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

Alejandro Jara and Luis Cabezas
Central Bank of Chile

In this paper we apply the inward transmission approach described in Buch and Goldberg (2017) to a selected group of internationally active banks in Chile for the 2002:Q2–2013:Q4 sample period. We find that the spillover effects generated by changes in the prudential policy abroad have a positive but relatively weak impact on domestic lending. When comparing the two inward approaches suggested by Buch and Goldberg (2017), the spillovers transmitted through the exposure-weighted prudential policy are stronger and economically more significant than those through the foreign subsidiary relationship. This result is robust to different specifications, and might suggest that foreign subsidiaries in Chile behave just like domestic banks, as they have to comply with the local regulation in the same way as local banks. Above all, capital requirements appear to be the most significant prudential policy affecting domestic lending.

JEL Codes: E32, F32, F34, G21, G15.

1. Introduction

As a result of the global financial crisis, the main international jurisdictions around the world have implemented important changes to their banking regulations. Among others, these changes are part of

*We are grateful to Claudia Buch, Linda Goldberg, Matthieu Bussière, Claudio Raddatz, and an anonymous referee for their excellent comments and suggestions. We also would like to thank Faruk Miguel and colleagues in the Monetary and Financial Statistical Department at the Central Bank of Chile for answering many questions related to the external exposure of Chilean banks; and we thank colleagues at the Bank's Financial Research Unit for their helpful comments at different stages of this research. The usual disclaimer applies. Corresponding author (Jara): ajara@bcentral.cl. Cabezas: lcabezas@bcentral.cl.

the Basel III proposal (capital, liquidity, etc.) and the Dodd-Frank and European Market Infrastructure Regulation (EMIR) initiatives in the United States and Europe, respectively. Several of these changes have been promoted by the Basel Committee on Banking Supervision and the Financial Stability Board, and have a mandatory implementation calendar for jurisdictions that are members of these groups.

The Chilean banking system fared very well during the global financial crisis, so there was no perception of an immediate need to reform its regulation and supervision. But Chile is an open economy with an important presence of subsidiaries of internationally active banks and with an incipient, but increasing, presence of local banks in the region. Moreover, some parent banks of these subsidiaries are systemically important at the global level, making the Chilean banking system especially sensitive to changes in the international banking regulation.

At the local level, the framework that regulates Chilean banks has seen no major reform since 1997. Although this framework is similar to Basel I in many respects, it is more demanding in terms of its definition of capital (tier 1 and tier 2) and the limits imposed. In addition, market risk regulation is in compliance with the 1996 Basel I amendment, and a leverage cap—similar to the one recently introduced in Basel III—has been an integral part of the Chilean banking regulation for over two decades. Moreover, liquidity risk exposures have been subject to prudential limits since the early 2000s, and are now in line to be regulated with the Basel III approach.

Therefore, it is fair to say that the Chilean supervisory and regulatory authorities have followed a conservative approach regarding the banking system. In fact, the active role played by independent rating agencies and the use of internal models to evaluate risks suggested in Basel II were never implemented in Chile, as they most probably would have lowered the levels of capital requirements. Despite this conservative approach, the Chilean regulatory authorities seek to meet higher international standards. Indeed, the General Banking Act that regulates banks in Chile is currently under revision and will probably be updated in line with the Basel III proposal. Similarly, the resolution setting could also be reformed, as suggested by International Monetary Fund (2011) and Larraín (2015).

In this article we address the following questions: Could the new banking regulation being implemented around the world affect the domestic lending behavior of banks in Chile? If so, how is this effect being transmitted? Are subsidiaries of foreign banks more likely to respond to these changes? Can even domestically owned banks be dependent on their actual exposure to different jurisdictions? What type of prudential instruments are more likely to generate spillover effects over the domestic banking system? Are these regulatory spillovers symmetric across different types of credit? How important are banks' balance sheets' characteristics in enhancing or reducing these effects?

To address these questions, we apply the inward transmission approach described in Buch and Goldberg (2017) to a selected group of internationally active Chilean banks for the 2002:Q2–2013:Q4 sample period. In particular, we study whether different prudential policies undertaken abroad have any impact on Chile's domestic lending. The inward transmission approach allows us to study two potential channels of regulatory spillovers: the transmission of policy through the international exposure of banks as well as the transmission via affiliates of foreign-owned banks. In the first case, regulatory spillovers are potentially transmitted through the assets and liabilities that each bank holds in the different foreign jurisdictions around the world; in the second, foreign-owned banks can potentially spill over the regulatory policies undertaken in the country where the parent bank is based.

Our main findings are that the spillover effects of changes in the prudential policy abroad have a relatively weak impact on domestic lending. However, a tightening in the prudential policy abroad tends to be associated with an increase in domestic lending. When comparing the two methodologies outlined above, we find stronger and economically more significant spillovers when looking at the exposure-weighted prudential policy rather than at the parent/subsidiary relationship. This result is robust to different specifications and might suggest that foreign subsidiaries in Chile behave just like domestic banks, as they have to comply with the local regulation in the same way as local banks. Above all, capital requirements appear to be the most significant prudential policy affecting domestic lending.

Table 1. The Structure of Chilean Banks (as of the end of 2013)

	Big and Medium	Retail	Treasury	Total
Number of Banks	12	3	8	23
Domestically Owned Banks	7	3	2	12
Foreign-Owned Banks	5	0	6	11
Total Assets (Billions of US$)	274	4	9	287
Domestically Owned Banks	172	4	4	180
Foreign-Owned Banks	102	0	5	107

Source: Authors' calculations based on the Superintendency of Banks and Financial Institutions and Jara and Oda (2015).
Note: This table reports the number of active banks and their total assets by cluster as of the end of 2013.

2. Data and Stylized Facts for Chile

The Chilean banking system is characterized by a high degree of heterogeneity, in terms of size, business orientation, and funding structure. Traditionally, banks in Chile are classified in four different categories: big, medium, retail, and treasury banks (Jara and Oda 2015). Big and medium-sized banks are the standard commercial banks that participate in all market segments (corporate, consumer, and mortgage credits). By the end of 2013, these banks consisted of twelve institutions, seven of which were domestically owned and five subsidiaries of foreign banks. As a whole, they account for more than 95 percent of total assets (table 1). On the other hand, all retail banks are domestically owned, relatively small in size, and focused on households' finance (consumer and mortgage loans). Finally, treasury institutions are mainly subsidiaries of foreign banks whose core activity is to provide investment banking services (corporate finance business and derivatives).

In addition to the differences in size, market focus, and ownership structure, Chilean banks differ in terms of their degree of international exposure. In fact, while treasury banks hold the highest relative level of assets and liabilities overseas, the international activity of retail banks is almost negligible. Since the purpose of this article is

to study potential prudential spillovers of foreign regulation into the domestic lending market, we constrain our analysis to the sub-group of big and medium banks. We leave aside the retail and treasury banks because of their small impact on domestic lending and, in the case of retail banks, also because of their lack of foreign exposure.

Additionally, we deal with the issue of mergers and acquisitions of banks which, over the past two decades, resulted in a substantial drop in the number of banks and a significant increase in the participation of foreign banks in the Chilean banking system. Notwithstanding, the most important mergers and acquisitions occurred during the 1990s and early 2000s (Ahumada and Marshall 2001), and therefore they have a minor impact in this study. For the mergers and acquisitions that did occur during the period of our analysis (2002:Q2–2013:Q4), we followed an eclectic approach. If two banks with their headquarters in the same country merged, we created a fictitious bank, as if both institutions had been merged for the entire sample period (similarly to that suggested in Aiyar et al. 2014). By contrast, if the merger occurred between institutions owned by banks of different origin, we kept these institutions separate. In the latter case, we added a dummy variable that identifies the first four quarters when the merger began in order to control for the effect generated by the merger on lending growth rates. Finally, for the acquisitions, we were especially careful in identifying when the relevant jurisdiction where the banks' headquarters were located changed, an issue that is particularly important when studying spillovers via foreign affiliates.

As a result, we ended up with an unbalanced panel of fourteen banks for the implementation of the inward transmission of policy through international exposures, and six banks for the implementation of the inward transmission via foreign affiliates of foreign-owned banks.

2.1 Bank-Level Data

2.1.1 Dependent Variables

Following Buch and Goldberg (2017), our baseline estimations are performed using the log quarterly changes of total loans as the main dependent variable. In addition, as robustness checks, we use two alternative dependent variables. First, we look at the relevance of

loans composition, by computing the log quarterly change of different types of loans (i.e., commercial, mortgage, and consumer loans). Second, we use an accounting measure of banks' risk taking, and study whether changes in foreign regulation might affect banks' preferences toward risk. Our risk-taking measure is based on Laeven and Levine (2009) and is equivalent to the sum of the capital adequacy ratio (CAR) and the return on assets (ROA), as a ratio of the standard deviation of ROA, i.e., $z\text{-}score_{i,t} = (ROA_{i,t} + CAR_{i,t})/\sigma_i(ROA_{i,t})$.

Table 2 shows the summary statistics of the dependent variables (upper panel) for three different groups of banks: (i) big and medium-sized banks, (ii) retail and treasury banks, and (iii) big and medium-sized banks that are foreign owned. Group (i) corresponds to the those banks used in the implementation of the inward transmission of policy through the international exposure of banks, which includes 568 observations. Group (iii) includes the six subsidiaries used in the transmission of policy through foreign affiliates of foreign-owned banks, equivalent to 250 observations. Finally, group (ii) includes the observations excluded in the empirical analysis presented below. Table 2 also compares the mean of groups (ii) and (iii) with the mean of group (i), and reports when the difference between these means is statistically significant at 5 percent.

As can be seen, when looking at the set of dependent variables (upper panel), the main differences between group (ii) and (iii), and the baseline group (i), are in the measure of risk taking. Nonetheless, the standard deviations are much higher for the group of retail and treasury banks, which is consistent with the fact that these banks do not participate actively in domestic lending, which makes their lending growth rates particularly volatile. When comparing the two groups of banks included in the empirical exercises below ((i) and (iii)), their lending growth rates are similar in both means and standard deviations. On the other hand, our measure of risk taking shows that foreign-owned banks are less risk averse than the banks included in group (i).

2.1.2 Control Variables

As control variables we consider a set of banks' balance sheet characteristics related to the assets and liabilities of each bank. In

Table 2. Summary Statistics on Lending Growth Rates and Banks' Characteristics

	Big and Medium Banks (N = 568)			Retail and Treasury Banks (N = 404)			Big and Medium (Foreign-Owned) Banks (N = 250)		
	Mean	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Dependent Variables:									
Δ Domestic Loans: Total	2.692	2.490	4.080	1.838	2.376	22.402	3.169	2.663	6.163
Δ Domestic Loans: Commercial	2.816	2.276	5.564	3.959	1.433	24.057	3.715	2.014	8.872
Δ Domestic Loans: Consumer	2.834	2.639	6.563	−0.646	0.275	38.552	1.240	2.864	30.300
Δ Domestic Loans: Mortgage	2.944	2.860	5.078	8.899	4.818	29.544	2.634	2.757	6.704
z-score	29.551	25.510	14.458	15.404**	14.653	7.490	26.370**	22.710	13.540
Independent Variables:									
Log Total Assets	21.996	22.073	1.315	19.037**	19.232	1.270	21.760**	21.850	1.389
Tier 1 Ratio (%)	8.142	7.530	2.992	29.072**	18.279	22.562	9.472**	8.594	3.737
Illiquid Assets Ratio (%)	83.406	84.634	7.714	67.349**	67.313	22.706	82.720	84.930	8.653
International Activity (%)	9.560	7.898	10.064	22.283**	10.060	29.390	12.520**	9.399	13.870
Net Due To (%)	−0.159	0.000	2.024	−9.152**	0.000	20.846	−0.426	0.000	3.211
Core Deposits Ratio (%)	74.338	75.469	12.063	85.592**	96.414	23.031	72.830	75.570	16.420

Source: Authors' calculations based on the Superintendency of Banks and Financial Institutions, and the Central Bank of Chile.
Notes: This table provides summary statistics for bank balance sheet and lending data for the 2002:Q2–2013:Q4 period, when three different groups of banks are considered: (i) big and medium banks, (ii) retail and treasury banks, and (iii) big and medium banks that are foreign owned. It also compares the mean of group (ii) and (iii) with the mean of group (i). ** shows the results of t-test when these differences are statistically significant at 5 percent.

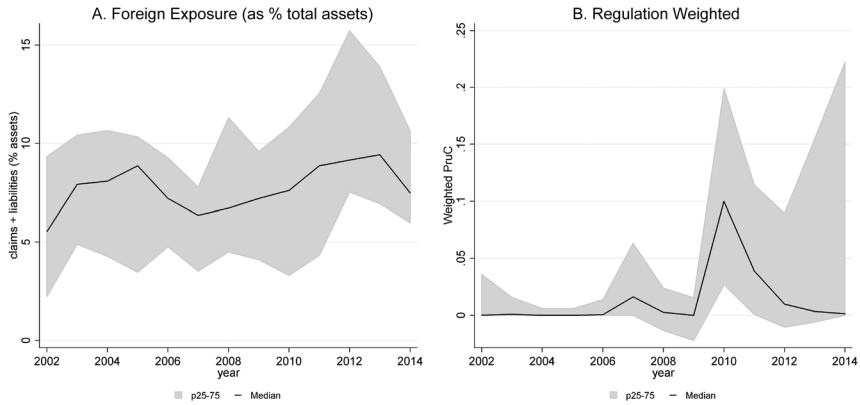
particular, we include (i) a measure of bank size, defined as the log of total assets, (ii) the ratio of tier 1 capital to total assets, (iii) the share of illiquid assets to total assets, and (iv) the ratio of core deposits to total liabilities. We consider the size of banks as a measure of scale economies. The ratio of illiquid assets is included, as it shows the capacity of banks to increase loans. Finally, higher core deposit ratios, as well as higher levels of capitalization, are directly related to lending growth rates, as they allow for a lower financing cost. See table 9 in the appendix for the detailed definitions and sources of these variables.

We also use individual banks' information reported to the Central Bank of Chile regarding their claims and liabilities outstanding positions held with non-residents. This information, which includes loans and deposits vis-à-vis the residency of the counterpart, is in compliance with the requirements needed to prepare the balance-of-payments statistics, and is reported on a quarterly basis. With this information at hand, we construct two additional control variables: (i) the international exposure ratio and (ii) the net due to head office ratio.[1] The international exposure ratio is equivalent to the sum of foreign assets and liabilities, as a percentage of total assets, while the net due to head office ratio is proxied by the difference between liabilities and assets that each bank holds in the country where the headquarters are based. Since we are unable to identify how much foreign assets and liabilities each bank holds of its related parties, we proxy this variable by computing the assets and liabilities that each bank holds in the country where the parent bank resides. Therefore, our measure of net due to head office represents an upper bound of the desired variable.

The summary statistics for all these control variables are shown in the lower panel of table 2. As expected, when comparing the mean value of the control variables, banks included in group (ii) are statistically different from banks included in group (i). On the other hand, group (i) is not statistically different than the subset of foreign affiliates in terms of liquidity, deposits, and net foreign exposure. As a complement to table 2, in figure 1A we present the dynamics of the distribution of the international exposure for the set

[1]Notice that we also use this information to construct the prudential weight variable described below.

Figure 1. International Exposure and Prudential Weighted Index



Source: Authors' calculations based on Cerutti et al. (2017) and the Central Bank of Chile.
Notes: Panel A shows the distribution of foreign exposure (claims and liabilities) as a percentage of total assets and panel B shows the distribution of the prudential weighted index (ExpPruC). The shaded area represents the 25th and 75th percentile of each distribution, and the solid line represents the median.

of big and medium-sized banks included in group (i). As can be seen, on average, banks have increased their international exposure after the global financial crisis, and decreased it slightly by the end of the period. In any case, the dispersion across banks remains relatively high.

Finally, as suggested by Buch and Goldberg (2017), we analyze the relevance of the economic and financial cycle in the transmission of international regulatory spillovers, in particular when accounting for the cyclical behavior of home countries when studying the spillovers via foreign affiliates. The economic and financial cycle is provided by the Bank for International Settlements (BIS), following the methodology suggested by Drehman, Borio, and Tsatsaronis (2012).

2.2 Data on Prudential Instruments

In our empirical analysis, we evaluate the impact of changes in the following seven prudential instruments: (i) an aggregate measure of

prudential policy (*PruC*), (ii) a general capital requirements policy (cap_req), (iii) a sector-specific capital buffer (sscb), (iv) a loan-to-value ratio limit (ltv), (v) a reserve requirement for foreign-currency operations (rr_foreign), (vi) a reserve requirement for local-currency operations (rr_local), and (vii) a regulation concerning the concentration ratio (concrat). We do not evaluate the relevance of the interbank exposure limit policy, as only 11 percent of commercial banks in Chile were exposed to countries where this instrument experienced a change during the sample period. Moreover, when looking at the subsample of foreign-owned banks, no jurisdiction where the headquarters were located experienced a variation in this particular instrument.

Table 3 summarizes the changes in prudential variables faced by banks located in Chile over the 2002:Q2–2013:Q4 sample period. The upper panel focuses on the prudential changes that are relevant when the exposure of banks is considered. As can be seen, Chilean banks were exposed to countries that only tightened their capital requirements during this sample period, while all other instruments were either tightened or loosened at some point in time. This issue might help to better identify the effect of capital requirements when using this specification, even though capital requirements were not the most extensively used instrument in the sample.

Table 3's lower panel shows the prudential changes that occurred in the jurisdictions where the headquarters of foreign banks are located. Here, in addition to capital requirements, the concentration ratio experienced only a tightening during our period of analysis, while the interbank exposure limit experienced no change.

2.2.1 Regulation Weighted by Foreign Exposure

When evaluating the inward transmission of prudential policies of the home country j at time t ($P_{j,t}$), through the international exposure of bank b at time t, we first need to compute the weighted exposure to these changes ($ExpP_{b,t}$), as follows:

$$ExpP_{b,t} = \sum_{j} \frac{(A_{b,j,t-1} + L_{b,j,t-1})P_{j,t}}{(A_{b,t-1} + L_{b,t-1})}.$$

Table 3. Summary Statistics: Changes in Prudential Instruments

Inward: Big and Medium Banks (Foreign and Domestically Owned)						
	Base Data (Before Aggregating to Exposure-Weighted Measures)					Exposure-Weighted Observations
Instrument	**No. of Country-Time Changes**	**No. of Country-Time Changes (Tightening)**	**No. of Country-Time Changes (Loosening)**	**No. of Bank-Time Changes**	**Proportion Base-MPP Non-zero**	**Proportion $ExpP_t$ Non-zero**
Prudential Index	338	256	82	2,046	0.16	0.76
General Capital Requirements	58	58	0	394	0.03	0.19
Sector-Specific Capital Buffer	61	34	5	369	0.03	0.31
Loan-to-Value Limits	71	56	15	488	0.11	0.48
Reserve Requirements: Foreign	100	61	17	475	0.04	0.40
Reserve Requirements: Local	160	87	66	965	0.07	0.58
Interbank Exposure Limit	16	15	1	124	0.02	0.11
Concentration Ratios	22	21	1	121	0.01	0.16

(*continued*)

Table 3. (Continued)

Inward: Big and Medium Banks (Foreign Owned)						
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	34	23	11	41	0.156	
General Capital Requirements	7	7	0	9	0.032	
Sector-Specific Capital Buffer	6	3	1	6	0.028	
Loan-to-Value Ratio Limits	12	8	4	14	0.092	
Reserve Requirements: Foreign	4	2	2	4	0.018	
Reserve Requirements: Local	11	4	7	13	0.050	
Interbank Exposure Limit	0	0	0	0	0.000	
Concentration Ratio	1	1	0	1	0.005	

Source: Authors' calculations based on Cerutti et al. (2017).
Notes: This table shows summary statistics on changes in prudential instruments for banks located in Chile over the period 2002:Q2–2013:Q4. The number of changes in prudential instruments is reported on the country-time level and on the bank-time level. The last column of each panel shows the share of prudential changes to total observations (i.e., the share of non-zero observations). The column "Exposure-Weighted Observations" is based on the underlying data on prudential changes in foreign countries (columns under the "Base Data" heading). The reported data are based on the regression sample.

This variable captures the effect of changes in the prudential policy of the home country j, weighted by the assets and liabilities held by bank b in the home country j($A_{b,j}$ and $L_{b,j}$, respectively).[2] Therefore, the regulation weighted by foreign exposure depends on the direction of the change in the regulation (tightening or loosening) and on how exposed banks are to that particular jurisdiction.

The upper panel of table 3 shows some key characteristics of this variable for the set of instruments included in our empirical analysis. As can be seen, the commercial banks established in Chile have been mostly exposed to jurisdictions where prudential policies have been tightened. In addition, the instrument that experienced the strongest variation was the reserve requirement imposed on local operations. Figure 1B complements this information by showing the distribution of this exposure-weighted policy for the aggregated prudential instrument (*ExpPruC*). As can be seen, while banks established in Chile have been exposed, on average, to a tightening in the prudential policy, in recent years the dispersion of this regulation-weighted index has increased. Indeed, while some banks have almost no exposure to changes in the foreign regulation, others have more than one-third of their total assets exposed to jurisdictions where there has been a tightening. In addition, some banks have been exposed to jurisdictions where the prudential policy was loosened (see the negative numbers in figure 1B). This high heterogeneity observed in the regulation weighted by foreign exposure implies that policy changes respond not only to global factors but also to some idiosyncratic bank characteristics.

2.2.2 Home-Country Regulations

Finally, we study the impact of home-country regulations on the domestic lending rates of foreign subsidiaries. In particular, we look at the changes in the prudential policies in those countries where the headquarters of the parent banks of foreign subsidiaries are located.

[2]Notice that big and medium-sized banks in Chile were exposed to a total of 134 different jurisdictions during the 2002:Q2–2013:Q4 sample period, from which 59 of them are included in the IBRN Prudential Instruments Database described in Cerutti et al. (2017). However, with these fifty-nine countries, we are able to capture an average of 96 percent of the total cross-border exposure that banks had during the entire sample period.

Considering the ownership structure of foreign banks in Chile, there are five jurisdictions that are relevant during the 2002:Q2–2013:Q4 sample period: United States, Spain, Canada, Brazil, and the Netherlands.

As can be seen in the lower panel of table 3, there is high heterogeneity across prudential instruments that are relevant for foreign owned banks in Chile. While LTV caps are the instruments most used across countries, the instrument that measures the concentration limits is the least used. The latter is valid excluding the interbank exposure limit, which experienced no variation in the jurisdictions that are relevant in our study. Table 3's lower panel also shows that the majority of prudential instruments relevant for the Chilean foreign subsidiaries have tightened their prudential policies.

Note that in Chile subsidiaries of foreign banks are subject to the same banking regulation as local banks. This is particularly relevant regarding capital requirements, which have to be established in Chile. This characteristic of the Chilean regulation should weaken any potential impact of changes in the prudential instruments that occurred in the home country.

3. Empirical Method and Regression Results

To evaluate potential regulatory spillovers to domestic lending, we implement two complementary methodologies. First, we study the inward transmission of exposure-weighted regulation on a panel of fourteen commercial banks, including domestic and foreign-owned banks. Second, we look at the inward transmission of home macroprudential policy via foreign affiliates, focusing on a panel of six foreign-owned banks. In this last case, we ask whether changes in the prudential policies implemented in the country where the parent bank resides have any impact on the domestic lending activities of these affiliates.

In all cases, we run simple regressions controlling for banks' balance sheet characteristics (lagged one quarter), banks' fixed effects, and time fixed effects. At the end of this section we go beyond the baseline representation by checking for the robustness of our results and exploring further alternatives. As a robustness test, we first look

at the stability of our results after applying alternative ways to measure the regulation weights. Second, we discuss the results associated with the cumulative impact of changes in the prudential policies. Finally, we show the implications of dropping the only state-owned bank present in the sample (BancoEstado). As a further exploration, we study the inward transmission of prudential policies to different types of lending (commercial, consumption, and mortgage) and to a measure of banks' risk aversion.

3.1 Exposure-Weighted Inward Transmission of Regulation

We estimate an equation of the following characteristics:

$$\begin{aligned}\Delta Y_{b,t} = \alpha_0 &+ (\alpha_1 ExpP_{b,t} + \alpha_2 ExpP_{b,t-1} + \alpha_3 ExpP_{b,t-2}) \\ &+ \alpha_4 X_{b,t-1} + (\beta_1 ExpP_{b,t} X_{b,t-1} + \beta_2 ExpP_{b,t-1} X_{b,t-1} \\ &+ \beta_3 ExpP_{b,t-2} X_{b,t-1}) + f_b + f_t + \epsilon_{b,t}. \end{aligned} \quad (1)$$

$\Delta Y_{b,t}$ is the log change in domestic lending of bank b at time t. $X_{b,t-1}$ is the one-quarter lagged vector of control variables, which captures the degree in which banks are exposed to changes in regulation through ex ante balance sheet composition and market access. The prudential weighted policy changes outside the home country are captured by $ExpP$. Its impact is evaluated contemporaneously, and after two lags. As explained before, under this specification, the effective exposure to foreign regulation is captured by the assets and liabilities that each bank holds in each jurisdiction.

From a conceptual point of view, a tightened prudential policy abroad affects domestic lending rates through two distinctive channels. First, it could affect domestic funding conditions through the dynamics of cross-border bank flows. If the regulation abroad tightens, international banks might want to reduce their risk-weighted assets and consequently their cross-border lending. If that is the case, we expect to find that domestic lending would fall after a tightening in the prudential policy overseas. However, as explained by Buch and Goldberg (2017), this expected negative sign also depends on how broad the policy change is in the home country—in particular, whether these changes will affect local and foreign banks equally. Second, a tightened prudential policy abroad could also be associated with an increase in domestic lending rates if, as a

result of that, international investors (including local banks) decide to reduce their positions in the jurisdictions that are tightening and reallocate their assets to those countries where the prudential policies remain unchanged. This potentially increases the availability of funds, busting domestic liquidity and potentially increasing domestic lending.

Before running equation (1), we look at the effects of foreign prudential policies assuming no interactions, i.e., assuming that β_i coefficients of equation (1) are equal to zero. Under this specification, we find almost no effect of prudential policies over domestic lending.[3] In particular, when testing the three-quarter joint effect of prudential policy, the joint p-values are statistically non-significant in almost all policy instruments except capital requirements, which is statistically significant at 1 percent. A snapshot of this last result can be seen in figure 2A, which applies the Frish-Waugh theorem over equation (1) with non-interactions. Here, it can be seen that a tightening in the exposure-weighted regulation on capital requirements has a positive effect on domestic lending rates.[4]

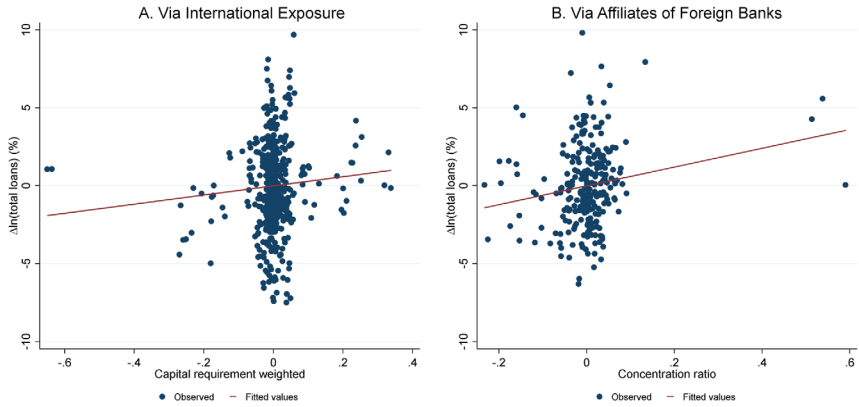
Table 4 then looks at the results from estimating equation (1) with interactions. Here, each column represents a different prudential instrument. The results for the prudential policy in levels are summarized as the sum of the $ExpP$ coefficient in time t and in the two previous quarters, and the corresponding p-value for the joint statistically significance of these coefficients. In addition, this table shows the estimated coefficients for the control variables in levels and interacted with the policy instrument.

The results of table 4 can be summarized as follows. The model fits the data quite well, as the adjusted R^2 is high and above 40 percent. Almost all coefficients associated with the control variables are statistically significant, present the expected signs, and are stable across different specifications. Indeed, banks that have less liquid

[3]These results are not presented here, but can be found in Cabezas and Jara (2016).

[4]The Frisch-Waugh theorem states that the multiple regression coefficient of any single variable can also be obtained by first netting out the effect of other variable(s) in the regression model from both the dependent variable and the independent variable. Therefore, it is always possible to respecify a linear regression model in terms of orthogonal complements, allowing to partial out right-hand-side variables.

Figure 2. Impact of Capital Requirements Weighted and Concentration Ratio on Log Changes in Total Loans



Source: Authors' calculations.
Notes: This figure shows the implementation of the Frish-Waugh theorem as a way to show the conditional impact of prudential measures on lending growth rates. Panel A focuses on the impact of capital requirements weighted on equation (1), and panel B shows the impact of concentration ratio on equation (2). In both cases the effects of interactions where excluded. The Frisch-Waugh theorem says the coefficient from this regression is exactly the same as the one in the multiple regression.

assets have lower lending growth rates, while banks that have higher tier 1 capital ratios and higher core deposits are associated with faster lending growth rates. Finally, banks that are more internationally active also have higher lending growth rates. Now, regarding the significance of prudential spillovers, we find that only two prudential instruments are significant in levels: the capital requirements and the loan-to-value ratios (see columns 2 and 4 in table 4). Capital requirements have a positive effect in lending growth rates, meaning that a tightening in the exposure-weighted prudential policy increases domestic lending, while loan-to-value ratios have a negative effect on lending growth rates. This latter effect is consistent with the idea that housing market cycles tend to be synchronized across countries (Milcheva and Zhu 2015).

When looking at the effects of interactions, we find mixed results. In short, being more exposed to jurisdictions that implemented, for example, a tight capital requirement has a smaller effect on those

Table 4. Inward Transmission of Policy through International Exposures of Domestic Banks

	ExpP = Prudential Index (1)	**ExpP = Capital Requirements (2)**	**ExpP = Sector-Specific Capital Buffer (3)**	**ExpP = LTV Ratio (4)**	**ExpP = Reserve Requirements: Foreign (5)**	**ExpP = Reserve Requirements: Local (6)**	**ExpP = Concentration Ratios (7)**
Sum ExpP	−7.319	81.87*	132.9	−351.4**	215.7	−0.702	−206.3
Joint p-value	0.815	0.057	0.458	0.044	0.180	0.990	0.689
Log Total Assets$_{t-1}$	−2.031	−1.940	−1.315	−1.730	−1.749	−1.522	−1.444
	(1.372)	(1.434)	(1.252)	(1.327)	(1.307)	(1.287)	(1.255)
Tier 1 Ratio$_{t-1}$	0.236*	0.242*	0.236	0.232**	0.237*	0.231*	0.186*
	(0.135)	(0.137)	(0.144)	(0.114)	(0.142)	(0.133)	(0.095)
Illiquid Assets Ratio$_{t-1}$	−0.136***	−0.127***	−0.136***	−0.136***	−0.127***	−0.134***	−0.116***
	(0.049)	(0.047)	(0.051)	(0.045)	(0.049)	(0.049)	(0.045)
International Activity$_{t-1}$	0.125***	0.121***	0.092***	0.087***	0.105***	0.096***	0.096***
	(0.033)	(0.031)	(0.029)	(0.033)	(0.031)	(0.030)	(0.029)
Net Due To (Head Office)$_{t-1}$	−0.000	−0.012	−0.027	−0.022	−0.001	0.007	−0.005
	(0.082)	(0.080)	(0.077)	(0.083)	(0.079)	(0.077)	(0.085)
Core Deposits Ratio$_{t-1}$	0.088***	0.078***	0.071**	0.067**	0.073**	0.074***	0.068**
	(0.030)	(0.030)	(0.029)	(0.029)	(0.029)	(0.028)	(0.028)
Sum Log Total Assets*ExpP	0.429	−3.571**	−4.536	22.47***	−6.313	0.100	34.27**
Joint p-value	0.768	0.030	0.607	0.001	0.287	0.964	0.035
Sum Tier 1 Ratio*ExpP	2.444**	3.780**	0.897	15.96*	−3.778	0.737	30.21
Joint p-value	0.039	0.041	0.830	0.093	0.599	0.698	0.181

(*continued*)

Table 4. (Continued)

	ExpP = Prudential Index (1)	**ExpP = Capital Requirements (2)**	**ExpP = Sector-Specific Capital Buffer (3)**	**ExpP = LTV Ratio (4)**	**ExpP = Reserve Requirements: Foreign (5)**	**ExpP = Reserve Requirements: Local (6)**	**ExpP = Concentration Ratios (7)**
Sum Illiquid Assets Ratio*ExpP	0.043	−0.284	0.993	−2.249	0.376	0.001	−2.726
Joint p-value	0.864	0.417	0.220	0.358	0.704	0.998	0.704
Sum International Activity*ExpP	−0.320**	−0.428***	−0.274	4.719**	0.451	0.257	7.829
Joint p-value	0.034	0.007	0.783	0.021	0.803	0.640	0.383
Sum Net Due To (Head Office)*ExpP	0.308	0.097	−10.07	0.166	−19.41*	−18.22**	−28.07
Joint p-value	0.669	0.893	0.780	0.989	0.096	0.013	0.388
Sum Core Deposits Ratio*ExpP	−0.275	0.141	−1.540	−1.751*	−1.019	−0.129	−7.888***
Joint p-value	0.175	0.545	0.455	0.085	0.520	0.839	0.009
Observations	568	568	568	568	568	568	568
Adjusted R^2	0.406	0.406	0.409	0.440	0.404	0.412	0.436
No. of Banks	14	14	14	14	14	14	14
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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 2002:Q2 to 2013:Q4 for a panel of domestic bank holding companies. Foreign-exposure-weighted regulation ExpP is calculated as the weighted average of changes in foreign regulation where the weights are total assets and liabilities of the bank in the respective foreign country. For ExpP and its interaction effects, the reported coefficient is the sum of the contemporaneous term and two lags, with the corresponding p-value for joint significance. For more details on the variables, see table 9 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include time and bank fixed effects. Standard errors in parentheses are robust. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

banks that are bigger in size and more internationally active. Meanwhile, banks that have higher tier 1 capital ratios are more sensitive to changes in the foreign prudential policies.

Finally, we test the net significance of prudential regulation. The net effects measure the significance of prudential policies, taking into account the interactions between these policies and banks' characteristics. These results are shown in table 7. Net effects are computed considering the contemporaneous weighted prudential policy only, and the contemporaneous plus two lags. Again, capital requirements appear to be the most significant policy instrument affecting domestic lending. Moreover, these effects are economically significant, as a one-standard-deviation tightening in capital requirements in all relevant jurisdictions increases lending growth rate by almost 80 percent of the median growth rate observed in the entire sample.

3.2 Inward Transmission of Home Macroprudential Policy via Affiliates

We now turn to the estimation of the following equation, which is run over a panel of six foreign affiliates:

$$\begin{aligned}\Delta Y_{b,t} = \alpha_0 &+ (\alpha_1 HomeP_{j,t} + \alpha_2 HomeP_{j,t-1} + \alpha_3 HomeP_{j,t-2}) \\ &+ \alpha_4 X_{b,t-1} + \alpha_5 Z_{j,t} + (\beta_1 HomeP_{j,t} X_{b,t-1} \\ &+ \beta_2 HomeP_{j,t-1} X_{b,t-1} + \beta_3 HomeP_{j,t-2} X_{b,t-1}) \\ &+ f_b + f_t + \epsilon_{b,t}. \qquad (2)\end{aligned}$$

Similarly to equation (1), $X_{b,t-1}$ is the vector of control variables for bank b at time t lagged one quarter. Regarding the prudential policy changes, we are now interested only in the prudential policy of the country where the parent of the foreign affiliates is located. We call this variable $HomeP$ and, as in the previous approach, we measure its effect at time t and in the previous two quarters. Finally, $Z_{j,t}$ represents the business and the financial cycle in home country j as measured by the BIS.

Table 5 shows the results of this estimation. We find that most changes in the prudential policies in the home countries do not have a significant effect on the domestic lending provided by foreign affiliates. This result is not surprising given that subsidiaries are required to comply with the local regulation.

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

	HomeP = Prudential Index (1)	HomeP = Capital Require-ments (2)	HomeP = Sector-Specific Capital Buffer (3)	HomeP = LTV Ratio (4)	HomeP = Reserve Require-ments: Foreign (5)	HomeP = Reserve Require-ments: Local (6)	HomeP = Concen-tration Ratios (7)
Sum HomeP	61.32**	−131.8	44.26	−191.9	651.4	50.53	18.63**
Joint p-value	0.044	0.368	0.906	0.237	0.153	0.805	0.010
Log Total Assets_{t-1}	−7.106*	−7.099*	−7.503**	−25.321**	−7.104**	−7.124**	−5.958**
	(2.774)	(2.557)	(2.066)	(3.061)	(2.198)	(2.113)	(1.925)
Tier 1 Ratio_{t-1}	0.135	0.174*	0.123	0.018	0.158	0.171	0.183*
	(0.076)	(0.078)	(0.082)	(0.126)	(0.079)	(0.089)	(0.074)
Illiquid Assets Ratio_{t-1}	−0.301***	−0.313***	−0.314***	−0.142	−0.332***	−0.293***	−0.253***
	(0.054)	(0.060)	(0.052)	(0.071)	(0.044)	(0.048)	(0.041)
International Activity_{t-1}	0.072*	0.086	0.080*	−0.238	0.067	0.089	0.057
	(0.027)	(0.048)	(0.031)	(0.186)	(0.041)	(0.043)	(0.031)
Net Due To (Head Office)$_{t-1}$	0.168	0.157**	0.116**	0.218	0.137**	0.139**	0.106**
	(0.085)	(0.051)	(0.029)	(0.283)	(0.043)	(0.043)	(0.037)
Core Deposits Ratio_{t-1}	0.083***	0.082***	0.089***	−0.282	0.083**	0.074**	0.068***
	(0.012)	(0.016)	(0.017)	(0.120)	(0.024)	(0.018)	(0.015)
BIS Financial Cycle (Home Country)	13.447*	12.580*	15.063**	23.777***	14.277**	13.463**	12.010**
	(5.266)	(5.161)	(4.300)	(1.872)	(4.524)	(4.403)	(3.328)
BIS Business Cycle (Home Country)	−58.760	−62.987	−40.151	−58.966*	−58.522	−51.053	−37.291
	(44.689)	(43.804)	(37.488)	(16.833)	(38.089)	(50.278)	(34.816)
Sum Log Total Assets*HomeP	−1.436*	−1.507	−3.743	3.874	−30.07	0.109	
Joint p-value	0.059	0.610	0.608	0.419	0.162	0.989	

(*continued*)

Table 5. (Continued)

	HomeP = Prudential Index (1)	HomeP = Capital Requirements (2)	HomeP = Sector-Specific Capital Buffer (3)	HomeP = LTV Ratio (4)	HomeP = Reserve Requirements: Foreign (5)	HomeP = Reserve Requirements: Local (6)	HomeP = Concentration Ratios (7)
Sum Tier 1 Ratio*HomeP	0.356	2.968*	−1.375	−0.066	−6.089	−0.114	
Joint p-value	0.363	0.073	0.105	0.817	0.392	0.956	
Sum Illiquid Assets Ratio*HomeP	−0.248	1.923*	0.495	1.200*	0.857	−0.390	
Joint p-value	0.412	0.063	0.547	0.094	0.422	0.547	
Sum International Activity*HomeP	−0.219	−0.029		0.275		−0.084	
Joint p-value	0.130	0.911		0.394		0.871	
Sum Net Due To (Head Office)*HomeP	−0.124	−1.676	−9.169	−2.475		7.608	
Joint p-value	0.839	0.134	0.568	0.438		0.506	
Sum Core Deposits Ratio*HomeP	−0.119	−0.285**	0.023	0.044		−0.214	
Joint p-value	0.345	0.033	0.991	0.669		0.670	
Observations	250	250	250	152	250	250	250
Adjusted R^2	0.727	0.720	0.725	0.878	0.727	0.719	0.743
No. of Banks	6	6	6	6	6	6	6
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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 2002:Q2 to 2013:Q4. HomeP refers to the changes in regulation in the home (i.e., parent-bank) country of foreign affiliates. For HomeP and its interaction effects, the reported coefficient is the sum of the contemporaneous term and two lags, with the corresponding p-value for joint significance. For more details on the variables, see table 9 in the appendix. Each column gives the result for the regulatory measure specified in the column headline. All specifications include time and bank fixed effects. Standard errors in parentheses are clustered by home country. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

However, the coefficient of the prudential instrument that regulates the concentration ratios is positive and statistically significant at 5 percent. See column 7 in table 5 and figure 2B, which shows the positive relationship between concentration ratios and the aggregate domestic lending growth. The positive effect is consistent with the existence of potential regulatory spillovers generated by the parent/subsidiary relationship. Under these circumstances, a tightening in the concentration ratio (provided that it does not affect cross-border lending) will facilitate the foreign funding of local subsidiaries. Despite this positive effect, the economic significance of this policy is lower than the one found for capital requirements through international exposures, as a tightening in the concentration index by one standard deviation in all foreign affiliates increases domestic lending growth rates by roughly 40 percent of the median growth rate observed in the entire sample.

The interactions between the home prudential policy and banks' characteristics are not statistically important, while most of the control variables have the expected sign, similarly to the previous specification. One additional variable that turns out to be consistently significant across different instruments is the financial cycle of the home country. The stronger the financial cycle in the home country, the higher the domestic lending growth of foreign subsidiaries.

Finally, table 6 shows the impact of foreign prudential regulation when all instruments are included at the same time with no interactions. The results shown in table 6 confirm the positive and statistically significant effect of capital requirements over domestic lending growth rates when the exposure-weighted specification is considered (column 1). Similarly, the positive effect of the concentration ratio remains statistically significant when prudential policy spillovers are measured via foreign affiliates (column 2).

3.3 Robustness Checks and Further Explorations

We run two robustness checks for our inward transmission estimates through international exposures. First, we use three alternative definitions of weights in the construction of the exposure-weighted prudential index. In addition to the definition of weights based on the sum of foreign claims and liabilities (w1), we use foreign claims only (w2), foreign liabilities only (w3), and the sample average of w1. The

Table 6. Inward Transmission of Policy: All Instruments Together

	ExpP = Via International Exposure (1)	**HomeP = Via Affiliates of Foreign Banks (2)**
Log Total Assets$_{t-1}$	−1.747	−6.428**
	(1.268)	(2.492)
Tier 1 Ratio$_{t-1}$	0.235*	0.181*
	(0.137)	(0.098)
Illiquid Assets Ratio$_{t-1}$	−0.124***	−0.257***
	(0.047)	(0.087)
International Activity$_{t-1}$	0.109***	0.056*
	(0.029)	(0.032)
Net Due To (Head Office)$_{t-1}$	−0.019	0.112
	(0.080)	(0.104)
Core Deposits Ratio$_{t-1}$	0.074***	0.065*
	(0.028)	(0.035)
BIS Financial Cycle (Home Country)	—	12.458***
		(3.508)
BIS Business Cycle (Home Country)	—	−37.209
		(30.149)
Sum Capital Requirements	12.69***	−4.261
Joint p-value	0.006	0.210
Sum Sector-Specific Capital Buffer	0.595	0.713
Joint p-value	0.803	0.765
Sum Loan-to-Value Ratio	−7.057	
Joint p-value	0.254	
Sum Reserve Requirements: Foreign	4.833	−1.056
Joint p-value	0.165	0.651
Sum Reserve Requirements: Local	−1.273	−0.161
Joint p-value	0.463	0.892
Sum Concentration Ratios	−2.484	19.42***
Joint p-value	0.891	0.000
Observations	568	250
Adjusted R^2	0.409	0.736
No. of Banks	14	6
Time Fixed Effects	Yes	Yes
Bank Fixed Effects	Yes	Yes

Notes: This table reports the effects of changes in regulation and bank characteristics on log changes in total loans. The data are quarterly from 2002:Q2 to 2013:Q4. Each column gives the result for the inward transmission of policy through international exposure of domestic banks and via affiliates of foreign-owned banks, respectively. For ExpP and HomeP, the reported coefficient is the sum of the contemporaneous term and two lags with the corresponding p-value for joint significance. Robust standard errors are clustered by home country and appear in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

net effects of the exposure-weighted prudential policy using these alternative definitions of weights are shown in table 7, which confirms the positive and statistically significant impact of a tightened capital requirement over domestic lending, independently on how the weights were constructed.

Secondly, we run a similar specification of equation (1), but now considering the cumulative prudential policy for each instrument, as follows:

$$\Delta Y_{b,t} = \alpha_0 + \alpha_1 ExpP_{cum,b,t-1} + \alpha_2 X_{b,t-1} + \alpha_3 ExpP_{cum,b,t-1} Z_t + f_b + f_t + \epsilon_{b,t}. \quad (3)$$

Here, $ExpP_{cum,b,t-1}$ represents the cumulative sum of each instrument since the first quarter of 2000 (see Cerutti et al. 2017 for more details). Under these specifications, we also control for the interactions between the cumulative policy and the business and the financial cycle of the host country provided by the BIS (Z_t). We find that, when adding the same set of controls, the net impact of capital requirements remains significant, although now only at the 10 percent confidence level (see table 7, panel B). Additionally, a tightened reserve requirement in foreign operations also generates a positive impact in domestic lending. Furthermore, when using the alternative definitions of weights described above, the net effect becomes not significant for capital requirements and significant at 1 percent for reserve requirements in foreign operations when using w3. This may suggest that capital requirements' spillovers from home to host are less important when the regulatory changes are permanent rather than transitory. The opposite is true for reserve requirements.

In addition, we run the exposure-weighted specification without including the state-owned bank (BancoEstado). The reason we do this is that although BancoEstado tends to behave similarly to private banks in normal times, it usually acts countercyclically during crises. Our results show that, if anything, the models presented in table 4 get a slightly better fit when the state-owned bank is not included.

As a further exploratory analysis, we implement equations (1) and (2) for a set of alternative dependent variables. First, we split total lending growth into different types of credits (commercial, consumer, and mortgage loans). Second, we look at the effect of

Table 7. Inward Transmission of Policy through International Exposures of Domestic Banks: Net Effects

Exercise	Coefficient Sum	ExpP = Prudential Index (1)	ExpP = Capital Requirements (2)	ExpP = Sector-Specific Capital Buffer (3)	ExpP = LTV Ratio (4)	ExpP = Reserve Requirements: Foreign (5)	ExpP = Reserve Requirements: Local (6)	ExpP = Concentration Ratios (7)
A. Inward Transmission through International Exposures								
w1 = Claims + Liabilities	$\Sigma_{i=1}^{3}(\alpha_i + \beta_i \bar{X}_{b,t-1})$	2.055	17.08***	8.061	−1.267	9.754	3.912	57.50
	Joint p-value	0.416	0.002	0.535	0.925	0.465	0.443	0.179
	$(\alpha_1 + \beta_1 \bar{X}_{b,t-1})$	0.716	7.760**	9.338	6.528	9.712	1.959	1.416
	Joint p-value	0.699	0.013	0.278	0.491	0.300	0.667	0.945
w2 = Claims	$\Sigma_{i=1}^{3}(\alpha_i + \beta_i \bar{X}_{b,t-1})$	0.294	13.61***	5.031	−0.174	3.898	−1.486	2.230
	Joint p-value	0.862	0.009	0.263	0.989	0.492	0.666	0.938
	$(\alpha_1 + \beta_1 \bar{X}_{b,t-1})$	−1.208	5.354**	4.588**	−2.626	3.011	0.577	−7.173
	Joint p-value	0.341	0.033	0.042	0.565	0.518	0.832	0.761
w3 = Liabilities	$\Sigma_{i=1}^{3}(\alpha_i + \beta_i \bar{X}_{b,t-1})$	1.398	21.44***	−5.414	3.477	30.55	−3.434	33.62
	Joint p-value	0.582	0.000	0.591	0.761	0.188	0.629	0.194
	$(\alpha_1 + \beta_1 \bar{X}_{b,t-1})$	1.448	9.752***	2.052	6.256	−2.730	−0.146	17.96
	Joint p-value	0.358	0.000	0.715	0.447	0.842	0.972	0.279
Mean w1	$\Sigma_{i=1}^{3}(\alpha_i + \beta_i \bar{X}_{b,t-1})$	−2.018	21.40***	−30.63*	−26.07***	35.45*	1.978	−68.18
	Joint p-value	0.626	0.010	0.099	0.006	0.080	0.80	0.157
	$(\alpha_1 + \beta_1 \bar{X}_{b,t-1})$	−0.917	15.60**	−6.199	−8.515	3.927	2.672	−18.36
	Joint p-value	0.709	0.016	0.408	0.188	0.779	0.605	0.554
Without BancoEstado	$\Sigma_{i=1}^{3}(\alpha_i + \beta_i \bar{X}_{b,t-1})$	−1.537	19.32***	4.091	−6.572	−1.206	1.423	−30.83
	Joint p-value	0.617	0.002	0.793	0.627	0.965	0.847	0.607
	$(\alpha_1 + \beta_1 \bar{X}_{b,t-1})$	−0.598	9.108**	10.03	6.687	13.42	2.359	−99.95***
	Joint p-value	0.773	0.019	0.267	0.476	0.455	0.669	0.006

(*continued*)

Table 7. (Continued)

Exercise	Coefficient Sum	ExpP = Prudential Index (1)	ExpP = Capital Requirements (2)	ExpP = Sector-Specific Capital Buffer (3)	ExpP = LTV Ratio (4)	ExpP = Reserve Requirements: Foreign (5)	ExpP = Reserve Requirements: Local (6)	ExpP = Concentration Ratios (7)
B. Inward Transmission of Cumulative Policy through International Exposures								
w1 = Claims + Liabilities	$(\alpha_1 + \alpha_3 \bar{Z}_t)$	0.232	11.54*	−0.335	0.479	2.467**	0.281	0.147
	Joint p-value	0.153	0.081	0.474	0.507	0.003	0.424	0.926
w2 = Claims	$(\alpha_1 + \alpha_3 \bar{Z}_t)$	0.132*	3.228	−0.375	0.396	0.377	0.210	1.398
	Joint p-value	0.096	0.325	0.303	0.175	0.364	0.208	0.202
w3 = Liabilities	$(\alpha_1 + \alpha_3 \bar{Z}_t)$	0.266	9.400	−0.372	0.671	8.705***	0.156	0.814
	Joint p-value	0.268	0.354	0.546	0.489	0.001	0.734	0.478
Mean w1	$(\alpha_1 + \alpha_3 \bar{Z}_t)$	0.185	3.031	−3.474**	0.304	2.885	1.322	−2.530
	Joint p-value	0.637	0.676	0.020	0.824	0.228	0.204	0.542
Without BancoEstado	$(\alpha_1 + \alpha_3 \bar{Z}_t)$	0.320*	11.17	−0.009	0.840	2.389***	0.371	2.132
	Joint p-value	0.051	0.119	0.986	0.326	0.005	0.302	0.256

Notes: This table reports the net effects of changes in regulation on log changes in loans. The data are quarterly from 2002:Q2 to 2013:Q4 for a panel of domestic banks. Each row shows an estimation according to equation (1) expressed in section 3 with different weight measures, and the last one excludes BancoEstado. Additionally, panel B expresses the net effect of cumulative weighted measure on log changes in total loans, according to equation (3). Each column gives the result for the regulatory measure specified in the column headline.

prudential policy spillovers on the banks' risk taking. These results are presented in table 8, which shows in panel A the results for the inward transmission through international exposures, and in panel B the inward transmission via foreign affiliates. For simplification, we only report the p-values for the joint net effects associated with each prudential instrument. We do not report the coefficients associated with the control variables and their interactions.

As one of the main results, we find that changes in the prudential policy generate small spillover effects on the disaggregated lending portfolio. Moreover, the effects found above tend to remain significant only for the commercial loan growth rates, and not for consumer or mortgage lending.

Table 8 also shows that, when applying the exposure-weighted prudential policy, a tightening in LTV abroad decreases risk aversion (i.e., reduces the z-score). A similar effect is found when applying the inward transmission via foreign affiliates after a tightening of capital requirements.

4. Concluding Remarks

We find that the spillover effects of changes in the prudential policy abroad have a relatively weak impact on domestic lending. If this relationship exists, it tends to be positive, meaning that a tightening of the prudential policy abroad is associated with an increase in domestic lending. Above all, capital requirements appear to be the most significant prudential policy affecting domestic lending.

When comparing the two methodologies analyzed in the paper, we find stronger and economically more significant spillovers when looking at the exposure-weighted prudential policy rather than at the parent/subsidiary relationship. This result is not surprising given that foreign subsidiaries in Chile have to comply with the local regulation just as if they were a domestic-owned bank.

Our results, although moderated, represent a challenge for domestic policymakers, as domestic credit may be affected by changes in prudential policies implemented in foreign jurisdictions. Moreover, the jurisdictions that may affect domestic credit go beyond those where parent banks of foreign subsidiaries are located.

Table 8. Inward Transmission of Policy: Types of Lending and Risk Taking

		ExpP = Prudential Index (1)	**ExpP = Capital Requirements (2)**	**ExpP = Sector-Specific Capital Buffer (3)**	**ExpP = LTV Ratio (4)**	**ExpP = Reserve Requirements: Foreign (5)**	**ExpP = Reserve Requirements: Local (6)**	**ExpP = Concentration Ratios (7)**
A. Through International Exposures of Domestic Banks								
Commercial	Sum Coef.	0.740	11.62*	1.367	−4.647	3.392	−1.368	2.777
	Joint p-value	0.630	0.073	0.540	0.562	0.464	0.430	0.906
	Observations	568	568	568	568	568	568	568
	Adjusted R^2	0.406	0.408	0.406	0.408	0.407	0.407	0.408
Consumer	Sum Coef.	1.599	2.879	−1.275	0.860	0.504	3.380	−28.65
	Joint p-value	0.547	0.757	0.712	0.920	0.931	0.304	0.147
	Observations	525	525	525	525	525	525	525
	Adjusted R^2	0.115	0.114	0.114	0.114	0.114	0.116	0.115
Mortgage	Sum Coef.	1.676	10.80*	2.961	−9.760	3.426	1.323	−15.92
	Joint p-value	0.351	0.093	0.200	0.119	0.463	0.484	0.207
	Observations	525	525	525	525	525	525	525
	Adjusted R^2	0.454	0.456	0.452	0.452	0.451	0.452	0.451
z-score	Sum Coef.	−1.142	2.770	5.158*	−12.33**	−5.877*	−1.995	3.492
	Joint p-value	0.459	0.523	0.092	0.049	0.096	0.274	0.825
	Observations	567	567	567	567	567	567	567
	Adjusted R^2	0.968	0.968	0.968	0.968	0.968	0.968	0.968

(*continued*)

Table 8. (Continued)

		HomeP = Prudential Index (1)	HomeP = Capital Requirements (2)	HomeP = Sector-Specific Capital Buffer (3)	HomeP = LTV Ratio (4)	HomeP = Reserve Requirements: Foreign (5)	HomeP = Reserve Requirements: Local (6)	HomeP = Concentration Ratios (7)
B. Via Affiliates of Foreign-Owned Banks								
Commercial	Sum Coef.	−0.827	1.412	−0.604	−2.958	−5.852*	−2.076*	20.54*
	Joint p-value	0.473	0.569	0.794	0.401	0.055	0.085	0.076
	Observations	250	250	250	152	250	250	250
	Adjusted R^2	0.716	0.714	0.715	0.878	0.717	0.722	0.726
Consumer	Sum Coef.	−0.037	−27.88	−0.010	4.655	0.753	2.362	
	Joint p-value	0.969	0.175	0.996	0.443	0.866	0.344	
	Observations	206	206	206	138	206	206	
	Adjusted R^2	0.318	0.364	0.316	0.328	0.315	0.324	
Mortgage	Sum Coef.	1.078	1.187	−0.837	4.497	−0.752	0.859	
	Joint p-value	0.254	0.362	0.619	0.157	0.444	0.537	
	Observations	206	206	206	138	206	206	
	Adjusted R^2	0.830	0.828	0.829	0.842	0.828	0.830	
z-score	Sum Coef.	−1.036**	−6.121**	−2.186	3.533	1.889	−0.697	−10.10
	Joint p-value	0.041	0.031	0.410	0.119	0.318	0.388	0.250
	Observations	248	248	248	152	248	248	248
	Adjusted R^2	0.957	0.957	0.957	0.970	0.957	0.957	0.957

Notes: This table reports the effects of changes in foreign regulation on log changes in domestic loans (considering separately commercial, consumer, and mortgage loans), and on a measure of risk taking. All specifications assume no interactions between the idiosyncratic bank characteristics and the prudential policy variables. The data are quarterly from 2002:Q2 to 2013:Q4 for a panel of domestic banks. In panel A, ExpP is calculated as the weighted average of changes in foreign regulation where the weights are total assets and liabilities of the bank in the respective foreign country. Robust standard errors are in parentheses. In panel B, 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. Standard errors are clustered by the country of the parent bank. In both specifications, the control variables and fixed effects are not reported, but they are available upon request.

Therefore, local regulatory authorities seeking international cooperation should take into account the exposure that banks have to different jurisdictions, both from their liabilities and from their assets.

Finally, an area for future research could consider the magnitude and potential asymmetries of regulatory changes, as the approach presented here relies only on the direction of changes, without considering their magnitude or the differences between tightening and loosening.

Appendix

Table 9. Definition and Source of Variables

Variable Name	Report Form Description	Source
	Dependent Variables	
ΔLn(Total Loans)	Quarterly change of the total loans' logarithm.	Bank's Balance Sheet Data
	Independent Variables	
Log Total Assets	Logarithm of total assets.	Bank's Balance Sheet Data
Tier 1 Ratio	Core capital to total asset ratio.	Bank's Balance Sheet Data
Illiquid Assets Ratio	Ratio of total assets minus liquid assets to total assets.	Bank's Balance Sheet Data
Net Due To (Head Office)	Ratio of liabilities minus claims to total assets. We assume that the liabilities and cliams of each bank with the entire parent country are totally sent to the subsidiary.	Central Bank of Chile (CBCh)

(*continued*)

Table 9. (Continued)

Variable Name	Report Form Description	Source
Core Deposits Ratio	Ratio of term deposit plus sight deposits to liabilities.	Bank's Balance Sheet Data
International Activity	Ratio of foreign liabilities plus foreign claims to total assets.	CBCh
BIS Financial Cycle (Home Country)	It corresponds to the financial cycle of the parent bank.	BIS
BIS Business Cycle (Home Country)	It corresponds to the economic cycle of the parent bank.	BIS
Weights		
w1	It corresponds to the ratio of total exposure (claims plus liabilities) to the sum of total exposure to every country.	CBCh
w2	It corresponds to the ratio of claims to the sum of total claims to every country.	CBCh
w3	It corresponds to the ratio of liabilities to the sum of total liabilities to every country.	CBCh
w1 Mean	It corresponds to the average by each bank of w1's weight.	CBCh

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