International Banking and Cross-Border Effects of Regulation: Lessons from Korea*

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This paper analyzes the inward spillover effects of overseas prudential policy changes through foreign bank affiliates in Korea. We do not find strong evidence of inward spillover effects: in general, a change in the prudential policies in the home countries of foreign bank affiliates has not led to significant changes in the lending behaviors of the bank affiliates in Korea. However, for some prudential measures such as sectoral-specific capital buffers and reserve requirements, we observe negative correlations between home countries' tightening of those instruments and the changes in their lending.

JEL Codes: G01, F34, G21, G28.

1. Introduction

International bank lending is becoming increasingly important for the safety of the global financial system, in that swings in cross-border bank lending can amplify domestic credit trends and thus trigger booms and busts in individual countries. For example, while the total foreign debt by Korea's depositary institutions tripled from 2006 to the second quarter of 2008 ($51.1 billion to $159.1 billion), it shrank by 34 percent to $104.6 billion in just half a year after the global financial crisis broke out in the third quarter of 2008. This sudden stop in cross-border loan supply brought a foreign-currency liquidity problem to these institutions, subsequently exacerbating the credit crunch in the financial markets during the period.

In the case of Korea, capital controls prior to the Asian financial crisis in 1997 limited the spillover of global monetary shocks,

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but financial deregulation and capital liberalization after the crisis[1] increased the vulnerability to global shocks such as the monetary and financial policies of foreign countries on the domestic financial market. In particular, with the introduction of macroprudential policy after the global financial crisis—in Korea as well as in major countries—the cross-border spillover has become an important issue.

The footprint of foreign banks in Korea in terms of the number of banks and the scale of assets is still small. As of end-2014, foreign banks' total assets accounted for 15.5 percent of that of the whole Korean banking sector, of which bank loans accounted for 8.3 percent.

Foreign bank branches operate quite differently from domestic banks in terms of their business model. Their principal means of funding is borrowing from both their head offices abroad and the Korean financial market via currency/interest rate swap transactions. Deposits accounted for only 17.2 percent of their total funding as of end-2014.

Turning to their asset management, derivative transactions such as interest rate swaps and currency swaps are major business concerns, whereas loans are relatively minor. Loans accounted for 29.1 percent of foreign banks' total assets as of end-2014, which is quite small compared with that of domestic banks (73.7 percent).

The significance of foreign banks in Korea in terms of systemic risk seems unremarkable considering that their assets comprise only a small portion of the Korean banking industry. However, taking into account the fact that they provide an important source of foreign wholesale funding in the Korean financial system, and considering that their transactions with Korean financial institutions have a great impact on liquidity conditions in the Korean financial market, their systemic importance should not be overlooked.

On top of that, foreign banks' derivative activities through swap transactions are sensitive to foreign exchange rate and interest rate movement. This high sensitivity of foreign banks tends to make the Korean financial system fragile to any changes in the global financial

[1]For major changes in the capital account regulations in Korea before and after the 1997 crisis, refer to Yang-taek Lim, "Liberalization Process of Korean Capital Markets," *Investment Management and Financial Innovations* 1 (2004), 25–44.

market and to policy changes in foreign countries. In this sense, the investigation of the impact of prudential policies abroad on foreign banks in Korea will have important implications in terms of financial stability in Korea.

In this respect, we have explored in this paper the evidence of inward spillover effects of prudential policy changes in foreign countries through their affiliates in Korea. In general, the results suggest that changes in prudential measures in home countries do not have an effect on the lending behavior of foreign banks in Korea. Though we observed statistically significant coefficients for some prudential measures such as sectoral-specific capital buffers and reserve requirements, the results are not robust enough to provide consistent implications across different model specifications and confirm the existence of inward spillover effects in Korea.

The remainder of this paper is organized as follows. Section 2 discusses the empirical models utilized to analyze the impact of home countries' prudential policies on foreign banks' lending in Korea. Section 3 provides a brief description of the data used, while section 4 presents the empirical results. Section 5 concludes and presents some policy implications.

2. Data

We collect the bank-level statistics from the FAIRS[2] (Financial Analysis Information Retrieval System) database, which provides various data from the financial statements of Korean financial institutions. As of end-2013, the amount of loans from foreign banks, which is the main focus of the analysis, is relatively small compared with asset levels, as foreign banks occupy 8.1 percent of total banking loans in Korea. While subsidiaries and branches have a similar amount of total loans (subsidiaries 4.1 percent and branches 4.0 percent of total banking loans), the composition of the loans is strikingly different. Subsidiaries account for 4.0 percent of the total loans issued in Korean won, compared with only 0.5 percent

[2]FAIRS is a database developed by the Bank of Korea (BOK) using the data provided by the Financial Supervisory Service (FSS) in accordance to the memorandum of understanding on the information sharing between the FSS and the BOK.

for branches. In contrast, branches account for 14.6 percent of the loans denominated in foreign currency, compared with 1.4 percent for subsidiaries.

Among the forty-two foreign banks in Korea, we exclude those that had no balance in loans as of the end of 2013. Banks that have had at least one zero loan balance since 2000 are further excluded.[3] Lastly, banks from countries that are not included in the prudential database or the BIS cycle database are excluded. Applying these criteria, twenty-eight foreign banks are selected, including two subsidiaries and twenty-six branches. As of end-2013, these banks accounted for 98.6 percent of total foreign bank loans, and the twenty-six branches included in the sample made up 97.4 percent of total foreign bank branch loans. The sample period covers from 2000:Q1 to 2013:Q4.

For the prudential policy index, we use the International Banking Research Network (IBRN) Prudential Instruments Database described in Cerutti et al. (2017). The foreign banks included in the sample are from eleven countries: the United States, Canada, the United Kingdom, France, Germany, Australia, New Zealand, India, Singapore, Japan, and China. Each country operates prudential measures in a different way. The prudential database summary shows that emerging countries use prudential policies more frequently than advanced economies. For this reason, in the case of Korea the sample includes very few observations that have non-zero values in regulation index, as most of the parent banks of foreign banks in Korea are located in advanced countries. Changes in reserve requirements for foreign-currency-denominated deposits are observed only in one country, and we also identify only ten changes in sector-specific capital buffer and seven changes in interbank exposure limits among 1,423 observations.

The most widely used measure is capital requirements, of which there are twenty observations, since most countries in the sample have adopted Basel-type capital regulation schemes. There are ten episodes of loan-to-value (LTV) ratio limits, which are relatively large considering the fact that most of the observations are from a

[3]As of the end of 2013, more than ten banks had no loan balances in their balance sheet. The businesses of those banks are concentrated on incidental businesses, such as securities investment.

Table 1. Summary Statistics on Bank Characteristics

Balance Sheet Characteristics	Median	75th Percentile
Log Assets	14.84	16.01
Tier 1 Ratio	20.54	40.78
Illiquid Assets Ratio	46.62	70.09
Net Intragroup Funding/Liabilities	35.77	71.38
Deposits Ratio	3.42	11.42
Loans (Ln Change)	2.35	13.19

Notes: This table provides summary statistics for bank balance sheet and lending data. Data are observed quarterly from 2000:Q1 to 2013:Q4. Banking data come from the FSS and are reported at the unconsolidated level. The Net Intragroup Funding variable measures from the perspective of a bank's head office total net internal lending (or borrowing) vis-à-vis all its related domestic and international offices.

few countries. There are forty-one observations of reserve requirements for deposits denominated in local currency. For concentration ratio limits we have twenty-one observations in the sample, and three countries are implementing the instrument. Among 112 episodes in total, measures were tightened in ninety-four cases (84 percent) and loosened in 18 cases (16 percent).

The summary statistics on bank characteristics and changes in prudential instruments are shown in tables 1 and 2.

3. IBRN Baseline Model Specification

Our work follows the empirical approach set by the IBRN, which suggests four main model specifications. The first model is specified as follows:

$$\Delta Y_{b,j,t} = \alpha_0 + \alpha_i \sum_{i=1}^{3} HomeP_{j,t-1} + \alpha_4 X_{b,j,t-1} + \alpha_5 Z_{j,t} + f_b + f_t + \varepsilon_{b,j,t}. \quad (1)$$

$\Delta Y_{b,j,t}$ is the quarterly change in log loans of foreign bank b in Korea whose parent bank or head office is located in country j. Only the change in total loans is considered, as foreign bank branches do

Table 2. Summary Statistics on Changes in Prudential Instruments

Instrument	No. of Country-Time Changes	No. of Country-Time Changes (Tightening)	No. of Country-Time Changes (Loosening)	No. of Bank-Time Changes	Proportion $HomeP_t$ Non-zero
Prudential Index	108	89	19	256	0.180
General Capital Requirements	20	20	0	35	0.025
Sector-Specific Capital Buffer (Real Estate)	9	6	3	9	0.006
Sector-Specific Capital Buffer (Consumption)	2	1	1	2	0.001
Sector-Specific Capital Buffer (Other)	4	2	2	4	0.003
Loan-to-Value Ratio Limits	10	7	3	65	0.046
Reserve Requirements: Foreign	3	3	0	14	0.010
Reserve Requirements: Local	41	29	22	137	0.096
Interbank Exposure Limit	7	7	0	7	0.005
Concentration Ratio	21	21	0	51	0.036

Source: IBRN.

Notes: This table shows summary statistics on changes in prudential instruments for banks located in Korea over the period 2000–13. Data on the instruments come from the IBRN Prudential Instruments Database described in Cerutti et al. (2017) and are on the quarter level. The number of changes in prudential instruments is reported on several dimensions, i.e., on the country-time level and on the bank-time level. The last column of the table shows the share of prudential changes to total observations (i.e., the share of non-zero observations). The reported data are based on the regression sample.

not actively provide all types of loans in the Korean domestic credit market.

$HomeP_{j,t}$ is the quarterly change in a macroprudential policy index for country j at time t. $X_{b,j,t-1}$ is a vector of bank characteristics control variables and $Z_{j,t}$ represents the business and financial cycle indexes for country j, which are compiled by the Bank for International Settlements (BIS). The baseline model includes not only bank fixed effects (f_b) but also time fixed effects (f_t).

$$\Delta Y_{b,j,t} = \alpha_0 + \alpha_i \sum_{i=1}^{3} HomeP_{j,t-i+1} + \alpha_4 X_{b,j,t-1} + \alpha_5 Z_{j,t} + \beta_i \sum_{i=1}^{3} HomeP_{j,t-i+1} \cdot X_{b,j,t-1} + f_b + f_t + \varepsilon_{b,j,t}. \quad (2)$$

The second model above adds to model (1) interaction terms between prudential policy variables and bank-specific characteristics.

The third model is specified as follows:

$$\Delta Y_{b,j,t} = \alpha_0 + \alpha_i HomeP_{cum,b,j,t} + \alpha_2 X_{b,j,t-1} + \alpha_3 Z_{j,t} + \alpha_4 HomeP_{b,j,t} \cdot Z_{j,t} + f_b + f_t + \varepsilon_{b,j,t}. \quad (3)$$

$HomeP_{cum,b,j,t}$ is a cumulative macroprudential index showing the level of policy tightness of country j at time t. On top of that, $HomeP_{cum,b,j,t}$ interacts with home-country cycle indicators, $Z_{j,t}$ in the regression.

$$\Delta Y_{b,j,t} = \alpha_0 + \alpha_i \sum_{i=1}^{3} HomeP_{j,t-i+1} + \alpha_4 X_{b,j,t-1} + \alpha_5 Z_{j,t} + \alpha_6 Z_{host,t} + \beta_i \sum_{i=1}^{3} HomeP_{t-i+1} + f_b + \varepsilon_{b,j,t}. \quad (4)$$

The final model considers the variables of the host country (Korea). More specifically, $HostP_t$ represents changes in prudential measures in Korea at time t and $Z_{host,t}$ represents Korea's real and financial cycles. This reflects the fact that the activities of foreign

bank subsidiaries and branches are significantly influenced by the host country's economic situation and regulatory environment. In Korea in particular, where even foreign branches are regarded as independent legal entities and supervised by the FSS, it is natural to think that host-country variables may be more relevant.

4. Estimation Results

In this section, we discuss the empirical evidence presented in tables 3–6. In general, a foreign bank would respond to prudential regulations in its home country by adjusting its lending. However, the degree of this adjustment could vary depending on the country or type of regulation. In response to prudential policy, the parent bank in the home country could reduce its exposures to the country to which it has the most significant amount of exposures. In this case, loans may not decrease in countries such as Korea that host banks with smaller assets or banks that concentrate on business types other than loans. The resulting regulatory coefficients would not be negative.

If tight regulations are applied on a country-specific basis instead of being applied to every country, they can lead to changes in the lending behavior of banks. For instance, if LTV caps were to be tightened in a specific country, the parent bank could respond by reducing loans in that country and increasing loans in countries that have not tightened the caps.

As seen so far, the response of loans to changes in regulations, or the sign of the regulatory coefficient, could differ depending on the countries analyzed. This should be taken into account when analyzing the empirical results in Korea's case.

4.1 Reactions to Capital-Related Regulations and Reserve Requirements

For general capital requirements, the estimated coefficients show different patterns among the specifications, as can be seen in the second columns of tables 3–6. The sums of coefficients in the models show different signs (negative in the first and fourth models, positive in the second), and the result from the F-test to check the statistical

Table 3. Inward Transmission of Policy via Affiliates of Foreign-Owned Banks (I)

	All Instruments (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	Loan-to-Value Ratio (4)	Reserve Requirements: Foreign (5)	Reserve Requirements: Local (6)	Interbank Exposure Limits (7)	Concentration Ratios (8)
Prudential Policies ($HomeP_t$)	−0.044*	0.005	−0.104***	0.015	−0.213**	−0.041*	−0.077	−0.195**
	(0.023)	(0.046)	(0.017)	(0.036)	(0.089)	(0.021)	(0.192)	(0.081)
Prudential Policies ($HomeP_{t-1}$)	0.014	0.005	−0.031	0.011	−0.066	−0.033***	0.002	0.180**
	(0.022)	(0.049)	(0.023)	(0.027)	(0.082)	(0.009)	(0.034)	(0.059)
Prudential Policies ($HomeP_{t-2}$)	−0.011	−0.077	0.007	−0.075*	−0.043	0.021	0.090	−0.003
	(0.017)	(0.043)	(0.013)	(0.037)	(0.054)	(0.020)	(0.063)	(0.057)
Log Total $Assets_{t-1}$	−0.126***	−0.124***	−0.126***	−0.125***	−0.127***	−0.127***	−0.125***	−0.122***
	(0.030)	(0.030)	(0.031)	(0.031)	(0.028)	(0.029)	(0.031)	(0.029)
Tier 1 $Ratio_{t-1}$	−0.000	0.000	−0.000	0.000	−0.000	−0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Illiquid Assets $Ratio_{t-1}$	−0.360***	−0.360***	−0.359***	−0.357***	−0.363***	−0.362***	−0.359***	−0.355***
	(0.058)	(0.059)	(0.060)	(0.058)	(0.058)	(0.058)	(0.059)	(0.057)
Net Intragroup Funding $Ratio_{t-1}$	0.084	0.078	0.076	0.071	0.087	0.081	0.075	0.066
	(0.104)	(0.103)	(0.104)	(0.104)	(0.105)	(0.104)	(0.104)	(0.100)
Core Deposits $Ratio_{t-1}$	−0.118	−0.118	−0.122	−0.109	−0.103	−0.121	−0.121	−0.097
	(0.178)	(0.184)	(0.184)	(0.188)	(0.185)	(0.179)	(0.178)	(0.184)
Credit Gap (Home Country)	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Output Gap (Home Country)	0.000	−0.001	−0.000	−0.001	−0.003	−0.000	−0.001	−0.001
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Prudential Policies (Combined)	−0.041	−0.067	−0.128***	−0.049	−0.322	−0.053	0.015	−0.018
	[0.232]	[0.427]	[0.000]	[0.429]	[0.149]	[0.132]	[0.953]	[0.866]
Observations	1,367	1,367	1,367	1,367	1,367	1,367	1,367	1,367
Adjusted R^2	0.138	0.137	0.138	0.138	0.139	0.138	0.137	0.144
No. of Banks	28	28	28	28	28	28	28	28

Notes: This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in total loans. The data are quarterly from 2000:Q1 to 2013:Q4. HomeP refers to the changes in regulation in the home (i.e., parent-bank) country of foreign affiliates. Each column gives the result for the regulatory measure specified in the column headline. All specifications include time and bank fixed effects. Standard errors are clustered by banks. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. Standard errors are in parentheses. P-values are in squared brackets.

Table 4. Inward Transmission of Policy via Affiliates of Foreign-Owned Banks (II)

	All Instruments (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	Loan-to-Value Ratio (4)	Reserve Requirements: Foreign (5)	Reserve Requirements: Local (6)	Interbank Exposure Limits (7)	Concentration Ratios (8)
Prudential Policies ($HomeP_t$)	−0.022	0.075	−0.564**	−0.074	−0.815*	−0.080	−1.269*	−0.232
	(0.037)	(0.136)	(0.180)	(0.129)	(0.429)	(0.125)	(0.660)	(0.228)
Prudential Policies ($HomeP_{t-1}$)	0.024	−0.029	0.873***	−0.022	−0.321***	0.036	−0.821**	0.361**
	(0.046)	(0.127)	(0.163)	(0.121)	(0.099)	(0.099)	(0.325)	(0.147)
Prudential Policies ($HomeP_{t-2}$)	0.014	−0.020	0.710	−0.072	0.143	−0.093	0.106	−0.020
	(0.068)	(0.128)	(0.434)	(0.231)	(0.079)	(0.103)	(0.248)	(0.137)
Log Total $Assets_{t-1}$	−0.126***	−0.124***	−0.127***	−0.128***	−0.130***	−0.125***	−0.126***	−0.124***
	(0.031)	(0.030)	(0.031)	(0.032)	(0.029)	(0.029)	(0.032)	(0.030)
Tier 1 $Ratio_{t-1}$	−0.000	0.000	−0.000	−0.000	0.000	0.000	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Illiquid Assets $Ratio_{t-1}$	−0.361***	−0.361***	−0.359***	−0.358***	−0.366***	−0.367***	−0.361***	−0.356***
	(0.060)	(0.061	(0.059)	(0.058)	(0.061)	(0.062)	(0.058)	(0.057)
Net Intragroup Funding $Ratio_{t-1}$	0.096	0.079	0.083	0.056	0.084	0.094	0.068	0.069
	(0.127)	(0.111)	(0.108)	(0.114)	(0.112)	(0.109)	(0.114)	(0.107)
Core Deposits $Ratio_{t-1}$	−0.177	−0.156	−0.132	−0.200	−0.166	−0.110	−0.128	−0.085
	(0.185)	(0.167)	(0.185)	(0.202)	(0.199)	(0.200)	(0.180)	(0.176)
Credit Gap (Home Country)	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Output Gap (Home Country)	0.001	−0.000	−0.002	−0.003	−0.004	−0.002	−0.003	−0.000
	(0.008)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Log Total Assets* HomeP	0.000*	0.000*	0.000	0.000*	0.000*	0.000*	0.000**	0.000
	[0.081]	[0.009]	[0.152]	[0.061]	[0.053]	[0.078]	[0.013]	[0.360]
Tier 1 Ratio*HomeP	0.001	−0.005	−0.015	0.000	0.009	0.002**	−0.042***	0.005
	[0.128]	[0.141]	[0.089]	[0.867]	[0.274]	[0.025]	[0.000]	[0.303]

(*continued*)

Table 4. (Continued)

	All Instruments (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	Loan-to-Value Ratio (4)	Reserve Requirements: Foreign (5)	Reserve Requirements: Local (6)	Interbank Exposure Limits (7)	Concentration Ratios (8)
Illiquid Assets Ratio* HomeP	−0.155 [0.442]	0.654 [0.266]	1.015 [0.024]	−0.204 [0.576]	0.070 [0.862]	0.059 [0.661]	1.236** [0.012]	−0.566 [0.369]
Net Intragroup Funding Ratio*HomeP	−0.062 [0.764]	−0.251 [0.655]	−3.765 [0.000]	0.093 [0.584]	−0.449 [0.498]	−0.245 [0.140]	2.909* [0.052]	0.061 [0.941]
Core Deposits Ratio* HomeP	0.489** [0.026]	0.991 [0.353]	9.553 [0.000]	2.309* [0.064]	4.626** [0.011]	0.665*** [0.005]	7.981*** [0.008]	0.759 [0.310]
Prudential Policies (Combined)	0.016 [0.885]	0.026 [0.904]	1.019 [0.108]	−0.168 [0.568]	−0.993** [0.035]	−0.137 [0.356]	−1.984** [0.047]	0.109 [0.760]
Observations	1,367	1,367	1,367	1,367	1,367	1,367	1,367	1,367
Adjusted R^2	0.143	0.141	0.144	0.146	0.143	0.144	0.146	0.151
No. of Banks	28	28	28	28	28	28	28	28

Notes: This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in total loans. The data are quarterly from 2000:Q1 to 2013:Q4. HomeP refers to the changes in regulation in the home (i.e., parent-bank) country of foreign affiliates. For HomeP interaction effects, the reported coefficient is the sum of the contemporaneous term and two lags, with the corresponding F-statistics for joint significance in parentheses. Each column gives the result for the regulatory measure specified in the column headline. All specifications include time and bank fixed effects. Standard errors are clustered by banks. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. Standard errors are in parentheses. P-values are in squared brackets.

Table 5. Inward Transmission of Policy via Affiliates of Foreign-Owned Banks (III)

	All Instruments (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	Loan-to-Value Ratio (4)	Reserve Requirements: Foreign (5)	Reserve Requirements: Local (6)	Interbank Exposure Limits (7)	Concentration Ratios (8)
Prudential Policies ($\text{HomeP}_{\text{cum}}$)	−0.003	−0.030	−0.011	−0.008	−0.033	−0.006	0.084	−0.018
	(0.004)	(0.041)	(0.012)	(0.010)	(0.022)	(0.006)	(0.052)	(0.031)
Log Total Assets_{t-1}	−0.127***	−0.114***	−0.118***	−0.126***	−0.127***	−0.126***	−0.110***	−0.122***
	(0.030)	(0.029)	(0.034)	(0.028)	(0.030)	(0.029)	(0.032)	(0.032)
Tier 1 Ratio_{t-1}	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Illiquid Assets Ratio_{t-1}	−0.370***	−0.356***	−0.356***	−0.368***	−0.368***	−0.369***	−0.380***	−0.365***
	(0.070)	(0.058)	(0.059)	(0.070)	(0.069)	(0.069)	(0.054)	(0.066)
Net Intragroup Funding Ratio_{t-1}	0.012	0.044	0.044	0.014	−0.002	0.007	0.039	0.028
	(0.130)	(0.116)	(0.109)	(0.125)	(0.135)	(0.134)	(0.112)	(0.118)
Core Deposits Ratio_{t-1}	−0.229	−0.148	−0.157	−0.233	−0.202	−0.225	−0.111	−0.198
	(0.177)	(0.174)	(0.177)	(0.174)	(0.183)	(0.174)	(0.160)	(0.173)
Credit Gap (Home Country)	−0.001	0.001	0.001	−0.001	−0.001	−0.001	0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Output Gap (Home Country)	0.001	0.000	0.001	0.002	0.000	0.001	−0.004	0.011
	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.009)	(0.008)	(0.008)
Credit Gap*HomeP	0.000***	−0.000	0.001	0.001**	0.003***	0.001***	0.003***	0.002
	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)
Output Gap*HomeP	0.000	0.037*	0.010***	0.000	−0.002	−0.001	0.023**	−0.013***
	(0.001)	(0.018)	(0.002)	(0.003)	(0.005)	(0.002)	(0.008)	(0.004)
Observations	1,395	1,395	1,395	1,395	1,395	1,395	1,395	1,395
Adjusted R^2	0.149	0.144	0.144	0.149	0.150	0.149	0.149	0.148
No. of Banks	28	28	28	28	28	28	28	28

Notes: This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in total loans. The data are quarterly from 2000:Q1 to 2013:Q4. HomeP refers to the changes in regulation in the home (i.e., parent-bank) country of foreign affiliates. Each column gives the result for the regulatory measure specified in the column headline. All specifications include time and bank fixed effects. Standard errors are clustered by banks. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. Standard errors are in parentheses.

Table 6. Inward Transmission of Policy via Affiliates of Foreign-Owned Banks (IV)

	All Instruments (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	Loan-to-Value Ratio (4)	Reserve Requirements: Foreign (5)	Reserve Requirements: Local (6)	Interbank Exposure Limits (7)	Concentration Ratios (8)
Home Prudential Policies ($HomeP_t$)	−0.028	0.026	−0.096**	0.056**	−0.079	−0.013	−0.091	−0.145***
	(0.020)	(0.069)	(0.033)	(0.022)	(0.052)	(0.023)	(0.200)	(0.044)
Home Prudential Policies ($HomeP_{t-1}$)	0.012	−0.043	−0.005	−0.004	−0.009	−0.032	−0.062**	0.075*
	(0.017)	(0.051)	(0.013)	(0.011)	(0.071)	(0.028)	(0.022)	(0.036)
Home Prudential Policies ($HomeP_{t-2}$)	0.021	−0.046	0.022	−0.066**	−0.034**	0.040	0.060	0.048
	(0.020)	(0.037)	(0.021)	(0.026)	(0.014)	(0.036)	(0.057)	(0.057)
Log Total $Assets_{t-1}$	−0.095***	−0.090***	−0.091***	−0.088***	−0.094***	−0.090***	−0.093***	−0.091***
	(0.025)	(0.027)	(0.025)	(0.025)	(0.024)	(0.023)	(0.025)	(0.025)
Tier 1 $Ratio_{t-1}$	0.000	0.001	0.000	0.001	0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Illiquid Assets $Ratio_{t-1}$	−0.331***	−0.330***	−0.329***	−0.330***	−0.330***	−0.328***	−0.329***	−0.329***
	(0.030)	(0.029)	(0.029)	(0.029)	(0.029)	(0.028)	(0.029)	(0.028)
Net Intragroup Funding $Ratio_{t-1}$	0.016	0.030	0.018	0.012	0.026	0.036	0.024	0.015
	(0.110)	(0.108)	(0.107)	(0.108)	(0.109)	(0.101)	(0.109)	(0.104)
Core Deposits $Ratio_{t-1}$	0.017	0.029	0.020	0.029	0.023	0.030	0.022	0.042
	(0.217)	(0.211)	(0.218)	(0.222)	(0.220)	(0.211)	(0.210)	(0.221)
Credit Gap (Home Country)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Output Gap (Home Country)	0.008	0.004	0.003	0.006	0.004	0.002	0.004	0.004
	(0.007)	(0.006)	(0.007)	(0.007)	(0.006)	(0.008)	(0.006)	(0.006)
Credit Gap (Host Country)	0.003**	0.003*	0.003*	0.003*	0.003**	0.003**	0.003**	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Output Gap (Host Country)	−0.008	−0.001	0.002	−0.004	−0.001	−0.000	−0.001	−0.001
	(0.006)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)

(*continued*)

Table 6. (Continued)

	All Instruments (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	Loan-to-Value Ratio (4)	Reserve Requirements: Foreign (5)	Reserve Requirements: Local (6)	Interbank Exposure Limits (7)	Concentration Ratios (8)
Host Prudential Policies ($HostP_t$)	0.033	−0.012	−0.097	0.026	NA	0.006	NA	NA
	(0.019)	(0.033)	(0.072)	(0.016)	NA	(0.042)	NA	NA
Host Prudential Policies ($HostP_{t-1}$)	−0.003	0.032	0.106*	−0.006	NA	−0.020	NA	NA
	(0.013)	(0.035)	(0.048)	(0.017)	NA	(0.081)	NA	NA
Host Prudential Policies ($HostP_{t-2}$)	0.047*	−0.002	0.030	0.042	NA	0.134	NA	NA
	(0.022)	(0.041)	(0.048)	(0.027)	NA	(0.148)	NA	NA
Home Prudential Policies (Combined)	0.005	−0.063	−0.079	−0.014	−0.122	−0.005	0.031	−0.022
	[0.872]	[0.598]	[0.100]	[0.678]	[0.343]	[0.917]	[0.894]	[0.816]
Host Prudential Policies (Combined)	0.077**	0.018	0.039	0.062*	NA	0.120	NA	NA
	[0.035]	[0.707]	[0.574]	[0.056]	NA	[0.462]	NA	NA
Observations	1,313	1,313	1,313	1,313	1,313	1,313	1,313	1,313
Adjusted R^2	0.105	0.098	0.102	0.104	0.096	0.101	0.096	0.107
No. of Banks	28	28	28	28	28	28	28	28

Notes: This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in total loans. The data are quarterly from 2000:Q1 to 2013:Q4. HomeP refers to the changes in regulation in the home (i.e., parent-bank) country of foreign affiliates. Each column gives the result for the regulatory measure specified in the column headline. All specifications include time and bank fixed effects. "NA" indicates that no data has been available for this instrument. Standard errors are clustered by banks. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. Standard errors are in parentheses. P-values are in squared brackets.

significance of the joint hypothesis fails to present clear evidence for the inward spillover effect of capital requirements regulation (p-values are greater than 10 percent in all specifications).

These results may reflect the relatively small size of foreign banks in Korea. In other words, as the loan assets of foreign bank affiliates in Korea are of relatively little importance in the consolidated level, the changes in capital requirements in the home countries have not made a significant impact on the loan-supplying activities of those banks in Korea. In addition, in response to a change in capital requirements regulation, banks adjust the composition of their asset portfolios to manage the optimal level of risk. This process is done at the consolidated level, so the headquarters' decisions on the degree of adjustment at the foreign branch level depend on the relative importance of the branch in terms of the total exposure. In this sense, it is possible that foreign bank branches, which have a relatively small exposure in the consolidated view, are pushed back on the priority list when the parent banks redistribute their portfolios.

An alternative explanation for the weak results is that in terms of the capital requirements there may not have been great opportunities for regulatory arbitrage, as the development of global capital requirements regulation has been led by the BIS, and most countries included in the sample (including Korea) have followed the supervisory guidance agreed to among BIS member countries.

Meanwhile, it is discovered that foreign bank loans do not respond significantly to capital requirement changes in Korea. In Korea, foreign bank branches are also required to meet capital ratio regulations based on the same criteria as Korean domestic banks. However, they normally tend to resort to headquarter financing, directly adjusting regulatory capital rather than adjusting their asset portfolios.

For the sector-specific capital buffer, in models using policy variables only, without balance sheet variables interactions (i.e., in models 1, 3, and 4), it turns out that tightening the sector-specific capital buffer in the home country generally leads to a decrease in the lending growth of foreign banks in Korea, as shown in the third column of tables 3, 4, and 6. It is applied at the consolidated balance sheet level, so the negative sign of the coefficients can also be interpreted to reflect the tendency that international banks adjust their total

lending portfolios and simply redistribute the adjustments to their business units.[4]

With respect to reserve requirements, our analysis consistently shows that a tightening of reserve requirements in home countries, whether it be for local- or foreign-currency deposits, has a negative inward spillover effect on the lending activities of foreign banks in Korea, as we can observe in the fifth and sixth columns of tables 3–6. Like LTV ratio limits, reserve requirements also control the supply of credit by banks directly. Thus, it is possible that a tightening in reserve requirements reduces the lending capacity of the parent banks in general, which also undermines the financing of foreign affiliates from their parent banks. Considering the fact that foreign bank affiliates in Korea and foreign bank branches in particular depend heavily on financing from their headquarters, these results seem reasonable. In contrast, changes in Korea's reserve requirements have no significant impact on the changes in the loan supply of foreign banks in Korea. We see this result as a reflection of the low dependency on deposits of foreign bank branches in Korea.

4.2 Reactions to the Other Policy Instruments

In the analysis of LTV limits, as shown in the fourth columns of tables 3–6, there is no striking evidence observed in the estimation results. An LTV ratio limit is a measure that directly controls the quantity of the mortgage loan supply. Therefore, it is generally expected that a forced shrinkage in the domestic mortgage market caused by a tightening of LTV limits will encourage banks to seek opportunities abroad, thus leading to an increase in the lending of foreign bank branches. However, considering the lack of retail banking activities of foreign bank branches in Korea, the absence of linkage between loan supply from foreign banks and LTV limit changes in the home country is not surprising. The result that foreign bank branches in Korea do not respond to LTV limit changes

[4]Among the countries included in the analysis, only two countries have implemented this regulation, and policy changes occurred only ten times in total. Also, there are only two foreign bank branches from these countries, one from each country, and the loans supplied by these banks account for just 3 percent of total foreign bank branch loans.

of Korea also reflects this characteristic of the business activities of foreign bank branches.

For the last two dependent variables, interbank exposure limits and concentration ratio limits, this study does not find any connection between the lending behaviors of foreign banks in Korea and the changes in these regulations in home countries, as shown in the seventh and eighth columns of tables 3–6. Interbank exposure limits have been implemented by a very limited number of countries and have not changed frequently. In addition, this measure focuses on limiting the contagion channel of a failure of a globally important financial institution. Even though foreign banks in Korea are involved in various interbank activities in the Korean financial market, generally with Korean domestic banks, this regulation seems to have had little influence on their activities, since Korean domestic banks are not classified as "systemically important" from a global view. Regarding the concentration limits of home countries, it is difficult to find any plausible reason to think that they may change the business activities of the foreign affiliates, because those measures intend only to mitigate the market domination of big banks in their domestic banking industries.

4.3 Note on the Reactions to the Korean Financial Cycle

Among the other independent variables, we would like to take notice of cycle variables. In most of the specifications, the loan-supplying behavior of foreign affiliates in Korea turned out not to be influenced by home countries' financial and business cycles. In contrast to this, we observe statistically significant positive coefficients for the financial cycle of the host country (Korea) in table 6, which implies that foreign bank branches are more sensitive to changes in the macroeconomic situations of host countries than home countries. Meanwhile, home countries' cycle variables turn out to have marginal effects on the inward spillover of regulatory changes in some cases. In table 5, which displays the coefficients on the interaction term between the financial cycle and regulatory variables, we can observe statistically significant positive numbers for LTV, reserve requirements, and interbank exposure limits. This means that the negative (positive) effects of regulation tightening on log loan changes are weakened

(strengthened) when the measure is implemented in the expansionary phase of the financial cycle. The business cycle has also a similar effect on capital requirements, sector-specific capital buffers, and interbank exposure limits.

4.4 Spillover through the "Funding Channel"

Foreign banks in Korea may contribute to total bank lending by providing liquidity through swap operations with domestic Korean banks. (We will refer to this channel in Korea as the "funding channel.") Thus, we investigate whether there is a significant spillover through the funding channel—specifically, changes in the internal funding of foreign bank affiliates. We slightly modify the first model specification, using a change in the intragroup funding (borrowing from the head office) ratio to total liabilities as a dependent variable and keeping other explanatory variables except the net intragroup funding ratio in the model. In general, we fail to find strong evidence to confirm a meaningful change in the funding behavior of foreign banks in response to changes in prudential measures of home countries.

However, this does not mean that the foreign banks' swap operations have no effect on total bank lending in Korea, considering that our dependent variable includes only lending by foreign banks. Additional analysis will be necessary to verify the funding channel, although that is beyond the scope of this IBRN project on prudential regulation spillover through foreign banks.

Regarding the above analysis, it should be pointed out that the activities of foreign banks in Korea are heavily influenced by Korean regulation of cross-border capital flows. In Korea, prudential policies related to foreign exchange risk have been implemented since the global financial crisis.[5] As these measures change the funding conditions of foreign banks, it is possible that their business activities are more significantly influenced by these regulations in Korea than by the home countries' prudential measures.

[5]Leverage caps on banks' foreign exchange (FX) derivatives positions require banks to limit their FX derivatives positions at or below a targeted level. Furthermore, a macroprudential stability levy (MSL) aims to limit the level of banks' non-core FX liabilities.

5. Conclusion

Since the global financial crisis, most countries have been introducing or strengthening prudential policies to limit systemic risk in the financial sector to a manageable level. However, in a world where financial markets are being globally integrated and the nationality of money is becoming less and less important, the effectiveness of prudential policy in one country can be significantly restricted by policy actions of other countries. In this sense, a multilateral approach in designing an effective prudential policy scheme is very crucial.

This paper aims to find evidence of inward spillover effects of prudential policy changes through foreign bank affiliates in Korea. The general conclusion is that the evidence of inward spillover effects is not strong; that is, a change in prudential policies in home countries has not led to significant changes in the lending behaviors of foreign banks in Korea generally. However, with respect to some prudential measures, such as sectoral-specific capital buffers and reserve requirements, we observed negative correlations between the tightening of those instruments in home countries and the changes in the lending of foreign bank affiliates in Korea.

As we discussed in an earlier section, we conjecture that the generally weak evidence is mainly due to the business practices of foreign banks in Korea. Lending is not their primary business activity, even though foreign banks are steadily expanding their retail banking activities. Instead, their role as providers of foreign currencies in the Korean financial markets remains crucial. In addition, the business model of foreign banks differs by nationality. For example, foreign bank branches from the United States and Europe act as investment banks, while Asian banks are more actively involved in trade finance.

Additional analysis on whether macroprudential policies affect the funding of foreign banks from their headquarters and thus eventually affect foreign bank lending in Korea produced a negative result. In other words, we could not find support for the hypothesis that foreign bank lending is affected by variation in funding from home-country headquarters caused by any macroprudential policy change. Despite this result, we cannot completely discard the possibility that foreign banks' funding from headquarters affects the bank

lending of Korean banks that engage in swap transactions with foreign banks in Korea. However, clarification of this issue seems to be beyond the scope of the current IBRN project, and we would like to leave it for future research.

References

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