and Sirenia Vazquez
1151 November	The financial origins of regional inequality	Anne Beck and Sebastian Doerr
1150 November	Markups and the asymmetric pass-through of cost push shocks	Enisse Kharroubi, Renée Spigt, Deniz Igan, Koji Takahashi, Egon Zakrajšek
1149 November	Housing affordability: a new data set	Nina Biljanovska, Chenxu Fu, Deniz Igan
1148 November	Firm heterogeneity, capital misallocation and optimal monetary policy	Beatriz González, Galo Nuño, Dominik Thaler, Silvia Albrizio
1147 November	Central Band Digital Currency and Privacy: A Randomized Survey Experiment	Syngjoo Choi, Bongseob Kim, Young-Sik Kim, Ohik Kwon
1146 November	On par: A Money View of stablecoins	Iñaki Aldasoro, Perry Mehrling, Daniel H. Neilson
1145 November	Dollar and Government Bond Liquidity: Evidence from Korea	Jieun Lee
1144 November	Profitability, valuation and resilience of global banks – a tight link	John Caparusso, Ulf Lewrick and Nikola Tarashev

All volumes are available on our website www.bis.org.