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International Banking and Cross-border Effects of Regulation: Lessons from Portugal

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Abstract
This paper offers a contribution to understand the cross-border effects of bank regulation using data on Portuguese banks. We find that the effect of foreign regulation on domestic credit growth depends on the type of regulation, on the channel of transmission as well as on the legal form of the bank. Our results show that a tightening in foreign regulation leads to a decrease in the growth of domestic credit in the case of concentration ratios and capital requirements and to the opposite effect in the case of sector specific capital buffers and reserve requirements in foreign currencies. We also find significant cross-border effects for the loan-to-value limits. In this case, cross-border spillovers work in different ways for domestic banks with international activity and for foreign banks: after a tightening in this instrument abroad domestic banks decrease credit growth in Portugal while foreign banks increase it. Finally, we show that the cross-border effects of capital requirements work differently through branches and subsidiaries.

JEL: F42, G21, G28

Keywords: prudential regulation, international banking, cross-border transmission.

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1. Introduction

In the aftermath of the global financial crisis, macroprudential authorities worldwide became equipped with broad range of macroprudential instruments. While the goal of these macroprudential toolkits is to allow authorities to manage and mitigate risks and vulnerabilities in their domestic financial systems, their implementation is likely to entail cross-border spillovers.

Our paper explores these cross-border effects of prudential regulation, being part of a joint project of the International Banking Research Network (IBRN).[1] The project looks at this issue from two angles: how does foreign regulation affect domestic lending and how does destination country regulation affect lending of domestic banks abroad. We focus our analysis on the former, which is labeled as the inward transmission channel, examining how changes in prudential regulation in other countries affected lending in Portugal.[2]

The Portuguese banking system provides an interesting setting to analyze this issue. The international dimension of the Portuguese banking system is relevant in two dimensions. First, domestic banks have important activities abroad, thus being exposed to foreign regulation through their branches and subsidiaries abroad. Second, foreign banks have a meaningful presence in the Portuguese banking system. Recent consolidation developments within the Banking Union suggest that this presence may be reinforced in the near future. Furthermore, Portugal is part of the European Monetary Union, thus not having a domestically targeted monetary policy. Within this setting, macroprudential policy may play a key role in the management of country-specific imbalances. It is thus essential to understand the transmission of prudential policy through bank lending. However, it is not enough to consider domestic prudential policy, as foreign regulation may also play an important role. The goal of this paper is precisely to gather evidence on this latter mechanism. This is a very relevant issue for policymakers, most notably when considering the large number of macroprudential policy measures being adopted worldwide.

Foreign banking regulation may have two opposing effects in domestic credit. On one hand, we could expect that there are cross-border

1. The IBRN is a research network comprising researchers from central banks worldwide. The main goal is to analyze issues pertaining to global banks. The IBRN offers a unique opportunity to explore a common research question with a common methodology across different countries, using high quality data available at central banks worldwide. For further details, please visit https://www.newyorkfed.org/ibrn.

2. The results of this joint international project are summarized in a meta-analysis paper conducted by Buch and Goldberg (2017). Other country contributions include Auer *et al.* (2017), Avdjiev *et al.* (2017), Baskaya *et al.* (2017), Berrospide *et al.* (2017), Bussière *et al.* (2017), Caccavaio *et al.* (2017), Damar and Mordel (2017), Frost *et al.* (2017), Gajewski and Krzesicki (2017), Hills *et al.* (2017), Ho *et al.* (2017), Jara and Cabezas (2017), Levin *et al.* (2017), Nocciola and Zochowski (2017), Ohls *et al.* (2017), Park and Lee (2017).

complementary effects arising from regulation: a tightening in foreign regulation targeted at constraining lending in the home country may also lead to less lending in other countries. On the other hand, there may be cross-border substitution effects: when facing a tightening in foreign regulation, banks may actually increase lending in other countries to diversify their exposures and to maximize profitability.

To analyze the effects of foreign regulation on domestic credit we consider two possible channels. First, we analyze the effect of foreign regulation on the credit granted in Portugal by Portuguese banks with activity abroad (specification A). We find that a tightening in foreign regulation yields an increase in the growth of loans granted by domestic banks in Portugal. This substitution effect works through sector specific capital requirements and reserve requirements in foreign currencies. For the loan-to-value ratio, the results show the opposite sign, thus supporting the cross-border complementary effects hypothesis. For this instrument a tightening might imply a decline in the profitability of the affiliates of Portuguese banks, which can lead to a reduction in the domestic activity due to the reduction in profits for the banking group as a whole. In this case there are cross-border complementary effects of foreign regulation, i.e., its effects on constraining credit go beyond borders. Alternatively, it is also possible that this result is explained by the setting under which loan-to-values are usually tightened, which often correspond to periods of booms in markets in which short-term profitability might be very high, despite the tightening of this instrument. If this is the case, given that banks have limited resources, they may prefer to increase credit abroad rather than continue to lend domestically.

Second, we analyze the influence of foreign regulation on the growth of credit granted in Portugal by the foreign banks operating in the country (specification B). In this case we find that a tightening abroad is associated with a decline in credit growth in Portugal in the case of general capital requirements and concentration ratios, while for the loan-to-value ratio we find the opposite effect. In this specification, we would expect that a tightening in regulation in the home country of a given bank should constrain the whole activity of the banking group, including of its affiliates abroad, most notably for instruments that are applied at the consolidated level. This is consistent with the result we obtain for general capital requirements and for concentration ratios. The result we obtain for the loan-to-value ratio is possibly related to substitution effects between the home and host country. In fact, loan-to-value limits are probably applied only at the domestic level, thus making the substitution effects plausible. Additionally, given that regulators usually tighten these instruments when home real estate markets are booming and risks are building up, the substitution for credit in the host country might reflect a diversification of exposures internationally. Foreign banks may be worried about the building up of risks in their home country and thus increase credit abroad to diversify their exposures and thus mitigate risk.

The results presented above are part of the core analysis common to all country teams participating in the IBRN project and are part of the input for the meta-analysis in Buch and Goldberg (2017). In addition to these results, our paper focuses on one important additional dimension of analysis: the potentially heterogeneous role of branches and subsidiaries in the cross-border effects of regulation. More specifically, we use specification B to zoom in on the cross-border transmission of regulation and ask whether the regulation implemented in the home countries of foreign banks operating in Portugal has different effects on the credit granted in Portugal through foreign branches and subsidiaries. This distinction is relevant if we consider the differences in the legal form of these two types of institutions: whereas branches are legally part of the parent foreign bank, subsidiaries are legally independent entities and might be allowed to fail on their own. This distinction has important regulatory consequences. For instance, deposits held at subsidiaries are guaranteed by the host country while those of branches are guaranteed by the home country. Furthermore, and perhaps more relevant for the purposes of our study, branches of European Union banks are exempt from capital requirements in the host country. We find that the negative effects of tighter capital requirements in the home country of a foreign bank on credit growth in the host country work only through branches. In the case of the loan-to-value, the increase in credit growth associated with a tightening operates as expected through both branches and subsidiaries.

This paper is organized as follows. In Section 2, we describe the data and present some stylized facts. In Section 3 we discuss the empirical methodology and our results. Finally, in Section 4 we present a few concluding remarks.

2. Data and Stylized Facts for Portugal

2.1. Bank-Level Data

We collect bank-level data from quarterly supervisory reports. We use solo basis data, which allows us to focus the analysis on the effect of foreign regulation on credit granted in Portugal. If we used consolidated data, we would be considering the effects of foreign regulation on all credit granted by Portuguese banks, which includes credit granted by affiliates abroad. Further, all bank controls would refer to this larger perimeter of activity. We considered that this could undermine the interpretation of the results.

Our analysis period begins in 2006:Q1 and ends in 2014:Q4. Some of the variables could be computed for earlier periods. However, before 2005 banks used a different accounting system. Using a longer period would imply important breaks in some series, which are hard to address without compromising the quality of the data. Furthermore, the quality of analysis could also be compromised if many more years were included, as the beginning of that decade was dominated by a merger wave that substantially changed the landscape in the Portuguese financial system (for details, please see Barros *et al.* 2014). During the analysis period, the structure of the Portuguese banking system was relatively stable. Furthermore, most of the changes in foreign regulation affecting Portuguese banks were implemented during the sample period.

We collect detailed information on key bank characteristics. All financial institutions are classified as domestic or foreign, depending on their ownership status. Foreign institutions are classified as branches or subsidiaries and there is information on the country of origin. Our dataset only includes monetary financial institutions (i.e., banks in their classic definition, as these are the only institutions authorized to receive deposits from the public). We exclude non-monetary financial institutions from the analysis, as there are important differences in their funding models and in their regulation that may hamper the interpretation of the results. From a practical point of view, another reason to exclude these institutions is that there is no information on their exposures to foreign countries. In addition, this choice enhances the comparability of the results with those of other countries participating in the project.

In order to have data on the international activity of banks, we merge the supervisory bank database with the bank level data underlying the International Banking Statistics reported to the BIS. In particular we use the BIS data, on a consolidated basis (i.e. excluding intragroup positions) and on immediate borrower basis, for the local claims and liabilities of the branches and subsidiaries of the Portuguese banks. Additionally, we use bank-level data collected for the construction of the Euro Area Monetary Financial Statistics to obtain information on assets and liabilities against the banks of the same banking group located abroad. The use of these two alternative data sources implied the exclusion of the Mutual Agricultural Credit Banks from the sample, as in these sources the data for this type of institutions is aggregated at a consolidated level. In any case, given that these institutions are devoted mainly to local activities and have a small weight on the total credit (around 3.75% over the sample period), we believe that their inclusion in the sample would not be relevant for the purpose of this study.[3]

We also merge the bank database with other data sources common to the project, namely with the IBRN Prudential Instruments Database, described in section 2.2 (and, in more detail, in Cerutti *et al.* 2017) and with economic and financial cycle data (obtained, respectively, from BIS 2014 and Drehmann *et al.* 2011). In both databases there is no information for Angola, so we had to delete from our sample all banks belonging to Angolan banking groups, which have a weight on the domestic credit lower than 0.05%.

3. All the bank level data is subject to confidentiality rules.

The final dataset includes 57 banks (25 domestic and 32 foreign), which account on average over the sample period for 96% of the credit granted by banks in Portugal.

2.1.1. Dependent Variables. In both specifications A and B, our dependent variable is $\triangle Y_{b,t}$, which is defined as the quarterly change in credit granted by bank b to non-financial residents in Portugal in quarter t, measured in log percentage points.

2.1.2. Balance Sheet Characteristics. To ensure the consistency in the IBRN project, it is of utmost importance to guarantee that the explanatory variables used are as close as possible in the papers of each country team and described in Buch and Goldberg (2017). The variables considered in our specifications are: the percentage of a bank's portfolio of assets that is illiquid ($IlliquidAssetsRatio_{b,t-1}$), the percentage of the bank's balance sheet financed with core deposits ($CoreDepositsRatio_{b,t-1}$), bank's capital to asset ratio ($CapitalRatio_{b,t-1}$), the percentage of the bank's net external intragroup funding relative to its total liabilities ($NetIntragroupFunding_{b,t-1}$), the log of total assets ($LogTotalAssets_{b,t-1}$), and the percentage of the assets plus liabilities of bank's affiliates abroad relative to total assets plus total liabilities ($InternationalActivity_{b,t-1}$). All the variables are defined in detail in Appendix 1. Table 1 summarizes these indicators for the full sample of banks operating in Portugal, as well as for domestic and foreign banks separately. Domestic banks are larger, better capitalized, less illiquid and rely more on core deposits and less on net external intragroup funding than foreign banks.

2.2. Data on Prudential Instruments

We use the IBRN Prudential Instruments Database, which is described in Cerutti *et al.* (2017). The database includes quarterly information on the timing of tightening or loosening of a number of prudential tools in 64 countries over the period 2000-14.

The prudential tools considered are capital requirements, sectoral specific capital buffers (which include an aggregate index as well as indexes for real estate, consumption and other loans), loan-to-value limits, foreign and local reserve requirements, interbank exposure limits and concentration ratios. For each prudential tool the database includes one index for its change, where a negative value corresponds to a loosening, a positive value to a tightening and zero signals that no change has occurred in the quarter. We also use a summary measure of the changes in all the above tools, which takes value -1, zero and 1 when the sum of indices for the individual tools is, respectively, negative, zero and positive.

In specification A we want to evaluate the impact of the prudential regulation implemented in the countries where the Portuguese banks have branches and subsidiaries. Thus, in line with the harmonized methodology for the IBRN project, we construct for each Portuguese bank and prudential instrument, an index ($ExpP_{b,t}$) for the change of the host countries' regulation ($HostP_{i,t}$), weighted by the bank foreign exposures to the host countries ($\theta_{b,i,t-1}$). In the calculation we used the weights data on the previous 4 quarters .

$$ExpP_{b,t} = \sum_i HostP_{i,t}\theta_{b,i,t-1} \tag{1}$$

$$\theta_{b,i,t-1} = \frac{\sum_{t=t-4}^{t-1} exposure_{b,i,t}}{\sum_i \sum_{t=t-4}^{t-1} exposure_{b,i,t}} \tag{2}$$

The exposure of the domestic bank b to country i is measured by the claims plus liabilities of the branches and subsidiaries of that bank on country i, denominated in local currency (i.e in the currency of country i) and on an immediate borrower basis.

In the construction of these exposure-weighted prudential policy indexes only exposures to countries with data available in the prudential database could be considered. In our sample, this means we are taking into account 87% of the total foreign exposures of the Portuguese banks, through their affiliates abroad.

With specification B we are interested in evaluating the impact of the regulation adopted in the home country of each foreign bank with branches and subsidiaries in Portugal. Thus, in this case the regulation variables used in the regressions correspond to the indexes of the prudential database for the change in the prudential instruments in the countries of the parent banks ($HomeP_{j,t}$).

Table 2 reports some descriptive statistics on the prudential policy variables. Around 18% of the observations in the sample of Portuguese banks (used in specification A) and around 14% in the sample of foreign banks (used in specification B) are associated with some change in the prudential variables.[4] We exclude from the analysis the indices referring to the decomposition of the sectoral specific capital buffer as well as other regulatory measures (the interbank exposure limit and, in the case of approach B, also the reserve requirements in foreign currencies) with a sample variation less than 2%, given that for these measures we were not able to obtain robust results.

4. The sample used in specification B includes both domestic and foreign banks, but the statistics for the incidence of regulation were calculated using only foreign banks. In fact, since we are interested in estimating the impact of foreign regulation, the regulation variable was set to zero for Portuguese banks in the regressions of specification B. This means regulation in Portugal is not explicitly included in the regressions, although its effects are embedded in the time fixed effects.

In the case of capital requirements, as explained in Cerutti *et al.* (2017), all the changes correspond to tightening movements, since they refer to the implementation of Basel. For the sectoral specific capital buffer and the concentration limits most of the changes in our sample also correspond to tightening movements. By contrast, for the reserve requirements in both specifications, and for the loan-to-value limits in specification A, both tightening and loosening movements occurred during the sample period.

2.3. Stylized Facts

In the period under analysis credit granted in Portugal witnessed strong movements. While in the mid-2000s credit was expanding quickly, it started to decelerate in 2008-09 during the global financial crisis and has been declining since the beginning of the euro area sovereign debt crisis and the Economic and Financial Assistance Programme to Portugal. Figure 1 shows that the evolution of credit in our sample is broadly consistent with the aggregate data of the monetary financial statistics. In this period, the behavior of domestic and foreign banks operating in Portugal has not always been alike (see Figure 2). In particular, while in the years 2010-11 domestic institutions faced with the increase in funding difficulties and the need to deleverage started to reduce credit, foreign banks continued to expand the credit granted in Portugal (Costa and Farinha 2011). In the most recent years, foreign banks have also cut their activity in Portugal. Nevertheless, their market share in the credit market remained around 25%, which is slightly higher than what was observed before the crisis.

The Portuguese banking system is highly concentrated. The five largest banking groups accounted for around 75% of bank credit to non-financial residents in Portugal in the last quarter of 2014. One of these five groups is part of a large foreign banking group. The rest of the Portuguese banking system comprises many small and medium-sized banks. Most of these banks are small scale universal banks, competing directly with the five largest banking groups. A few of them have specialized business models, offering only specific products such as consumer loans or asset management services.

By ownership nationality, Spanish banks dominate the market with a weight on the total credit granted by foreign banks of more than 65% over the period under analysis. The other countries with a non-negligible presence in the Portuguese credit market are the United Kingdom, Germany and France.

Spain has also a dominant weight in the international activity of Portuguese banks, accounting for around 30% of the total foreign exposure through affiliates over the period 2006-14. Additionally, domestic banks were, during our sample period, significantly exposed to Poland and to a lesser extent to Greece, France, and some emerging market economies, such as Brazil, Angola and Mozambique.

3. Empirical Method and Regression Results

In this section we discuss the results of our empirical estimations, trying to understand how foreign regulation affected the evolution of credit granted in Portugal. In section 3.1 we present the results of the baseline specifications, which are common to all country teams analyzing the inward transmission mechanism. In section 3.2 we discuss the results of an extension to the baseline analysis, where we explore in depth the results from specification B to try to understand whether the transmission of foreign regulation through foreign banks operating in Portugal is different for branches and subsidiaries. Finally, in section 3.3 we describe some of the robustness analyses and minor extensions done on these baseline specifications.

3.1. Baseline Analysis of Inward Transmission of Prudential Policies

3.1.1. Empirical Approach. The empirical approach we use to analyze the inward transmission of foreign regulation on loans granted by banks in Portugal is described in detail in Buch and Goldberg (2017) and includes two different specifications.[5]

In specification A, the objective is to understand how foreign regulation affects the evolution of credit granted by domestic banks. The channel in focus in this specification comes from the exposures that domestic banks have abroad. To capture this, the regressions are estimated only for domestic banks. In this specification, the following regression is estimated:

Specification A: Exposure-weighted inward transmission of regulation (see Table 3).

$$\begin{aligned} \triangle Y_{b,t} = \sum_{k=o}^{2} \alpha_{k+1} ExpP_{b,t-k} + \alpha_4 X_{b,t-1} + \\ \sum_{k=o}^{2} \beta_{k+1} ExpP_{b,t-k} X_{b,t-k} + f_b + f_t + \varepsilon_{b,t} \end{aligned} \tag{3}$$

where $\triangle Y_{b,t}$ is the quarterly log change in domestic credit of bank b at time t (measured in percentage). The prudential policy changes are captured by $ExpP_{b,t-k}$, which measures exposure-weighted prudential policy outside Portugal. $X_{b,t-1}$ is the vector of bank control variables. Its interaction with

5. The IBRN project considers two mechanisms for the cross-border transmission of prudential policies: inward and outward. We chose not to analyze the outward transmission channel because the regulation of the Portuguese banking system did not change significantly during the sample period and an important part of the international activity of Portuguese banks relates to emerging market economies not covered in the prudential database.

$ExpP_{b,t-k}$ captures the degree to which a bank is exposed to changes in regulation through ex-ante balance sheet composition and market access. These regressions include bank and time fixed effects.

In specification B, the goal is to understand how foreign regulation affects the growth of credit granted in Portugal by branches and subsidiaries of foreign branches. In this second approach, the following specification is estimated:

Specification B: Inward transmission of home prudential policy via affiliates (see Table 4).

$$\begin{aligned} \triangle Y_{b,j,t} = \alpha_o + \sum_{k=o}^{2} \alpha_{k+1} HomeP_{j,t-k} + \alpha_4 X_{b,j,t-1} + \alpha_5 Z_{j,t} \\ + \sum_{k=o}^{2} \beta_{k+1} HomeP_{j,t-k} X_{b,j,t-k} + f_b + f_t + \varepsilon_{b,j,t} \end{aligned} \tag{4}$$

where $\triangle Y_{b,j,t}$ is the quarterly change in log loans extended by bank b, from country j, to residents in Portugal at time t (in percentage). The prudential policy changes are captured by $HomeP_{j,t-k}$ prudential policy in the home country j of the parent bank. $X_{b,j,t-1}$ is the vector of bank control variables. Its interaction with $HomeP_{j,t-k}$ captures the degree to which a bank b is exposed to changes in regulation of country j through ex-ante balance sheet composition and market access. $Z_{j,t}$ represents the economic and credit cycle variables for country j. These regressions include bank and time fixed effects. Standard errors are clustered by country.

Besides controlling for time fixed effects, as in equation (3), these regressions control for macroeconomic and financial conditions in the home country of foreign banks. The regressions are estimated for the full sample, including domestic banks. However, for this latter group, the regulation variables and the financial and business cycle variables are set to zero. This allows all the identification on the regulation and cycle variables to come from foreign banks. Domestic banks enter the regressions to provide more strength on the conclusions regarding the effect of bank characteristics on credit growth.

3.1.2. Main Results. Table 3 presents the results of the estimation of equation (3). We consider contemporaneous effects and two lags for the regulation variable. In the first lines of the table we report the results for these three terms and in the bottom of the table the results for the sum of the three coefficients. Given space constraints, for the interactions of regulation with the bank control variables we report only the joint economic and statistical significance of these three coefficients, i.e., the results for sum of the interactions with the contemporaneous and lagged regulation. In order to have an idea of the impact of regulation when both the direct effect and the interactions effects are taken into account, at the bottom of the table we also include the average marginal effects of changes in regulation. The marginal effects are calculated both for all banks and only for the banks/periods subject to changes in regulation in our sample.

The first column reports the results for the aggregate prudential index ($PrudentialIndexC$) and the remaining columns show the results for each prudential tool individually. By examining the lines of the table with the marginal effects, we can conclude that foreign regulation affects the evolution of loans granted domestically through the international exposures of domestic banks. This effect is statistically significant for the aggregate prudential index. This aggregate effect seems to work through specific instruments, for which we obtain statistically significant marginal effects: sector specific capital requirements, loan-to-value ratios and reserve requirements on foreign currencies. For the remaining instruments (general capital requirements, reserve requirements on local currencies and concentration ratio), the effects of foreign regulation on the growth of credit granted by Portuguese banks are not statistically significant.

Analyzing the statistical significance of the marginal effects allows us to establish that there are cross-border spillovers of regulation. However, it is also very important to understand in which direction do these spillovers go. Does a tightening in regulation abroad lead to more or less credit at home? In aggregate terms, we find that a tightening in foreign regulation yields an increase in the growth of loans granted by domestic banks in Portugal. This result suggests that Portuguese banks operating internationally divert their resources to internal markets when they face tougher regulation abroad. This aggregate effect is coming from the sector specific capital requirements and the reserve requirements on foreign currencies. For the loan-to-value ratio the effect is the opposite: a tightening of this instrument abroad decreases credit growth domestically. For these instruments a tightening might imply a decline in the profitability of the affiliates, which can lead to a reduction in the domestic activity. It is also possible to argue that despite tighter loan-to-value limits banks still find it profitable to lend abroad, given that this instrument is usually tightened when credit and real estate markets are booming and hence (short-term) profitability might be very high. Assuming that resources are limited, this might imply a constraint in domestic credit. Cerutti *et al.* (2017) find that there is a positive correlation between credit growth and the increase of loan-to-value limits, thus supporting this hypothesis.

The magnitude of the marginal effects reflects the average impact (in percentage points) on the growth rate of credit of a simultaneous tightening in regulation in all countries where Portuguese banks have affiliates. Thus, we have computed the economic effects of these changes by rescaling the marginal effects for the average value of the exposure-weighted prudential measure observed in our sample in the periods of regulatory changes. After a tightening in the sector specific capital requirements, a tightening in the reserve requirements on foreign currencies and a loosening in the loan-to-value ratio, on average, the quarterly loan growth rate for the banks/periods exposed to the regulatory changes in our sample increased 3.1, 12.2 and 3.6 percentage points, which is around 35%, 144% and 44% of the mean absolute change of credit for these banks/periods. These large effects should be interpreted with caution given the small number of regulatory changes analyzed.

Though the signal of the effects of foreign regulation on the evolution of domestic credit is of primary interest, it is also relevant to understand exactly through which mechanisms these effects are transmitted across borders. Our specification allows us to do that through the analysis of the interaction terms. The substitution effects of foreign regulation leading to an increase in domestic credit growth, which work though sectoral capital buffers and foreign reserve requirements, are stronger for smaller banks, as well as for banks with more liquid assets and with more intense international activity. In turn, the complementary effects arising from a tightening in the loan-to-value ratio are reinforced for smaller banks and for banks with more net external intragroup funding and a higher core deposits ratio. Banks' size and liquidity thus seem to play an important role on how foreign regulation affects domestic credit.

Table 4 presents the results of the estimation of equation (4), i.e. specification B. In this case, the goal is to understand how foreign regulation affects credit granted in Portugal by branches and subsidiaries of foreign banks. As shown in equation (4), we consider contemporaneous effects and two lags for the foreign regulation variable. As in the previous table, the reported coefficients for interaction effects are the sum of the contemporaneous term and two lags. For the direct effects we report both the coefficients of the three $HomeP$ terms (in the first lines of the table) and their sum (at the bottom of the table). The table also includes the average marginal effects of changes in regulation and their significance, calculated for all the foreign banks and only for the foreign banks/periods subject to changes in regulation in our sample.

As in Table 3, the first column reports the results for the aggregate prudential index and the remaining columns show the results for each prudential tool individually. At the aggregate level, changes in foreign regulation do not affect credit granted in Portugal in this specification. This is possibly because of the mixed directions of effects coming from different prudential tools. While for the loan-to-value ratio a tightening abroad is associated with more credit growth in Portugal, for the general capital requirements and the concentration ratios we find the opposite. After a tightening in the capital requirements, a tightening in the concentration ratio and a loosening in the loan-to-value limit, on average, the quarterly loan growth rate for the banks/periods with changes in these regulatory measures in our sample declined 6.7, 5.2 and 11.1 percentage points, which is around 75%, 81% and 138% of the mean absolute change for these sub-samples. As before, the magnitude of these effects should be interpreted with caution.

To better understand these results, it is important to discuss our expectations of this transmission channel. When regulation is tightened in the home country of a given bank, this might affect the whole activity of the banking group, including its affiliates abroad if the regulation is applied at the consolidated level. So, while in the previous specification domestic banks could to some extent substitute between foreign and domestic credit when regulation was tightened or loosened abroad, in this specification this substitution might be more likely to occur in the case of regulations that are not applied at the consolidated level. The results we obtain are line with this reasoning. In fact, both capital requirements and concentration ratios are usually applied at the consolidated level, while limits to the loan-to-value ratio are most often applied at the local level, when specific risks are building up in the home country of the bank, where most of its activity is usually concentrated. To be more effective, these instruments are typically targeted to the vulnerabilities they want to address and thus do not cover the international activity of banks.

As before, our empirical strategy allows us to understand through which channels these mechanisms are working by exploring the interaction terms in the regressions. The negative effect of tighter capital requirements on credit growth in Portugal by foreign banks is mitigated when banks have less intragroup external net debt. Other indicators of banks' financial strength and business models are not statistically significant. For concentration ratios the negative effect on credit growth is mitigated by higher capital ratios, more illiquid assets, more net intragroup external debt and more core deposits, thus not providing a very clear picture about how the financial health of a banks' affiliate affects this cross-border effect. Looking at the positive effect of a tightening in the loan-to-value ratio, we find that this effect is stronger when the affiliate becomes better capitalized and more liquid. This suggests that foreign banks with better financial standing substitute some of the credit granted abroad by domestic loans when lending requirements become tighter at home. Additionally, the substitution effect is stronger for the affiliates that rely more on intragroup funding and less on deposits from residents in the host country.

In sum, the results suggest that the cross-border effects of regulation depend on the prudential tool considered as well as of the channel of transmission. A tightening in foreign regulation leads to a decrease in domestic credit growth in the case of concentration ratios and capital requirements. These effects operate through foreign banks located in Portugal. By contrast, in the cases of sector specific capital buffers and foreign reserve requirements, a tightening in foreign regulation leads to an increase in credit growth in Portugal. These effects operate through the domestic banks with international activity. We also find significant cross-border effects for the loan-to-value limits. In this case, it is interesting to note that the cross-border spillovers work in different ways for domestic banks with international activity and for foreign banks - after a tightening in this instrument abroad domestic banks decrease credit growth in Portugal while foreign banks increase it. Since the tightening of loan-to-value limits generally occurs when real estate markets are booming, one possible explanation for these different effects is that Portuguese banks might constrain their domestic credit growth to be able to increase credit abroad, while foreign banks might be more worried with the building up of risks in the home country (where most of their activity is concentrated) and thus increase credit growth abroad.

3.2. Further Exploring Cross-Border Spillovers of Prudential Policies

In this section we extend our previous analysis in several directions with two purposes: to gain further insight on some issues and to test the robustness of the results to different specifications.

The most important extension is related with an effort to understand how the cross-border transmission of prudential policy works through different types of foreign banks. More specifically, we look separately at the transmission through foreign branches and subsidiaries located in Portugal as their legal form has implications for the way regulation is applied. In this analysis we will focus on the prudential tools for which we find evidence of transmission through foreign banks to the domestic economy and for which we have enough variation in our data: capital requirements and loan-to-value limits.

Afterwards, we summarize the results of the extensive battery of robustness tests we conducted on the baseline results.

3.2.1. Cross-Border Spillovers through Branches and Subsidiaries. A bank might be present in a foreign country through two different legal forms: a branch or a subsidiary. A branch is not a legally autonomous entity and belongs directly to the parent bank. In turn, a subsidiary is a legally independent institution in the host country. In legal terms, it works in a very similar way to the domestic banks operating in that country, with the main difference being that its capital is held by a foreign bank. For an uninformed customer the differences between a branch and a subsidiary would not be perceptible as the management of their operations and their relationships with customers have no reason to differ. However, important differences apply in regulatory terms due to legal nature of each institution. For instance, deposits held by customers in a branch are guaranteed by the deposit guarantee scheme of the home country, while for the subsidiary the responsibility lies entirely with the host country. More importantly for the purposes of our study, some prudential instruments are applied differently for branches and subsidiaries. Cerutti *et al.* (2007), Dell'Ariccia and Marquez (2010), Focarelli and Pozzolo (2005), and Goldberg and Saunders (1981) discuss in more detail some of the differences between branches and subsidiaries and the way banks choose to expand internationally, while Peek and Rosengren (1997) and Peek and Rosengren (2000) analyze the implications on the transmission of shocks.

The most relevant example in the European Union is perhaps the case of capital requirements: branches of EU banks are exempt from fulfilling capital requirements in the host country, but are directly subject to capital requirements in the home country. In this setting, the cross-border implications of regulations may be differentiated. While both branches and subsidiaries are affected by the capital requirements implemented in the home country, only subsidiaries are affected by changes in capital requirements in the host country. In contrast, loan-to-value ratios are usually applied directly to exposures in markets in which there are concerns regarding the buildup of risks in real estate markets. Thus, if the regulator applies this measure in the home country, the loans granted by home country affiliates abroad should not be directly affected.

Given these important differences, the cross-border effects of regulation may depend on the legal form of foreign banks. To analyze this, we adapt equation (4) and estimate the following regression:

Specification B1: Inward transmission of home prudential policy via branches and subsidiaries (see Table 5).

$$\begin{aligned} \triangle Y_{b,j,t} = \alpha_0 + \sum_{k=o}^{2} \alpha_{k+1} HomeP_{j,t-k} Branch_{b,t} \\ + \sum_{k=o}^{2} \alpha_{k+4} HomeP_{j,t-k} Subsidiary_{b,t} + \alpha_7 X_{b,j,t-1} + \alpha_8 Z_{j,t} \\ + \sum_{k=o}^{2} \beta_{k+1} HomeP_{j,t-k} X_{b,j,t-k} Branch_{b,t} \\ + \sum_{k=o}^{2} \beta_{k+4} HomeP_{j,t-k} X_{b,j,t-k} Subsidiary_{b,t} + f_b + f_t + \varepsilon_{b,j,t} \end{aligned} \tag{5}$$

All the variables and estimation restrictions are the same as in equation (4). The only difference is that the prudential variable is interacted with a categorical variable for branches and subsidiaries. The omitted category is the one referring to domestic banks. These regressions include bank and time fixed effects. Standard errors are clustered by country.

The results of this approach are presented in Table 5.[6] The results in Table 4 show that tighter capital requirements in the home country of a foreign bank are associated with less credit growth in the host country. By looking at the marginal effects in Table 5 we are able to find that this cross-border spillover of regulation works only through branches. As discussed above, the impact of foreign regulation should in theory affect both types of foreign banks. One possible explanation for this difference might be the different way branches and subsidiaries are affected by capital regulation. Branches are only affected by their home country regulation and so it makes sense to find this statistically

6. Given space constraints, we do not report the coefficients of the direct effects of bank control variables.

significant spillover. In turn, subsidiaries are simultaneously affected by home and host regulation. Capital requirements were higher in Portugal than in most other European countries during a large part of the sample period. These measures were taken to strengthen the resilience of the Portuguese banking system amidst an environment of erosion of trust. Given this backdrop, when capital requirements were tightened in the home countries, their effect on subsidiaries was possibly not felt as they were already subject to more demanding capital requirements due to host regulation.

Regarding the loan-to-value ratio, in Table 4 we reported that a tightening in the home country implies more credit growth in the host country through foreign banks. In Table 5, we report positive marginal effects both for branches and subsidiaries, which supports our hypothesis that this instrument should affect in the same way the two types of institutions.

3.2.2. Further Extensions and Robustness Tests. To be sure of the validity of the results presented above, we did several further extensions to the analysis.[7]

On the construction of the dataset, we estimated the baseline regressions using a sample with all explanatory variables winsorized at the 1st and 99th percentile. The results are broadly consistent. Further, we tested the implications of excluding the smallest banks in the sample from the analysis. When we exclude banks with a market share smaller than 0.05% in the loan market, there are some changes in the results. One possible reason for this might be that when we exclude these small banks there is much less variation in foreign regulation, thereby affecting the precision of the estimation of the cross-border effects of regulation. This happens because even though these banks are very small, they represent an important share of the number of observations (the total number of banks in the sample decreases from 57 to 31).

Since we decided to use solo data from supervisory reports instead of consolidated data, we considered that a relevant robustness test would be to estimate the regressions including banking group fixed effects. The results are consistent in qualitative terms.

Another issue that could affect the results is the treatment of missing observations in the prudential instruments database. In the baseline specifications, the missing observations are treated as zeros. If we keep them as missing, thereby losing some observations, the results are consistent.

One issue in which we differ significantly from the approach used in other countries participating in the IBRN project is the definition of the capital ratio. We use an unweighted accounting capital ratio instead of regulatory Tier 1 risk-based capital. Using Tier 1 capital would eliminate from the sample all branches exempt from capital requirements in Portugal. Nevertheless, given the important differences between the two variables, we also estimated whenever

7. The results are not reported, but are available upon request.

possible the regressions with Tier 1 capital for a subsample, excluding foreign branches for which there is no data on regulatory capital. The differences we find in the results are attributable to the change in the sample and not to change in the definition of the capital ratio.

In Specification B we chose to include all banks, domestic and foreign. All the observations concerning the home cycle and the home regulation were set to zero for Portuguese banks. For robustness purposes, we estimate the regressions in specification B only for foreign banks. We find some differences in the results, including the lack of significance of the negative marginal effect associated with a tightening of capital requirements. However, we would like to note that the estimations with foreign banks rely on a much smaller sample of banks, most of which are relatively small. Furthermore, there is a lot of heterogeneity in the business models of these banks, with some being more targeted to consumer loans, others to asset management and investment banking and others to local retail activities, for instance. The volatility generated by this smaller sample is the main reason to justify our inclusion of domestic banks in the baseline regressions.

Finally, as discussed before, there is a strong integration between the Spanish and the Portuguese banking systems. Recent consolidation trends within the European Union will possibly reinforce this integration. As such, it might be interesting to focus in more depth on the transmission of regulation implemented in Spain. We re-estimate specification B including only changes in Spanish regulation, our previous results are much stronger: we find significant cross-border effects of regulation for all the instruments considered. For the aggregate prudential index, we find that tighter regulation in Spain is associated with more credit growth in Portugal, thus showing the existence of non-negligible substitution effects between these two highly integrated banking markets. These effects work mainly through loan-to-value ratios and local reserve requirements. In contrast, a tightening in general and sectoral capital requirements in Spain leads to a decrease in the growth of credit granted in Portugal.

Still focusing in Spain, there is one prudential instrument that deserves further analysis: dynamic provisions. As discussed in Jiménez *et al.* (2017), this is one of the few time-varying regulatory tools in the world. This tool was introduced in Spain in July 2000 to improve the regulatory coverage of credit risk. The previously existing provisioning system was highly procyclical, increasing in bad times, and one of the main goals of the new tool was to reduce that procyclicality (Trucharte and Saurina 2013). Given the prominent role that the countercyclical capital buffer plays in the Basel III framework and its similarities with the spirit of dynamic provisions, this analysis offers a key input by providing for the first time evidence on the cross-border effects of a cyclical regulatory tool. We do not find a significant effect of changes in the dynamic provisioning system on Portuguese banks working through their exposures in Spain (specification A), but when we consider the credit behavior of the affiliates of Spanish banks in Portugal, we find that when dynamic provisions are loosened in Spain, the growth of credit granted by these affiliates increases in Portugal, thereby showing that this measure has significant cross-border spillovers (specification B). However, it should be noted that our sample period includes only two episodes in which the regime of dynamic provisions was loosened, both during the global financial crisis. As such, these results should be interpreted with some reserves.

4. Concluding Remarks

In this paper we find that a tightening in foreign regulation yields an increase in the growth of credit granted by domestic banks in Portugal, which suggests the presence of substitution effects. This effect works through the sector specific capital requirements and the reserve requirements on foreign currencies (and only through the foreign exposures of domestic banks). For the loan to value ratio, we obtain the opposite sign, thus suggesting the existence of complementary effects. Indeed, a tightening of the loan-to-value ratio abroad is associated with a decrease in the growth of domestic loans granted by Portuguese banks. This result might stem from the reduction in profits for the banking group as a whole. Alternately it might reflect the conditions under which this instrument is usually applied, i.e. periods of booms in real estate markets. Having limited resources, banks may prefer to limit domestic lending to continue to lend abroad if this market still yields high profitability despite the tighter regulation.

When we analyze the influence of foreign regulation on the growth of credit granted in Portugal by the foreign banks operating in the country, the effects are mixed. A tightening of general capital requirements and concentration ratios is associated with less credit growth in Portugal, while a tightening in loan-to-value ratios has the opposite effect, reflecting possible substitution effects. These results are in line with what could be expected given that when regulation is tightened in the home country of a given bank, substitution effects are more likely to occur if regulation is applied at the local level, than if it is applied at the consolidated level. It is interesting to note that for the loan-to-value ratio the cross-border spillovers work in different ways for domestic banks with international activity and for foreign banks.

Our contribution also tries to understand whether the transmission of foreign prudential policy through foreign banks operating in a given country works differently through branches or subsidiaries. We find as expected that in the case of the loan-to-values ratio the positive effect works both through branches and subsidiaries. By contrast, the negative effect of tighter capital requirements, in the home country of a foreign bank, on credit in the host country work only through branches. One possible explanation for this difference might be the fact when capital requirements were tightened in the home countries, their effect on subsidiaries was possibly not felt as these banks were already subject to more demanding capital requirements due to Portuguese regulation. These results show that the legal form of credit institutions plays an important role of the cross-border transmission of prudential regulation, most notably due to differences in the scope and perimeter of application of the instruments.

With increasingly harmonized regulation across the world, this project contributes to understand how changes in prudential tools in one country might affect the evolution of credit granted in another country. This is relevant to think about intended and unintended international spillovers when designing regulation. With increased pressure for international reciprocity between regulators (as set out for instance in the countercyclical capital buffer framework), having at hand empirical evidence on the way regulation affects lending in other countries will certainly be highly valuable for policymakers.

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Tables and figures

Table 1: Summary Statistics on Bank Credit and Characteristics

This table provides summary statistics for bank balance sheet and credit data. Data are observed quarterly from 2006:Q1-2014:Q4. Banking data are reported at the solo level. All variables defined in Table 1a in Appendix 1.

Balance sheet data (for each bank i and quarter t)

	All banks (n=57)			Portuguese banks (n=25)			Foreign banks (n=32)		
Variable	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Dependent variables									
Domestic credit (ln change) (in %)	0.318	-0.169	15.34	0.380	-0.293	14.13	0.266	-0.0720	16.30
Independent variables									
Log Assets	7.278	7.088	1.952	7.805	7.538	2.090	6.831	6.881	1.705
Capital Ratio (in %)	6.459	5.116	12.77	8.580	6.517	15.30	4.660	3.436	9.799
Illiquid Assets Ratio (in %)	79.95	89.88	24.13	78.61	88.16	24.04	81.09	92.57	24.17
International Activity (in %)	-	-	-	2.429	0	4.075	-	-	-
Net intragroup funding (in %)	25.36	4.763	42.48	1.297	0	9.798	45.77	56.42	48.45
Core Deposits Ratio (in %)	16.22	10.34	18.30	25.29	22.59	20.72	8.522	2.386	11.22

Table 2: Summary Statistics on Changes in Prudential Instruments

These tables show summary statistics on the changes in the regulation on prudential instruments used in our sample. In the table for specification A, the data refers to changes in regulation in the countries where the branches and subsidiaries of the Portuguese banks are located over the period 2005:Q4-2014:Q4. In the table for specification B, the data refers to changes in regulation in the home countries of the foreign banks operating in Portugal over the period 2005:Q4-2014:Q4. 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 table also shows the share of prudential changes to total observations (i.e. the share of nonzero observations). In the first table, the column "Exposure weighted observations" is based on the underlying data on prudential changes in foreign countries (columns "base data"). The reported data are based on the regression sample.

Inward: Specification A

	Base Data (Before Aggregating to Exposure-Weighted Measures)					Exposure-Weighted Observations
Instrument	# of Country-Time Changes	# of Country-Time Changes (Tightening)	# of Country-Time Changes (Loosening)	# of Bank-Time Changes	Proportion Base-MPP Nonzero on total observations	Proportion ExpP_t Nonzero on total observations
Prudential Index	107	80	27	209	0,014	0,175
General capital requirements	30	30	0	55	0,003	0,035
Sector specific capital buffer	17	15	2	36	0,002	0,052
Sector specific capital buffer (Real Estate)	10	10	0	19	0,001	0,031
Sector specific capital buffer (Consumption)	6	5	1	15	0,001	0,019
Sector specific capital buffer (Other)	4	3	1	9	0,001	0,012
Loan-to-value ratio limits	18	11	7	36	0,002	0,049
Reserve requirements: Foreign	19	10	9	31	0,002	0,036
Reserve requirements: Local	32	13	19	60	0,004	0,070
Interbank exposure limit	11	11	0	16	0,001	0,014
Concentration ratio	8	7	1	17	0,001	0,023

Inward: Specification B

Instrument	# of Country-Time Changes	# of Country-Time Changes (Tightening)	# of Country-Time Changes (Loosening)	# of Bank-Time Changes	Proportion HomeP_t Nonzero on total observations
Prudential Index	41	30	11	136	0,142
General capital requirements	15	15	0	48	0,050
Sector specific capital buffer	10	8	2	21	0,022
Sector specific capital buffer (Real Estate)	5	5	0	16	0,017
Sector specific capital buffer (Consumption)	3	2	1	3	0,003
Sector specific capital buffer (Other)	2	1	1	2	0,002
Loan-to-value ratio limits	3	0	3	23	0,024
Reserve requirements: Foreign	4	2	2	4	0,004
Reserve requirements: Local	14	5	9	29	0,030
Interbank exposure limit	6	6	0	12	0,013
Concentration ratio	3	3	0	19	0,020

Table 3: Inward Transmission of Policy through International Exposures of Domestic Banks

This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in domestic loans. The data are quarterly from 2006:Q1 to 2014:Q4 for a panel of domestic banks. Foreign exposure weighted regulation ExpP is calculated as the weighted average of changes in foreign regulation where the weights are assets and liabilities of the bank affiliates in the respective foreign country. For ExpP 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. For more details on the variables see Appendix Table 1a. 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 not clustered. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ExpP= Prudential IndexC	ExpP= Capital Requirements	ExpP= Sector-Specific Capital Buffer	ExpP= Loan To Value Ratio	ExpP= Reserve Requirement Foreign	ExpP= Reserve Requirement Local	ExpP= Concentration Ratios
ExpP_t	41.57***	-58.08***	13.91	29.59	1,467**	0.644	-1,144***
	(9.994)	(19.08)	(22.83)	(25.49)	(533.8)	(24.57)	(382.0)
ExpP_t-1	10.82	41.58	37.61	-156.3*	390.6	15.04	-57.00
	(21.03)	(39.24)	(40.59)	(79.69)	(372.3)	(28.38)	(266.2)
ExpP_t-2	28.97	1.331	58.39**	-112.5**	-408.2	19.97	-166.5
	(17.73)	(21.62)	(27.30)	(47.77)	(304.7)	(43.10)	(147.2)
Log Total Assets_t-1	2.109	1.895	1.062	3.002	1.083	1.439	1.331
	(2.633)	(2.653)	(2.513)	(2.960)	(2.329)	(2.398)	(2.364)
Capital Ratio_t-1	0.0671	0.0539	0.0768	0.0676	0.106*	0.0823	0.0886*
	(0.0692)	(0.0534)	(0.0585)	(0.0625)	(0.0539)	(0.0509)	(0.0478)
Illiquid Assets Ratio_t-1	0.0337	0.0419	0.0543	0.0256	0.0451	0.0386	0.0346
	(0.117)	(0.109)	(0.107)	(0.118)	(0.109)	(0.109)	(0.109)
International Activity_t-1	0.141	0.828**	0.347	0.763**	0.567	0.452	0.507
	(0.245)	(0.310)	(0.282)	(0.326)	(0.352)	(0.423)	(0.337)
Net intragroup funding_t-1	0.0915	0.0955	0.0576	0.137**	0.0659	0.0841	0.0846
	(0.0672)	(0.0648)	(0.0683)	(0.0663)	(0.0655)	(0.0621)	(0.0627)
Core Deposits Ratio_t-1	0.101	0.0768	0.108	0.0680	0.0673	0.0770	0.0892
	(0.135)	(0.125)	(0.130)	(0.136)	(0.124)	(0.129)	(0.129)
Log Total Assets * ExpP	-6.19***	4.45***	-2,41	40.13***	-106.59***	-6,32	-70,90
	(8.6511)	(11.2928)	(0.6192)	(5.0245)	(9.4879)	(1.5684)	(0.8783)
Capital Ratio * ExpP	0,04	2.35***	-0,02	2,20	1.7***	0,32	-4.33*
	(0.2869)	(10.7245)	(0.0961)	(1.9921)	(33.6121)	(0.2125)	(2.786)
Illiquid Assets Ratio * ExpP	-0,34	-0,48	-0.95**	-0,75	-7.35***	0,10	16.39***
	(0.5509)	(1.782)	(3.4517)	(1.1776)	(9.4271)	(0.5166)	(6.0442)
International Activity* ExpP	2.74*	1.41**	0,72	-0,92	35.55*	1.65*	34.29*
	(2.9003)	(3.9663)	(1.9943)	(1.1751)	(2.8248)	(2.9011)	(2.5488)
Net intragroup funding * ExpP	0,34	0.48**	0,82	-3.44**	0.1*	0,03	3,98
	(1.6361)	(4.414)	(1.9257)	(3.1076)	(2.8478)	(0.2281)	(1.4908)
Core Deposits Ratio * ExpP	-0,08	-0.68***	-0.27***	-4.12**	3,08	0,55	19.7**
	(1.185)	(7.725)	(9.2166)	(3.3567)	(0.7987)	(1.0793)	(4.0381)
ExpP (ExpP_t+ExpP_t-1+ExpP_t-2)	81.3531**	-15,17	109.9069***	-239.2609*	1449,29	35,65	-1367.1461**
F-Statistics	(4.9682)	(0.0839)	(8.8012)	(4.2453)	(2.3015)	(0.448)	(4.828)
P-Values	0,04	0,77	0,01	0,05	0,14	0,51	0,04
Average marginal effects of ExpP							
For all banks	11,32	-12,32	11.97*	-71.63**	196.99**	13,36	-93,32
For banks/periods with changes in ExpP	10.87***	0,95	8.04*	-10,04	67.85***	7,85	-4,55
Observations	703	703	703	703	703	703	703
Adjusted R-squared	0,04	0,04	0,02	0,03	0,03	0,01	0,01
Number of banks	25	25	25	25	25	25	25

Table 4: Inward Transmission of Policy via Affiliates of Foreign-Owned Banks

This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in domestic loans. The data are quarterly from 2006:Q1 to 2014: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. For the Portuguese banks the regulation variables and the financial and business cycle variables are zero. For more details on the variables see Appendix Table 1a. 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 country. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	HomeP= Prudential IndexC	HomeP= Capital Requirements	HomeP= Sector-Specific Capital Buffer	HomeP= Loan To Value Ratio	HomeP= Reserve Requirement Local	HomeP= Concentration Ratios
HomeP_t	1.156	-10.19	13.78	82.47***	-3.993	8.657
	(6.126)	(12.15)	(10.62)	(22.66)	(11.82)	(7.127)
HomeP_t-1	22.92**	24.61*	34.93**	18.43***	-0.673	-33.31***
	(7.832)	(11.28)	(13.15)	(3.501)	(10.82)	(8.197)
HomeP_t-2	-2.691	-12.66**	31.46*	18.15**	10.08	-46.09***
	(5.456)	(5.555)	(15.82)	(6.553)	(16.26)	(7.925)
Log Total Assets_t-1	-1.814	-1.300	-1.709	-1.514	-1.465	-1.432
	(1.586)	(1.557)	(1.581)	(1.558)	(1.580)	(1.532)
Capital Ratio_t-1	0.0713*	0.0835*	0.0798*	0.0753**	0.0790*	0.0785*
	(0.0341)	(0.0374)	(0.0396)	(0.0329)	(0.0368)	(0.0366)
Illiquid Assets Ratio_t-1	-0.0416	-0.0577	-0.0436	-0.0739	-0.0578	-0.0531
	(0.0755)	(0.0774)	(0.0744)	(0.0775)	(0.0755)	(0.0732)
Net intragroup funding_t-1	-0.0427	-0.0408	-0.0578	-0.0376	-0.0546	-0.0525
	(0.0488)	(0.0448)	(0.0484)	(0.0410)	(0.0472)	(0.0467)
Core Deposits Ratio_t-1	0.106*	0.0842	0.0922	0.0973*	0.0803	0.0780
	(0.0557)	(0.0651)	(0.0643)	(0.0492)	(0.0656)	(0.0662)
Financial cycle (Home country)	-0.0332*	-0.0405*	-0.0438	-0.0350	-0.0473	-0.0537*
	(0.0155)	(0.0209)	(0.0256)	(0.0209)	(0.0276)	(0.0246)
Business cycle (Home country)	1.214**	1.375**	1.489**	1.246**	1.456**	1.577***
	(0.443)	(0.470)	(0.506)	(0.495)	(0.496)	(0.476)
Log Total Assets * HomeP	0,51	0,23	1,51	1,10	1,10	-0,90
	(0.2744)	(0.0124)	(0.7981)	(2.1151)	(0.1272)	(0.2443)
Capital Ratio * HomeP	0,03	-0,54	-0.91**	2.44***	0,58	1.6**
	(0.0056)	(1.2924)	(7.3717)	(28.9896)	(1.0358)	(6.2872)
Illiquid Assets Ratio * HomeP	-0,15	0,16	-1.09***	-1.51***	-0,18	0.49***
	(1.2312)	(0.7227)	(24.3021)	(17.74)	(1.6279)	(12.2658)
Net intragroup funding * HomeP	-0,16	-0.37*	0.24*	0.31***	0,08	0.18***
	(1.6166)	(3.9579)	(4.8046)	(14.68)	(1.1721)	(14.1518)
Core Deposits Ratio * HomeP	-0.55*	-0,41	-0,43	-0.54***	-0,48	3.04***
	(3.3943)	(1.6546)	(0.6513)	(87.823)	(1.8278)	(56.9368)
HomeP (HomeP_t+HomeP_t-1+HomeP_t-2)	21.38*	1,75	80.17***	119.05***	5,41	-70.75***
F-Statistics	(4.6434)	(0.0171)	(43.432)	(20.3492)	(0.0582)	(16.4792)
P-Values	0,06	0,90	0,00	0,00	0,81	0,00
Average marginal effects of HomeP						
For foreign banks	1,00	-7.1*	4,87	24.91***	0,99	5,49
For foreign banks/periods with changes in HomeP	1,08	-6.73*	3,69	11.1***	2,36	-5.21**
Observations	1,619	1,619	1,619	1,619	1,619	1,619
Adjusted R-squared	0,050	0,046	0,046	0,052	0,038	0,034
Number of banks	57	57	57	57	57	57

Table 5: Inward Transmission of Policy via Affiliates of Foreign-Owned Banks – branches versus subsidiaries

This table reports the effects of changes in regulation and firm characteristics and their interactions on log changes in domestic loans. The data are quarterly from 2006:Q1 to 2014:Q4. HomeP refers to the changes in regulation in the home (i.e. parent bank) country of foreign affiliates. For HomeP interaction effects with bank characteristics the reported coefficient is the sum of the contemporaneous term and two lags with the corresponding F-statistics for joint significance in parentheses. For the Portuguese banks the regulation variables and the financial and business cycle variables are zero. For more details on the variables see Appendix Table 1a. 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 country. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
	HomeP= Prudential IndexC	HomeP= Capital Requirements	HomeP= Loan To Value Ratio
HomeP_t*Subsidiaries	-12.01	-54.73	-43.82***
	(6.677)	(39.71)	(4.802)
HomeP_t*Branches	37.28*	11.66	25.66***
	(17.57)	(26.87)	(7.122)
HomeP_t-1*Subsidiaries	4.114	-81.43*	26.55***
	(11.40)	(44.36)	(4.560)
HomeP_t-1*Branches	30.25**	28.41	34.83***
	(9.970)	(16.16)	(8.106)
HomeP_t-2*Subsidiaries	-6.396	-81.46***	-14.57
	(25.72)	(22.70)	(10.21)
HomeP_t-2*Branches	-13.75	-8.625	46.35***
	(9.495)	(7.357)	(8.019)
Financial cycle (Home country)	-0.0251	-0.0348	-0.0286
	(0.0164)	(0.0232)	(0.0234)
Business cycle (Home country)	1.231**	1.398**	1.235**
	(0.441)	(0.492)	(0.508)
Log Total Assets * HomeP*Subsidiaries	3,100	24.7664***	2,768
	(1.2878)	(39.8632)	(1.4382)
Log Total Assets * HomeP*Branches	-3.0592*	-2,801	13.9214***
	(4.434)	(1.5096)	(61.3848)
Capital Ratio* HomeP*Subsidiaries	0,497	4.4552***	6.6972***
	(0.7014)	(10.9829)	(28.8127)
Capital Ratio* HomeP*Branches	-0,308	-0,787	-0.7752**
	(0.1381)	(0.9531)	(7.3751)
Illiquid Assets Ratio* HomeP*Subsidiaries	-0,056	-0,125	-0,120
	(0.0503)	(0.0443)	(0.0799)
Illiquid Assets Ratio* HomeP*Branches	-0,275	0,125	-2.2814***
	(1.2421)	(0.2071)	(89.1302)
Net intragroup funding * HomeP*Subsidiaries	0,046	-0,045	0,111
	(0.0798)	(0.8222)	(0.2571)
Net intragroup funding* HomeP*Branches	-0,158	-0.4185*	0.2852*
	(1.4909)	(4.6719)	(4.9366)
Core Deposits Ratio * HomeP*Subsidiaries	-0.5017*	-0.6817*	-0.6982***
	(4.8538)	(3.3879)	(20.8261)
Core Deposits Ratio * HomeP*Branches	-0,636	-1,226	0,364
	(1.0467)	(3.2624)	(2.0952)
HomeP (HomeP_t+HomeP_t-1+HomeP_t-2)*Subsidiaries	-14,297	-217.6286***	-31,847
F-Statistics	(0.2149)	(15.244)	(3.088)
P-Values	0,654	0,004	0,113
HomeP (HomeP_t+HomeP_t-1+HomeP_t-2)*Branches	53.7754**	31,448	106.8409***
F-Statistics	(6.4632)	(1.2814)	(34.985)
P-Values	0,032	0,287	0,000
Average marginal effects of HomeP for foreign banks			
For subsidiaries	5.4672*	1,038	44.2201***
For branches	-3,112	-12.222***	27.8768***
Average marginal effects of HomeP foreign banks/periods with changes in HomeP			
For subsidiaries	6.0252**	-2,269	13.214***
For branches	-2,605	-8.5557**	8.1721***
Observations	1,619	1,619	1,619
Adjusted R-squared	0,056	0,047	0,055
Number of banks	57	57	57

Figure 1: Credit granted by banks in Portugal

The figure depicts the year-on-year growth rate of credit granted by domestic and foreign banks operating in Portugal. The full line refers to data used in this paper, which was compiled from supervisory reports, while the dashed line refers to data from the Monetary and Financial Statistics published by Banco de Portugal.

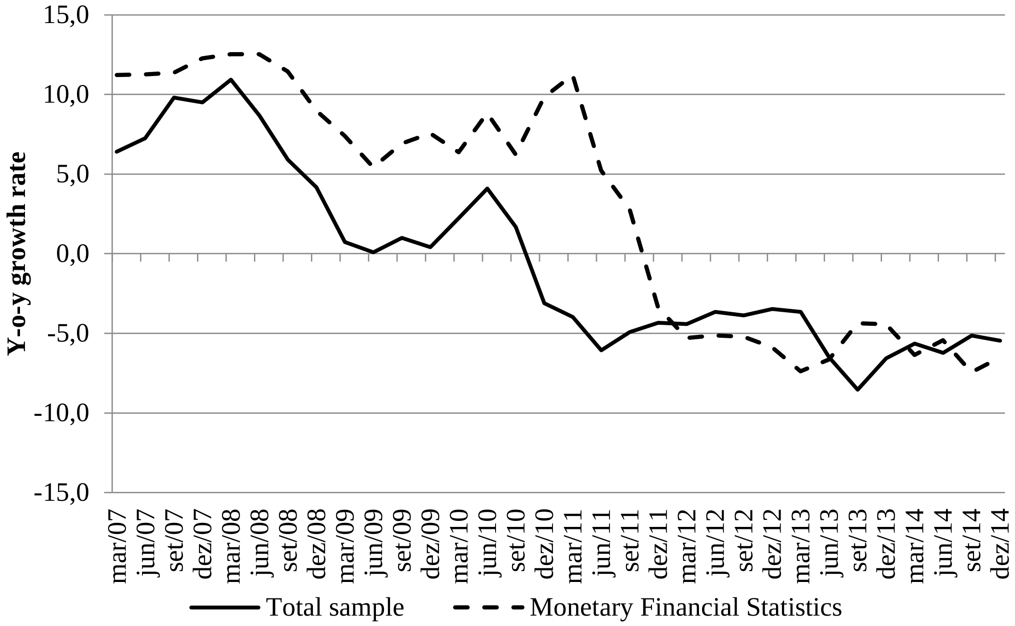

Figure 2: Credit granted by domestic and foreign banks in Portugal

The figure depicts the year-on-year growth rate of credit granted by domestic and foreign banks operating in Portugal in full and dashed lines, respectively, for the banks in the sample used in this paper.

Appendix

Table 1a: Construction of Balance Sheet Independent Variables

Variable Name	Description	Data Source
Illiquid Assets Ratio	(1-(Cash and claims on central banks and credit institutions/Total assets)) (in %)	Supervisory data (Banco de Portugal)
Log Assets	Ln (Total assets/GDP deflator 2012)	Supervisory data (Banco de Portugal) and National accounts (Statistics Portugal)
Core Deposits Ratio	(Time deposits from residents + deposits redeemable at notice from residents + savings deposits from residents)/Total assets (in %)	Supervisory data (Banco de Portugal)
Capital Ratio	Equity capital/Total assets (in %)	Supervisory data (Banco de Portugal)
Net intragroup funding	(Deposits of banks of the same banking group located abroad - credit, debt securities shares and other equity to banks of the same banking group located abroad)/Total liabilities (in %)	Montlhy balance sheet statistics and supervisory data (Banco de Portugal)
International Activity	Local claims plus liabilities (denominated in local currency) of the branches and subsidiaries (of the portuguese banks) located outside Portugal/(Total assets and total liabilities of the parent bank + Local claims and liabilities of the branches and subsidiaries located outside Portugal) (in %)	Bank level data on a consolidated basis underlying the report to the International Banking Statistics of the BIS and Supervisory data (Banco de Portugal)

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