Effectiveness of macroprudential and capital flow measures in Asia and the Pacific[1]

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Abstract

We assess the effectiveness of macroprudential policies in 12 Asia-Pacific economies, using comprehensive databases of capital flow measures (CFMs) and domestic macroprudential measures. We show that banking sector CFMs and bond market CFMs are effective in slowing down banking inflows and bond inflows, respectively. Our findings also provide some evidence of spillover effects from these types of CFM. Finally, we find that domestic macroprudential measures have insignificant effects on cross-border lending, bank credit and total credit.

Keywords: banking inflow, bond inflow, domestic macroprudential measure, capital flow measure

JEL classification: F34, G15, G28

Introduction

This paper aims to give a comparative empirical assessment of the impact of capital flow measures (CFMs) and domestic macroprudential measures across countries. In particular, we aim to control for the impact of global and local factors through our panel estimates and examine the effect of these policy actions on cross-border banking inflows, bond portfolio inflows and aggregate credit.

The impact of CFMs is determined in large part by the external environment, and our findings reflect the shift in the pattern of financial intermediation from the banking sector to the capital market. Turner (2014) illustrates the shift in the pattern of cross-border financial intermediation from the banking sector to the capital markets. In particular, he shows that the capital flows from global banks to emerging market economy (EME) banks had slowed to a trickle by 2012 and that, in their place, EME banks have increased their debt securities issuance. For non-banks, the growth in net issuance of international debt securities has been even more dramatic over the period 2010–12.

We focus on the experience of 12 Asia-Pacific economies in implementing CFMs and domestic macroprudential measures over the period 2004–13. For this exercise, we use a comprehensive database of domestic macroprudential measures and also a comprehensive data set of CFMs. In particular, we consider both CFMs that address the cross-border spillover of financial conditions through banking sector and bond market capital flows, and macroprudential policies that have a domestic credit focus such as maximum loan-to-value and debt-service-to-income ratios. Our policy data sets include 152 distinct CFMs on banking inflows and bond inflows and 177 domestic macroprudential measures taken by 12 Asia-Pacific economies during our sample period.

Our panel regression analysis finds the following results. First, banking sector CFMs are associated with a reduction in the growth of banking inflows before 2007, but not after 2007. Bond market CFMs are associated with a slowdown in bond inflows before 2009, but not during the surge in bond issuances after 2009. Second, we find some evidence of spillover effects from bond market and banking sector CFMs. In particular, banking sector CFMs are positively associated with an increase in international debt securities before 2007, and bond market CFMs are associated with an increase in cross-border bank lending after 2009. Third, we find that domestic macroprudential measures have insignificant effects on cross-border lending, bank credit and total credit.

We should bear in mind the issue of endogeneity (eg countries may adopt the policies in reaction to surges in credit or capital flows) when interpreting our results. For CFMs and domestic macroprudential measures are not introduced in a vacuum. They often reflect the external environment and the perception that surges in banking or bond inflows may lead to destabilising capital outflows in any subsequent reversal of such flows. If new macroprudential measures and CFMs are introduced only after a lengthy period of discussion within the government, central bank and other public authorities such as financial regulators, the implementation of such policies often coincides with the late stages of the boom. If the boom then subsides under its own weight, the introduction of the policy action and the subsequent slowdown of capital flows and credit growth would be a coincidence, not a causal effect. To this extent, the results reported below should be taken with some caution. More effort is needed to find empirical strategies that can address

the counterfactual question of what would have happened in the absence of these policy measures. Nevertheless, summarising the empirical associations between these policy measures and financial outcomes would be a necessary first step, and our exercise is offered in that spirit. In this context, our comprehensive databases of CFMs and domestic macroprudential measures allow us to reach conclusions that are based on comprehensive evidence.

Data

In assessing the impact of banking and bond inflow measures as well as domestic macroprudential measures on capital flows and aggregate credit, we consider the following 12 Asia-Pacific economies: Australia, China, Hong Kong SAR, India, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore and Thailand. The sample period spans almost a decade from the first quarter of 2004 to the third quarter of 2013 (or a few quarters earlier for some economies).

We consider the quarterly growth of cross-border banking inflows, bond portfolio inflows, offshore bond issuance, domestic credit and total credit as left-hand side variables. In particular, for banking inflows we consider the quarterly growth in external claims in US dollars of BIS-reporting country banks on the Asia-Pacific economies by residency, as given by the BIS locational banking statistics (*BIS Loans*). For bond inflows, we consider the quarterly growth in the amount outstanding of domestic debt securities in US dollars purchased by non-residents for the 12 Asia-Pacific economies (*BoP Bonds*). The data are obtained from the Balance of Payment and International Investment Position statistics of the IMF. For offshore borrowing in the form of bonds, we consider the quarterly growth in the US dollar amount outstanding of international debt securities issued by banks and corporations residing in the 12 economies, as given by the BIS international debt securities statistics (*BIS Bonds*). It should be noted that the proceeds from the issuance of these bonds could still find its way back to the issuing country.

We also include domestic bank credit and total credit as dependent variables. In particular, we use the quarterly and annual growth in bank credit in local currency value to private non-financial sectors, which is available for the 12 economies (*Bank Credit*), and the quarterly and annual growth in credit in local currency value extended by domestic banks, all other sectors in the economy and non-residents, which is available for 10 economies[3] (*Total Credit*), as given by the BIS database for total credit to the private non-financial sector. All dependent variables are winsorised at the 2.5% level to reduce the effect of outliers.

We include several control variables – both global and local – as possible determinants of banking and bond inflows. As a global factor, we consider the log of the VIX, which can be a proxy for the leverage of global banks (see Bruno and Shin (2015) or risk sentiment of global investors in bond markets (see Ahmed and Zlate (2013). For local factors, we use the log of real exchange rate, real GDP growth, CPI inflation, M2 growth, interest rate differential between the three-month domestic interbank rate and US Libor, and the sovereign credit rating.

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[3]   The total credit series for New Zealand and the Philippines are not available.

In this paper, we are interested in both CFMs and domestic macroprudential measures. We obtained information on CFMs taken by the 12 Asia-Pacific economies from 2004 to 2013 from the database included in Chantapacdepong and Shim (2014). In particular, they classify policy actions by direction (tightening inflows, loosening inflows, loosening outflows, tightening outflows), by target flow (bond inflows, equity inflows, banking inflows, real estate inflows, direct investment inflows, other inflows (such as remittances and export flows) and outflows), and by target group (non-residents, or both residents and non-residents). Among various types of capital flow measure, we use banking inflow measures and bond inflow measures in this paper.

In addition to CFMs, we also consider domestically oriented macroprudential measures to see their impact on bank credit and banking/bond inflows. In particular, we use the database for policy actions on housing markets compiled by Shim et al (2013). The database contains three types of non-interest rate monetary policy action (reserve requirements, credit growth limits and liquidity requirements) which affect the amount of general credit to the private sector provided by banks, as well as five types of prudential measure (maximum loan-to-value ratios, maximum debt-service-to-income ratios, risk weights on housing loans, loan-loss provisioning on housing loans and exposure limits on the real estate sector) specifically targeting housing credit. The database differentiates tightening actions (ie reducing credit) and loosening actions (ie increasing credit). The coverage of this database ends in June 2012, so we collected information on relevant policy actions taken by the 12 economies from July 2012 to December 2013.

Empirical analysis

We conduct panel regressions without country fixed effects. In particular, *BIS Loans*, *BoP Bonds* and *BIS Bonds* are regressed on indicators of *Banking Inflow Measures* and *Bond Inflow Measures* (capturing both tightening and loosening actions) and various control variables. Also, *Bank Credit* and *Total Credit* are regressed on *Macroprudential Measures* (the sum of non-interest rate monetary policy measures and prudential measures capturing both tightening and loosening actions), *Banking Inflow Measures* and *Bond Inflow Measures*, and the control variables. For each specification, we include time dummies (year dummies). When we calculate standard errors, we cluster them at the country level. Finally, we do not include country dummies because CFM indicators have little variation or are unchanged for some economies.

Table 1 shows regression results for the direct impact of banking and bond inflow measures on targeted flows. In columns 1 and 2 of Table 1, the coefficient on the VIX is negative and significant in both specifications, which is consistent with earlier studies finding a decrease in cross-border lending during periods of high volatility, corresponding to deleveraging by global banks. We find that bank inflow measures are associated with lower growth in bank inflows. The coefficient on the indicator *Bank Inflow Measures* capturing the sum of tightening (+1) actions and loosening (−1) actions in a quarter is negative and significant, meaning that a greater tightening on bank inflow measures reduces cross-border banking inflows (column 1). The coefficient on the interaction term *Bank Inflow Measures x VIX* is positive and significant, meaning that bank inflow measures at the margin alleviate

the effect on the change in cross-border banking flows during periods of high volatility. In column 2, we interact the *Bank Inflow Measures* indicator with a dummy variable equal to 1 in every quarter after 2007 and 0 otherwise (*post 07*), and with a dummy variable equal to 1 in every quarter in or before 2007 and 0 otherwise (*pre 07*). The results from this specification show that *Bank Inflow Measures* are effective in reducing the growth in cross-border lending during the period before the 2007 financial crisis. The financial crisis consistently reduced the magnitude of the cross-border banking flows. In this sense, it is not surprising to see that bank inflow measures were effective during the booming period of cross-border lending.

Direct effects of bank and bond inflow measures   Table 1

Dependent variable	(1) BIS Loans	(2) BIS Loans	(3) BoP Bonds	(4) BoP Bonds	(5) BIS Bonds	(6) BIS Bonds
VIX	-0.0804** [0.027]	-0.0801** [0.019]	-0.0393** [0.029]	-0.0435** [0.016]	-0.0511*** [0.006]	-0.0370*** [0.000]
Bank Inflow Measures	-0.0645* [0.068]					
Bank Inflow Measures x VIX	0.0186* [0.068]					
Bank Inflow Measures x post 07		0.0054 [0.395]				
Bank Inflow Measures x pre 07		-0.0241** [0.025]				
Bond Inflow Measures			-0.1121* [0.099]		0.0968* [0.092]	
Bond Inflow Measures x VIX			0.0324* [0.100]		-0.0279* [0.095]	
Bond Inflow Measures x post 09				0.0042 [0.740]		0.0189 [0.134]
Bond Inflow Measures x pre 09				-0.0405*** [0.004]		-0.0063 [0.703]
Constant	0.2367** [0.023]	0.2340** [0.016]	0.1539*** [0.005]	0.1667*** [0.001]	0.1961*** [0.008]	0.1200*** [0.000]
Observations	445	445	445	445	445	445
R-squared	0.119	0.123	0.153	0.160	0.143	0.108

Note: This table shows results from regressions with year dummies and robust-clustered standard errors at the country level. *p*-values are reported in brackets. *BIS Loans* is the growth in cross-border banking inflows. *BoP Bonds* is the growth in the amount outstanding of domestic debt securities purchased by non-residents. *BIS Bonds* is the growth in the amount outstanding of international debt securities issued by non-financial corporations. *Bank Inflow Measures* or *Bond Inflow Measures* is the sum of tightening (+1) actions and loosening (−1) actions in a quarter. VIX is the Chicago Board Options Exchange Volatility Index. *Post 07* (*Pre 07*) is a dummy variable equal to 1 in every quarter after (in or before) 2007 and 0 otherwise. *Post 09* (*Pre 09*) is a dummy variable equal to 1 in every quarter in or after (before) 2009 and 0 otherwise. Control variables not reported in the table include the log of real exchange rate, real GDP growth, inflation, M2 growth, interest rate differential between the three-month domestic interbank rate and US Libor, and the sovereign credit rating.

In columns 3 and 4 of Table 1, we replicate the specifications used in columns 1 and 2 by using the growth in the amount outstanding of domestic debt securities purchased by non-residents (*BoP Bonds*) as our dependent variable. Correspondingly, we use the indicator *Bond Inflow Measures*. Column 3 presents results over the entire sample period. As in the case of *Bank Inflow Measures*, *Bond Inflow Measures* also statistically significantly reduce the growth in domestic debt securities purchased by non-residents. The coefficient on the VIX is again

statistically significant, as well as that on the interaction term between *Bond Inflow Measures* and the VIX, meaning that bond inflow measures attenuate the decrease in bond flows during periods of high volatility. Column 4 interacts *Bond Inflow Measures* with a dummy variable equal to 1 in every quarter in or after 2009 and 0 otherwise (*post 09*), and with a dummy variable equal to 1 in every quarter before 2009 and 0 otherwise (*pre 09*). Results from this specification show that bond inflow measures are effective in reducing the growth in the amount outstanding of domestic debt securities purchased by non-residents before the surge in bond issuances occurred after 2009.

In columns 5 and 6 of Table 1, we replicate the specifications used in columns 3 and 4 by using the growth in the amount outstanding of international debt securities issued by financial and non-financial corporations residing in the 12 economies (*BIS Bonds*) as our dependent variable. Column 5 presents results over the entire sample period. Different from the case with *BoP Bonds*, *Bond Inflow Measures* are statistically positively associated with the growth in international debt securities. This could be interpreted as a counter-reaction from corporations to the bond inflows measures as they may want to shift to (from) issuing offshore bonds from (to) issuing domestic bonds.

In Table 2, we try to gauge possible spillover effects from the introduction of banking and bond inflow measures. For instance, does cross-border lending increase when bond inflow measures are introduced? Similarly, are bond inflows affected by more stringent bank inflow measures? Regression results show that bond inflow measures are associated with an increase in cross-border bank lending after 2009 (column 1). Similarly, bank inflow measures are positively associated with

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Spillover effects of bank and bond inflow measures   Table 2

Dependent variable	(1) BIS Loans	(2) BoP Bonds	(3) BIS Bonds
VIX	-0.0842** [0.018]	-0.0414** [0.022]	-0.0498*** [0.010]
Bond Inflow Measures x post 09	0.0296** [0.025]		
Bond Inflow Measures x pre 09	-0.0336 [0.308]		
Bank Inflow Measures x post 07		-0.001 [0.781]	0.0029 [0.297]
Bank Inflow Measures x pre 07		0.0064 [0.430]	0.0170** [0.033]
Constant	0.2482** [0.013]	0.1626*** [0.002]	0.1945*** [0.010]
Observations	445	445	445
R-squared	0.122	0.146	0.149

Note: This table shows results from regressions with year dummies and robust-clustered standard errors at the country level. *p*-values are reported in brackets. *BIS Loans* is the growth in cross-border banking flows. *BoP Bonds* is the growth in the amount outstanding of domestic debt securities purchased by non-residents. *BIS Bonds* is the growth in the amount outstanding of international debt securities issued by non-financial corporations. *Bond Inflow Measures* or *Bank Inflow Measures* is the sum of tightening (+1) actions and loosening (−1) actions in a quarter. VIX is the Chicago Board Options Exchange Volatility Index. *Post 07* (*Pre 07*) is a dummy variable equal to 1 in every quarter after (in or before) 2007 and 0 otherwise. *Post 09* (*Pre 09*) is a dummy variable equal to 1 in every quarter in or after (before) 2009 and 0 otherwise. Control variables not reported in the table include the log of real exchange rate, real GDP growth, inflation, M2 growth, interest rate differential between the three-month domestic interbank rate and US Libor, and the sovereign credit rating.

an increase in international debt securities before 2007 (column 3). These results could highlight possible spillover effects where policy actions on inflows into one sector lead to an increase in inflows to another sector. Such effects on bank and bond inflows did not happen during the first or second phase of global liquidity when bank and bond inflows, respectively, were increasing dramatically. Hence, a "coincidence" of bank (bond) inflow measures jointly with increased bond (bank) inflows is less likely.

Finally, in addition to the capital flow measures considered in Tables 1 and 2, we also consider domestically oriented macroprudential measures and investigate their impact on bank credit, total credit and banking inflows. Columns 1 and 2 of Table 3 show regression results when *Macroprudential Measures* are used in lieu of *Bank Inflow Measures* and *Bond Inflow Measures*. The impact of such measures is more ambiguous as they tend to have a positive or insignificant impact on cross-border lending (column 1) and on bank credit (column 2). These results may indicate some limitations of macroprudential policy measures or they may suggest that bank credit is slower-moving than capital flows.

In columns 3 to 6 of Table 3, we regress the growth of bank credit and total credit on all the policy measures so far considered: *Bank Inflow Measures*, *Bond Inflow Measures* and *Macroprudential Measures*. Results on one-quarter growth (between *t* and *t*-1, columns 3 and 5) and four-quarter growth (between *t*+3 and *t*-1, columns 4 and 6) are presented. Macroprudential measures continue to have an insignificant impact on bank credit and total credit. Also bank inflow measures do not seem to significantly impact credit.

Effects of domestic macroprudenital measures and bank/bond inflow measures

Table 3

Dependent variable	(1) BIS Loans	(2) Bank Credit Q	(3) Bank Credit Q	(4) Bank Credit Y	(5) Total Credit Q	(6) Total Credit Y
VIX	-0.0609** [0.025]	-0.0029 [0.498]	-0.0028 [0.564]	-0.0098 [0.480]	-0.0021 [0.777]	-0.0070 [0.676]
Macroprudential Measures	0.0227*** [0.006]	0.0015 [0.235]	0.0018 [0.188]	0.0015 [0.806]	0.0023 [0.125]	0.0034 [0.598]
Bank Inflow Measures			-0.0016 [0.204]	-0.0022 [0.609]	-0.0009 [0.465]	-0.0023 [0.509]
Bond Inflow Measures			0.0032 [0.190]	0.0142** [0.047]	0.0023 [0.101]	0.0145* [0.077]
Constant	0.1634** [0.026]	0.0145 [0.402]	0.0227 [0.269]	0.0885 [0.206]	0.0165 [0.512]	0.0968 [0.249]
Observations	480	528	445	439	373	367
R-squared	0.136	0.297	0.293	0.469	0.381	0.557

Note: This table shows results from regressions with year dummies and robust-clustered standard errors at the country level. *p*-values are reported in brackets. *BIS Loans* is the growth in cross-border banking flows. *Bank Credit Q* is the one-quarter growth in bank credit to private non-financial sectors. *Bank Credit Y* is the four-quarter growth in bank credit to private non-financial sectors. *Total Credit Q* is the one-quarter growth in credit extended to private non-financial sectors by domestic banks, all other sectors of the economy and non-residents. *Total Credit Y* is the four-quarter growth in credit extended to private non-financial sectors by domestic banks, all other sectors of the economy and non-residents. *Macroprudential Measures* consist of non-interest rate monetary policy actions which affect the amount of general credit to the private sector provided by banks, and five types of prudential measure specifically targeting housing credit. *Macroprudential Measures*, *Bank Inflow Measures* or *Bond Inflow Measures* is the sum of tightening (+1) actions and loosening (−1) actions in a quarter. VIX is the Chicago Board Options Exchange Volatility Index. Control variables not reported in the table include the log of real exchange rate, real GDP growth, inflation, M2 growth, interest rate differential between the three-month domestic interbank rate and US Libor, and the sovereign credit rating.

By contrast, the results in columns 4 and 6 of Table 3 that bond inflow measures are positively correlated with the growth in bank credit and total credit suggest that bond inflow tightening measures may have induced domestic banks to increase domestic bank credit to compensate for the reduced amount of bond financing induced by bond tightening measures. The results are mostly consistent with the evidence in Table 2 on the existence of cross-flow substitution or spillover effects.

Conclusion

In this paper, we conduct a comparative empirical assessment of the impact of CFMs and domestic macroprudential measures taken in 12 Asia-Pacific economies over the period 2004–13 on capital flows and aggregate credit. Our panel regression analysis finds that bank inflow measures and bond inflow measures were effective in reducing the growth in banking inflows before 2007 and in slowing down bond inflows before 2009, respectively. In addition to the direct impact of CFMs on targeted flows, we find some evidence of spillover effects: bank inflow measures seem to increase the issuance of international debt securities before 2007, and bond inflow measures seem to increase the growth of cross-border bank lending and also the growth of domestic bank credit and total credit.

There are a few directions for further research. First, we can divide bond inflow loosening measures into two types: policy actions taken as part of a long-term capital account liberalisation plan, and those introduced to reverse or lift existing bond inflow tightening measures with the goal of attracting more capital inflows. The policy actions in the former group are of a structural nature, while those in the latter group are of a cyclical nature. This distinction is especially important when EME financial authorities try to understand the effectiveness of capital flow loosening measures to mitigate the negative impact of capital outflows triggered by global shocks such as a sudden increase in advanced economy interest rates. Second, data on banking inflows (*BIS Loans*), bond inflows (*BoP Bonds*) and international bond issuance (*BIS Bonds*) used in the paper are in US dollar terms. Thus, we can consider exchange rate effects to find out the net impact of policy actions.

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