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

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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, the 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 the 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 the aggregate level.

Keywords: Monetary policy transmission; bank lending channel; financial globalization
JEL Classifications: E50; E52; E59

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1. Introduction

In view of Asia's bank-dominated financial systems, banks represent an important conduit for the transmission of domestic monetary policy. Banks are the primary financing source for both the corporate sector and households throughout most of Asia.[1] However, banks across Asia, and even within a single country, are far from homogeneous in terms of key characteristics that may impact policy transmission. Discerning how banks react to changes in monetary policy is, therefore, important in 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 varying characteristics and financial strengths adjust their loan supply differently in response to changes in monetary policy.[2] Our study is motivated by anecdotal and early empirical evidence that the bank lending channel, or more generally the broad credit channel, is not particularly strong at the aggregate level in Asia — a finding which is puzzling in view of the pervasiveness of bank-based financial systems in most Asian economies. We conjecture that the weak aggregate response to monetary policy may mask a significant variation in responses at the level of individual banks. A bank-level data analysis that allows heterogeneity across banks to play a distinctive role in the transmission mechanism may, therefore, be a key to solving this puzzle. 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 formulating monetary and financial sector policies.

We explore the effectiveness of the lending channel in the face of ongoing changes in both 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 — in turn may alter the way domestic banks behave.

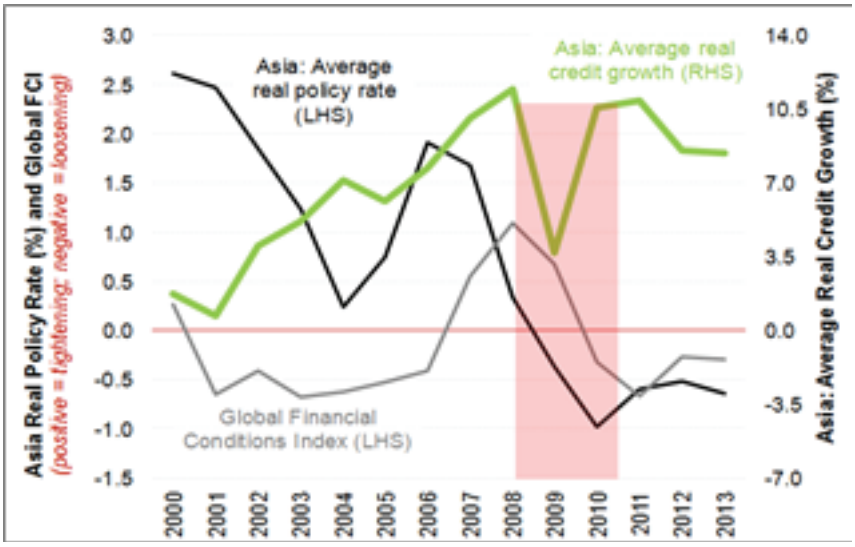
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[1] Banks have been an important source of finance in most Asian economies. The total size of banks' private credit in emerging Asia is roughly 70-80 percent of GDP. Although stock markets have been growing quite rapidly, access to stock markets as 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.

[2] The bank lending channel is one of two possible mechanisms within the credit channel (Bernanke and Gertler, 1995). It emphasizes 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, a risk-taking channel has been identified as another bank-based transmission mechanism (Borio and Zhu, 2007).

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, notwithstanding domestic monetary policy tightening during 2005–2007 against the backdrop of loose global financial conditions (Figure 1). Until recently, both domestic monetary policies and global financial conditions were kept loose. Going forward, a challenge for policymakers lies, therefore, in 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[3]



Sources: Haver Analytics; CEIC data co. ltd; US Federal Reserve; and authors' calculations.

Taken together, the key questions raised 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?

[3] Global financial conditions index refers to 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.

- To what extent do global financial conditions matter for domestic credit expansion in Asia?

Our Vector Autoregression analysis using macroeconomic data on claims from the private sector in Asian economies suggests that the credit channel (distinct from the interest rate channel) plays a very small amplifying role affecting aggregate GDP. Using a bank-level panel dataset of about 300 banks from nine Asian economies drawn from the period 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 banks contract their loan supply to the greatest degree. Domestic private banks display a much lower sensitivity, while foreign banks are found to, perversely, increase their credit supply.[4] In addition, more financially constrained banks (measured by a higher loan-to-deposit ratio (LDR) or a low liquidity ratio, compared to their peers) will shrink their loan portfolio by a higher rate than the average of banks as a whole, 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 potentially becomes 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 2 reviews the existing work on bank lending channels and places the paper in the context of the relevant literature. Section 3 outlines the data. Section 4 displays key stylized facts within 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 5 presents the econometric methodology and discusses the empirical results. Section 6 concludes.

2. Related Literature

The role of banks in monetary policy transmission has been extensively studied in the context of analyzing 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

[4] This result could also be interpreted as foreign banks reducing their loan supply after a monetary policy loosening, as was the dominant case during the Global Financial Crisis.

the role of imperfect information and other frictions within credit markets which 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 constructed based on the theoretical prediction that the external finance premium facing a borrower should depend on that 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 attempted to test for the existence of such a bank lending channel using aggregate data (Bernanke and Blinder, 1992, and Kashyap et al., 1993). However, the main obstacle in investigating the bank lending channel lies in 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 which constitute a distinct bank lending channel. To overcome this problem, recent studies have increasingly resorted to employing 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 at a greater rate than the mean of banks as a whole. Using bank-level data, several studies have found 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). Bank ownership has also been used to proxy for financial constraints. For instance, Houstan and James (1998) found that the 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 a similar vein, Wu, et al. (2011) revealed that foreign banks are less responsive to monetary shocks in host countries. They suggest that the access of foreign banks to funding from parent banks through the internal capital market represents the most convincing explanation for this phenomenon.

Beyond testing for 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) studied the role of market structure in the banking sector and present 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 the loan supply less sensitive to interest rate shocks. The results

from Wu, et al. (2011) imply that the rise in foreign bank penetration has constituted another weakening of the bank lending channel in emerging Asia and Latin America. Furthermore, Altunbas, et al. (2009) found 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 for 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 constitute either an important proxy for bank balance sheet conditions or represent 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 investigate whether bank loan supply also reacts to global financial conditions, which potentially 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, based on the premise that non-Asian (i.e., European or United States) multi-national banks may have strategies and approaches being expedited within their Asian operations that differ from those of 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 channels of monetary policy that go beyond the traditional banking sector.

3. 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 is sourced

from Bureau van Dijk's Bankscope database covering the years 2000 to 2013 with respect to nine Asian economies. The main data set comprises commercial banks from the Asian economies of Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand, and the Taiwan Province of China.[5] After removing outliers, there are a total of 3,393 bank-level observations within the main dataset.[6] 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 (Table 1). 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.[7] The total bank coverage in our non-commercial-bank financial institution sample comprises 137 units. With regard to 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 2).

The dataset is constructed primarily with unconsolidated data from the Bankscope database. Where unconsolidated data is not available — for instance in very few cases where only one form of account 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 host country's government, an entity outside the host country, or by domestic private entities within the host country, respectively.[8] We employ the following strategy to identify the ownership information.

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[5] We originally included 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 cause a bias in the overall results due to the large number of banks involved. Thus, we excluded China from our sample and leave it for future research.

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

[7] 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.

[8] The cutoff of 51 percent for defining a type of ownership may be considered arbitrary and may not reflect the real 'control' of the bank. For instance, a foreign shareholder may hold, say, 25 percent of a bank, but still be regarded as a major shareholder who can assert a considerable degree of control over the bank. Nevertheless, we still consider a 51 percent cutoff to be appropriate for our purposes since we aim to differentiate foreign banks from domestic banks in terms of the balance sheet linkages or financial ties with a foreign parent bank (with an assumption that financial institutions with lower than 51 percent foreign ownership are less likely to have close financial ties), not a control over the bank policy per se.

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, Central Banks' websites, as well as Internet articles and news related to these banks to identify bank ownership information. Subsequently, we use the Bureau van Dijk's Zephyr database, a comprehensive mergers and acquisitions database with integrated detailed company information, to identify any ownership changes that have 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.[9]

Table 1. Sample Coverage

Commercial Bank Sample

	State-Owned	Foreign	Domestic Private	Total	Coverage[1] (%)	
					No. of Banks	Bank loans
HKG	0	15	5	20	62%	92%
IDN	5	23	26	54	48%	76%
IND	25	5	23	53	35%	86%
KOR	3	2	10	15	58%	46%
MYS	5	13	5	23	83%	72%
PHL	2	10	18	30	83%	71%
SGP[2]	0	2	6	8	7%	87%
THA	2	8	11	21	70%	73%
TWN	5	3	28	36	54%	97%
Total	47	81	132	260	56%	78%

Notes: (1) We exclude very small banks (with both asset share and loan share of less than 0.05% of the total domestic banking system) for data quality purposes.
(2) The majority of 120 foreign banks in Singapore operate as foreign branches, not subsidiaries, thus are not covered in Bankscope.

[9] 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.

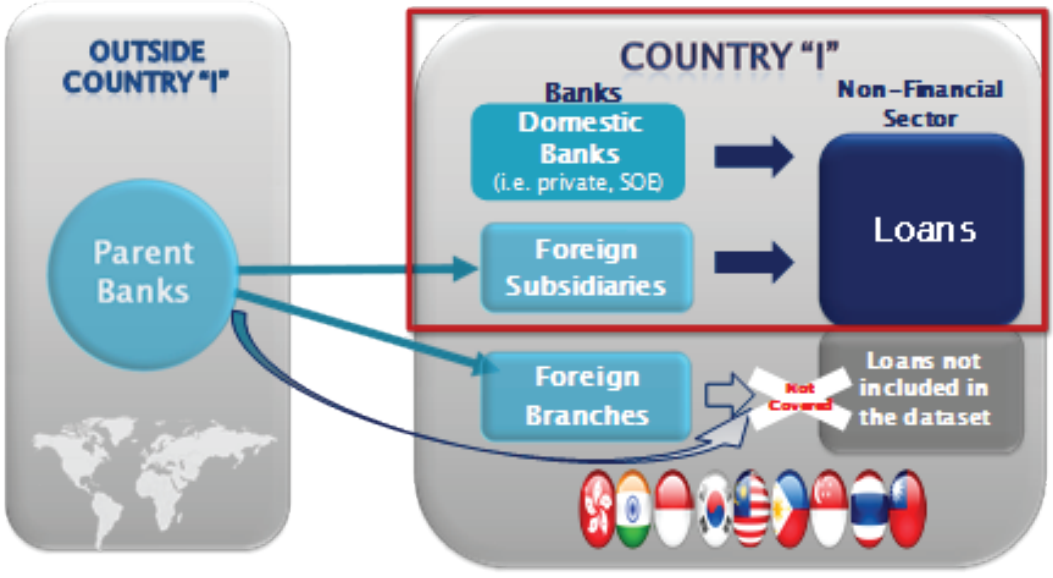
Non-Commercial-Bank FIs Sample

	State-Owned	Foreign	Domestic Private	Total	Percentage of domestic ...	
					Bank assets	Bank loans
HKG	0	2	4	6	1%	2%
IDN	1	0	2	3	1%	1%
IND	16	0	11	27	20%	21%
KOR	2	1	20	23	30%	14%
MYS	16	0	5	21	13%	12%
PHL	4	0	7	11	13%	12%
SGP	0	2	2	4	1%	1%
THA	4	1	9	14	19%	15%
TWN	2	0	16	18	24%	12%
Total	45	6	76	127	14%	10%

Note: (3) Non-commercial bank financial institutions (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.

Source: Authors' calculation from Bureau van Dijk's Bankscope database

Figure 2. Data Coverage for Commercial Banks



Source: Authors' illustration

Our dependent variable, real loan growth, is calculated 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.[10] In addition, we also calculate other bank characteristic variables including total assets (in logs), loan-to-deposit ratios, liquid assets-to-total assets, and capital adequacy ratios using the data from Bankscope.

Macro-level data is 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 prevailing CPI inflation. The monetary policy variable included in our empirical analysis is constructed by taking the first difference of the real policy rate from the above. Given that 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 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.

4. Stylized Facts

4.1 Bank ownership

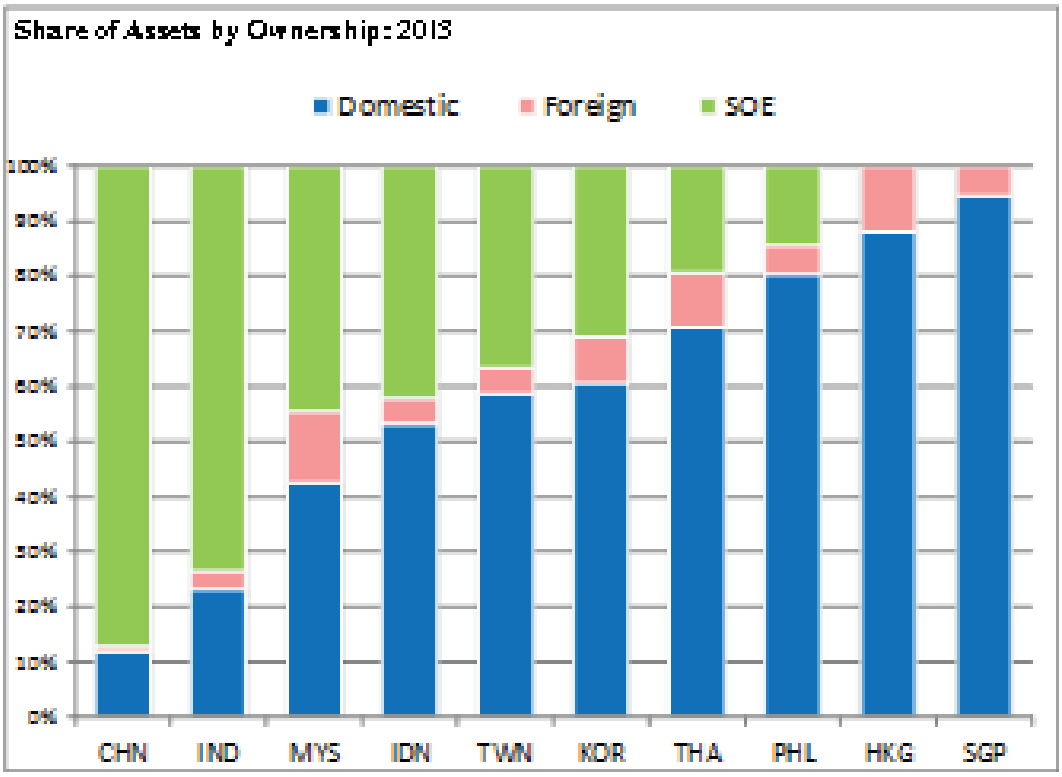
The bank ownership structure displays considerable diversity across Asian economies (Figure 3). At one end of the spectrum, China and India have very high concentrations of state-owned commercial banks, representing 87 and 74 percent of total domestic bank assets, respectively. At the other end, the 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.[11] Malaysia has a relatively high foreign bank representation in the domestic banking system compared to other non-financial-center economies. Given that mandates, funding sources and

[10] The 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.

[11] The representativeness of foreign banks in Singapore, as shown in Figure 3, 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.

marketing strategies 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 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 are able to 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 within the bank lending channel of monetary policy transmission.

Figure 3. Banking Sector's Ownership Structure

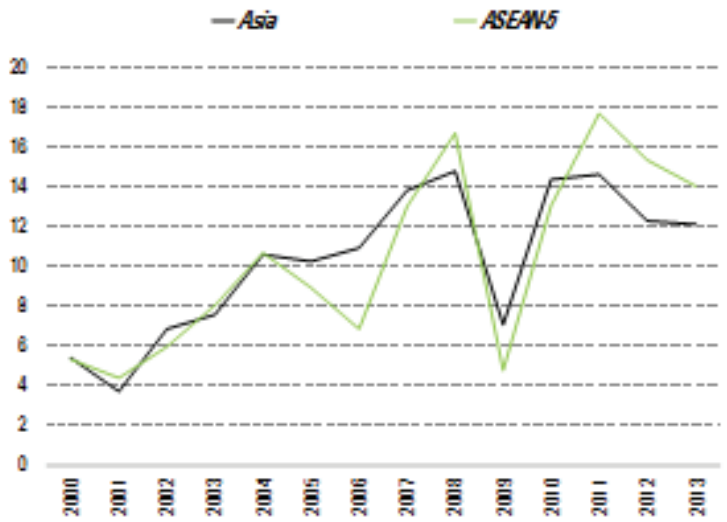


Sources: Bankscope and authors' calculations.

4.2 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 4). Such robust credit growth has given rise to higher loan-to-deposit ratios (LDRs) in some Asian economies, as shown with respect to a few countries in Figure 5.

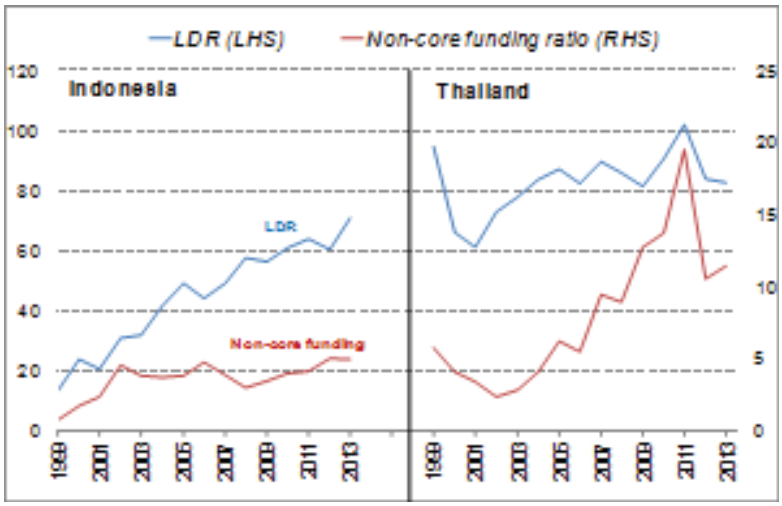
Figure 4. Private Sector Credit Growth
(Year-on-year percent change)

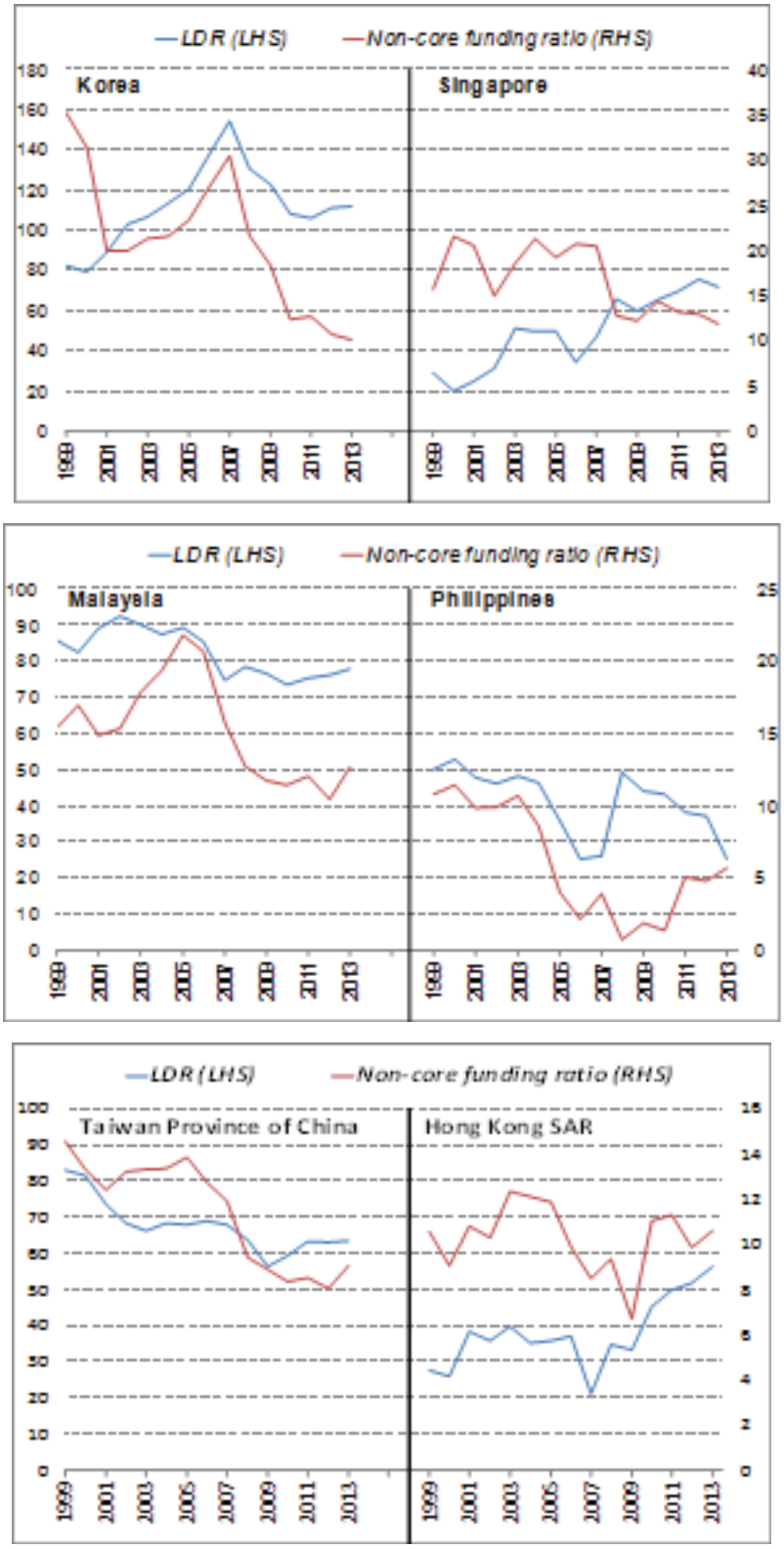


Note: Nominal growth is shown. See figure 1 for real credit growth
Sources: CEIC Data Co. Ltd; and Haver Analytics.

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 potentially make them more vulnerable to changes in external funding conditions (Figure 6).

Figure 5. Selected Asia: Loan-to-Deposit Ratio and Non-core Funding Ratio (In percent)

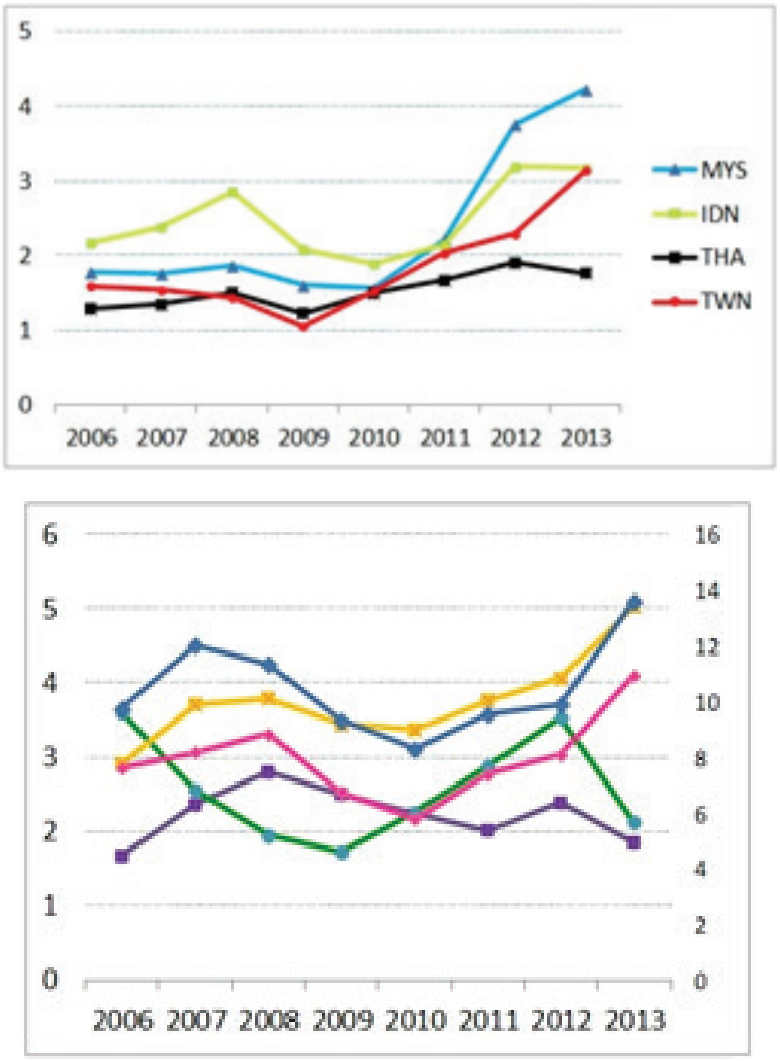




Note: The loan-to-deposit ratio of commercial banks excludes interbank transactions. The non-core funding ratio is calculated as the share of non-deposit funding within total funding. Both indicators are weighted average by bank assets.

Sources: Bankscope; and authors' calculations.

Figure 6. External Non-Core Funding Ratio
(In percent)



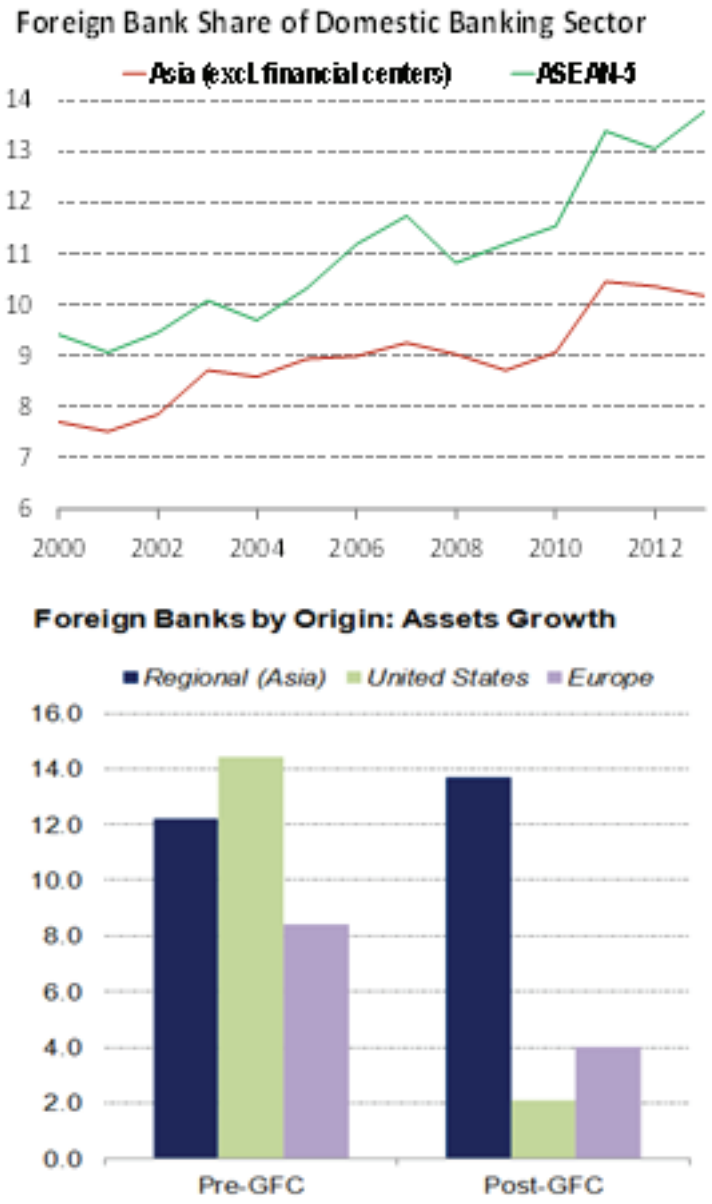
Note: The external non-core funding ratio is measured as the ratio of cross-border non-deposit liabilities of the banking sector vis-à-vis the BIS reporters to total funding of the banking sector in each country.
Sources: BIS Locational Banking Statistics; IMF, International Financial Statistics; and authors' calculations.

4.3 Foreign bank penetration

In parallel, foreign penetration of the domestic banking sectors in Asia has also increased, possibly due to both financial globalization and deregulation concerning barriers to foreign entry. In particular, strong growth in the performance of foreign banks from within the region, especially after the GFC, is evident, as opposed to those originating from Europe or the United States (Figure 7). 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.[12] These developments may, therefore, impact monetary policy transmission in Asia.

Figure 7. Foreign Bank Penetration



Sources: Bankscope; and IMF staff calculations

[12] 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.

5. Empirical Analysis

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

5.1 Macro-level VARs

In this macro-level analysis, a vector autoregression (VAR) is applied to quarterly macroeconomic, seasonally adjusted, data from nine Asian economies (Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, the Taiwan Province of China, and Thailand) and, for comparison, five Latin America EMs (Brazil, Chile, Colombia, Mexico, and Peru), together with 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 comprise global commodity price index (pcom) using IMF Primary Commodity Price Index, US output (yUS), U.S. short-term interest rate (iUS), domestic output i.e. GDP (y), domestic prices i.e. CPI (p), domestic short-term interest rate (i), real bank credit (credit), and the real effective exchange rate (er), 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 here.[13]

$$\{p^{com},\ y^{US},\ i^{US},\ y,\ p,\ i,\ credit,\ er\}$$

The empirical approach follows Disyatat and Vongsinsirikul (2003). The existence of a bank lending channel is measured by comparing the differences in output responses 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[14] — relative to when it is treated as endogenous. This exogeneity test provides a measure of the strength of the separate bank lending channel, which is in addition to the traditional interest rate channel.[15] 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 supply in amplifying the effect of monetary policy beyond what would be predicted by the traditional interest rate (cost of capital) channel alone.

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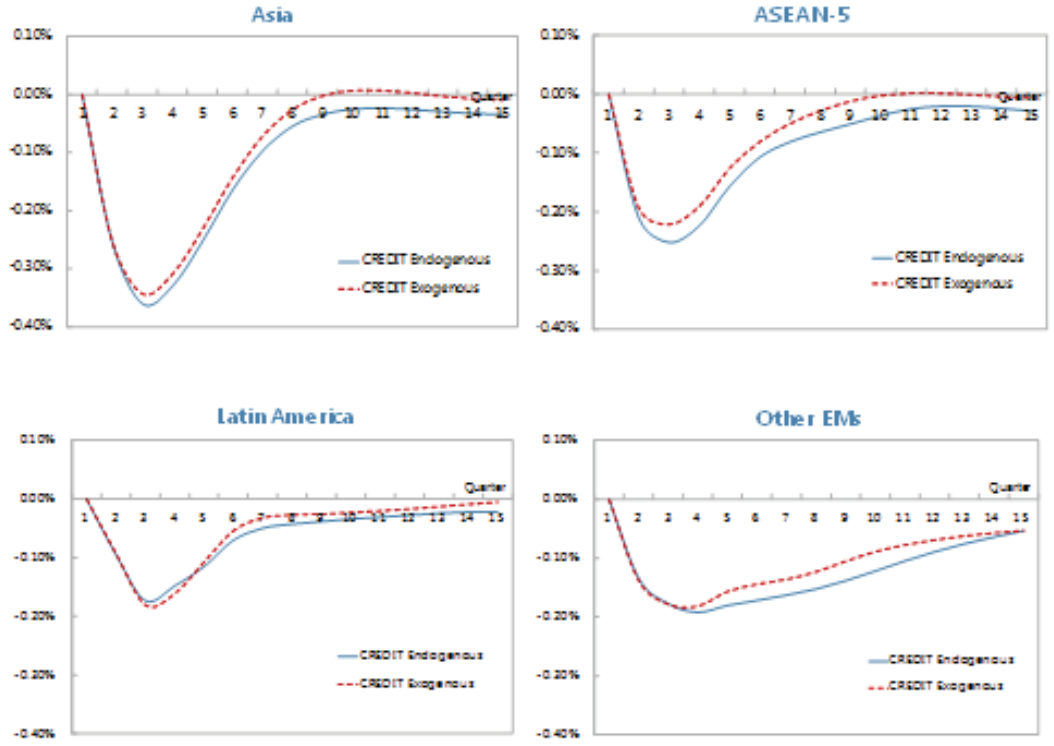
[13] As for a robustness check, VARs in first differences are also performed. The difference between the cumulative responses of output to interest rate shocks when credit is exogenous relative to when credit is endogenous also turns out to be very small.

[14] 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.

[15] 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.

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 8. Overall, an unexpected monetary policy tightening gives rise to a contraction of output which bottoms out after around three or four quarters.[16] 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 8. Cumulative Response of Real GDP to One S.D. of Interest Rate Shock



Source: Authors' estimates.

Comparing the two models of VAR, the output response is indeed dampened (after about two to three quarters) when credit is exogenized. However, the difference is very small: the accumulated response of output after eight quarters is only about one tenth lower, in terms of its output impact, when the bank credit channel is blocked off compared to the baseline case where interest rate effect is allowed to pass through credit.[17] Although the finding that the credit channel appears quite weak is consistent with findings in

[16] 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.

[17] The confidence intervals for the two scenarios overlap in most cases, implying that they may not be statistically different from each other.

previous studies, it may seem puzzling given the bank-dominated financial systems operating in most of the sample countries, especially within Asia.[18]

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.

5.2 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. The baseline model is specified as follows:

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

where $L_{i,j,t}$ denotes the growth rate of real credit by bank *i*, in country *j*, at time *t*. $MP_{j,t}$ represents the monetary policy stance measured as the first difference of the real policy or short-term interest rate. Both contemporaneous and one-year lag measures 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 ($GDPgrowth_{j,t}$) as a proxy for loan demand.[19] bank and time effects are included to capture bank- and year-specific factors that may matter in terms of loan growth.

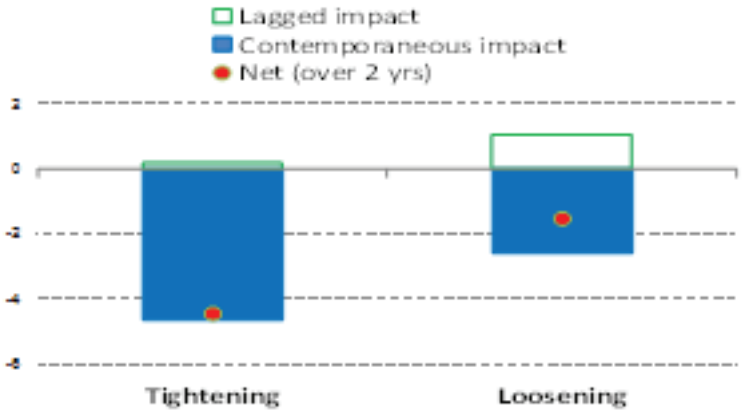
The size of individual banks is defined as comprising the log of total assets. Liquidity is represented as the ratio of liquid assets to total assets. Bank capitalization is measured as the ratio of total equity-to-total assets, while the loan-to-deposit ratio (LDR)

[18] In the case of Thailand, Disyatat and Vongsinsirikul (2003) 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.

[19] 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 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.

is calculated as the ratio of non-interbank loans to total customer deposits. Bank asset size is normalized with respect to the average figures concerning counterpart 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 — are constructed for bank ownership types based on the definition of state-owned and foreign banks, as discussed above. 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.[20] Standard errors are clustered at the bank level to address any remaining heteroskedasticity.

Figure 9: Impact of a One Standard Deviation Change in Policy Rate on Loan Growth
(In percentage points)



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. One S.D. = 2.6 percentage point change of policy rate (cumulative change over one year).
Source: Authors' estimates.

Baseline results

Key findings in bank-level panel are summarized as follows:

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 0.6 percentage point decrease in the real loan growth rate on average (Table 2). This seemingly small

[20] 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.

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.[21] Loan growth is found to decline by about 4.4 percentage points following a one-percentage-point monetary tightening (Figure 9). However, the result is perverse in the loosening cycle as loan growth also declines in response to a decrease in interest rates.[22]

Table 2: Banks' Loan Growth Responses to Monetary Policy Shocks

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

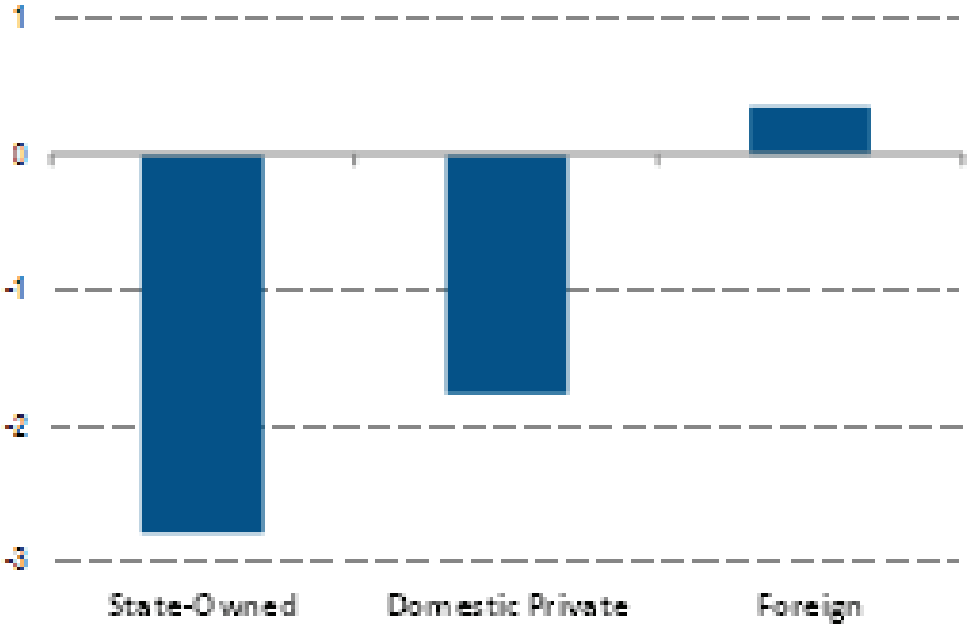
Notes: This table presents the results of fixed effect panel regressions with bank-level and time fixed effects using the sample of commercial banks operation in nine asian countries. Standard errirs are clustered at the bank level Robust t-statistics are in parentheses. ***,** and * indicate significance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

Source: Authors' estimates.

[21] 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 is 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.

[22] 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.

Figure 10: Impact of a One Standard Deviation Increase in Policy Rate on Loan Growth across Different Types of Bank Ownership
(In percentage points)



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. One S.D. = 2.6 percentage point change of policy rate (cumulative change over one year).

Source: Authors' estimates.

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 3 show that following a tightening of monetary policy, state-owned banks shrink their loan supply more sharply than domestic private banks, while foreign banks react in a perverse direction. Figure 10 illustrates the differential effects of monetary policy on loan growth by type of bank ownership. A one standard deviation increase in the policy rate results in a reduction of loan supply by 2.6 percent for state-owned banks, and 0.6 percent for domestic private banks, while foreign banks' loans increase by 2.5 percent.

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. 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 volatility during the global crisis period, dampening the effect of expansionary monetary policy in the host

economy. Indeed, when we divide the sample into crisis- and non-crisis-periods, we find that the perverse outcomes on foreign banks' loans are even more pronounced.[23]

The stronger response of state-owned banks to domestic monetary policy potentially reflects the existence of their quasi-fiscal lending that is not directly related to the financial characteristics of those banks. In any case, 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.

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 4 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.[24] 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,[25] and away from typically relatively stable deposit funding in order to sustain their loan growth rates. Rising LDRs and an increasing reliance on wholesale funding raise banks' sensitivity to external funding conditions, which are beyond the control of domestic monetary authorities.

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[23] 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) reported 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 the international transmission of liquidity shocks and dampening the effects of domestic monetary policy. Jeon et. al. (2014) found 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.

[24] 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.

[25] See Figure 7 in the stylized fact section for some evidence.

Table 3. Banks' Loan Growth Response to Monetary Policy Shocks: State-owned, Foreign, vs. Private Domestic Banks

Dependent variable: Real loan growth	(1) Baseline	(2) Interaction with ownership
MP	-0.399	-0.265
	(-0.638)	(-0.446)
MP (t-1)	-0.926	-1.499***
	(-1.792)	(-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*	0.588*
	(2.160)	(2.126)
Capital (t-1)	-0.445	-0.455
	(-1.397)	(-1.452)
LnAsset (t-1)	-7.366**	-7.003*
	(-2.351)	(-2.216)
GDP growth	1.980***	1.980***
	(4.392)	(4.316)
Constant	5.880	5.589
	(1.266)	(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 the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimates.

Table 4. Banks' Loan Growth Response to Global Financial Conditions

Dependent variable: Real loan growth	(1) Baseline	(2) Interaction with ownership
MP	-0.399	-0.326
	(-0.921)	(-0.768)
MP (t-1)	-0.926**	-1.067***
	(-2.586)	(-3.047)
Global FCI	-0.112***	-0.106***
	(-4.321)	(-4.045)
Global FCI (t-1)	0.030	0.041
	(1.111)	(1.357)
Global FCI * SOE		-0.030
		(-0.763)
Global FCI (t-1) * SOE		-0.135**
		(-2.398)

Dependent variable: Real loan growth	(1) Baseline	(2) Interaction with ownership
Global FCI * FOREIGN		-0.119**
		(-2.071)
Global FCI (t-1) * FOREIGN		0.195***
		(2.760)
Liquidity (t-1)	0.595***	0.594***
	(3.247)	(3.295)
Capital (t-1)	-0.445	-0.417
	(-1.093)	(-1.034)
LnAsset (t-1)	-7.366*	-8.328**
	(-1.797)	(-2.036)
GDP growth	1.980***	2.099***
	(5.022)	(5.284)
Constant	0.249	-0.874
	(0.099)	(-0.315)
Observations	2,427	2,427
R-squared	0.097	0.109
Number of banks (countries)	257 (9)	257 (9)

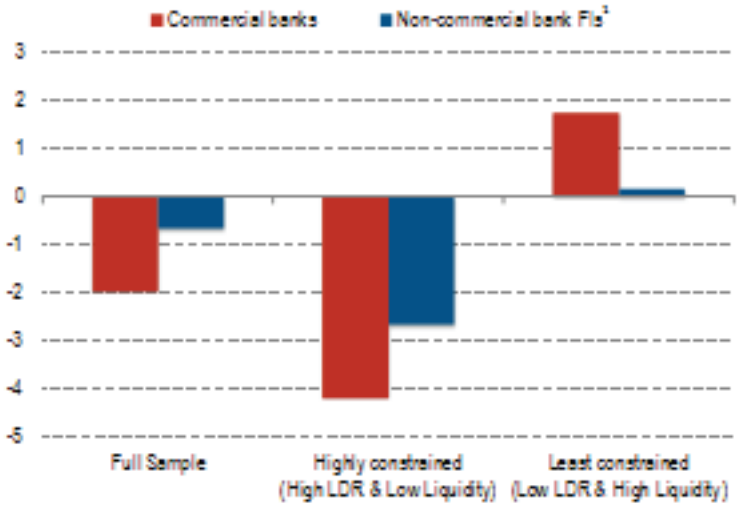
Notes: This table presents the results of fixed effects panel regressions with bank-level and time fixed effects, using the sample of commercial banks operating in nine Asian countries. Global financial conditions index (FCI) is the Chicago Fed's adjusted U.S. National Financial Conditions Index (NFCI).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

Source: Authors' estimates.

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, 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 5, left panel).

Figure 11. Impact of a One Standard Deviation Increase in Policy Rate on Loan Growth
(In percentage points)



Notes: (1) 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.
(2) One S.D. = 2.6 percentage point change of policy rate (cumulative change over one year).
(3) 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.

Source: Authors' estimates.

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, the loan supply of such 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 5 shows the differential effects of global financial conditions on the 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 the development banks, savings 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.

To illustrate, we divide banks in the sample in terms of 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 11 shows that the most financially constrained banks and non-bank FIs will shrink their loan

portfolio by about three times the average bank measure (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 portfolios against changes in monetary policy, whereas lending by weaker banks will be more sensitive to such shocks (e.g., Kashyap and Stein, 1995).

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 6) changes.[26] Importantly, we find that the reduction in sensitivity extends beyond the foreign bank subsidiaries themselves, to all the domestic private banks. Figure 12 illustrates that a ten percentage point increase in foreign presence in the domestic banking system will reduce the effect of monetary policy tightening on domestic private banks, from a 2.4 percent contraction of loan growth to a net effect of 0.8 percent. The effect of monetary policy is almost neutralized for foreign banks themselves. In contrast, state owned banks react even more strongly to monetary policy in the presence of higher foreign bank penetration.

This result may reflect the fact that the presence of foreign banks in the domestic economy helps increase domestic banks' access to non-central bank funding through the interbank, wholesale, or external funding markets, thereby making the loan supply less sensitive to domestic monetary policy changes.[27]

In addition, credit supply may be less sensitive to fluctuations in marginal funding costs when banks are striving to preserve their loan market share in the face of increased competition due to foreign bank entries. This result is especially important given the backdrop of growing foreign bank penetration in Asia (see stylized facts above).

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[26] Foreign bank penetration is proxied by the share of foreign bank assets as a proportion of the total domestic banking sector assets. We also check for robustness using instead the share of foreign bank loans in the total of 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. For instance, in several Asian economies (apart from Asian financial centers), foreign bank branches have an equally important presence compared to foreign subsidiaries; in the Philippines, the ratio of total assets of foreign branches to the total assets of foreign subsidiaries is about 0.6-to-0.4. In Korea, the presence of foreign branches is only slightly lower than that of foreign subsidiaries.

[27] Growing cross-border bank lending and increased (foreign-currency) corporate bond financing, which became evident in Asia in recent years, could 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). As a robustness check, we thus add bank competition as an additional control variable, in addition to interacting it with the monetary policy variables under consideration.[28] 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 become smaller.

We also investigate further the country origins of foreign banks in Asia (Table 6, columns 3 and 4). In doing so, we find that the dampening effect of foreign bank presence on monetary policy effectiveness is stronger when foreign banks originate within the region, mostly from Japan, China and Malaysia. This could be because regional foreign banks are more inclined to compete directly with domestic banks, especially in the retail banking sector, unlike European or US banks that potentially focus on different business activities, such as catering to multinational clients and enacting foreign exchange related business activities.

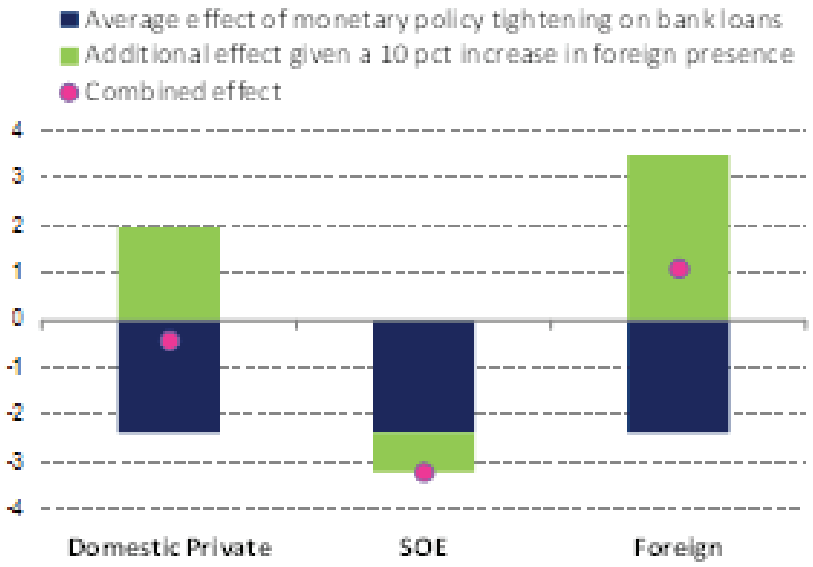
So far, we have shown that through the bank lending channel ("quantity" channel), the impact of monetary policy on loan growth may be hampered by foreign bank participation in the domestic banking system. To touch upon the interest rate channel ("price" channel) of monetary policy, we run separate regressions on the response of individual banks' deposit and lending interest rates to monetary policy shocks.[29] The results in Table 7 suggest that higher foreign bank participation, while weakening the bank lending channel, in fact strengthens the interest rate channel. Given the 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 into the market 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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[28] 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.

[29] 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).

Figure 12. Impact of Foreign Presence on Monetary Policy Transmission to Loan Growth
(In percentage points)



Note: Change in monetary policy is measured as percentage point change in policy rates or short-term interest rates. 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).
Source: Authors' estimates.

Table 5. 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					
	(1)	(2)	(3)	(4)	(5)	(6)
MP	0.160	0.267	0.155	0.184	1.753	0.715
	(0.349)	(0.560)	(0.336)	(0.384)	(1.539)	(0.604)
MP (t-1)	-0.909**	-1.144***	-0.869**	-0.861**	0.008	-0.951
	(-2.378)	(-3.103)	(-2.360)	(-2.530)	(0.004)	(-1.150)
GlobalFCI	-0.102***	-0.099***	-0.102***	-0.101***	-0.106***	-0.101***
	(-3.750)	(-3.654)	(-3.754)	(-3.707)	(-4.019)	(-3.763)
GlobalFCI (t-1)	0.015	0.022	0.015	0.015	0.018	0.023
	(0.528)	(0.786)	(0.533)	(0.535)	(0.651)	(0.828)
MP * Liquidity (t-1)		0.130***				0.118***
		(3.182)				(3.064)
MP (t-1) * Liquidity (t-1)		0.074***				0.065**
		(5.371)				(2.441)
MP * Capital (t-1)			-0.021			-0.015
			(-0.383)			(-0.244)
MP (t-1) * Capital (t-1)			0.035			0.024
			(0.655)			(0.433)
MP * LnAsset (t-1)				-0.155		-0.006
				(-0.643)		(-0.023)
MP (t-1) * LnAsset (t-1)				-0.497**		-0.204
				(-2.270)		(-0.750)
MP * LDR (t-1)					-0.023*	-0.007
					(-1.677)	(-0.489)

Dependent variable: Real loan growth	Domestic monetary policy					
	(1)	(2)	(3)	(4)	(5)	(6)
Liquidity (t-1)	0.542***	0.604***	0.545***	0.532***	0.561***	0.607***
	(2.817)	(3.159)	(2.809)	(2.720)	(2.828)	(3.078)
Capital (t-1)	-0.328	-0.295	-0.326	-0.343	-0.447	-0.384
	(-0.796)	(-0.708)	(-0.802)	(-0.844)	(-1.031)	(-0.902)
LnAsset (t-1)	-7.764*	-7.628*	-7.607*	-7.742*	-8.633*	-8.495*
	(-1.795)	(-1.776)	(-1.754)	(-1.816)	(-1.958)	(-1.930)
GDP growth	2.485***	2.555***	2.498***	2.487***	2.453***	2.533***
	(6.117)	(6.305)	(6.129)	(6.099)	(6.098)	(6.196)
Constant	-2.990	-3.114	-3.061	-2.967	-2.782	-2.903
	(-1.185)	(-1.237)	(-1.211)	(-1.169)	(-1.099)	(-1.137)
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
Number of banks (countries)	228 (7)	228 (7)	228 (7)	228 (7)	227 (7)	227 (7)

Dependent variable: Real loan growth	Global financial conditions					
	(7)	(8)	(9)	(10)	(11)	(12)
MP	0.160	0.196	0.158	0.166	0.025	0.082
	(0.349)	(0.426)	(0.344)	(0.363)	(0.055)	(0.178)
MP (t-1)	-0.909**	-0.916**	-0.912**	-0.922**	-1.026***	-1.022***
	(-2.378)	(-2.390)	(-2.377)	(-2.495)	(-2.819)	(-2.814)
Global FCI	-0.102***	-0.105***	-0.102***	-0.101***	-0.099***	-0.100***
	(-3.750)	(-3.877)	(-3.745)	(-3.724)	(-3.737)	(-3.750)
Global FCI (t-1)	0.015	0.027	0.015	0.017	0.120**	0.123**
	(0.528)	(0.955)	(0.516)	(0.596)	(2.359)	(2.316)
Global FCI * Liquidity (t-1)		0.008**				0.008**
		(2.248)				(2.434)
Global FCI (t-1) * Liquidity (t-1)		0.003				-0.001
		(1.035)				(-0.389)
Global FCI * Capital (t-1)			0.000			0.001
			(0.098)			(0.144)
Global FCI (t-1) * Capital (t-1)			-0.001			0.003
			(-0.178)			(0.735)
Global FCI * LnAsset (t-1)				0.015		0.028
				(0.795)		(1.504)
Global FCI (t-1) * LnAssets (t-1)				-0.038		-0.040
				(-1.396)		(-1.524)
Global FCI * LDR (t-1)					-0.001	-0.000
					(-0.959)	(-0.112)
Global FCI (t-1) * LDR (t-1)					-0.002**	-0.003***
					(-2.595)	(-2.773)
Liquidity (t-1)	0.542***	0.842***	0.542***	0.539***	0.612***	0.802***
	(2.817)	(4.612)	(2.811)	(2.806)	(3.280)	(4.326)
Capital (t-1)	-0.328	-0.385	-0.347	-0.291	-0.642	-0.497
	(-0.796)	(-0.955)	(-0.669)	(-0.707)	(-1.429)	(-0.968)
LnAsset (t-1)	-7.764*	-8.288*	-7.754*	-8.387**	-9.147**	-9.850**
	(-1.795)	(-1.963)	(-1.796)	(-2.019)	(-2.157)	(-2.383)
GDP growth	2.485***	2.482***	2.483***	2.516***	2.296***	2.363***
	(6.117)	(6.156)	(6.067)	(6.197)	(5.661)	(5.770)
Constant	-2.990	-2.969	-2.980	-3.204	-8.087**	-8.076**
	(-1.185)	(-1.178)	(-1.176)	(-1.264)	(-2.365)	(-2.349)
Observations	2,159	2,159	2,159	2,159	2,150	2,150
R-squared	0.124	0.133	0.124	0.126	0.140	0.149
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 the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimates.

Table 6. 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	-0.029	-0.007	-0.045
	(-0.395)	(-0.047)	(-0.011)	(-0.083)
MP(t-1)	-3.293***	-3.134***	-3.456***	-2.740***
	(-6.182)	(-6.157)	(-6.099)	(-6.440)
Foreign Presence	1.184**	1.170**	0.942*	5.872**
	(2.309)	(2.284)	(1.740)	(2.356)
MP * Foreign Presence	0.034	0.046	0.073	0.125
	(0.562)	(0.542)	(0.631)	(0.434)
MP(t-1) * Foreign Presence	0.196***	0.150**	0.241***	0.369**
	(3.861)	(2.567)	(2.842)	(1.992)
MP * Foreign Presence * SOE		-0.199***	-0.261***	-0.756**
		(-2.705)	(-2.724)	(-2.588)
MP(t-1) * Foreign Presence * SOE		-0.080*	-0.110*	-0.285
		(-1.662)	(-1.659)	(-1.602)
MP * Foreign Presence * FOREIGN		0.038	0.053	0.147
		(0.413)	(0.432)	(0.438)
MP(t-1) * Foreign Presence * FOREIGN		0.114*	0.154*	0.427**
		(1.843)	(1.799)	(1.987)
Liquidity (t-1)	0.547***	0.546***	0.551***	0.583***
	(2.953)	(2.974)	(2.980)	(3.306)
Capital (t-1)	-0.376	-0.369	-0.371	-0.413
	(-0.893)	(-0.880)	(-0.888)	(-0.979)
LnAssets (t-1)	-9.505**	-9.613**	-9.612**	-8.836**
	(-2.205)	(-2.237)	(-2.234)	(-2.023)
GDP growth	2.243***	2.255***	2.329***	2.333***
	(5.054)	(5.060)	(5.283)	(5.182)
Constant	-5.719	-5.818	-2.570	-6.538
	(-1.105)	(-1.132)	(-0.565)	(-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 the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimates.

Table 7. Banks' Interest Rate Response to Monetary Policy Shocks: The Effects of Foreign Bank Presence and Bank Competition

Dependent variable:	(1) Δ Lending Rate	(2) Δ Deposit Rate	(3) Δ Lending Rate	(4) Δ Deposit Rate
MP	-0.161	0.064***	-0.161	0.064***
	(-1.524)	(2.661)	(-1.524)	(2.661)
MP(t-1)	-0.044	0.088***	-0.044	0.088***
	(-0.428)	(4.117)	(-0.428)	(4.117)
Foreign Presence (t-1)	0.074	-0.010	0.074	-0.010
	(1.066)	(-0.750)	(1.066)	(-0.750)
MP * Foreign Presence (t-1)	0.009*	0.003*	0.009*	0.003*
	(1.782)	(1.737)	(1.782)	(1.737)

Dependent variable:	(1) Δ Lending Rate	(2) Δ Deposit Rate	(3) Δ Lending Rate	(4) Δ Deposit Rate
MP (t-1) * Foreign Presence (t-1)	0.005	0.004**	0.005	0.004**
	(1.023)	(2.519)	(1.023)	(2.519)
LnAsset (t-1)	-0.487	0.413***	-0.487	0.413***
	(-0.262)	(3.296)	(-0.262)	(3.296)
Capital (t-1)	0.029	-0.012	0.029	-0.012
	(0.367)	(-1.087)	(0.367)	(-1.087)
Liquidity (t-1)	-0.070*	-0.001	-0.070*	-0.001
	(-1.807)	(-0.101)	(-1.807)	(-0.101)
GDP growth	0.047	0.059***	0.047	0.059***
	(1.116)	(3.699)	(1.116)	(3.699)
Constant	-1.269	-1.190***	-1.269	-1.190***
	(-1.182)	(-4.084)	(-1.182)	(-4.084)
Observations	2,416	1,665	2,416	1,665
R-squared	0.013	0.388	0.013	0.388
Number of banks (countries)	251	226	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 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 the parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' estimates.

6. Conclusion

In view of Asia's bank-dominated financial systems where bank loans remain the primary financing source for both the corporate sector and 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, tends 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 changes. 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 itself 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. Such bank characteristics interact with external financial conditions and banking sector structure in explaining 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 more complete 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 environment in formulating strategy when global financial conditions are not aligned with those that are warranted to meet domestic monetary policy objectives. Policymakers will, therefore, need to internalize the effects of greater foreign bank presence on monetary policy effectiveness and recalibrate interest rate decisions accordingly, while also standing ready to employ other supporting policy instruments. Moreover, the diminishing effectiveness of the credit channel in the context of extended foreign bank penetration may alter the perceived trade-off between competition and stability that should be taken into account when considering further financial liberalization.

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