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# Monetary Policy Transmission in Emerging Asia: The Role of Banks and the Effects of Financial Globalization

by

Nasha Ananchotikul and Dulani Seneviratne

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# **Monetary Policy Transmission in Emerging Asia: The Role of Banks and the Effects of Financial Globalization**

**Nasha Ananchotikul and Dulani Seneviratne<sup>1</sup>**

September 2015

## **Abstract**

Given the heavy reliance on bank lending as the main source of financing in most Asian economies, banks could potentially play a pivotal role in monetary policy transmission. However, we find that Asia's bank lending channel or, more broadly, credit channel of domestic monetary policy is not very strong at the aggregate level. Using bank-level data for nine Asian economies during 2000–2013, we show that heterogeneity of bank characteristics (e.g., ownership type, financial position), degree of foreign bank penetration of the domestic banking sector, and global financial conditions all have a bearing on the response of domestic credit to changes in domestic monetary policy, and may account for the apparently weak credit channel at aggregate level.

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Authors' E-Mail Address: [nashaa@bot.or.th](mailto:nashaa@bot.or.th); [dseneviratne@imf.org](mailto:dseneviratne@imf.org)

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## I. INTRODUCTION

In view of Asia's bank-dominated financial systems, banks may be an important conduit for the transmission of domestic monetary policy. Banks are the primary financing source for the corporate sector and for households across most of Asia.<sup>2</sup> However, banks across Asia, and even within a single country, are far from homogeneous in key characteristics that may impact policy transmission. Discerning how banks react to a change in monetary policy is therefore important for understanding how monetary policy affects the real economy.

This paper examines the effectiveness of monetary policy transmission in selected Asian countries. We focus our analysis on the 'bank lending channel'—whereby banks with different characteristics and financial strengths adjust their loan supply differently in response to a change in monetary policy.<sup>3</sup> We conjecture that the aggregate response to monetary policy may mask significant variation of responses at the level of individual banks. A bank-level data analysis would allow heterogeneity across banks to play a distinctive role in the transmission mechanism. Given the uniqueness of the banking sector structure in Asia, understanding the factors determining bank lending behavior will allow us to draw important implications for monetary and financial sector policies.

We explore the effectiveness of the lending channel in the face of ongoing changes in the structural characteristics of domestic banking sectors and the external financial environment. In recent years, the banking industry in Asia has seen a significant increase in foreign bank participation, driven by financial integration, deregulation, and a wave of mergers and acquisitions. To the extent that foreign banks have different funding structures and market strategies than domestic banks, they may respond differently than their domestic counterparts to monetary policy shocks, a further rise in foreign bank penetration—which implies a change in competitive conditions—and which, in turn, alter the way domestic banks behave.

Increased financial globalization may also influence the effectiveness of monetary policy due to its powerful effects on the economic and financial environment in which monetary policy operates. Globalization may cause domestic bank credit to be more sensitive to external financial conditions to the extent that banks can access wholesale and interbank funding in international markets, thereby diluting the effects of domestic monetary policy on bank lending. In fact, credit growth in Asia had been exceptionally strong before the Global Financial Crisis against the backdrop of loose global financial conditions, notwithstanding domestic monetary policy

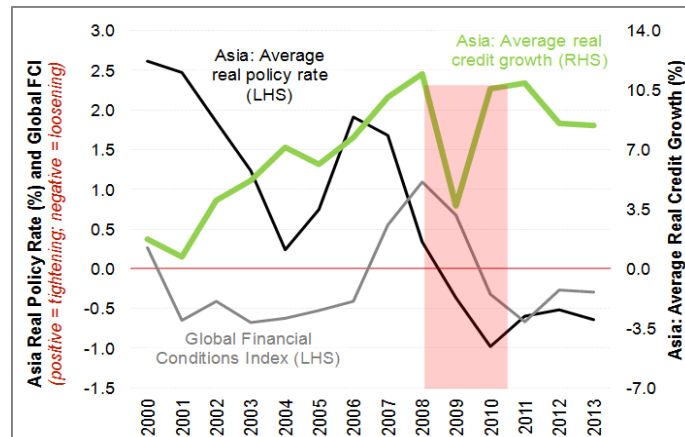
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<sup>2</sup> Banks have been an important source of finance in most Asian economies. The total size of banks' private credit in emerging Asia is roughly 70-80 percent of GDP. Although stock markets have been growing quite rapidly, access to stock markets as an alternative source of funding is still limited to very large firms. Corporate bond markets in most emerging Asian countries have been relatively underdeveloped, though they are now evolving into an alternative and viable nonbank source of funding.

<sup>3</sup> The bank lending channel is one of the two possible mechanisms of the credit channel (Bernanke and Gertler, 1995). It emphasizes on the possible amplification effects of monetary policy actions on the supply of loans offered by the banking system. The other mechanism, dubbed the balance sheet channel, focuses the impact of monetary policy on the borrower's balance sheet. More recently, the risk-taking channel has been identified as another bank-based transmission mechanism (Borio and Zhu, 2007).

tightening during the 2005–2007 (Figure 1)<sup>4</sup>. Until recently, both domestic monetary policies and global financial conditions were kept loose. Going forward, a challenge for policymakers is, therefore, whether monetary policy will be able to keep credit conditions attuned to domestic economic circumstances if domestic monetary policies and global financial conditions happen to diverge.

**Figure 1. Credit Growth vs. Domestic and External Financial Conditions<sup>5</sup>**



Sources: Haver Analytics; CEIC data co. ltd; US Federal Reserve; and IMF staff calculations.

Taken together, key questions in this paper are as follows:

- How important is the bank lending channel in the transmission of monetary policy in Asia?
- How do banks' characteristics affect the effectiveness of monetary policy transmission?
- Does foreign bank penetration reduce the effectiveness of domestic monetary policy?
- To what extent do global financial conditions matter for domestic credit expansion in Asia?

Our vector autoregression analysis using macroeconomic data on claims on private sector in Asian economies suggest that the credit channel (distinct from the interest rate channel) plays a very small amplifying role for aggregate GDP. Using a bank-level panel dataset of about 300 banks from nine Asian economies during 2000–2013, we test for systematic differences in the sensitivity of bank loan growth to a measure of monetary policy shocks, controlling for global financial conditions, domestic demand, bank characteristics, and bank and time fixed effects.

The results indicate that banks with different types of ownership react heterogeneously to monetary policy changes. In particular, in response to monetary policy tightening, state-owned

<sup>4</sup> Jain-Chandra and Unsal (2012) estimate the pass-through from domestic policy rates to lending rates from 2000–09 and find that, while monetary policy transmission remains effective in Asia, it is weaker in periods of large and volatile capital inflows, amidst easy external financial conditions.

<sup>5</sup> Global financial conditions index is the Chicago Fed's adjusted U.S. National Financial Conditions Index (NFCI). Positive (negative) values indicate financial conditions that are tighter (looser) than average. See further description in the Data section.

banks contract their loan supply the most. Domestic private banks display a much lower sensitivity, while foreign banks are found to perversely increase their credit supply. In addition, more financially constrained banks (measured by a higher loan-to-deposit ratio (LDR) or a low liquidity ratio, compared to peers) will shrink their loan portfolio by more than the average bank, while banks with high liquidity and low LDRs contradict standard theory by continuing to expand their loan portfolios, notwithstanding the tightening of monetary policy. We find that monetary policy in host countries could become less effective as the level of foreign bank penetration increases, and this result extends to domestic banks through stronger banking sector competition. Lastly, we also find that bank credit responds not only to changes in domestic monetary policy, but also to external financial conditions, making the task of calibrating monetary policy ever more challenging in a world with increasing global financial integration.

The rest of the paper is organized as follows. Section II reviews the existing work on the bank lending channel and places the paper in the context of the literature. Section III describes the data. Section IV displays key stylized facts on Asia's banking sectors, including recent trends that are important in understanding the heterogeneity across countries and across banks in Asia, and potential external influences on bank behavior in the region. Section V presents the econometric methodology and discusses the empirical results. Section VI concludes.

## II. RELATED LITERATURE

The role of banks in monetary policy transmission has been extensively studied under the view of the credit channel, which has traditionally been divided into two separate channels: the balance sheet channel (the broad credit channel) and the bank lending channel (Bernanke and Gertler, 1995). Both of these credit channels emphasize the role of imperfect information and other frictions in credit markets that amplify the effects of monetary policy shocks by changing the "external finance premium" and hence the cost and availability of credit. The balance sheet channel, also referred to as the broad credit channel or financial accelerator, is based on the theoretical prediction that the external finance premium facing a borrower should depend on borrower's financial position, and it is the endogenous procyclical movements in borrowers' balance sheets that act to propagate monetary policy shocks. The bank lending channel stresses the potential effect of monetary policy changes on the supply of bank credit due to imperfect substitutes between deposits and other sources of finance. Changes in banks' loan supply induced by monetary policy actions, in turn, affect the real economy due to the lack of close substitutes for bank credit on the part of borrowers.

Earlier studies attempt to test the existence of the bank lending channel using aggregate data (Bernanke and Blinder, 1992, and Kashyap et al., 1993). However, the main obstacle in testing the bank lending channel is the identification problem: how to distinguish between movements in credit aggregates due to shifts in demand resulting from effects operating through the traditional interest rate channel, and those due to supply factors that constitutes a distinct bank lending channel. To overcome this problem, recent studies have increasingly resorted to bank-level data, verifying the existence of the bank lending channel by showing that banks with different characteristics respond differently to changes in monetary policy depending on their ability to

shield their supply of loans from the negative shocks. Banks that are more financially constrained (i.e. have a higher external finance premium) will be forced to reduce their loan supply by more. Using bank-level data, several studies find evidence for the existence of a bank lending channel with financial constraints commonly proxied by bank size, liquidity, and capitalization (for example, Kashyap and Stein, 1995 and 2000, Kishan and Opiela, 2000, Khwaja and Mian, 2008). Bank ownership has also been used to proxy for financial constraints. For instance, Houston and James (1998) find that loan growth of banks affiliated with a multi-bank holding company is less sensitive to their cash flow, liquidity, and capital positions than in the case of unaffiliated banks. In the similar vein, Wu, et al. (2011) find that foreign banks are less responsive to monetary shocks in host countries. They suggest that access of foreign banks to funding from parent banks through the internal capital market is the most convincing explanation.

Beyond testing the existence of the bank lending channel, an emerging strand of research examines certain aspects of the banking sector landscape that may impact the strength of the bank lending channel of monetary policy transmission. Olivero, et al. (2011a, 2011b) study the role of market structure in the banking sector and find evidence that increases in bank competition and bank consolidation weaken the bank lending channel, potentially due to a reduction in information asymmetries in the credit market and better access to alternative sources of funding for larger and more competitive banks, thereby making loan supply less sensitive to interest rate shocks. The results from Wu, et al. (2011) imply that the rise in foreign bank penetration has further weakened the bank lending channel in emerging Asia and Latin America. Furthermore, Altunbas, et al. (2009) find that the dramatic increase in securitization activity in Europe has weakened the efficacy of the bank lending channel, as it allows greater bank access to liquidity without the need to expand balance sheets and hence the ability to continue lending in the face of a tightening of monetary policy.

By emphasizing the role of bank characteristics and banking sector structure in explaining the heterogeneity of monetary policy effects on banks' loan growth in Asian economies, this paper is in the same spirit as the bank lending channel literature mentioned above. Although our aim is not to test the existence of the bank lending channel per se, the arguments related to financial constraints or differential external finance premia under the bank lending view can be one of the explanations for why banks with different characteristics respond differently to monetary policy shocks. We extend the literature in various directions in an attempt to understand the transmission of monetary policies through banking sectors in Asia. First, given the prominence of state-owned banks in Asia and a presumption that they tend to behave differently from privately-owned banks, we categorize bank ownership into three groups: state-owned banks, domestic private banks, and foreign banks. Second, beyond the common set of proxies for financial constraints—namely, size, liquidity, and capitalization—we identify the lending to deposit ratio as another important factor that affects banks' sensitivity to monetary policy shocks, as it may be an important proxy for bank balance sheet conditions or an indication of the extent to which banks resort to different sources of funding other than deposits.

Third, with increased financial integration and globalization, we test whether bank loan supply also reacts to global financial conditions, which could amplify or dampen the effectiveness of

domestic monetary policy through the lending channel. Fourth, we also explore whether foreign bank presence in the domestic banking sector affects the strength of the bank lending channel. We distinguish between foreign bank presence that originates from Asian versus non-Asian parent banks, on the view that non-Asian (i.e., European or United States) multi-national banks may have strategies and approaches in their Asian operation that differ from their counterpart Asian-parent banks. Finally, we also explore the role of non-bank financial institutions in order to obtain a more complete picture of the effectiveness of monetary policy by shedding light on the additional transmission channel of monetary policy that goes beyond the traditional banking sector.

### III. DATA

For the bank-level analysis, we construct an unbalanced panel dataset using micro-level (i.e., bank level data) and macroeconomic data. The bank level data are sourced from Bureau van Dijk's Bankscope database from years 2000 to 2013. The main data set comprises commercial banks from nine Asian economies: Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Thailand, and Taiwan Province of China.<sup>6</sup> After removing the outliers, there are a total of 3,393 bank-level observations in the main dataset.<sup>7</sup> Our commercial bank sample includes 260 banks, covering 78 percent of total bank credit, 80 percent of total bank assets, and about 56 percent of the total number of banks (Figure 2). Given that the bank lending channel's response to domestic monetary policy may also rely on the nature of the business models and mandates of financial institutions, we extract data on commercial bank and non-commercial bank samples separately.<sup>8</sup> Total bank coverage in our non-commercial-bank financial institutions sample is 137. For foreign banks, only foreign subsidiaries (not branches) are included in our sample as foreign bank branches' balance sheet information is not identified separately from that of their parent bank. Thus, our bank loan data will neither cover domestic loans made by foreign branches, nor foreign loans made directly by foreign banks abroad (Figure 3).

The dataset is constructed primarily with unconsolidated data from the Bankscope database. Where unconsolidated data are not available—for instance in very few cases where only one form of accounts is available for a bank—we revert to consolidated financial statement data. As the next step, we then identify the ownership of banks included in our dataset. We define a bank as state-owned, foreign, or domestic private, if 51 percent of the bank's capital is owned by: the

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<sup>6</sup> We originally include China (76 banks after data cleaning) in our sample and regressions. However, Chinese banks tend to behave quite differently from typical banks in Asia and bias the overall results due to the large number of banks. Thus, we exclude China from our sample and leave it for future research.

<sup>7</sup> We used the following criteria to clean the data and remove outliers. First, we eliminate observations with missing values for loans and total assets. Second, we drop observations with loan growth that exceed plus or minus 200 percent. Third, we delete observations with negative values for equities. Forth, we remove banks that are very small—defined as banks that on average have an asset share or loan share less than 0.05 percent of total domestic bank assets and credit. Fifth, we remove banks that have too few observations, i.e., no data for at least two consecutive years. Finally, we delete observations that have loan-to-deposit ratio over 500 percent. About 40 banks and 350 observations were removed after the above data cleaning process.

<sup>8</sup> Non-commercial bank financial institutions include savings banks, cooperative banks, real estate and mortgage banks, investment banks, other nonbank credit institutions, specialized government credit institutions, and micro-financing institutions.



host country's government, an entity outside the host country, or by domestic private entities within the host country, respectively. We employ the following strategy to identify the ownership information. We first identify the global ultimate ownership information from Bankscope. We then begin with checking the overview of the banks in Bankscope to identify any ownership changes. Subsequently, we check the banks' own websites, the Central Banks' websites, as well as Internet articles and news related to these banks to identify bank ownership information. Then we use Bureau van Dijk's Zephyr database, a comprehensive mergers and acquisitions database with integrated detailed company information, to identify any ownership changes that occurred due to mergers and acquisitions throughout our sample period. Following the above strategy, we identify 47 banks as state-owned (SOE) commercial banks, 81 as foreign commercial bank subsidiaries, and 132 as private domestic commercial banks. We then construct three time-varying dummy variables (1–0) to capture these ownership types in our dataset. We also construct three separate time-invariant dummy variables for ownership based on the ownership type that prevailed during the sample period.<sup>9</sup>

**Figure 2. Sample Coverage**

Commercial Bank Sample							Non-Commercial-Bank FIs Sample						
	State-Owned	Foreign	Domestic Private	Total	Coverage <sup>1</sup> (%)		State-Owned	Foreign	Domestic Private	Total	Percentage of domestic ...		
					No. of Banks	Bank loans					Bank assets	Bank loans	
HKG	0	15	5	20	62%	92%	HKG	0	2	4	6	1%	2%
IDN	5	23	26	54	48%	76%	IDN	1	0	2	3	1%	1%
IND	25	5	23	53	35%	86%	IND	16	0	11	27	20%	21%
KOR	3	2	10	15	58%	46%	KOR	2	1	20	23	30%	14%
MYS	5	13	5	23	89%	72%	MYS	16	0	5	21	13%	12%
PHL	2	10	18	30	83%	71%	PHL	4	0	7	11	13%	12%
SGP <sup>2</sup>	0	2	6	8	7%	87%	SGP	0	2	2	4	1%	1%
THA	2	8	11	21	70%	73%	THA	4	1	9	14	19%	15%
TWN	5	3	28	36	54%	97%	TWN	2	0	16	18	24%	12%
<b>Total</b>	<b>47</b>	<b>81</b>	<b>132</b>	<b>260</b>	<b>56%</b>	<b>78%</b>	<b>Total</b>	<b>45</b>	<b>6</b>	<b>76</b>	<b>127</b>	<b>14%</b>	<b>10%</b>

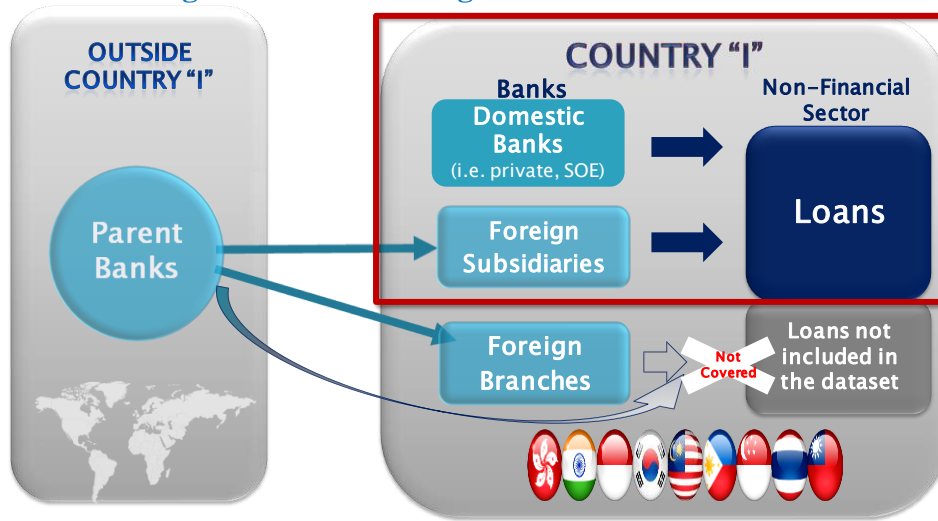
Notes: <sup>1</sup>We exclude very small banks (with both asset share and loan share of less than 0.05% of total domestic banking system) for data quality purposes.

<sup>2</sup> The majority of 120 foreign banks in Singapore operate as foreign branches, not subsidiaries, thus are not covered in Bankscope.

Note: Non-commercial bank financial institutions include savings banks, cooperative banks, real estate and mortgage banks, investment banks, other non-banking credit institutions, specialized governmental credit institutions, and micro-financing institutions.

<sup>9</sup> As a robustness check, we have used both measures of ownership dummy variables in our regressions, and results remain robust. Therefore, we only report the results and stylized facts based on the time-invariant ownership dummy variables.

**Figure 3. Data Coverage for Commercial Banks**



Source: Authors' illustration.

Our dependent variable, real loan growth, is based on the value of loans outstanding excluding interbank loans from the bank balance sheets sourced from Bankscope, and deflated by the consumer price index in order to construct a variable in constant prices.<sup>10</sup> In addition, we also calculate other bank characteristic variables including total assets (in logs), loan-to-deposit ratios, liquid assets-to-total assets, and the capital adequacy ratios using data from Bankscope.

Macro-level data are obtained from several sources. Nominal interest rates—the official monetary policy rates and Treasury bill rates when official policy rates are not available—are obtained from Haver Analytics. Real policy rates are constructed by deflating the nominal rates by the consumer price index. The monetary policy variable included in our empirical analysis is constructed by taking the first difference of the real policy rate from above. Given that the bank lending responds not only to domestic monetary policy, we use the Chicago Fed's U.S. financial conditions index as a proxy for global financial conditions. This index provides “a comprehensive indicator of U.S. financial conditions in money markets, debt and equity markets, and the traditional and “shadow” banking systems” (Federal Reserve Bank of Chicago). Positive values of the index indicate financial conditions that are tighter than average, while negative values indicate financial conditions that are looser than average. We use the adjusted index that isolates a component of financial conditions uncorrelated with economic conditions. Apart from these two macro-level variables, we also include real GDP growth from the IMF's World Economic Outlook database as a control variable in our regressions. The next section illustrates the trends pertaining to the variables we introduced in this section, in the context of overall bank balance sheet conditions in Asia.

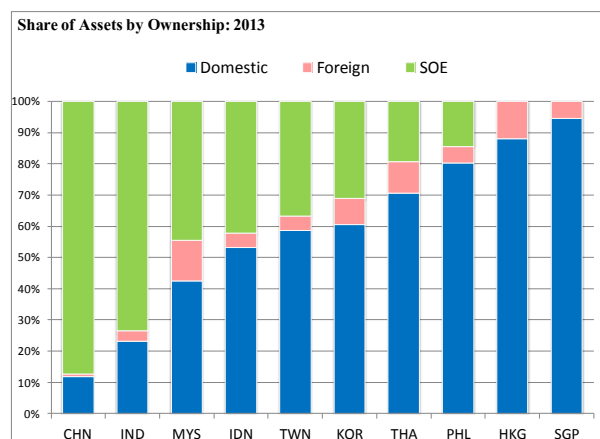
<sup>10</sup> Consumer price index (CPI) may not be the more relevant price index for deflating credit data, especially for the part of loans that are denominated in foreign currencies. Due to unavailability of a deflator that is more appropriate while consistent across countries, we follow the existing literature and use CPI as a proxy for credit price index. As a robustness check, we also run the main regressions using all nominal variables. Overall results are unchanged.

## IV. STYLIZED FACTS

### A. Bank ownership

The bank ownership structure displays considerable diversity across Asian economies (Figure 4). At one end of the spectrum, China and India have very high concentrations of state-owned commercial banks, representing 87 and 74 percent of total domestic bank assets, respectively. At the other end, the two Asian financial centers, Singapore and Hong Kong SAR, are free of government-controlled banks, leaving the banking sector in the hands of the private sector and foreign competition.<sup>11</sup> Malaysia has relatively high foreign bank representation in the domestic banking system compared to other non-financial-center economies. Given that the mandates, the funding sources, the marketing strategy are possibly very different across the three types of bank ownership, we expect ownership to play a prominent role in determining banks' responses to monetary policy even after we control for other bank characteristics. For example, state-owned banks' credit supply may be more subject to government's directives and political pressure rather than funding constraints induced by monetary policy. At the same time, foreign banks' loan growth may be less sensitive to monetary shocks because they can take advantage of internal-to-the-bank-group capital markets to buffer the impact of monetary policy changes on loan supply. Ownership should, thus, be an important source of heterogeneity in the bank lending channel of monetary policy transmission.

**Figure 4. Banking Sector's Ownership Structure**



Sources: Bankscope; and IMF staff calculations.

### B. Bank balance sheet positions

On average, banks have continued to strengthen their balance sheets in Asia (Figure 5). Profitability across the region—captured by the return-on-assets ratio—remains in line with the levels seen in the United States and Latin America. Tier 1 capital ratios remain at or above the

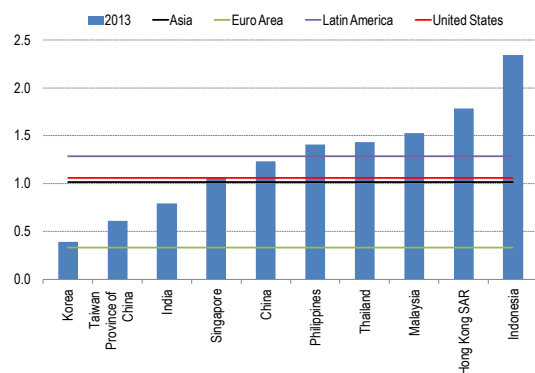
<sup>11</sup> The representativeness of foreign banks in Singapore as shown in Figure 4 is vastly under-stated. This is because most of the 120 foreign banks in Singapore are operated as *foreign branches*, not subsidiaries, for which balance sheet information is not provided in Bankscope.

threshold of 8.5 percent in most Asian Economies, although they remain below those in advanced economies (i.e., United States and the Euro Area). Loss absorbing buffers—estimated as excess tier-1 capital plus net loan loss reserves, in percent of risk weighted assets—remain sizable in emerging Asia. Nevertheless, liquidity indicators remain somewhat low compared to other regions amidst rising loan-to-deposit ratios.

**Figure 5. Asian Bank Balance Sheet Positions**

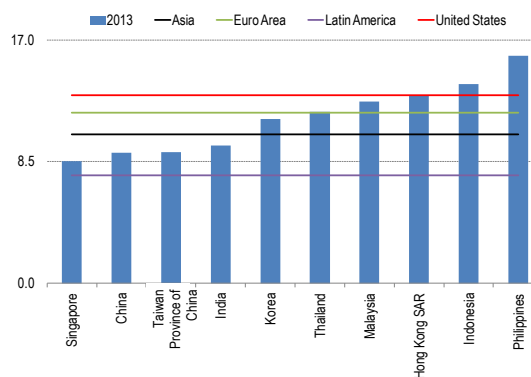
**Return on Bank Assets**

(percent; asset-weighted average)



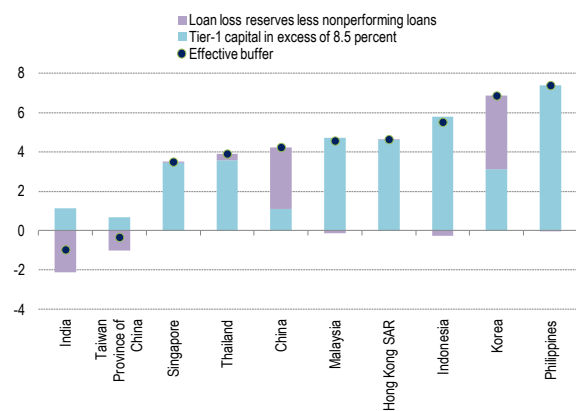
**Tier-1 Capital Ratio <sup>1/</sup>**

(percent; asset-weighted average)



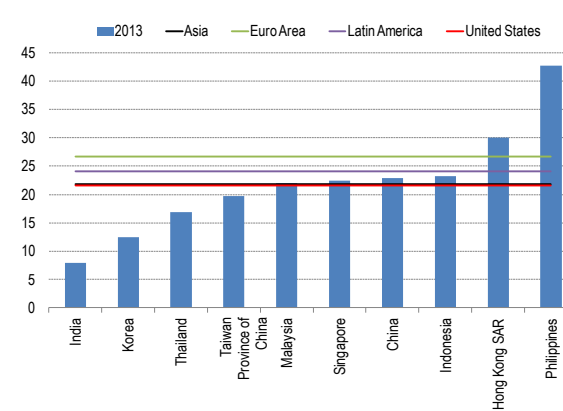
**Commercial Banks' Loss Absorbing Buffers<sup>2/</sup>**

(percent of risk-weighted assets; asset-weighted average)



**Liquidity Ratio <sup>3/</sup>**

(percent; asset-weighted average)



Sources: Bankscope; and IMF staff calculations.

<sup>1/</sup> The coverage may differ significantly from core financial soundness indicators data reported to the IMF.

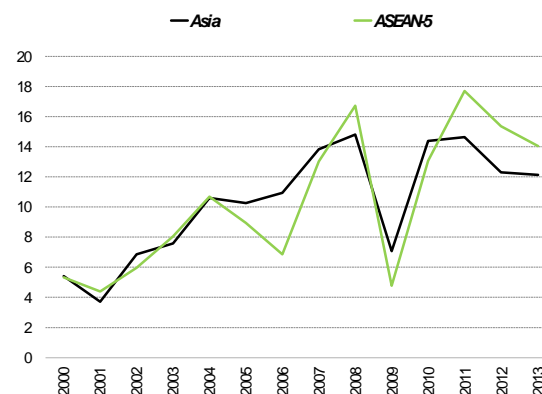
<sup>2/</sup> Loss absorbing buffers are calculated as Tier-1 capital in excess of 8.5 percent plus loan loss reserves less impaired loans as percent of total risk-weighted assets.

<sup>3/</sup> Total liquid assets/(total deposits + short-term borrowing + other short-term liabilities).

### C. Recent developments in credit growth and funding structure

While banks' balance sheets remain strong as noted above, credit growth has also been rising, apart from the abrupt slump seen during the global financial crisis (Figure 6). The strong credit growth has given rise to higher loan-to-deposit ratios (LDRs) in some Asian economies, as shown for a few countries in Figure 7. To sustain loan expansion, the rapid increase in LDRs was typically accompanied by rising non-core (non-deposit) funding as a share of total funding, such as interbank or wholesale funding, which are viewed as less stable than customer deposits. There is also evidence that some Asian banks have started to turn to external sources of funding, which can make them more vulnerable to changes in external funding conditions (Figure 8).

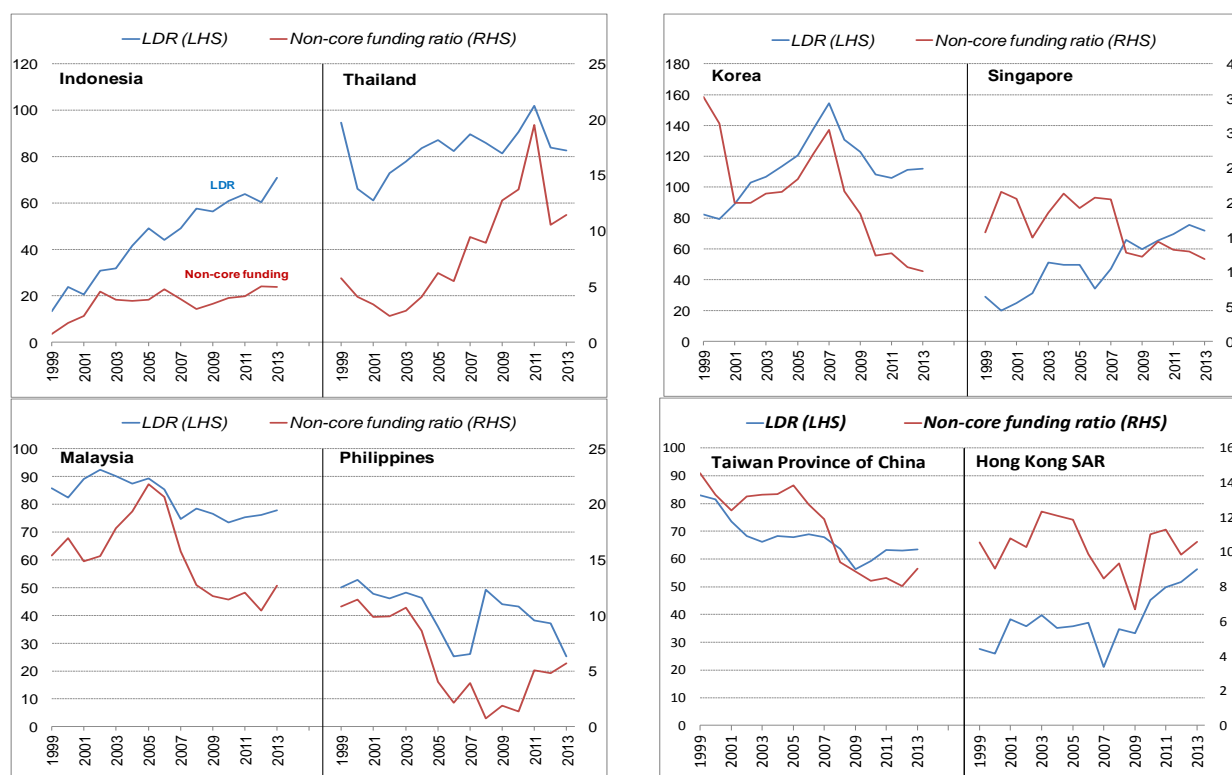
**Figure 6. Private Sector Credit Growth<sup>1</sup>**  
(Year-on-year percent change)



Sources: CEIC Data Co. Ltd; and Haver Analytics.

<sup>1</sup>Nominal growth is shown. See figure 1 for real credit growth.

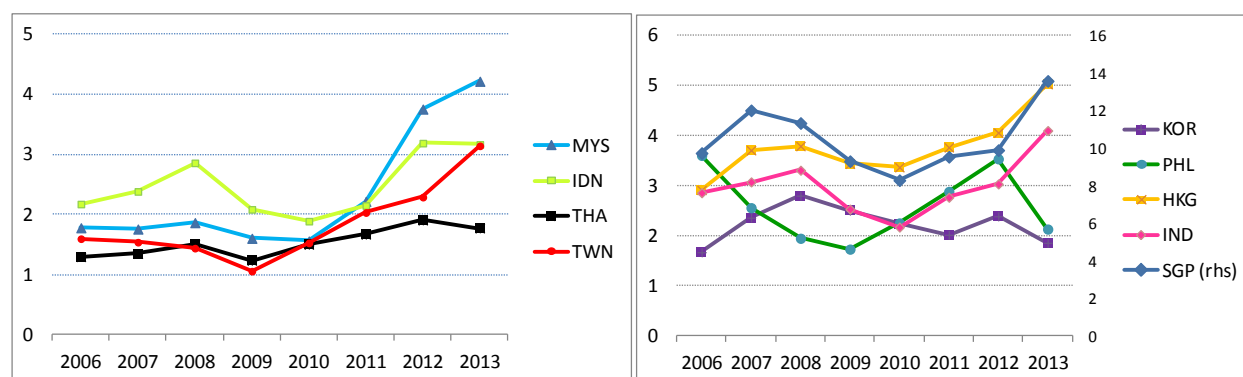
**Figure 7. Selected Asia: Loan-to-Deposit Ratio and Non-core Funding Ratio<sup>1</sup>**  
(In percent)



Sources: Bankscope; and IMF staff calculations.

Note: <sup>1</sup> Loan-to-deposit ratio of commercial banks excludes interbank transactions. Non-core funding ratio is calculated as the share of non-deposit funding in total funding. Both indicators are weighted average by bank assets.

**Figure 8. External Non-Core Funding Ratio<sup>1</sup>**  
(In percent)



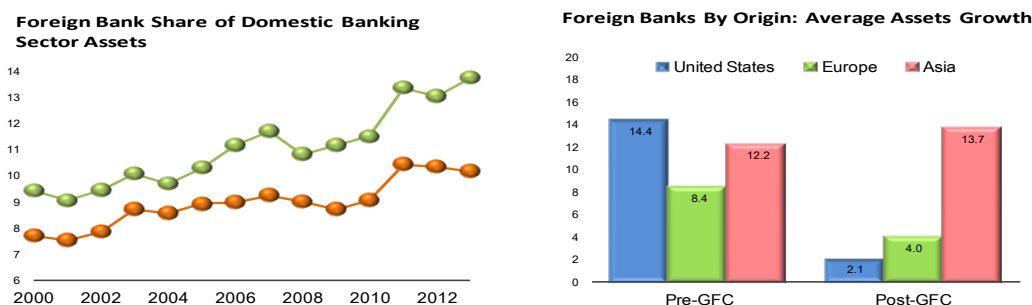
Sources: BIS Locational Banking Statistics; IMF, International Financial Statistics; and IMF staff calculations.

Note: <sup>1</sup> External non-core funding ratio is measured as the ratio of cross-border non-deposit liabilities of the banking sector vis-à-vis the BIS reporters to total funding of the banking sector in each country.

#### D. Foreign bank penetration

In parallel, foreign penetration of domestic banking sectors in Asia has also increased, possibly due to financial globalization and deregulation on foreign entry. In particular, strong growth in foreign banks from within the region, especially after the GFC, is evident, as opposed to those from Europe or the United States (Figure 9). The growth in regional foreign banks is largely due to greater internationalization of Chinese banks and the robust expansion of Japanese banks in the region. The increasing foreign bank presence in domestic banking systems contributes to changing the financial landscape, especially in terms of bank competition and the rise in non-core funding.<sup>12</sup> These developments may therefore impact monetary policy transmission in Asia.

<sup>12</sup> EM Asia's bank concentration remains high. However, based on the Herfindahl-Hirschman (HH) index we construct, EM Asia's bank concentration declined from 45 to 40 in the period of 2000-13. ASEAN-5 remains more concentrated with the HH index at 55 (although it too has declined by 5 percentage points over the same period). The index is calculated as:  $HH = \sum_{i=1}^N s_i^2$ , where  $s_i$  is the asset share of bank  $i$  in a country's total bank assets, and  $N$  is the number of banks in the country.

**Figure 9. Foreign Bank Penetration**

Sources: Bankscope, and IMF's staff calculations.

## V. EMPIRICAL ANALYSIS

Our empirical analysis consists of two parts. The first part attempts to gauge the existence of the broad credit channel at the aggregate macro-level using country-specific vector autoregression (VAR) models.<sup>13</sup> The second part, which is the main analytical contribution of this paper, examine how individual bank characteristics, ownership structure of the banking system, and global financial conditions affect the bank lending channel of domestic monetary policy transmission.

### A. Macro-level VARs

In this macro-level analysis, a vector autoregression (VAR) is applied to quarterly macroeconomic, seasonally adjusted, data from nine Asia economies (Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan Province of China, and Thailand) and five Latin America EMs (Brazil, Chile, Colombia, Mexico, and Peru), and other emerging markets (Hungary, Lithuania, Romania, Russia, Turkey, South Africa), covering the period of 1995Q1 to 2014Q2. Global variables and domestic variables included in the VAR are global commodity price index, US output, U.S. interest rate, domestic interest rate, domestic output, domestic prices, real bank credit, and the real effective exchange rate, where the global variables are assumed to be exogenous. Country-by-country VARs are estimated in log levels of the variables (except for interest rates), assuming a recursive Cholesky decomposition with the ordering of variables as listed above.<sup>14</sup>

The empirical approach follows Disyatat and Vongsinsirikul (2010). The existence of a broad credit channel is measured by comparing the difference in output response to interest rate shocks when real credit is treated as exogenous in the VAR—effectively removing any response within the VAR that passes through credit<sup>15</sup>—relative to when it is treated as endogenous. This

<sup>13</sup> This VAR approach may not be able to distinguish credit supply from credit demand, thus what we measure here is the broad credit channel rather than the bank lending channel which refers to the policy-induced change in credit supply alone.

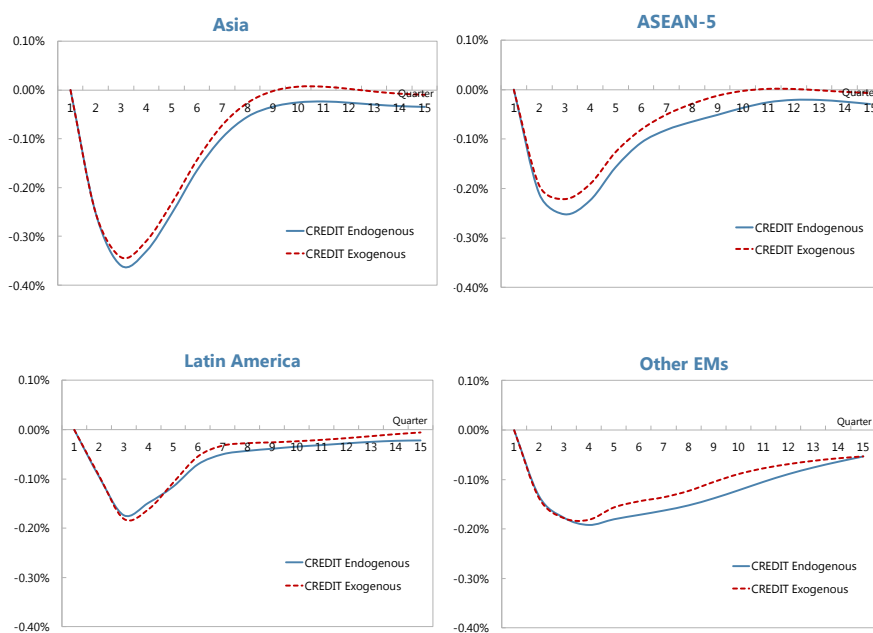
<sup>14</sup> As for a robustness check, VARs in first differences are also performed. The difference between the cumulative responses of output to interest rate shocks when credit is exogenous relative to when credit is endogenous also turns out to be very small.

<sup>15</sup> In other words, in the 'exogenous credit' setting, credit is not allowed to react to the endogenous variables in the VAR system, while the endogenous variables respond to the exogenous credit path.

exogeneity test provides a measure of the strength of the separate credit channel, which is in addition to the traditional interest rate channel.<sup>16</sup> If the output responses of interest rate shocks become substantially smaller when bank credit is exogenized from the system, that signifies the importance of the bank loan in amplifying the effect of monetary policy beyond what would be predicted by the traditional interest rate (cost of capital) channel alone.

These two versions of the VAR model are estimated for all countries in the sample. Average cumulative impulse responses of output to interest rate shocks across different groupings of countries by region, and with and without exogenized bank credit, are shown in Figure 10. Overall, an unexpected monetary policy tightening gives rise to a contraction of output which bottoms out after around 3–4 quarters.<sup>17</sup> One noticeable observation is that the size of the output response is significantly larger for the emerging Asia group than for the other non-Asia counterparts, implying a relatively stronger interest rate channel in Asian economies in general.

**Figure 10. Cumulative Response of Real GDP to One S.D. of Interest Rate Shock**



Source: IMF staff estimates.

Comparing the two models of VAR, the output response is indeed dampened (after about 2–3 quarters) when credit is exogenized. However, the difference is very small: the accumulated response of output after 8 quarters is only about one tenth lower, in terms of its output impact, when the credit channel is blocked off compared to the baseline case where interest rate effect is

<sup>16</sup> To the extent that an increase in interest rates also deteriorates firms' balance sheets, making it more difficult for firms to borrow from banks, a decline in bank credit, and subsequently in real activity, following an interest rate shock may also be due to this "balance sheet" channel of monetary policy transmission.

<sup>17</sup> Interest rate shocks correspond to an increase in interest rates by an average of 1.13 percent for Asia, 1.06 percent for ASEAN-5, 1.96 percent for Latin America, and 4.17 percent for other emerging markets in the sample.



allowed to pass through credit.<sup>18</sup> Although the finding that the credit channel appears quite weak is consistent with what has been found in previous studies, it may seem puzzling given the bank-dominated financial systems in most of the sample countries, especially in Asia.<sup>19</sup>

In the next part of the empirical analysis, which examines the bank lending channel using bank-level data, we will show that heterogeneity across banks and banking sector structures, combined with the exogenous impact of global financial conditions, may explain the relatively weak credit channel in these economies at the aggregate level.

## B. Bank-level panel regressions

To better understand the role of banks (and their characteristics) in the transmission mechanism, bank-level fixed-effects panels are applied to gauge the effect of changes in domestic policy rates on banks' loan growth.<sup>20</sup> The baseline model is specified as follows:

$$L_{i,j,t} = \alpha + \sum_{s=0}^1 \beta_s \cdot \Delta MP_{j,t-s} + \theta \cdot BankChar_{i,j,t-1} + \sum_{s=0}^1 \gamma_s \cdot BankChar_{i,j,t-1} \cdot \Delta MP_{j,t-s} \\ + \delta \cdot \Delta GDP_{j,t} + BankEffects_j + TimeEffects_t + u_{i,j,t}$$

where  $L_{i,j,t}$  denotes the growth rate of real credit by bank  $i$ , in country  $j$ , at time  $t$ .  $\Delta MP_{j,t}$  is the monetary policy stance measured as the first difference of the real policy or short-term interest rate. Both contemporaneous and the one-year lag of the monetary policy variable are included to allow for immediate and delayed responses of bank loans to interest rate shocks.  $BankChar_{i,j,t}$  is a vector of individual bank characteristics of interest, including bank size, type of ownership, liquidity, capitalization, and loan-to-deposit ratio. We use one-year lag values of the bank characteristics to reduce the potential endogeneity between loan growth and bank characteristics. Inclusion of the interaction terms between the monetary policy variable and bank characteristics allows us to isolate the indirect effect of monetary policy on loan growth that varies with bank characteristics (the bank lending channel) from the direct impact that is common across banks (the interest rate channel). To control for the demand effects on credit expansion, we include the growth rate of real GDP ( $\Delta GDP_{j,t}$ ) as a proxy for loan demand.<sup>21</sup> Finally, dummies for bank and time effects are included to capture bank- and year-specific factors that may matter for loan growth.

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<sup>18</sup> The confidence intervals for the two scenarios overlap in most cases, implying that they may not be statistically different from each other.

<sup>19</sup> In the case of Thailand, Disyatat and Vongsinsirikul (2010) suggest that the weakening of the bank lending channel may have been due to structural problems relating to non-performing loans during the post-Asian crisis period and, more recently, a smaller sensitivity of both bank loans to monetary policy and of output to bank loans as firms have increasingly turned to non-bank financing.

<sup>20</sup> See section II for review of past research that uses bank-level data in studying the bank lending channel. In particular, we follow mainly the strategy described in Wu, et al. (2011) in constructing the variables and designing the specification.

<sup>21</sup> The “balance sheet channel”—the potential impact of changes in monetary policy on *borrowers'* balance sheets and income statements which may affect their credit worthiness—cannot be directly controlled for since we do not have information on

Size of individual banks is defined as the log of total assets. Liquidity is a ratio of liquid assets to total assets. Bank capitalization is measured as a ratio of total equity-to-total assets. The loan-to-deposit ratio (LDR) is calculated as a ratio of non-interbank loans to total customer deposits. Bank asset size is normalized with respect to their average over banks in the same country and year. The resulting variable has a zero mean for each country and year. All other bank-specific characteristics are normalized with respect to the sample average across all banks and years in the same country. Two dummy variables—state-owned and foreign bank dummies—are constructed for bank ownership types based on the definition of state-owned and foreign banks, as discussed in the Data section. Private domestic banks thus constitute the baseline group in our regressions whenever the two ownership dummies are included. Our sample is an unbalanced panel. We estimate the model above using a fixed-effects panel regression method.<sup>22</sup> Standard errors are clustered at the bank level to address any remaining heteroskedasticity.

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firms' balance sheet, although balance sheet strength is likely correlated with output growth which is included as a proxy for the demand effects in the model.

<sup>22</sup> Many recent studies of the bank lending channel using bank-level data tend to estimate the loan growth equation using the dynamic panel data approach (eg. Arellano-Bond generalized method of moments) with a lagged dependent variable as a regressor based on the assumption of persistent loan growth. However, we do not find loan growth to be persistent or to have a dynamic process in our sample. This could be because our sample period covers atypical times in that it encompasses the global financial crisis. Moreover, we find that, although loan growth tends to persist from month to month, or quarter to quarter, it does not have strong persistence after a year. Thus, we deem the fixed-effects method to be appropriate.

## Bank-level panel results

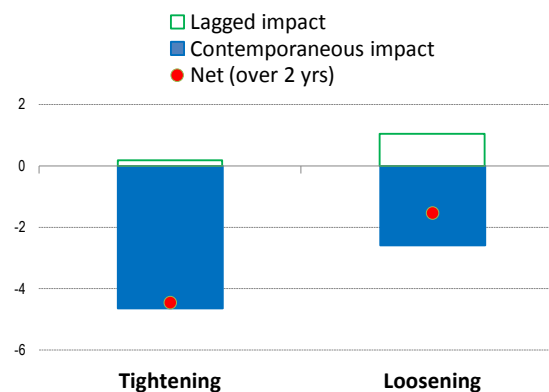
Key findings are summarized as follows:

### *Baseline results*

As predicted, loan growth responds negatively to a change in domestic monetary policy: a one percentage point increase in a policy rate leads to about a 1.3 percentage point decrease in the real loan growth rate on average (Table 1). This seemingly small effect of monetary policy shocks on loan growth may be explained by the asymmetric effects of monetary policy.

To test the asymmetry of monetary policy effectiveness, we create a dummy variable that is equal to 1 if a (net) change in the policy rate is greater than zero; and 0 otherwise.<sup>23</sup> Loan growth is found to decline by about 4.4 percentage points following a one-percentage-point monetary tightening (Figure 11). But the result is perverse in the loosening cycle as loan growth also declines in response to a decrease in interest rates.<sup>24, 25</sup>

**Figure 11: Impact of a One Percent Change in Policy Rate on Loan Growth during Tightening vs. Loosening Episodes (In percentage points)**



Source: IMF staff estimates.

Note: The results are based on fixed-effects panel regressions of banks' real credit growth on changes in real policy rate, controlling for global liquidity, domestic demand, bank characteristics, and bank and time fixed effects.

<sup>23</sup> Ideally, observations should be collected based on monetary policy cycles (instead of being aggregated over a year). But this is constrained by the availability of the bank balance sheet data which are reported on an annual basis. However, this problem is somewhat mitigated since most of the policy changes within a year are usually in the same direction.

<sup>24</sup> When we explore the asymmetric effects of monetary policy across different ownership types, we find that foreign-owned banks are those driving this perverse result in the loosening cycle, while state-owned and private domestic banks react in the expected direction (increasing loan supply) in response to monetary policy loosening but only marginally.

<sup>25</sup> Das (2015) also finds evidence of an asymmetric response of banks to monetary policy tightening and loosening in India.

**Table 1: Banks' loan growth response to monetary policy shocks 1/**

Dependent variable: Real loan growth	(1)	(2)
	Baseline	Asymmetric effects
MP	-0.399 (-0.638)	2.581** (2.484)
MP (t-1)	-0.926 (-1.792)	-1.052** (-2.375)
Positive MP dummy		-1.450 (-0.550)
MP * Positive MP dummy		-4.644*** (-2.822)
MP (t-1) * Positive MP dummy		0.191 (0.249)
Liquidity (t-1)	0.595* (2.160)	0.591*** (3.117)
Capital (t-1)	-0.445 (-1.397)	-0.334 (-0.792)
LnAsset (t-1)	-7.366** (-2.351)	-8.217* (-1.903)
GDP growth	1.980*** (4.392)	2.389*** (5.681)
Constant	5.880 (1.266)	12.177*** (3.953)
Observations	2,427	2,159
R-squared	0.097	0.132
Number of banks (countries)	257 (9)	257 (9)

Notes: This table presents the results of fixed effects panel regressions with bank-level and time fixed effects, using the sample of commercial banks operating in nine Asian countries. Standard errors are clustered at the bank level. Robust t-statistics are in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5% and 10 % levels, respectively.

1/ The column 2 in table 1 presents the asymmetry of monetary policy effectiveness, and therefore only includes observations during tightening and loosening episodes (i.e. excluding observations when there was no change in the policy rate); hence the number of observations differ in columns 1 and 2.

### ***Loan growth response by bank ownership***

We find that the response of credit growth to domestic monetary policy varies with the ownership type of individual banks. Results in Table 2 show that following a tightening of monetary policy, state-owned banks shrink their loan supply more sharply than do domestic private banks, while foreign banks react in a perverse direction. Figure 12 illustrates the differential effects of monetary policy on loan growth by type of bank ownership. A one percent increase in the policy rate results in a *reduction* of loan supply by 2.6 percent for state-owned banks, and 1.8 percent for domestic private banks, while foreign banks' loans *increase* by 0.3 percent.

**Table 2. Banks' Loan Growth Response to Monetary Policy Shocks:  
State-owned, Foreign, vs. Private Domestic Banks**

Dependent variable: Real loan growth	(1)	(2)
	Baseline	Interaction with ownership
MP	-0.399 (-0.638)	-0.265 (-0.446)
MP (t-1)	-0.926 (-1.792)	-1.499*** (-3.993)
MP * SOE		-0.435 (-0.448)
MP (t-1) * SOE		-0.592* (-1.992)
MP * FOREIGN		0.188 (0.223)
MP (t-1) * FOREIGN		1.908*** (3.606)
Liquidity (t-1)	0.595* (2.160)	0.588* (2.126)
Capital (t-1)	-0.445 (-1.397)	-0.455 (-1.452)
LnAsset (t-1)	-7.366** (-2.351)	-7.003* (-2.216)
GDP growth	1.980*** (4.392)	1.980*** (4.316)
Constant	5.880 (1.266)	5.589 (1.270)
Observations	2,427	2,427
R-squared	0.097	0.104
Number of banks (countries)	257 (9)	257 (9)

Notes: This table presents the results of fixed effects panel regressions with bank-level and time fixed effects, using the sample of commercial banks operating in nine Asian countries. Standard errors are clustered at the bank level. Robust t-statistics are in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5% and 10 % levels, respectively.

The finding that foreign banks are the least affected by domestic monetary policy likely reflects their funding ties to the parent bank, which allows them to cushion domestic monetary shocks.<sup>26</sup> In the same vein, because of their financial ties with parent banks, this result could also be driven by the parent banks' reallocation of liquidity and assets toward their headquarters and away from the host markets less affected by the crisis during the global crisis period, dampening the effect of expansionary monetary policy in the host economy.<sup>27</sup> Indeed, when we divide the sample into crisis- and non-crisis-periods, we find that the perverse outcomes on foreign banks' loans are more pronounced.

### Figure 12: Impact of a One Percent

<sup>26</sup> In fact, in the following subsection, we find that foreign banks respond more strongly to global financial conditions, rather than monetary policy in host countries, compared to domestic banks.

<sup>27</sup> This is in line with the literature that claims foreign banks to be a major channel of shock transmission. For example, using a sample of U.S. banks, Cetorelli and Goldberg (2012) find evidence that global banks usually manage liquidity on a global scale, actively using internal capital markets in reallocating funds in response to local shocks, thus contributing to international transmission of liquidity shocks and dampening the effect of domestic monetary policy. Jeon et. al. (2014) finds that foreign bank branches reduce their lending amidst expansionary monetary policy in Korea due to the existence of internal capital markets operated by multinational banks and the impact is larger than that of foreign subsidiaries.

The stronger response of state-owned commercial banks to domestic monetary policy could reflect their directed or quasi-fiscal lending that is not directly related to the financial characteristics of those banks. For example, in the economic downturn, stimulus measures through state-owned financial institutions is often used as a countercyclical policy tool by the government to shore up the economy. This would happen to coincide with monetary policy loosening, resulting in state-owned commercial banks appearing to respond more strongly to changes in monetary policy.<sup>28</sup>

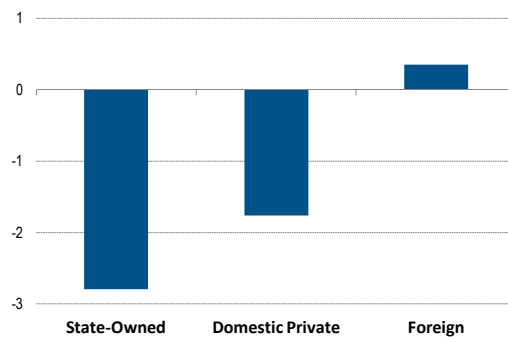
In any case, we find that domestic private banks do not appear to be very sensitive to monetary policy. This could be due to other bank characteristics that are prevalent in the banking sector that dominate the overall responsiveness of domestic private banks. We will turn to those issues shortly. On the whole, the results suggest that the effectiveness of monetary policy should depend on the relative presence of each type of bank ownership in the banking system.

Given the heterogeneity in the response of credit growth to domestic monetary policy, we further examine the variation in the impact by different types of bank business models within our sample of commercial banks. Following Roengpitya, et al. (2014), we calculate key balance sheet ratios, both on the assets and the liabilities sides, which reflect business models employed by individual banks. Figure 13 shows that the average state-owned banks has a strong orientation towards traditional banking activities (i.e. retail banking) with very high shares of gross loans and deposits, as well as other stable funding. The average domestic private bank also has similar business model characteristics, where stable funding, gross loans, and deposits remain high. On the other hand, foreign banks have significantly higher average wholesale debt and interbank borrowing ratios and lower share of deposit funding. On the asset side, however, domestic and foreign banks do not establish clear distinction in the asset ratios. Banks in Asia, including foreign-owned banks, on average do not seem to be active in trading activities; their main business remain in lending, though interbank lending is somewhat higher in the case of foreign banks.

**Figure 13: Bank Business Model Profiles:  
Average Value of Ratios to Total Assets (in percent) <sup>1/</sup>**

### Increase in Policy Rate on Loan Growth across Different Types of Bank Ownership

(In percentage points)



Source: IMF staff estimates.

Note: The results are based on fixed-effects panel regressions of banks' real credit growth on changes in real policy rate, controlling for global liquidity, domestic demand, bank characteristics, and bank and time fixed effects.

<sup>28</sup> One could argue that quasi-fiscal lending according to the non-commercial mandates, on the contrary, should result in a weak response of state-owned banks to monetary policy. This is true for the non-commercial bank sample where we find that state-owned banks (aka, "specialized financial institutions") response less to monetary policy.

	Domestic private	State-owned	Foreign	All banks
<b>Gross loans</b>	58.2	58.0	54.7	57.2
<b>Trade</b>	1.1	0.3	1.2	0.9
<b>Trading book</b>	0.9	0.2	0.9	0.8
<b>Interbank lending</b>	10.6	5.4	14.1	10.4
<b>Interbank borrowing</b>	4.9	4.3	7.9	5.6
<b>Wholesale debt</b>	8.1	8.1	8.3	8.2
<b>Stable fund</b>	77.5	82.0	69.1	76.2
<b>Deposits</b>	73.7	77.4	65.3	72.3
<i>Memo: Number of bank-years</i>	1,483	625	773	2,881

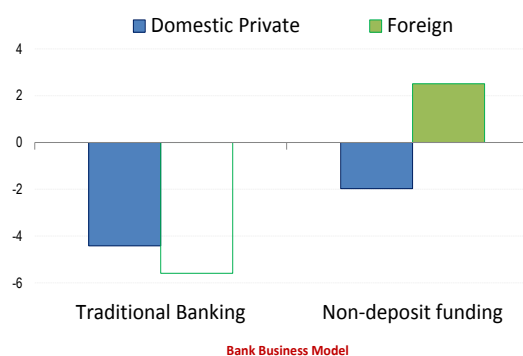
Source: Authors' calculations.

<sup>1/</sup> In percent of total assets excluding derivatives. Trade = trading assets plus liabilities, net of derivatives; trading book = trading securities plus fair value through income book; interbank lending = loans and advances to banks plus reverse repos and cash collateral; wholesale debt = other deposits plus short-term borrowing plus long-term funding; stable funding = total customer deposits plus long-term funding; interbank borrowing = deposits from banks plus repos and cash collateral.

We then divide our sample into “traditional banking” and “non-deposit (non-traditional) funding” subsamples by applying thresholds to the ratios in Figure 13, and run the same regressions as in Table 2.<sup>29</sup> Figure 14 illustrates that within the traditional banking business model, both domestic private and foreign banks both respond very strongly to monetary policy in host economies. It is the banks with non-traditional funding that respond significantly less, and even less so for foreign banks. This result provides further insight by showing that some foreign banks that are retail-funded (presumably locally), usually those entering the host country through merger and acquisition, may not behave differently from domestic banks. But foreign banks on average are more wholesale-oriented, and it is this group that are less responsive to domestic monetary policy.

**Figure 14: Impact of a One Percent Increase in Policy Rate on Loan Growth across Different Types of Bank Business Models<sup>1</sup>**

(In percentage points)



Source: IMF staff estimates.

Note: The results are based on fixed-effects panel regressions of banks' real credit growth on changes in real policy rate, controlling for global liquidity, domestic demand, bank characteristics, and bank and time fixed effects.

<sup>1/</sup> See definition in footnote 29.

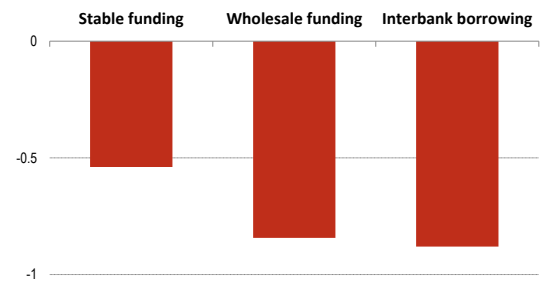
<sup>29</sup> Traditional banking subsample include banks that rely on deposits greater than 70 percent of total funding and have gross loans accounting for greater than 60 percent of total assets. Non-deposit funding banks are banks that rely on wholesale and interbank borrowing, and other non-deposit funds, greater than 30 percent of total funding.

### *The role of global financial conditions*

In light of increasing financial globalization and interconnectedness, we next examine whether global financial factors also play a role in influencing domestic credit supply. Global financial conditions are proxied by the Chicago Fed’s adjusted U.S. National Financial Conditions Index (NFCI) as described in the data section. A higher index indicates a tightening of global financial conditions. The results in Table 3 show that banks respond not only to changes in domestic monetary policy, but also to external financial conditions. A global financial tightening (loosening) reduces (increases) the size of banks’ loan portfolios, and the effect is stronger for financially-constrained banks (See Figure 17).<sup>30</sup> This is of relevance in the current context where banks in some Asian economies—after a prolonged period of low global interest rates and abundant global liquidity—have started to turn to wholesale or other external sources of funding, and away from typically more-stable deposit funding in order to sustain their loan growth. Rising LDRs and increasing reliance on wholesale funding raise banks’ sensitivity to external funding conditions, which are beyond the control of the domestic monetary authorities. Our results on bank business models confirm that banks with a funding structure more oriented towards wholesale funding and other non-traditional funding sources react more to global financial conditions compared to banks that rely on stable retail funding (Figure 15).

**Figure 15: Impact of a One Percent Increase in Global Financial Conditions on Loan Growth across Funding Structures**

(In percentage points)



Source: IMF staff estimates.

Note: The results are based on fixed-effects panel regressions of banks’ real credit growth on changes in global financial conditions, controlling for real policy rate, domestic demand, bank characteristics, and bank and time fixed effects.

<sup>1</sup> Retail funding, wholesale funding, and interbank borrowing subsamples include banks that belong to the top 25 percentile of the sample, that rely on customer deposits, wholesale debt, and interbank borrowing as a share of total funding, respectively.

<sup>30</sup> When we divide the sample into crisis (2008 and 2009) and non-crisis period, we find that the effect of global financial conditions (apart from global macro economic conditions) on domestic bank loans is more pronounced during the global financial crisis.



**Table 3. Banks' Loan Growth Response to Global Financial Conditions**

Dependent variable: Real loan growth	(1) Baseline	(2) Interaction with ownership
MP	-0.399 (-0.921)	-0.326 (-0.768)
MP (t-1)	-0.926** (-2.586)	-1.067*** (-3.047)
Global FCI	-0.112*** (-4.321)	-0.106*** (-4.045)
Global FCI (t-1)	0.030 (1.111)	0.041 (1.357)
Global FCI * SOE		-0.030 (-0.763)
Global FCI (t-1) * SOE		-0.135** (-2.398)
Global FCI * FOREIGN		-0.119** (-2.071)
Global FCI (t-1) * FOREIGN		0.195*** (2.760)
Liquidity (t-1)	0.595*** (3.247)	0.594*** (3.295)
Capital (t-1)	-0.445 (-1.093)	-0.417 (-1.034)
LnAsset (t-1)	-7.366* (-1.797)	-8.328** (-2.036)
GDP growth	1.980*** (5.022)	2.099*** (5.284)
Constant	0.249 (0.099)	-0.874 (-0.315)
Observations	2,427	2,427
R-squared	0.097	0.109
Number of banks (countries)	257 (9)	257 (9)

Notes: This table presents the results of fixed effects panel regressions with bank-level and time fixed effects, using the sample of commercial banks operating in nine Asian countries. Global financial conditions index (FCI) is the Chicago Fed's adjusted U.S. National Financial Conditions Index (NFCI). Standard errors are clustered at the bank level. Robust t-statistics are in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5% and 10 % levels, respectively.

### ***Bank balance sheet characteristics and the bank lending channel***

Following the bank lending channel literature, we test one of the main propositions—that the response of banks to monetary policy shocks differs depending on individual bank characteristics that proxy for their financial constraints or balance sheet strength. We interact the measure of monetary policy with bank size based on bank assets, capitalization, liquidity, and the loan-to-deposit ratio (LDR). We do not find bank size to be an important factor determining the credit supply response to monetary policy changes as the coefficients on the interaction terms between bank size and monetary policy are not statistically different from the baseline effect (Table 4).

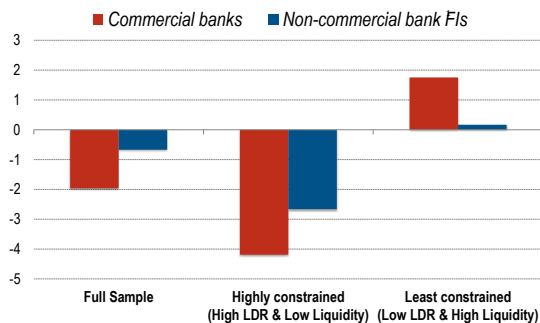
The interaction terms on capitalization are only weakly significant. This could be because capital adequacy ratios are generally not a binding constraint for most Asian banks, as capital ratios are well above regulatory floors. Rather, the liquidity ratio and the LDR appear to be financial constraints that impinge on monetary transmission. Less liquid banks and/or banks with higher LDRs are found to respond more strongly to domestic monetary policy shocks. Constrained by low liquidity and low capacity to extend new loans due to limited available deposits, loan supply

of those banks tends to be more affected by a change in the marginal cost of funding caused by monetary policy tightening. The right panel of Table 4 shows the differential effects of global financial conditions on credit growth of banks with different characteristics. Again, less liquid and high LDR banks are also more affected by changes in external financial conditions.

These findings tend to also hold for other types of financial institutions (FIs) such as development banks, saving banks, and cooperative banks included in our non-commercial-bank FI sample. However, the magnitude of the effects appears to be different, pointing to the importance of heterogeneity in the nature of business models and mandates of financial institutions that can be another source of differential responses to domestic monetary policy.

For illustration, we divide banks in the sample by their degree of liquidity and LDRs. We group banks belonging to the top 30 percentile of LDRs and bottom 30 percentile of liquidity into one group (called “highly constrained”), and banks that belong to the bottom 30 percentile of LDRs and top 30 percentile of liquidity into another group (called “least constrained”). Figure 16 shows that the most financially constrained banks and non-bank FIs will shrink their loan portfolio by about three times more than the average bank (full-sample result) following a contractionary monetary policy shock. In fact, the least constrained banks contradict standard theory by continuing to expand their loan portfolios, notwithstanding the tightening of domestic monetary policy. This result lends support to the existence of the bank lending channel based on the hypothesis that banks with stronger balance sheet positions will be able to protect their loan portfolio against changes in monetary policy, whereas lending by weaker banks will be more sensitive to such shocks (e.g., Kashyap and Stein, 1995).

**Figure 16. Impact of a One Standard Deviation Increase in Policy Rate on Loan Growth** <sup>1,2</sup> (In percentage points)



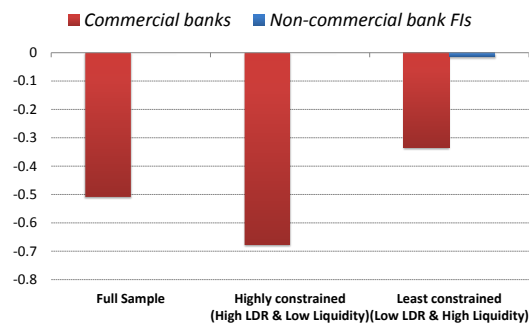
Source: IMF staff estimates.

<sup>1</sup> The results are based on fixed-effects panel regressions of banks’ (or non-commercial bank FIs’) real credit growth on changes in real policy rate, controlling for global liquidity, domestic demand, bank characteristics, and bank and time fixed effects.

<sup>2</sup> One S.D. = 2.6 percentage point change of policy rate (cumulative change over one year).

<sup>3</sup> Non-commercial bank FIs include savings banks, cooperative banks, real estate and mortgage banks, investment banks, other non-banking credit institutions, specialized governmental credit institutions, and micro-financing institutions.

**Figure 17. Impact of a One Standard Deviation Increase in Global Liquidity Conditions on Loan Growth** <sup>1,2</sup> (In percentage points)



Source: IMF staff estimates.

<sup>1</sup> The results are based on fixed-effects panel regressions of banks’ (or non-commercial bank FIs’) real credit growth on changes in global financial condition, controlling for real policy rate, domestic demand, bank characteristics, and bank and time fixed effects.

<sup>2</sup> One S.D. = 0.6 percentage point change of Global Financial Condition Index

<sup>3</sup> Non-commercial bank FIs include savings banks, cooperative banks, real estate and mortgage banks, investment banks, other non-banking credit institutions, specialized governmental credit institutions, and micro-financing institutions.

**Table 4. Banks' Loan Growth Response to Domestic Monetary Policy and Global Financial Conditions:  
Interaction with Bank Balance Sheet Characteristics**

Dependent variable: Real loan growth	Domestic monetary policy						Dependent variable: Real loan growth	Global financial conditions					
	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)	(9)	(10)	(11)	(12)
MP	0.160 (0.349)	0.267 (0.560)	0.155 (0.336)	0.184 (0.384)	1.753 (1.539)	0.715 (0.604)	MP	0.160 (0.349)	0.196 (0.426)	0.158 (0.344)	0.166 (0.363)	0.025 (0.055)	0.082 (0.178)
MP (t-1)	-0.909** (-2.378)	-1.144*** (-3.103)	-0.869** (-2.360)	-0.861** (-2.530)	0.003 (0.004)	-0.931 (-1.150)	MP (t-1)	-0.909** (-2.378)	-0.916** (-2.390)	-0.912** (-2.377)	-0.922** (-2.495)	-1.026*** (-2.819)	-1.022*** (-2.814)
Global FCI	-0.102*** (-3.750)	-0.099*** (-3.654)	-0.102*** (-3.754)	-0.101*** (-3.707)	-0.106*** (-4.019)	-0.101*** (-3.763)	Global FCI	-0.102*** (-3.750)	-0.105*** (-3.877)	-0.102*** (-3.745)	-0.101*** (-3.724)	-0.099*** (-3.737)	-0.100*** (-3.750)
Global FCI (t-1)	0.015 (0.528)	0.022 (0.786)	0.015 (0.533)	0.015 (0.535)	0.018 (0.651)	0.023 (0.828)	Global FCI (t-1)	0.015 (0.528)	0.027 (0.955)	0.015 (0.516)	0.017 (0.596)	0.120** (2.359)	0.123** (2.316)
MP * Liquidity (t-1)		0.130*** (3.182)				0.118*** (3.064)	Global FCI * Liquidity (t-1)		0.008** (2.248)				0.008** (2.434)
MP (t-1) * Liquidity (t-1)		0.074*** (5.371)				0.065** (2.441)	Global FCI (t-1) * Liquidity (t-1)		0.003 (1.035)				-0.001 (-0.389)
MP * Capital (t-1)			-0.021 (-0.383)			-0.015 (-0.244)	Global FCI * Capital (t-1)			0.000 (0.098)			0.001 (0.144)
MP (t-1) * Capital (t-1)			0.035 (0.655)			0.024 (0.433)	Global FCI (t-1) * Capital (t-1)			-0.001 (-0.178)			0.003 (0.735)
MP * LnAsset (t-1)				-0.155 (-0.643)		-0.006 (-0.023)	Global FCI * LnAsset (t-1)				0.015 (0.795)		0.028 (1.504)
MP (t-1) * LnAsset (t-1)				-0.497** (-2.270)		-0.204 (-0.750)	Global FCI (t-1) * LnAssets (t-1)				-0.038 (-1.396)		-0.040 (-1.524)
MP * LDR (t-1)					-0.023* (-1.677)	-0.007 (-0.489)	Global FCI * LDR (t-1)					-0.001 (-0.959)	-0.000 (-0.112)
MP (t-1) * LDR (t-1)					-0.014*** (-2.626)	-0.002 (-0.314)	Global FCI (t-1) * LDR (t-1)					-0.002** (-2.595)	-0.003*** (-2.773)
Liquidity (t-1)	0.542*** (2.817)	0.604*** (3.159)	0.545*** (2.809)	0.532*** (2.720)	0.561*** (2.828)	0.607*** (3.078)	Liquidity (t-1)	0.542*** (2.817)	0.842*** (4.612)	0.542*** (2.811)	0.539*** (2.806)	0.612*** (3.280)	0.802*** (4.326)
Capital (t-1)	-0.328 (-0.796)	-0.295 (-0.708)	-0.326 (-0.802)	-0.343 (-0.844)	-0.447 (-1.031)	-0.384 (-0.902)	Capital (t-1)	-0.328 (-0.796)	-0.385 (-0.955)	-0.347 (-0.669)	-0.291 (-0.707)	-0.642 (-1.429)	-0.497 (-0.968)
LnAsset (t-1)	-7.764* (-1.795)	-7.628* (-1.776)	-7.607* (-1.754)	-7.742* (-1.816)	-8.633* (-1.958)	-8.493* (-1.930)	LnAsset (t-1)	-7.764* (-1.795)	-8.288* (-1.963)	-7.754* (-1.796)	-8.387** (-2.019)	-9.147** (-2.157)	-9.850** (-2.383)
GDP growth	2.485*** (6.117)	2.555*** (6.305)	2.498*** (6.129)	2.487*** (6.099)	2.453*** (6.098)	2.533*** (6.196)	GDP growth	2.485*** (6.117)	2.482*** (6.156)	2.483*** (6.067)	2.516*** (6.197)	2.296*** (5.661)	2.363*** (5.770)
Constant	-2.990 (-1.185)	-3.114 (-1.237)	-3.061 (-1.211)	-2.967 (-1.169)	-2.782 (-1.099)	-2.903 (-1.137)	Constant	-2.990 (-1.185)	-2.969 (-1.178)	-2.980 (-1.176)	-3.204 (-1.264)	-8.087** (-2.365)	-8.076** (-2.349)
Observations	2,159	2,159	2,159	2,159	2,150	2,150	Observations	2,159	2,159	2,159	2,159	2,150	2,150
R-squared	0.124	0.138	0.125	0.128	0.131	0.141	R-squared	0.124	0.133	0.124	0.126	0.140	0.149
Number of banks (countries)	228 (7)	228 (7)	228 (7)	228 (7)	227 (7)	227 (7)	Number of banks	228 (7)	228 (7)	228 (7)	228 (7)	227 (7)	227 (7)

Notes: This table presents the results of fixed effects panel regressions with bank-level and time fixed effects, using the sample of commercial banks operating in seven Asian countries. Global financial conditions index (FCI) is the Chicago Fed's adjusted U.S. National Financial Conditions Index (NFCI). Standard errors are clustered at the bank level. Robust t-statistics are in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5% and 10% levels, respectively.

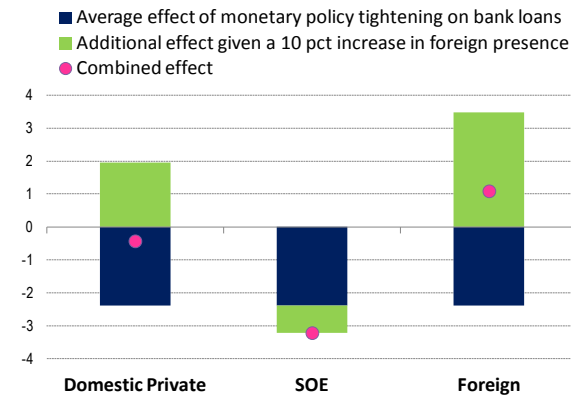
### *Foreign bank penetration and the effectiveness of domestic monetary policy*

Higher foreign bank penetration in the domestic banking system is found to reduce the responsiveness of *all* banks' loan growth to domestic monetary policy (Table 5).<sup>31</sup> Importantly, we find that the reduction in sensitivity extends beyond the foreign bank subsidiaries themselves, to all the domestic private banks. Figure 18 illustrates that a 10 percentage point increase in foreign presence in the domestic banking system reduces the effect of monetary policy tightening on domestic private banks, shifting it from a 2.4 percent contraction of loan growth to a net contraction of 0.4 percent. In the case of foreign banks, a 10 percentage point increase in foreign presence neutralizes the effect of monetary policy, inducing them to increase their credit growth. In contrast, state-owned banks react even more strongly to monetary policy in the presence of higher foreign bank penetration. The net impact on economy-wide loan growth will therefore depend on the ownership structure of the banking sector.

The finding that larger foreign bank presence in the domestic economy reduces the effectiveness of monetary policy on domestic private banks may reflect their greater access to non-central bank funding through the interbank, wholesale, or external funding markets, thereby making loan supply less sensitive to domestic monetary policy.<sup>32</sup> In addition, credit supply may be less sensitive to changes in marginal funding costs when banks are striving to preserve their loan market shares in the face of increased competition due to foreign bank entry. This result is especially important given the backdrop of growing foreign bank penetration in the Asia (see stylized facts above).

### **Figure 18. Impact of Foreign Presence on Monetary Policy Transmission to Loan Growth**

(In percentage points)



Source: IMF staff estimates.

Note: Foreign bank presence is a percentage share of foreign bank assets in total domestic banking sector assets. The results are based on fixed-effects panel regressions of banks' (or non-commercial bank FIs') real credit growth on changes in real policy rate, controlling for global liquidity, domestic demand, bank characteristics, and bank and time fixed effects. One S.D. = 2.6 percentage point change of policy rate (cumulative change over one year).

<sup>31</sup> Foreign bank penetration is proxied by the share of foreign bank assets in total domestic banking sector assets. We also check for robustness using instead the share of foreign bank loans in total domestic banking sector loans. The main results are unchanged. As a caveat, however, our foreign presence measure may understate the true level of foreign bank participation, since we do not include foreign bank branches due to data unavailability. As noted in IMF (2011), in several Asian economies (apart from Asian financial centers), foreign bank branches have an equally or larger presence compared to foreign subsidiaries. For instance, in the Philippines, total assets of foreign branches are 50 percent larger than total assets of foreign subsidiaries. In Korea, assets of foreign branches are only marginally smaller than those of foreign subsidiaries.

<sup>32</sup> Asia's growing cross-border bank lending and increased (foreign-currency) corporate bond financing in recent years may further weaken the bank lending channel of domestic monetary policy.

One might argue that an increase in foreign bank presence in the domestic banking system merely reflects greater bank competition (i.e. simply an increase in the number of banks) or simply more financial openness. As a robustness check, we thus run separate regressions adding (1) bank competition, and (2) financial openness, as an additional control variable as well as interacting it with the monetary policy variables.<sup>33</sup> It should be noted that the presence of foreign banks and the degree of bank competition are highly correlated. Due to multicollinearity problems, bank competition enters the regression with no statistical significance. Nevertheless, the main results regarding the impact of foreign presence on monetary policy effectiveness remain robust, though the size of the coefficients on the interaction terms between foreign presence and monetary policy are reduced. Financial openness and its interaction terms with monetary policy enter the regression with no significance and do not alter the key results stated above.

We also investigate further effects of country-of-origin of foreign banks in Asia (Table 5, columns 3 and 4). We find that the dampening effect of foreign bank presence on monetary policy effectiveness is stronger when foreign banks originate within the region. This could be because the region's foreign banks are more inclined to compete directly with domestic banks, especially in retail banking sector, unlike European or US banks that might focus on different business activities, such as catering to multinational clients and foreign exchange business.

So far, we have shown that through the bank lending (“quantity”) channel, the impact of monetary policy on loan growth may be hampered by foreign bank participation in the domestic banking system. To touch upon the interest rate channel (“price” channel) of monetary policy, we run separate regressions on the response of individual banks’ deposit and lending interest rates to monetary policy shocks.<sup>34</sup> The results in Table 6 suggest that higher foreign bank participation, while weakening the bank lending channel, in fact *strengthens* the interest rate channel. Given oligopolistic structure of banking sectors common in Asia, one explanation for this result may be that increased bank competition brought about by foreign bank entry could undermine the collusive power of the domestic incumbent banks, thus increasing the interest rate pass-through in the banking system. The effects are stronger on banks’ deposit rates than their lending rates.

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<sup>33</sup> Bank competition is measured by the Herfindahl-Hirschman (HH) bank concentration index, calculated as:  $HH = \sum_{i=1}^N s_i^2$ , where  $s_i$  is the asset share of bank  $i$  in country's total bank assets, and  $N$  is the number of banks in the country. A higher HH index implies less competition. Financial openness is proxied by the Chinn-Ito index (Chinn and Ito, 2006).

<sup>34</sup> Ideally, the bank-specific interest rates used here should be marginal lending rates and deposit rates. However, due to lack data, we proxy them by average lending and deposit rates, calculated as interest income (expense) divided by earning assets (total deposits).

**Table 5. Banks' Loan Growth Response to Monetary Policy Shocks:  
The Effect of Foreign Bank Presence in the Domestic Banking Sector**

Dependent variable: Real loan growth	(1) Baseline	(2) Foreign Presence (All foreign banks)	(3) Foreign Presence (Non-Asian foreign)	(4) Foreign Presence (Asian foreign)
MP	-0.243 (-0.395)	-0.029 (-0.047)	-0.007 (-0.011)	-0.045 (-0.083)
MP (t-1)	-3.293*** (-6.182)	-3.134*** (-6.157)	-3.456*** (-6.099)	-2.740*** (-6.440)
Foreign Presence	1.184** (2.309)	1.170** (2.284)	0.942* (1.740)	5.872** (2.356)
MP * Foreign Presence	0.034 (0.562)	0.046 (0.542)	0.073 (0.631)	0.125 (0.434)
MP (t-1) * Foreign Presence	0.196*** (3.861)	0.150** (2.567)	0.241*** (2.842)	0.369** (1.992)
MP * Foreign Presence * SOE		-0.199*** (-2.705)	-0.261*** (-2.724)	-0.756*** (-2.588)
MP (t-1) * Foreign Presence * SOE		-0.080* (-1.662)	-0.110* (-1.659)	-0.285 (-1.602)
MP * Foreign Presence * FOREIGN		0.038 (0.413)	0.053 (0.432)	0.147 (0.438)
MP (t-1) * Foreign Presence * FOREIGN		0.114* (1.843)	0.154* (1.799)	0.427** (1.987)
Liquidity (t-1)	0.547*** (2.953)	0.546*** (2.974)	0.551*** (2.980)	0.583*** (3.306)
Capital (t-1)	-0.376 (-0.893)	-0.369 (-0.880)	-0.371 (-0.888)	-0.413 (-0.979)
LnAssets (t-1)	-9.505** (-2.205)	-9.613** (-2.237)	-9.612** (-2.234)	-8.836** (-2.023)
GDP growth	2.243*** (5.054)	2.255*** (5.060)	2.329*** (5.283)	2.333*** (5.182)
Constant	-5.719 (-1.105)	-5.818 (-1.132)	-2.570 (-0.565)	-6.538 (-1.210)
Observations	2,159	2,159	2,159	2,159
R-squared	0.124	0.138	0.125	0.128
Number of banks (countries)	228 (7)	228 (7)	228 (7)	228 (7)

Notes: This table presents the results of fixed effects panel regressions with bank-level and time fixed effects, using the sample of commercial banks operating in seven Asian countries. *Foreign Presence* is a country-level variable measured as the share of foreign loans in the overall banking system loans. It is further divided into *Foreign Presence (Asia)* which covers only the share of loans by foreign banks whose parent banks are from Asian region, and *Foreign Presence (Non-Asia)* when parent banks are non-Asian. Standard errors are clustered at the bank level. Robust t-statistics are in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5% and 10 % levels, respectively.

**Table 6. Banks' Interest Rate Response to Monetary Policy Shocks:  
The Effects of Foreign Bank Presence**

Dependent variable:	(1) $\Delta$ Lending Rate	(2) $\Delta$ Deposit Rate
MP	-0.161 (-1.524)	0.064*** (2.661)
MP (t-1)	-0.044 (-0.428)	0.088*** (4.117)
Foreign Presence (t-1)	0.074 (1.066)	-0.010 (-0.750)
MP * Foreign Presence (t-1)	0.009* (1.782)	0.003* (1.737)
MP (t-1) * Foreign Presence (t-1)	0.005 (1.023)	0.004** (2.519)
LnAsset (t-1)	-0.487 (-0.262)	0.413*** (3.296)
Capital (t-1)	0.029 (0.367)	-0.012 (-1.087)
Liquidity (t-1)	-0.070* (-1.807)	-0.001 (-0.101)
GDP growth	0.047 (1.116)	0.059*** (3.699)
Constant	-1.269 (-1.182)	-1.190*** (-4.084)
Observations	2,416	1,665
R-squared	0.013	0.388
Number of banks (countries)	251	226

Notes: This table presents the results of fixed effects panel regressions with bank-level and time fixed effects, using the sample of commercial banks operating in nine Asian countries. Foreign Presence is a country-level variable measured as the share of foreign loans in the overall banking system loans. Standard errors are clustered at the bank level. Robust t-statistics are in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5% and 10% levels, respectively.

## VI. CONCLUSION

In view of Asia's bank-dominated financial systems where bank loans remain the primary financing source for the corporate sector and for households, banks play a pivotal role in the effectiveness of monetary policy transmission in Asia. This paper examines how bank characteristics influence the effectiveness of domestic monetary policy transmission in emerging economies in Asia, particularly in the presence of increased financial globalization. The analysis suggests that the bank credit channel in Asia may not be as strong as might be expected based on the importance of bank-based financing. Using aggregate data, the vector-autoregression results indicate that the marginal contribution of the credit channel of monetary policy—above and beyond the separate interest rate channel—to output growth is quite weak.

Using bank-level panel data from nine emerging economies in Asia, we find that heterogeneity across banks and in banking sector structures, together with exogenous global financial conditions, tend to dampen the credit response to domestic monetary policy changes. Specifically, banks that are more financially constrained, as reflected by low liquidity or a higher loan-to-deposit ratio, will respond more strongly to changes in monetary policy. The effectiveness of monetary policy also depends on the ownership of individual banks, with foreign-owned banks the least responsive to domestic monetary policy. Moreover, external financial conditions are found to affect the behavior of all banks in the system, making it more difficult for central banks to

fine tune domestic activity in the face of increasing global financial interconnectedness which loosens the ties between bank funding and domestic monetary policy. Another effect of financial globalization manifests through the size of the foreign bank presence in the domestic economy. We find that higher foreign bank penetration in the domestic banking system reduces the credit response of foreign and domestic private banks to changes in domestic monetary policy.

Overall, the analysis here implies that bank characteristics are an important determinant of the efficacy of monetary policy. These bank characteristics interact with external financial conditions and banking sector structure in explaining in the net effect of monetary policy. Our findings, thus, highlight the importance of identifying key characteristics of banks and the banking system—including ownership structure, degree of competition, funding sources, and financial conditions—in order to gain a better understanding of the monetary transmission mechanism across economies and at different periods of time.

The analysis also suggests that the transmission of monetary policy is weakened in the presence of global financial integration, reflecting the direct and indirect effects of greater foreign bank penetration. This finding implies that policymakers will face a more challenging policy setting environment when global financial conditions are not aligned with those that are warranted to meet domestic monetary policy objectives. The policy tradeoff between macro stabilization and financial stability will also become harsher as financial spillovers become more rampant. Policymakers will therefore need to internalize the effects of financial globalization and greater foreign bank presence on monetary policy effectiveness and recalibrate interest rate decisions accordingly, while also standing ready to use other supporting policy instruments. To this end, effective macroprudential policies would not only safeguard the stability of the financial system as a whole, but also help maintain the conditions in which the monetary policy could remain effective and primarily focused on price and output stability.



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