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A comparison of the internal and external determinants of global bank loans: Evidence from bilateral cross-country data

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Abstract
This paper finds that factors determined outside of a country are more closely related to the global bank loans she receives. These loans are more stable when global banks are less competitive and have a higher presence in the recipient country. We obtain our results by using data on the bilateral loans positions of 15 countries and a unique methodology to identify and compare the independent effects of external and internal factors. We find support for our empirical results and draw more detailed inferences for competition and global bank presence by solving a simple model of global banking.

JEL Classification: E44; F34; G15; G21
Keyword(s): Cross-country loans, global banks, competition, overlapping generations model.

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1. Introduction

Over the past 15 years, banks have become more global, larger and an important source of finance for countries.[1,2] These developments have sparked a rapid expansion in the literature on global banking (we discuss this literature below). While this expansion has been largely through papers investigating the effects of global banks on economic stability and international business cycles (especially after the key role that they played during the 2008-09 crisis), studies that focus on the dynamic determinants of global bank flows are relatively small in number.

In this paper, we focus on the global loans of banks and use their country-specific lending behavior as a means of determining why loans flow in and out of countries.[3] Throughout the paper, our analysis revolves around a simple question: Are the cross-country flows of bank loans determined mostly by internal or external factors? If internal factors are more important, this could suggest that an economy with a high, robust growth rate and healthy borrower balance sheets would receive more loans from global banks and that these loans would diminish in countries that are performing poorly; countries would have control over their own destinies. Conversely, if external factors are more important, the state of an economy may not be strongly related to the loans it receives and economies may be more susceptible to external developments. These answers to our question, albeit, do not have any implications for economic stability. Continuing with our example above, it is possible for a rapidly growing economy to be destabilized by external funding if these funds are allocated to inefficient investments. It is also

[1] The foreign claims of Bank of International Settlements (BIS) reporting banks as a share of world GDP, for example, have increased from 25.9 to 43.9 percent from 1995 to 2011 and the Lerner index of bank competition has increased from 0.19 to 0.27 from 1996 to 2010, indicating a decrease in the degree of competition. We should note, however, that both variables have demonstrated different trends, a negative one after 2007 in particular. The foreign claims data are obtained from the BIS quarterly statistics and the annual ratios are computed by averaging the quarterly variables. The Lerner index is from the FRED database of the Federal Reserve Bank of St. Louis. Other indicators of bank concentration, also obtained from FRED, similarly reveal a deterioration of competitive conduct. The Boone indicator of bank competition in the world has increased from -0.060 to -0.043 from 1997 to 2010 and the 3-bank asset concentration has increased from 34.1 to 70.4 percent from 1995 to 2011.

[2] See Bruno and Shin (2013), and Cetorelli and Goldberg (2012) for similar trends in bank globalization.

[3] While the global expansion of banks has been observed for all asset types, loans constitute the largest share. The share of loans amongst foreign claims for all BIS reporting banks was approximately 74 percent in 2011.

possible for global bank lending to have a stabilizing effect when they are mostly determined by external factors given that these factors are relatively more stable. Our analysis does, however, allow us to draw important conclusions for economic integration and the alignment of business cycles. If global bank flows are mainly determined by external factors, for example, this would suggest that economies are now more integrated financially and that global financial crises, such as the 2008-09 crisis, could be more frequently observed. For periods not characterized by a crisis, the importance of external factors would imply a higher degree of alignment in global business cycles and it would suggest that macroeconomic imbalances across countries have become a less critical international concern compared to global financial stability.

While our question is simple, it is very broad and finding an answer is far from straightforward. Faced with these obstacles, we follow a few careful steps to draw empirical inferences and build a theoretical model to guide us in describing and comparing the effects of external and internal shocks.

We first narrow down our empirical investigation by focusing on the strength of borrower balance sheets, approximated by the real GDP growth rate and the unemployment rate, and the global banks' funding costs, measured by interbank borrowing rates and deposit rates, as the potential internal and external determinants of bank lending, respectively, since these are the most commonly used indicators of credit worthiness and the cost/ease of lending (e.g. Ashcraft and Campello, 2007; Kashyap and Stein, 2000). Next, we construct a quarterly dataset that includes the outstanding amount of bilateral bank loans across 15 advanced economies (210 pairs). The data are from the Bank of International Settlements (BIS) locational banking statistics and span the 2000Q1-2012Q4 period. We then combine the BIS data with various borrower balance sheet and bank funding cost variables to form our dynamic, balanced panel dataset.

The main difficulty in our estimations lies in identifying the independent effects of internal and external factors on lending; i.e., do banks lend more in a specific country because her borrowers have stronger balance sheets or because the banks' cost of funding is lower? To answer this question, we follow a unique identification strategy, made possible only by the bilateral dimension of our dataset. Since we can observe a lending country's (or its banks') loans in the other 14 countries, we are able to measure her country-specific loan growth rates relative to her average global loan growth rate. Matching this variable with the balance sheet strength measures of the recipient countries then allows us to control for any supply side factors that may facilitate or impede lending and identify the independent effects of a country's balance sheets (internal factors) on the amount of global loans she receives. We reverse this methodology to identify the effects of external factors (cost of funding), and measure the country-specific loan growth rates in a given country relative to the average loan growth rate in that country. By doing so, we control for demand side (internal) factors since global banks lend in the same country.

Here we should mention two aspects of our methodology. First, when measuring the loan growth rates in deviational form, we implicitly assume that supply side (lender-specific) restrictions apply symmetrically to all borrowers. Although banks can possibly face different supply side restrictions in different countries, the usual findings of the internal capital markets literature indicate otherwise; banks use their internal markets effectively to allocate funds across their subsidiaries and thus face similar restrictions when lending in different countries.[4] Second, given that bank level data on country-specific loans are not available, to the best of our knowledge, we use country level data. While this could potentially mask the different bank level sensitivities to the two factors, we find that the banking sectors are, in general, highly concentrated in our sample countries and a few large global banks account for most of the loans.

[4] See for example, Houston et al. (1997), Campello (2002), Cetorelli and Goldberg (2012) and De Haas and Lelyveldb (2010).

Our results indicate that global bank loans are positively related to the strength of borrower balance sheets and negatively related to the banks' cost of funding. In other words, countries with relatively lower unemployment rates and higher growth rates receive more loans and banks that face lower borrowing costs expand their lending by more. We find that these relationships are economically important and robust to alternative measures of balance sheet strength and funding costs. To compare the two factors, we standardize the balance sheet and cost of funding variables so that they have a mean of zero and a standard deviation of one. The estimation results reveal a clear disparity between the two factors and indicate that the cost of funding, the external factor, is a more important determinant of global bank loans.

As we mentioned, at the same time that banks were becoming more global, they were also growing in size and causing deterioration in competitive conduct. Although it is uncertain whether the two developments are related, most economists would agree that banks would behave differently in markets with different degrees of competition. In an alternative set of regressions, we therefore investigate how the degree of competition in the recipient countries is related to the sensitivities to balance sheet strength and funding costs. Here, we also investigate how foreign bank presence (their share in total loans) is related to these sensitivities. Our results indicate that when there is less competition in banking, both sets of sensitivities are smaller in magnitude; there is more stability in external funding when banks are larger. Foreign presence regressions reveal a similar mitigating effect; as foreign bank presence increases external loans become more stable. We find that both of these effects are economically important.[5]

In the second half of the paper, we build a simple model populated by overlapping generations (OLG) to identify the mechanisms that determine global banks' sensitivities to

[5] For example, according to our results if Italy's foreign bank assets to GDP ratio (average of 22.1 percent) were to reach the level for Denmark (46.3 percent), her sensitivity to the baseline balance sheet and cost of capital measures would decrease by 50 and 34 percent, respectively. We find an even larger effect on the sensitivities in our estimations with competition.

internal and external shocks and investigate the role of competition and foreign bank presence. In the model we include domestic and foreign banks, each group forming a Cournot oligopoly, and incorporate borrower balance sheets by following the investment-capital conversion framework in Cetorelli and Peretto (2012). In this framework investment is financed by bank loans and it can be successfully converted to capital with only a certain probability; there is default otherwise. This friction helps us generate balance sheet (default probability) shocks and analyze the reaction of foreign banks in a straightforward way. External shocks are the changes in foreign banks' funding costs and the default probability of another country that affects foreign banks' leverage.

The model's symmetric Nash equilibrium reveals several results. As expected, foreign banks lend more when their funding costs are lower and domestic balance sheets improve. The more insightful results are related to the interaction of banks. In particular, the two types of banks influence each other through their effects on the returns from lending and funding costs; higher domestic (foreign) bank lending causes a decrease in the marginal returns and an increase in the marginal costs of foreign (domestic) banks. We find a weaker interaction when bank profits are more sensitive to shocks. If, for example, foreign banks' returns, relative to domestic banks, increase substantially in response to a decrease in default probability and their costs do not, they lend more not only because they face larger profit margins but also because domestic banks have a smaller negative impact on their profits. The disparity between the sensitivities to external and internal shocks thus depends on the shocks' direct impact on foreign banks' profits and their impact through domestic banks. If, for example, a default shock prompts a relatively large domestic bank response, foreign banks' sensitivity to funding costs can be larger.

Investigating the role of competition, we find that banks display higher sensitivity when they are large in number and thus more competitive. The reason is that these relatively small

banks reach diminishing marginal returns and increasing marginal costs less quickly than they would if they were large. The effect of competition on foreign lending sensitivity is, however, not straightforward and it depends asymmetrically on the level of competition amongst foreign and domestic banks. If foreign banks are more competitive, their sensitivity to both external and internal shocks is higher. If domestic banks are more competitive, foreign sensitivities are lower. The latter effect is due to the mitigating impact that a higher domestic bank response has on foreign bank lending. Turning to foreign bank presence, we find that with a larger share of foreign banks, the mitigating effects of domestic banks are smaller and thus foreign lending is more sensitive. Here, a comparison of these theoretical inferences with our empirical results, recommends a more nuanced and detailed approach to studying the impact of competition and foreign bank presence on foreign lending stability. Specifically, a lower degree of competition brings more stability only if it is observed among foreign banks and if foreign bank presence is low. Conversely, higher foreign bank presence brings stability, as suggested by our empirical findings, only if foreign and domestic banks are less and more competitive, respectively.

Our paper is related to several strands of literature. Separating the effects of supply and demand side factors on bank lending empirically is, for example, a notorious problem in the credit channel literature of monetary economics, first mentioned by Bernanke and Gertler (1995). Given this difficulty, studies typically focus on either supply side (e.g. Kashyap and Stein, 2000) or demand side factors (e.g., Ashcraft and Campello, 2007; Alpanda and Aysun, 2012; Aysun and Hepp, 2011, 2013) and mostly investigate the transmission of U.S. monetary policy. A common finding is that while supply side factors have declined in importance due to financial innovation and the growing size of banks, demand side factors (i.e., borrower balance sheets) are still an important conduit for monetary policy. Our methodology allows us to not only measure

the effects of the two factors but also to compare them. Our cross-country analysis indicates that supply side factors are the primary determinant of lending. Thus while the effect of supply side factors may be declining in the U.S., they may still be important globally.

Our paper is more directly related to the literature on the relationship between business cycles and foreign bank lending. In this literature, the evidence for the importance of external and internal factors for foreign lending is mixed. On the one hand, studies such as Buch (2000), Dahl et al. (2002), De Haas and Van Lelyveld (2006), Goldberg (2002), Hernandez and Rudolph (1995), Jeanneau and Micu (2002), Martinez Peria et al. (2002) and Morgan and Strahan (2004) find that banks destabilize economies by shifting funds from economies with weak balance sheets to those with strong balance sheets. This mechanism, referred to as the substitution effect in De Haas and Van Lelyveld (2010), is consistent with the usual finding that foreign banks extend loans with shorter maturity and do less house-bank/relationship lending which makes them more sensitive to borrower balance sheets. On the other hand, studies such as Cetorelli and Goldberg (2012), Crystal et al. (2002), Dages et al. (2000), and Peek and Rosengren (2000) find that global banks help their subsidiaries across the world through their internal capital markets to equate returns. This mechanism, referred to as the support effect, favors supply side factors as the primary determinants of bank flows. In this paper, we find that the support effect is more important and foreign bank loans are more stable when they have a higher presence in the borrowing country and they are not too competitive.

Given the crucial role that global banks played during the 2008-09 crisis, recent studies have included their balance sheets and the frictions they face into open economy models to improve their performance (e.g. Davis, 2010; Gertler and Karadi, 2011; Kollmann, 2013; Kollmann et al., 2011; Meh and Moran, 2010). These enrichments have allowed for a more

accurate representation of international business cycles and have generated the much needed cross-country output correlation these models were lacking with the symmetric effects of global banks on the countries that they lend to (e.g. Alpanda and Aysun, 2014). Our results are consistent with this literature and imply that a higher frequency of global financial shocks (external shocks) can increase output correlation and align business cycles around the world.

Turning to the literature on competition and financial stability we find that it is similarly divided. While theoretical findings and evidence from a more comprehensive set of countries suggest that less competition can bring more stability (Allen and Gale, 2000, 2004; Boot and Thakor, 1993; Hellman et al., 2000; Keeley, 1990; Marcus, 1984), there is considerable evidence suggesting otherwise (e.g. Boyd and De Nicolo, 2005; Johnson and Kwak, 2010). In this paper, we make a distinction between the competition among foreign and domestic banks, respectively, and find that they can have opposite effects on financial stability. We further conclude that the effects of competition critically depend on foreign bank presence and that a more nuanced approach is warranted. This conclusion is supported by the findings of Anginer et al. (2012) and Claessens and Van Horen (2014). While the former study finds that the lack of competition only becomes destabilizing in countries with lower foreign bank presence, the latter finds that the two may be related; there may be more competition with larger foreign banks.

The rest of the paper is organized as follows. Section 2 discusses our data, methodology and results. Section 3 describes the model and discusses the inferences. Section 4 concludes.

2. Empirical evidence

In this section we first describe the methodology that helps us identify the unique effects of internal and external factors on foreign lending. We then describe our dataset and present our results. In doing so, we assess the importance of competition and foreign bank presence.

2.1. Local balance sheets and global bank loans

We begin by investigating the relationship between the strength of a country's balance sheets (the demand side of the credit market) and the global bank flows she receives. In doing so, we control for the supply side by measuring the loan growth rate and the balance sheet strength variables as deviations from the lender-specific averages. Specifically, let l_{ijt} and $\bar{l}_{it}^{bs}$ denote the growth rate of loans that country *i's* banks make in country *j* and their average cross-country loan growth rate at time *t*, then the dependent variable, the relative loan growth rate $\tilde{l}_{ijt}^{bs}$, is given by,

$$\tilde{l}_{ijt}^{bs} = l_{ijt} - \bar{l}_{it}^{bs} \tag{1}$$

Similarly the main independent variable, the relative strength of local balance sheets, $\tilde{y}_{ijt}$, is measured as the difference between the output growth rate in country *j*, y_{ijt}, and the average output growth rate across all the countries that country *i*'s banks lend in, $\bar{y}_{it}$, so that

$$\tilde{y}_{ijt} = y_{ijt} - \bar{y}_{it} \tag{2}$$

After constructing the main variables, we include them in the following model:

$$\tilde{l}_{ijt}^{bs} = \alpha^{bs} + \sum_{k=1}^{4} \beta_k^{bs} \tilde{l}_{ijt-k}^{bs} + \sum_{k=1}^{4} \gamma_k^{bs} \tilde{y}_{ijt-k} + \sum_{k=1}^{4} \lambda_k^{bs} bs_{ijt-k} + \varepsilon_{ijt}^{bs} \tag{3}$$

where bs_{ijt} is a vector of lender-specific control variables that help us account for any residual supply side effects on the banks' ability to lend. Here, we follow the common parameterization and include four lags of both the dependent and independent variables on the right hand side (e.g., Ashcraft and Campello, 2007; Cetorelli and Goldberg, 2012; Kashyap and Stein, 2000).

Since banks' supply side restrictions, as mentioned above, apply similarly across all the countries that they lend in, we can focus on the demand side, i.e., the idiosyncratic fluctuations in the credit worthiness of borrowers, by constructing the variables in deviational form. A simple

thought experiment here can further clarify our identification. Assume, for example, that the cost of obtaining loanable funds for Belgian banks increases. This can either be a shock common to every country or specific to Belgium. Assume also that the German economy is growing considerably faster than all the other economies that Belgian banks lend in. Then, by measuring both the loans that Germany receives from Belgium and her economy's growth rate relative to the other economies that Belgian banks lend in, we are able to identify the effect of German balance sheet strength on her bank loan inflows independent of the increase in Belgian banks' funding costs.

Although this methodology allows us to control for supply side factors, we acknowledge that borrower credit worthiness is not the only demand side determinant of global loans. There are other recipient-country-specific, time-variant and time-invariant, factors (such as the quality of institutions) that can potentially mitigate or amplify the withdrawal from or flows into these countries when banks face supply side shocks. To hone in on the dynamic effects of borrower balance sheets, we express the main variables in log differences to eliminate time invariant effects and we use the most comprehensive measures that reflect balance sheet strength; i.e., the GDP growth rate and unemployment rate. We also consider three factors that are less volatile yet directly related to bank behavior (competition, lending share and foreign bank presence).

2.2. Banks' cost of funding and global bank loans

We proceed by reconfiguring our model to investigate the relationship between banks' cost of capital and their global lending behavior. The challenge in this section, conversely, is to control for the recipient countries' balance sheets when measuring the effect of supply side factors on the global bank loans that they receive. To continue with the thought experiment above, assume now that amongst all the banks that lend to Germany, Belgian banks are the ones

that face the largest increase in the cost of obtaining loanable funds. To identify the unique effects of this funding shock on the amount of Belgian lending in Germany, we could then measure both the growth rate of Belgian loans in Germany and the Belgian banks' cost of capital relative to their average values measured across all the global banks that lend in Germany and quantify the relationship between the two variables. By doing so, we would be controlling for demand side factors (German balance sheets) when measuring the impact of supply shocks.

To conduct this analysis, we reconstruct our variables as follows: Let $\bar{l}^{l}_{jt}$ denote the average growth rate of all global loans in country *j*, then the relative growth rate of country *i*'s loans, $\tilde{l}^{l}_{ijt}$, is given by

$$\tilde{l}^{l}_{ijt} = l_{ijt} - \bar{l}^{l}_{jt} \tag{4}$$

Similarly, let b_{ijt} and $\bar{b}_{jt}$ denote the cost of funding for country *i*'s banks and the average cost of funding across all the global banks that lend in country *j*, respectively. Then the relative cost of capital for country *i's* banks, $\tilde{b}_{ijt}$, is constructed as

$$\tilde{b}_{ijt} = b_{ijt} - \bar{b}_{jt} \tag{5}$$

We include these two variables in the following model,

$$\tilde{l}^{l}_{ijt} = \alpha^{l} + \sum_{k=1}^{4} \beta^{l}_{k} \tilde{l}^{l}_{ijt-k} + \sum_{k=1}^{4} \gamma^{l}_{k} \tilde{b}_{ijt-k} + \sum_{k=1}^{4} \lambda^{l}_{k} cs_{jt-k} + \varepsilon^{l}_{ijt} \tag{6}$$

where the main focus is on the coefficients of $\tilde{b}_{ijt}$ and a vector of borrower specific variables, cs_{jt}, is included to account for the residual demand side effects that are not shut off.

2.3. Data

In this section, we describe our dataset, report various descriptive statistics, and discuss our estimation methodology. The data definitions and sources are provided in Appendix A.

We obtain our data mainly from two sources: the Bank of International Settlements' (BIS) Locational Banking Statistics and the FRED database of the Federal Reserve Bank of St. Louis. The cross-country loan data are from the BIS database and they are available after 1984 for 26 reporting countries. We restrict our dataset to include quarterly observations between 2000Q1 to 2012Q4. We choose the year 2000 as our cutoff point since prior to this year the data are reported semi-annually and there are many missing observations; we further restrict our dataset to 15 countries that have no missing observations. The countries in our balanced panel dataset (Austria, Belgium, Canada, Switzerland, Germany, Denmark, Spain, France, United Kingdom, Italy, Japan, Netherlands, Portugal, Sweden, United States) are also the larger economies in the world, and they account for an overwhelming share of the loans in the BIS database. The loans are in millions of U.S. dollars, positive for each borrower-lender pair and represent BIS reporting banks' outstanding amount of external loans vis-à-vis all sectors (Table 7A).[6]

To construct the dependent variable in equation (3), we measure, for each lending (reporting) country, the growth rate of her loans in each of the 14 other countries and the average value of these growth rates. We then compute the relative loan growth rate as the difference between the borrower specific and the average loan growth rate. To construct the dependent variable in equation (6), we measure, for each borrowing country this time, the growth rate of her loans extended by the other 14 countries and the average value of these loan growth rates. We then similarly measure the relative loan growth rate as the difference between the two variables. One advantage of our methodology is that it allows us to draw inferences from a relatively large panel data set (especially since the data are at the country level) that includes approximately 9,000 observations (210 country pairs and 47 quarters) for each regression.

[6] We used the loans to all sectors since loans to the non-financial sectors were not available vis-à-vis individual countries.

The remaining data are from the FRED database.[7] From seasonally adjusted data we compute the quarterly real GDP growth rate and the quarterly change in the harmonized unemployment rate to obtain our baseline indicators of borrowers' balance sheet strength. We capture the banks' funding costs by their local 3-month and 24-hour interbank rates and deposit rates. We also include other measures of funding costs and various bank balance sheet and income statement ratios to check the sensitivity of our results. The independent variables here are similarly measured as deviations from averages. In equations (3) and (6) we use the lenders' and the borrowers' real GDP growth rates and the change in their 3-month interbank interest rates as control variables, respectively, to account for the residual lender and borrower specific effects.

Besides its relatively large size, our dataset accounts for an important share of the loans for the countries in our sample. In Panel A of Table 1 we illustrate this feature of our dataset by reporting the ratio of the BIS loan inflows and outflows to the total amount of local private credit (in U.S. dollars). The average ratios (computed from 2000 to 2012) are generally large and demonstrate a considerable amount of variation both across time (the standard deviation of the ratios across the sample period) and across countries.[8] As expected, we observe that some countries are net lenders and the others are net borrowers during the sample period.

The 3-bank and 5-bank concentration ratios are the share of the top 3 and 5 banks' assets in their local banking sector, respectively. Notice that for a majority of the countries these ratios are above 50 percent and demonstrate a considerable amount of variation across countries (for example, the 3-bank concentration is 27.6 percent for the U.S. and 94.5 percent for Sweden). Below, we explore whether this variation impacts the global banks' lending decisions. The next row, in Panel A indicates a significant foreign bank presence in the sample countries. Consistent

[7] The data that we obtained from FRED are compiled from OECD and IMF statistics.
[8] The ratios can be greater than 100 percent since the local credit variable includes only private loans.

with the ratios in the first two rows, the total amount of outstanding foreign loans to GDP ratios are certainly not negligible. The next two variables show that foreign banks are few in number and they are large (foreign banks' assets to domestic banks' assets ratios are greater than 100 percent for some countries).

We should reiterate that importance of the latter observation for our paper. Since we do not have bank-level data on country specific lending, our estimations may mask the different sensitivities that banks exhibit and lead to misleading inferences. Since the cross-country loans in our sample are mostly made by a very few large banks, however, it is less likely for a bank to behave differently without impacting country-level sensitivities.

The structural banking variables in the last four rows of panel A similarly reveal a significant degree of variation across countries (or banks chartered by the countries). The difference between the credit/deposit ratio of Japan and Sweden, for example, is over 100 percent, and while Swedish banks' return on equity was 17.4 percent, Japanese banks incurred losses. The credit/deposit ratios also show that deposits are an important source of funding. In our analysis, we thus include the deposit interest rate as an alternative indicator of funding costs.

In our panel model estimations we consider the time series and cross sectional variation in cross-country lending. This analysis would not be informative if the lending, balance sheet, and funding cost variables behaved similarly across time and countries. In panel B of Table 1 we report the time series and cross sectional variation of our key variables. The standard deviations for both dimensions are large and often greater than the mean values thus demonstrating a considerable amount of variation in our panel dataset. Below, we utilize this variation to measure and compare the sensitivities of global bank lending to the strength of balance sheets and funding costs.

To estimate equations (3) and (6) we use the General Method of Moments strategy of Arellano and Bond (1991). We use this method since it is designed for dynamic panel models that, similar to ours, have a larger cross-sectional dimension. The methodology also accounts for the unobserved panel-level fixed/random effects, endogeneity of the independent variables, nonstationarity of the dependent variable and helps us obtain heteroskedasticity-consistent standard errors. In our estimations we use the *t-1* dated independent variables as instruments.

2.4. Results

We report our estimation results in Table 2. The central result here is that global bank loan flows are positively and significantly related to the strength of local balance sheets and negatively and significantly related to the banks' funding costs. The positive (negative) value of the GDP growth rate (the unemployment rate) coefficient, reported in the first row, imply that if a country's GDP increases (unemployment rate decreases) more than the other countries in the sample, she receives more loans. On the supply side, the negative coefficients of the 3-month and 24-hour interbank, and deposit rates, also reported in the first row, imply that if a country's banks face higher costs of raising loanable funds relative to banks chartered by other countries, they withdraw their loans at a higher rate. In addition to these three country-specific interest rates, we use the average rates for the 57 banks most actively borrowing euros.[9] The results in the last column show that these rates are also negatively related to global bank lending.

The coefficients of the control variables (GDP growth rates and 3-month interbank rates) are in general insignificant, suggesting that measuring the main variables in deviational form is allowing us to effectively control for lender and borrower specific effects in estimating equation (3) and (6), respectively. When we do not measure the variables in deviational form, as in the euro rate regressions, we find that borrower specific effects are significant. For all our

[9] Since the euro rate is not country-specific, we measure the loan growth rate in levels when including this rate in our regressions.

regressions, diagnostic tests support the validity of the instruments (captured by the Sargan test statistic) and do not reveal any evidence for second order serial correlation in the error term.

2.4.1. Comparing the sensitivity coefficients

In addition to being statistically significant, the sensitivity coefficients in Table 2 are also not negligible economically. To uncover the economic importance of the GDP growth coefficient in Table 2, for example, let's assume that Belgium experiences a one percent growth rate in the past four quarters and that the remaining economies do not grow. The aggregate coefficient value of 0.2223 then implies that global bank loans in Belgium grow 0.2223 percentage points more (quarterly) than the average growth rate of loans to all countries. Given that the average quarterly loan growth rate in our sample is 1.37 percent, this implies that the loans in Belgium increase approximately 16 percent more than the average rate across all countries (25 percent on an annual basis). A similar thought exercise reveals a larger economic impact for funding costs. Assume that among the countries lending to Belgium, Canada is the only one that experiences a one percent increase in her interbank borrowing rates in the past 4 quarters. Then the coefficient value of -0.0187 implies that Canada's loan growth rate in Belgium is -1.87 percentage points lower than Belgium's average loan inflow rate, which is 1.37 percent for the whole sample. In other words, while the average country increases her loans to Belgium by 1.37 percent, Canada decreases her loans by 0.49 percent. For the median economy in our sample (Spain, in terms of GDP), 1.87 and 0.2223 percent of the BIS loans correspond to approximately 0.19 and 0.02 percent of quarterly GDP.[10]

Notice that although the results so far point to a larger supply side effect, the comparison can be misleading if the indicators of balance sheet strength and funding costs have different means/units and volatilities. Specifically, the coefficient value for the indicator with a higher

[10] We used GDP by expenditure in constant prices (2005 Dollars) and total BIS loans to and from Spain in our calculations.

mean and standard deviation would be smaller.[11] To correct for this potential bias, we standardize all the indicators so that they all have a mean of zero and a standard deviation of one and estimate our models by using these standardized variables. The coefficient values reported in the first row of Table 3, by construction, represent the loan growth response to a one standard deviation change in the balance sheet and funding cost variables. These results reveal that the sensitivity to funding costs is higher compared to the sensitivity to borrowers' balance sheets. The magnitude of the response to a one standard deviation change in the borrowers' relative GDP growth rate and the lenders' 3-month interbank borrowing rate, for example, are 0.10 and 0.33 percent, respectively. The same disparity is observed when we use the unemployment rate and the other interest rate variables.

The cost of funding is, of course, not the only indicator of supply side constraints. There are other characteristics of banks such as their liability structure, liquidity, and profitability that could affect their ability to lend. We used cost of funding in our baseline analysis because it was the only measure that was available at a quarterly frequency for all the countries in our sample. A more comprehensive set of measures is available at the annual frequency in the database that we use. As a next step, we test whether supply side constraints, when captured by alternative variables, similarly have a larger impact on global bank loans compared to demand side factors. To make this comparison, we construct the annual variables as in Section 2.3 and then standardize them as explained above. The estimated values of the key coefficients are reported in Table 4.[12] In our model we use two lags of the balance sheet variables and the number in parenthesis are the F-statistics that indicate joint significance. The results, though mixed, generally suggest the presence of a similar disparity between the sensitivity coefficients. The

[11] Since we measure GDP growth in log differences and interest rate change in percentages, the units are also different.
[12] We excluded the control variables' coefficients from Table 4 for brevity and since they were insignificant.

banking variables' coefficients, though not always significant, are considerably larger. In addition to the interest rate variables (in annual frequency), we use the return on equity, net interest margin, and the cost to income ratios as indicators of profitability, and two ratios that measure liquidity and leverage (liquid-assets-to-short-term-liabilities and capital-to-assets ratios). The signs of the significant coefficients indicate that banks lend more when they are more profitable and leveraged. On the balance sheet side, we use the local nonperforming-loans-to-total-loans ratio and the GDP growth rates (not relative to the other countries) as additional indicators of balance sheet strength. Although the coefficients of these variables similarly indicate a positive relationship between balance sheet strength and loan inflows, they too are small in magnitude compared to the supply side coefficients and they are insignificant.

2.4.2. The effect of competition and foreign presence

We proceed by investigating three potential determinants of the lending sensitivities estimated above. First, we investigate the role of bank competition in the borrowing countries and ask whether global banks become more or less sensitive to the strength of balance sheets and their funding costs when they face more/less competition. Second, we include country-specific lending shares to determine whether countries with a larger share of the recipient country's loan market exhibit higher or lower sensitivity to demand and supply side variables. We conduct a similar experiment as a third step and test whether borrowing countries with a higher global bank presence (higher global bank loans to GDP ratio) face higher lending sensitivity.

To incorporate competition into our analysis of balance sheet effects, we interact different measures of competition with our balance sheet variables, and include the interaction term in our model as follows:

$$\tilde{l}_{ijt}^{bs} = \alpha^{bs} + \sum_{k=1}^{4} \beta_k^{bs} \tilde{l}_{ijt-k}^{bs} + \sum_{k=1}^{4} \gamma_k^{bs} \tilde{y}_{ijt-k} + \sum_{k=1}^{4} \gamma_k^{bs} \tilde{y}_{ijt-k} \tilde{comp}_{jt-5} + \sum_{k=1}^{4} \lambda_k^{bs} bs_{ijt-k} + \varepsilon_{ijt}^{bs} \quad (7)$$

We follow the same methodology to extend our analysis of the supply side effects:

$$\widetilde{l}_{ijt}^{\,l} = \alpha^{l} + \sum_{k=1}^{4} \beta_k^{l} \widetilde{l}_{ijt-k}^{\,l} + \sum_{k=1}^{4} \gamma_k^{l} \widetilde{b}_{ijt-k} + \sum_{k=1}^{4} \gamma_k^{l} \widetilde{b}_{ijt-k} \widetilde{comp}_{jt-5} + \sum_{k=1}^{4} \lambda_k^{l} cs_{jt-k} + \varepsilon_{ijt}^{l} \quad (8)$$

In equations (7) and (8), the variable $\widetilde{comp}_{jt}$ measures the degree of competition in the banking industry of borrowing country *j* and every other variable in the two equations is constructed similarly (we follow the baseline methodology and do not standardize the variables).

Our baseline competition measure, the 3-bank concentration ratio, measures the share of the three largest banks' assets in total commercial banking assets and it is available at the annual frequency. By construction, therefore, an increase in $\widetilde{comp}_{jt}$ implies further concentration and a deterioration in competitive conduct. We measure this variable also in deviational form so that it represents a country's level of competition relative to the average level across all the countries. Since this variable is available at the annual frequency, we interact the quarterly balance sheet and funding cost variables with the level of competition observed in the previous year.

The results in Table 5 suggest a positive relationship between the degree of competition and the sensitivity to balance sheets and funding costs. In particular, if the top 3 banks in the size distribution of a country are substantially larger than the other banks, global bank loans in this country become less sensitive to local borrowers' balance sheets and global banks' funding costs. Comparing the two sides, we observe a stronger relationship on the demand side. The interaction term coefficient in the first column, for example, implies that the sensitivity to GDP growth rates decreases by approximately one-third when the concentration ratio increases by one percentage point. The 4.7 percentage point decrease in the sensitivity to unemployment rate, albeit smaller, is large compared to the funding cost measures. The corresponding values are 1.4, 1.3, and 1.1 percentage points for the 3-month and 24-hour interbank rates, and the deposit rate, respectively.

We obtain similar results when we use the 5-bank concentration ratio and the Lerner index as alternative measures of competition. The Lerner index is a markup based measure with higher values implying a lower degree of competition. The results in Table 6 suggest that the sensitivities to both factors are lower when there is less competition. The interaction term coefficients similarly indicate a larger drop in the sensitivity to borrower balance sheets, though, notice that the GDP coefficients are insignificant when we use the Lerner index.

Next, we replace the competition variable in equations (7) and (8) with the share of the lending countries' loans in the total BIS loans made in the borrowing countries. We measure this ratio quarterly and interact it with the balance sheet and funding cost variables in the same quarter. The estimation results are reported in the top panel of Table 7. Unlike the results in Table 6, the effect of lending share is not unidirectional. While banks/countries with a higher share in the borrowers' loan market are more sensitive to their funding costs, they are less sensitive to the borrowers' balance sheets. We should point out, however, that the demand side coefficients are not large. For example, the interaction term coefficient value of -0.0706, implies that if a lender's share increases by 100 percentage points, her sensitivity to the borrower's relative GDP growth rate decreases by only 6.4 percent. A similar observation can be made for the unemployment rate (a 6.1 percent decrease). On the supply side, the results are mixed. While the sensitivity to the 3-month and 24 hour interbank rates increase by 46.9 and 44.7 percent, respectively, when the lender's share increases by 100 percentage points, the sensitivity to deposit rates increases by only 1.8 percent.

We find a larger impact on the lenders' sensitivity when we replace the country-specific lending share variable with an indicator of foreign banks' presence in the borrowers' loan market. We capture foreign bank presence with the total loans (amount outstanding) by nonresident

banks to borrower's GDP ratio. This ratio, similar to the competition variables, is available only at the annual frequency. Therefore, the estimation methodology is the same as the one we used for the competition regressions. The results are displayed in the bottom panel of Table 7. The central result is that with higher (lower) global bank presence, sensitivity to both the demand and supply side variables is lower (higher). Compared to the country-specific lending share regressions, the size of the coefficients is large. For example, if the global bank loans to GDP ratio increases by only 1 percentage point, sensitivity to GDP growth rates and the 3-month interbank rates decreases by 2.1 and 1.4 percent, respectively. These numbers imply that if Italy's global bank loans to GDP ratio (with a sample average of 22.1 percent) were to reach the level for Denmark (46.3 percent), for example, the sensitivity to GDP growth and 3-month interbank rates would decrease by approximately 50 and 34 percent, respectively, for Italy.

3. Inferences from a simple model

So far, we uncovered a disparity between the sensitivity of global bank lending to borrower balance sheets and to funding costs and found that a higher degree of banking competition and foreign bank presence in the borrowing countries have a mitigating effect on the sensitivities. In this section, we investigate mechanisms that may explain these empirical results by building and solving a model of global bank lending. The focus of this section is similarly on the reaction of global banks to local balance sheet and funding cost shocks.

3.1. The consumers and the production process

The economy is represented by a 2-period OLG model. The young agents in the model are endowed with a unit of labor and they do not own capital. Their labor supply is inelastic (equal to one) and the share of their labor income that is not consumed in period 1 finances their period 2 consumption, when they are old. Old agents do not work. In each group, the number of

agents is finite and constant and the agents are identical. The maximization problem of a representative agent in this economy in period *t* is then given by,

$$\max_{s_t} u(c_t, c_{t+1}) = c_t^{\xi} + c_{t+1}^{\xi} \tag{9}$$

$$c_t = w_t - s_t \tag{10}$$

$$c_{t+1} = s_t r_t^d \tag{11}$$

where c_t, w_t, s_t and r_t^d denote the amount of consumption, labor income, savings and the rate of return on savings, respectively, and ξ is the power function parameter that is less than 1.[13]

Substituting equations (10) and (11) into the utility function and maximizing with respect to the amount of savings yields the following savings supply condition:

$$r_t^d = \left(\frac{s_t}{w_t - s_t} \right)^{\frac{1-\xi}{\xi}} \tag{12}$$

where the young agents require a higher deposit rate to save more. The labor services of the young agents, h_t, are hired by a representative, competitive firm that combines labor with capital, k_t, to produce the final output according to the standard neoclassical function,

$$y_t = k_t^{\alpha} h_t^{1-\alpha} \tag{13}$$

Given that $h_t = 1$, the wage rate (labor income), w_t, and returns to capital, r_t^k, can be derived from the maximization problem of the firm as,

$$w_t = (1-\alpha) k_t^{\alpha} \tag{14}$$

$$r_t^k = \alpha k_t^{\alpha-1} \tag{15}$$

3.2. The entrepreneurs and the financial market

[13] We follow Cetorelli and Peretto (2012) by setting the discount factor to 1 and by using a power function to streamline the exposition. We reach similar conclusions with a discount factor less than 1 and a more standard function.

The young agents in the economy are also the entrepreneurs. They borrow from the financial market, convert their loans into capital and then supply this capital to a competitive firm. The financial market consists of a finite and constant number of domestic and foreign/global banks (n^d domestic and n^f foreign) so that there is no entry or exit. Hereafter, we refer to the latter as foreign banks to simplify the exposition, although, it should be noted that foreign banks operate/lend globally in our model. In channeling funds to the entrepreneurs, both types of banks face frictions. Specifically, a unit of credit can be converted to a unit of capital with probability ϕ. The conversion is unsuccessful with probability $1-\phi$ and the banks cannot recover any of their loans. This credit shock is *i.i.d* across the entrepreneurs so that $k_{jt} = \varepsilon_j l_{jt}$, where k_{jt}, ε_j and l_{jt} represent the amount of capital, the idiosyncratic credit shock, and the amount of loans for entrepreneur *j*. The firms are indifferent to domestic and foreign bank loans as long as they face the same lending rate and capital is divisible so that both types of banks lend to the entire population and diversify the entrepreneur-specific credit risk.

It is important to note here that the parameter ϕ is analogous to the borrower balance sheet strength in the empirical section. If borrowers have stronger balance sheets, they are less like to default on their loans and ϕ is high.

We proceed by describing the banks' optimization problem and explaining how the two types of banks are different. At this point, however, we should mention that the banks in the economy are Cournot competitors. Each bank (domestic and foreign), therefore, simultaneously chooses its amount of loans, and when it does, it knows the total amount of lending by the other banks. We choose to use Cournot competition because it allows us to consider the entire spectrum of competitive practices in a straightforward way; by changing the number of banks from 1 to ∞, we can capture any degree of competition from monopoly to perfect competition.

3.2.1. Domestic banks

Domestic banks are owned by the domestic savers, i.e. generation *t-1* young agents (generation *t* old agents), and the savings finance the capital expenditure of generation *t* young agents (the entrepreneurs). The bank owners transfer their ownership to the next generation young agents when they die and they maximize next period's profits. Here, we assume that the bank owners collect banking profits and that their return is represented by both the return on equity (profits plus the change in the price of equity) and the deposit rate as there is perfect arbitrage between the two. Let n^e and l_{ijt}^d denote the number of entrepreneurs and domestic bank *i*'s loans to entrepreneur *j*, then the profit maximization problem of bank *i* is given by,

$$\max_{l_{ijt}^d} \sum_{j=1}^{n^e} \left(\phi \alpha k_t^{\alpha-1} l_{ijt}^d - r_t^d l_{ijt}^d \right) \qquad s.t. \tag{16}$$

$$k_t = \phi \left(l_t^d + l_t^f \right) \tag{17}$$

$$r_t^d = \left(\frac{l_t^d}{w_t - l_t^d} \right) \tag{18}$$

where l_t^d and l_t^f represent the total amount of domestic and foreign bank lending, respectively and the total capital stock in the economy is given by equation (17). Solving the problem and aggregating over the entrepreneurs yields the following optimality condition:

$$r_t^k = \frac{1}{\phi} \left[r_t^d + \left(\frac{\partial r_t^d}{\partial l_t^d} - \phi \frac{\partial r_t^k}{\partial l_t} \right) l_{it}^d \right] \tag{19}$$

where $l_{it}^d = \sum_{j=1}^{n^e} l_{ijt}^d$ and $l_t = l_t^d + l_t^f$.[14] According to equation (19), the markup that domestic banks apply on their loans depends on the probability of success, ϕ, and the effect of their loans

[14] To simplify notation, we omit the *d* superscript from the derivative of the returns to capital on the right hand side since the derivatives with respect to domestic bank and total loans are identical. We do the same for foreign loans. Notice also that since the returns to capital expression is linear in entrepreneur-specific loans, the aggregation over the entrepreneurs is straightforward.

on the deposit rate and the aggregate returns to capital. The wedge between the lending and the deposit rate increases when there is a higher probability of default and when bank *i*'s loans substantially increase the deposit rate and decrease the returns to capital, respectively.

3.2.2. Foreign banks

Foreign banks obtain all of their funding from outside of the borrowing country and similarly use these funds to finance entrepreneurs' capital expenditures.[15] Each foreign bank lends globally and has positions in n^c countries. In choosing their country-specific markups, the foreign banks take into account the amount of lending by the other banks in the recipient country and their loans in other countries. Let l^f_{ijmt} and r^f_{it} denote foreign bank *i's* loans to entrepreneur *j* in country *m* and its funding rate, respectively, then its profits, π^f_{it}, can be represented by,

$$\pi^f_{it} = \sum_{m=1}^{n^c} \sum_{j=1}^{n^e_m} \left(\phi_m \alpha k_{mt}{}^{\alpha-1} l^f_{ijmt} - r^f_{it} l^f_{ijmt} \right) \tag{20}$$

where *m* indexes the countries and n^e_m denotes the number of entrepreneurs in country *m*. In maximizing profits, foreign banks face constraints that are similar to those faced by domestic banks. As in equation (17) the amount of capital in country *m* is the sum of total foreign and domestic bank loans (l^d_{mt} and l^f_{mt}) that are successfully converted to capital so that,

$$k_{mt} = \phi_m \left(l^d_{mt} + l^f_{mt} \right) \tag{21}$$

Unlike equation (18), however, the funding costs of foreign banks do not directly depend on the amount of domestic savings. These banks obtain funding from a transnational capital market where borrowing rates depend on financial leverage:

[15] It is possible to draw similar conclusions from our model if foreign banks also accept domestic deposits in addition to raising funds externally. This assumption, however, generates very complicated optimality conditions and considerably confounds the analysis. To make the model more tractable, we thus assume that the foreign banks raise all of their funding externally.

$$r_{it}^{f} = r_{t}^{w} f\left(\frac{\sum_{m=1}^{n^c} \sum_{j=1}^{n_m^e} l_{ijmt}^{f}}{\sum_{m=1}^{n^c} \sum_{j=1}^{n_m^e} \phi_m \alpha k_{mt}^{\alpha-1} l_{ijmt}^{f}} \right) \tag{22}$$

where r_t^w is a global, risk free rate. In the literature, the wedge between r_t^f and r_t^w is usually generated by an idiosyncratic net worth shock that can cause banks to default.[16] To simplify the analysis, we assume that the borrowing premium function $f(\cdot)$ is linear in leverage.[17]

The formulation in equation (22) allows for a realistic representation of international shock transmission. Specifically, a shock to country *m*'s economy affects the other economies as well and since the profit function is separable and capital cannot be transferred across countries, the transmission in our model operates through foreign banks' funding rates.

Foreign bank *i*'s profit maximization yields the following participation condition in country *m* (after aggregating over entrepreneurs):

$$r_{mt}^{k} = \frac{1}{\phi_m} \left[r_{it}^{f} + \left(\frac{\partial r_{it}^{f}}{\partial l_{mt}^{f}} - \phi \frac{\partial r_{mt}^{k}}{\partial l_{mt}} \right) l_{imt}^{f} \right] \tag{23}$$

3.3. Sensitivity to internal shocks

In this section, we derive the sensitivity of foreign banks' loans in a given country to the default probability $(1-\phi)$ of its borrowers. We approach this section from the perspective of a borrowing country. The returns to capital in equations (19) and (23) are, thus, identical and the *m* subscripts can be dropped. We further simplify notation by dropping the time subscript.

To derive the sensitivity to default probability, we begin by differentiating the optimality conditions in equations (19) and (23) with respect to l^d, l^f and ϕ. In these equations, we

[16] Since we do not attempt to close the model or draw quantitative inferences, the derivation of equation (22) is not critical to our analysis. One can, albeit, conceive a set of risk neutral global investors who pool their funds and lend to banks. These investors can be few in number and thus their consumption could be very small and negligible compared to total consumption.

[17] In models with credit frictions, borrowing spreads are usually derived from the optimization problem of the lender and the functional forms are often complicated (e.g., Bernanke et al., 1999). Here, we simplify the analysis by using a linear form.

impose symmetry across domestic and foreign banks so that $l^d = n^d l_i^d$, $l^f = n^f l_i^f$, $r_i^f = r^f$. The differentiations of equations (19) and (23) yield the following two conditions, respectively:

$$d_1 \frac{dl^d}{d\phi} + d_2 \frac{dl^f}{d\phi} = d_3 \tag{24}$$

$$f_1 \frac{dl^d}{d\phi} + f_2 \frac{dl^f}{d\phi} = f_3 \tag{25}$$

where the coefficients $d_1,\ d_2,\ d_3,\ f_1,\ f_2,\ f_3$ are given by,

$$d_1 = \left(1 + \frac{1}{n^d}\right)\left(\frac{\partial r^d}{\partial l^d} - \phi \frac{\partial r^k}{\partial l}\right) + \chi_1^d,\ d_2 = \frac{\partial r^d}{\partial l^f} - \phi \frac{\partial r^k}{\partial l} + \chi_2^d,\ d_3 = r^k + \frac{\partial r^k}{\partial \phi}\phi - \frac{\partial r^d}{\partial \phi} + \frac{\partial r^k}{\partial l}\frac{l^d}{n^d} + \chi_3^d,$$

$$f_1 = \frac{\partial r^f}{\partial l^d} - \phi \frac{\partial r^k}{\partial l} + \chi_1^f,\ f_2 = \left(1 + \frac{1}{n^f}\right)\left(\frac{\partial r^f}{\partial l^f} - \phi \frac{\partial r^k}{\partial l}\right) + \chi_2^f,\ f_3 = r^k + \frac{\partial r^k}{\partial \phi}\phi - \frac{\partial r^f}{\partial \phi} + \frac{\partial r^k}{\partial l}\frac{l^f}{n^f} + \chi_3^f,$$

and χ represents the second order terms in the expressions.[18] We assume that these second order terms are relatively small to simplify the exposition.

Before we proceed, it is convenient at this point to provide an interpretation of the coefficients above. These coefficients have symmetric implications for domestic and foreign banks' profits and loans. f_3 and d_3, both positive, measure the effect of ϕ on foreign and domestic banks' profits from a unit of loans, respectively. In response to an increase in ϕ (a decrease in the probability of default), the banks' returns increase not only because the higher percentage of successful investment projects increases the amount of capital and thus the returns from capital but also because the banks recover a higher share of their loans. On the cost of

[18] $\chi_1^d = -\frac{l^d}{n^d}\left(\frac{\partial^2 r^d}{(\partial l^d)^2} - \frac{\partial^2 r^k}{\partial l^2}\right),\ \chi_2^d = -\frac{l^d}{n^d}\left(\frac{\partial^2 r^d}{\partial l^d \partial l^f} - \frac{\partial^2 r^k}{\partial l^2}\right),\ \chi_3^d = \frac{l^d}{n^d}\left(\frac{\partial^2 r^d}{\partial l^d \partial \phi} - \frac{\partial^2 r^k}{\partial l \partial \phi}\right)$

$\chi_1^f = -\frac{l^f}{n^f}\left(\frac{\partial^2 r^f}{\partial l^f \partial l^d} - \frac{\partial^2 r^k}{\partial l^2}\right),\ \chi_2^f = -\frac{l^f}{n^f}\left(\frac{\partial^2 r^f}{(\partial l^f)^2} - \frac{\partial^2 r^k}{\partial l^2}\right),\ \chi_3^f = \frac{l^f}{n^f}\left(\frac{\partial^2 r^f}{\partial l^f \partial \phi} - \frac{\partial^2 r^k}{\partial l \partial \phi}\right)$

funding side, an increase in ϕ prompts a decrease in deposit rates since it affects wages and the amount of savings positively. A similar negative effect is observed for foreign banks since a higher value of ϕ decreases leverage by increasing revenues. The last term in the expressions for f_3 and d_3 represent the decrease in returns caused by additional lending. These negative effects are larger when ϕ is large and the number of banks is small. The latter observation is critical for our analysis of competition and it implies that as the number of banks increase, each bank has a smaller impact on the profitability of the project. Lending decisions in markets with different degrees of competition are therefore made under different circumstances.

The coefficients d_1 and f_2 capture the marginal impact of domestic and foreign banks' lending on their costs. Both coefficients are positive and as banks lend more, their costs increase for two reasons: They have to offer higher deposit rates to attract the necessary funding and their marginal returns from the project decrease with each additional unit of lending. These effects are stronger when the market is less competitive since with fewer banks additional loans have a more substantial effect on banks' funding costs and their returns from the project.

The off-diagonal coefficients f_1 and d_2 capture the marginal impacts of domestic and foreign bank lending on foreign and domestic banks' profits, respectively. The cross-bank transmission operates similarly through funding costs and marginal returns. As domestic bank loans increase, for example, foreign banks' returns from the project decrease, they become more leveraged and face higher funding costs ($f_1 > 0$). By contrast, when foreign bank loans increase, domestic banks funding costs (deposit rates) decrease since wages are higher. But domestic banks' returns similarly decrease. For reasonable values, the former effect dominates ($d_2 < 0$).[19]

[19] d_2 is negative if $\left(r^d\right)^2 > l^d / \left(l^d + l^f\right)$. This condition holds for any positive value of deposit rates and loans.

We obtain the symmetric equilibrium by equating the returns from an additional unit of lending to the costs incurred as in equations (24) and (25). The sensitivity of foreign bank lending to domestic default shocks can then be solved for from these equations as

$$\frac{dl^f}{d\phi} = \frac{f_3 - f_1 \frac{d_3}{d_1}}{f_2 - f_1 \frac{d_2}{d_1}} \tag{26}$$

First, notice that if the lending decisions of foreign and domestic banks were formed independently (if they were in segmented markets), the second terms in the numerator and the denominator would equal zero. The sensitivity of foreign lending to default shocks would then be higher, for example, if a decrease in default probability substantially increased the returns net of funding costs, (i.e., if f_3 was large), and the incremental amount of lending did not cause a large drop in the net marginal returns (i.e., if f_2 was small).

With a positive denominator, the second term in the numerator implies that the domestic banks' reaction to the default shock has a mitigating effect on foreign banks' sensitivity. If this effect is large enough, foreign bank lending and the strength of local balance sheets (represented by ϕ) can even be negatively related. Domestic banks have a greater impact on foreign banks' default sensitivity when their lending has a large effect on foreign banks' funding costs and marginal returns from the project (f_1 is high), when the sensitivity of their net returns to default shocks is large relative to the sensitivity of their returns to the amount of lending (d_3 / d_1 is high) and when foreign banks' effect on their marginal cost of lending (both in terms of returns and funding costs) is small compared to their effects on their own costs (d_2 / d_1 is low).

To summarize, foreign banks become more sensitive to the strength of domestic balance sheets if their returns, net of funding costs, are more sensitive to the probability of default and

less sensitive to the additional amount of lending compared to domestic banks. In other words, if foreign banks have more to gain and less to lose when there is a positive balance sheet shock, their response is larger in magnitude (opposite conclusions are drawn for an adverse shock). This model response depends on the market share of domestic banks. For example, if domestic banks also expect a substantial increase in profits after a drop in default probability, and if their loans constitute a large share of the market, the sensitivity of foreign banks would be smaller. The reason is that an increase in domestic bank loans, combined with their large share, would cause the economy to reach diminishing returns quickly and hinder foreign bank lending.

To understand the relationship between competition and foreign bank lending, we separately consider the effects of n^f and n^d. Lower n^f, or less competition amongst foreign banks, implies a smaller f_3 and a larger f_2 and a lower sensitivity to borrower balance sheets. The reason is that when foreign banks are smaller in number, and larger in size, their loans have a bigger impact on the returns to capital and their cost of funding. Thus any positive impact of a drop in default probability, for example, would erode away faster when there are a few large foreign banks. Conversely, a lower n^d (low d_3 and a high d_1) would imply higher foreign sensitivity. The mechanism is similar. Domestic banks, when small in number, do not increase their loans significantly when default probability is lower since they face diminishing returns and high funding costs more quickly. This allows foreign banks to extend a larger amount of loans. Overall, the effect of competition on foreign lending is not straightforward and it depends asymmetrically on the level of competition amongst foreign and domestic banks.

3.4. Sensitivity to external shocks

We proceed by measuring the sensitivity of foreign lending to two types of external shocks: An exogenous change in foreign interest rates, r^f, and a change in the default

probability of another country. The former can be interpreted as a global liquidity shock (or a change in r^w) that makes it easier or harder for global banks to raise loanable funds. In response to the latter shock, investment becomes more (less) profitable in another country and foreign banks increase (decrease) their lending in a given country even if the strength of her balance sheets remains unchanged.

We assume that the shock to r^f affects every foreign bank symmetrically and that it does not affect domestic banks' deposit rates. Differentiating equations (19) and (23) with respect to l^d, l^f and r^f, and solving for the sensitivity of foreign lending yields the following expression:

$$\frac{dl^f}{dr^f} = -\frac{1}{f_2 - f_1 \frac{d_2}{d_1}} \tag{27}$$

where d_1, d_2, f_1 and f_2 have the same definitions.

Notice first that an increase in foreign interest rates, as expected, prompts a decrease in lending. Since foreign interest rates are not directly related to the returns from the project, the size of the sensitivity coefficient depends on how much the change in lending affects profits. For example, if the negative lending response to a positive interest rate shock generates a substantial increase (decrease) in the foreign banks' returns (costs), or if f_2 is large, then its amplitude would be smaller. The magnitude of the sensitivity, similarly, depends negatively on the effect of domestic banks on foreign bank profitability (f_1) and the relative impact of foreign banks on the domestic banks' marginal cost of lending (the d_2 / d_1 ratio).

When we investigate the effects of a default shock in a different country, we find a similar expression for the sensitivity to external shocks,

$$\frac{dl^f}{d\phi_m} = -\frac{f_4}{f_2 - f_1 \frac{d_2}{d_1}} \tag{28}$$

where $f_4 = \frac{\delta r^f}{\delta \phi_m}$ and country m is any country except the baseline domestic country in our analysis. Since $f_4 < 0$, the sensitivity coefficient is positive. Therefore, if there is an increase in country m's default probability (a decrease in ϕ_m), for example, r^f would increase and lending in every country, including the baseline domestic country, would decrease. For both types of shocks, the degree of competition amongst foreign banks and domestic banks are similarly related negatively and positively to the lending sensitivity in equation (28), respectively. In particular, as foreign banks become less competitive (as n^f decreases) their lending becomes less sensitive to external shocks.

Comparing equations (27) and (28) with equation (26), we observe that the disparity between the sensitivity to internal and external shocks depends on the shocks' relative impact on the profitability of investment (the numerator of equation (26)) and external funding costs (the numerators of (26) and (28)). For example, if a default shock increases the foreign banks' net returns much more than an external funding shock (a unit change for the interest rate shock), then foreign banks are more sensitive to internal shocks. While a decrease in n^f mitigates the disparity by causing a larger drop in marginal profits, a decrease in n^d reinforces it by decreasing the impact of domestic banks on foreign bank profits. The magnitude of the disparity also depends on the denominator of the three expressions. In particular, the disparity is larger when foreign and domestic bank lending responses do not have a large effect on the profits of foreign banks. This is, similarly, consistent with having a large number of foreign banks.

The sensitivity expressions also reveal a negative relationship between the share of domestic lending and the sensitivity to both internal and external shocks. If domestic banks have a large share, their responses have a larger impact on both the returns and the costs of foreign banks (f_1 is higher). This, in turn, decreases the sensitivity of foreign bank lending.

4. Conclusion

In this paper, we uncover an empirical disparity between the external and internal determinants of the international flow of loanable funds. By using cross-country data, we find that factors determined outside of a country are more important determinants of the foreign/global bank loans she receives. We additionally find that foreign loans are more stable when banks are less competitive and there is a higher foreign bank presence in the borrowing countries. Investigating the theoretical mechanisms that may explain these empirical findings, we find that the disparity between the sensitivities to internal and external shocks depends on the shocks' relative impact on the profits of foreign and domestic banks. If foreign banks have more to gain and less to lose from a positive internal shock compared to domestic banks, for example, internal factors become a more determinant of foreign loans. These loans are more stable and thus less sensitive to both types of shocks if foreign banks are less competitive and they have a higher share in the lending market. The theoretical results, especially when compared with our empirical findings, suggest that the effects of competition and foreign bank presence on the stability of external funding are not independent from each other and a more nuanced approach is warranted.

Our findings have critical implications for international business cycles and global macroeconomic policy. Specifically, our results suggest that international business cycles have become more aligned with the expansion of global banking and that countries with a higher share

of foreign loans, extended by less competitive larger global banks, could enjoy greater financial stability. In formulating global macroeconomic policy, the larger economies of the world should therefore put more emphasis on the stability of global capital markets and global bank balance sheets should receive a greater consideration. The benefits of recent policies enacted to prevent banks from becoming too big and to enhance competition should be weighed against the stability costs suggested by our findings.

There are two directions in which our analysis could be expanded. Since bank loans are more directly related to economic activity and the strength of borrower balance sheets, we used data on global banks' cross-country loans in our analysis. To make broader predictions for financial stability, one could expand our analysis to cover total global bank assets and examine how these holdings depend on internal and external shocks. Another way to draw more detailed inferences would be to use bank-level data and replicate our estimations. This analysis could help in determining the type of global bank that provides stable funding for countries (e.g. the sectors it lends in, its sources of funding, capital structure, ownership type) and design policy to attract and promote these banks.

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Appendix A. Data

Table A.1. Data sources and definitions

Variables	Source	Description
Bilateral loans	BIS	Country-specific, international bank claims reported by domestically owned banks. Immediate borrower basis, millions of US dollars. Table 7A of BIS locational banking statistics.
Real gross domestic product	FRED	Gross Domestic Product by Expenditure in Constant Prices. Quarterly, seasonally adjusted index, 2010=1.
Unemployment rate	FRED	Harmonized unemployment rate.All Persons, seasonally adjusted. We used the total registered unemployment rate for Switzerland since the harmonized unemployment rate data were only avaiable at the annual frequency prior to 2010.
24-hour interest rate	FRED	Immediate Rates: Less than 24 Hours: Call Money/Interbank Rate.
3-month interest rate	FRED	3-Month or 90-day Rates and Yields: Interbank Rates. Either the three month interbank offer rate attaching to loans given and taken amongst banks for any excess or shortage of liquidity over several months or the rate associated with Treasury bills, Certificates of Deposit or comparable instruments, each of three month maturity.
Euro rate	FRED	3-Month, average lenders' rates supplied by a sample of the 57 most active banks trading in euros. Calculated on a 360 day basis, it is released at 11.00 a.m. providing at least 50% of banks in the sample have submitted data. The average is calculated after elimination of 15% of the extreme values and expressed to 3 decimal places.
Deposit rate	FRED, ECB, IFS, central banks	Austria, Belgium, Switzerland, Germany, Denmark France, Italy, Netherlands, Portugal: MFI deposit rates, euro deposits with agreed maturity. Non-financial corporations, source ECB. Spain: Tipos interés (medio ponderado). Saldos vivos. ENTIDADES DE DEPOSITO. Crédito a las sociedades no financieras, source: Banco de Espana. Japan: Deposit interest rate is the rate paid by commercial or similar banks for demand, time, or savings deposits, source: IFS. United Kingdom: Quarterly average of sterling certificates of deposit interest rate, 3 months, mean offer/bid, source: Bank of England. Sweden: Banks' deposit rates, period ending stock, percentage, nonfinancial corp, source: Riksbank. United States: 3-Month Certificate of Deposit: Secondary Market Rate.
Local bad loans	FRED	Ratio of defaulting loans (payments of interest and principal past due by 90 days or more) to total gross loans (total value of loan portfolio). The loan amount recorded as nonperforming includes the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue.
Return on Equity	FRED	Commercial banks' net income to yearly averaged equity.
Net interest margin	FRED	Accounting value of bank's net interest revenue as a share of its average interest-bearing (total earning) assets.
Cost to income ratio	FRED	Operating expenses of a bank as a share of sum of net-interest revenue and other operating income
Liquid assets to deposits and short term funding	FRED	The ratio of the value of liquid assets (easily converted to cash) to short-term funding plus total deposits. Liquid assets include cash and due from banks, trading securities and at fair value through income, loans and advances to banks, reverse repos and cash collaterals. Deposits and short term funding includes total customer deposits (current, savings and term) and short term borrowing (money market instruments, CDs and other deposits).
Regulatory capital to risk-weighted assets	FRED	The capital adequacy of deposit takers. It is a ratio of total regulatory capital to its held assets, weighted according to risk of those assets. (International Monetary Fund, Global Financial Stability Report)
3 and 5 bank asset concentration ratios		Assets of the three and five largest banks as a share of total commercial banking assets. Total assets include total earning assets, cash and due from banks, foreclosed real estate, fixed assets, goodwill, other intangibles, current tax assets, deferred tax, discontinued operations and other assets.
Lerner index	FRED	A measure of market power in the banking market. It compares output pricing and marginal costs (that is, markup). An increase in the Lerner index indicates a deterioration of the competitive conduct of financial intermediaries.
Foreign bank share	FRED	Percentage of the total banking assets that are held by foreign banks. A foreign bank is a bank where 50 percent or more of its shares are owned by foreigners.

Note: FRED: Federal Reserve Bank of St. Louis, Federal Reserve Economic Data database. IFS: International Monetary Fund, International Financial Statistics database. BIS: Bank of International Settlements.

Table 1. Descriptive statistics

Panel A.

	Austria	Belgium	Canada	Switz.	Germany	Denmark	Spain	France	U.K.	Italy	Japan	Nether.	Portugal	Sweden	U.S.
BIS inflows / Local Credit															
average	61.5	111.2	15.6	30.8	33.3	39.2	29.7	37.4	64.5	45.3	11.3	55.3	51.5	39.4	58.3
std. deviation	9.4	13.0	4.3	3.3	8.1	8.3	3.9	3.9	5.4	6.4	3.5	7.2	4.4	14.5	9.1
BIS outflows / Local Credit															
average	31.8	180.4	30.4	226.0	69.3	21.5	28.1	74.6	42.2	22.4	23.3	95.2	18.8	67.2	11.4
std. deviation	10.5	74.7	5.8	58.1	8.8	7.8	4.3	15.1	5.6	8.5	7.2	34.1	2.6	19.2	4.8
3-bank concentration	67.7	83.0	58.2	88.5	71.1	81.7	74.1	59.2	48.4	57.7	38.8	82.6	78.6	94.5	27.6
5-bank concentration	77.3	92.1	73.4	91.4	85.1	89.5	84.5	71.4	62.2	70.8	51.6	90.0	88.9	98.0	36.6
Foreign loans / GDP	28.0	79.3	16.6	128.8	30.1	46.3	28.5	40.5	127.9	22.1	13.0	84.3	66.0	39.4	20.1
Foreign / Dom. assets	80.6	113.8	32.4	137.7	55.8	88.1	55.7	56.1	131.5	53.0	17.5	124.6	96.2	57.9	36.5
% Foreign banks	0.8	1.9	41.7	0.5	0.3	0.4	0.7	0.6	0.2	0.2	1.1	0.3	1.9	0.2	0.04
Credit/Deposits ratio	125.0	86.9	96.5	121.4	119.4	242.1	133.8	136.3	126.6	148.2	61.5	148.4	147.4	233.9	77.4
ROE	6.0	7.5	8.3	7.5	2.9	8.7	9.6	8.4	11.5	6.8	-1.5	8.1	7.0	17.4	11.0
Capital-Asset ratio	13.6	13.8	13.4	13.3	13.0	13.3	12.0	11.7	13.6	11.0	11.9	12.4	10.4	10.2	13.2
% nonperforming loans	2.5	2.4	1.0	1.9	4.1	1.5	2.0	4.2	2.4	7.9	3.8	2.3	3.2	1.4	2.0

Panel B.

Cross sectional variation

	Loan growth		GDP growth		Unemployment rate (quarterly change)		3-month interbank rate (quarterly change)		24-hour interbank rate (quarterly change)		Deposit rate (quarterly change)	
	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean
2000	0.23	-0.01	0.62	0.66	0.14	-0.18	0.26	0.34	0.24	0.39	0.23	0.27
2001	0.22	-0.01	0.68	0.11	0.23	0.08	0.30	-0.42	0.32	-0.36	0.32	-0.34
2002	0.30	0.04	0.66	0.24	0.24	0.12	0.15	-0.07	0.26	-0.05	0.18	-0.07
2003	0.29	0.05	0.56	0.43	0.20	0.09	0.15	-0.18	0.16	-0.23	0.17	-0.16
2004	0.26	0.05	0.50	0.52	0.27	0.00	0.16	0.03	0.16	0.04	0.14	0.03
2005	0.24	0.03	0.69	0.71	0.24	-0.04	0.15	0.06	0.16	0.04	0.15	0.05
2006	0.21	0.05	0.79	0.84	0.23	-0.15	0.13	0.27	0.12	0.28	0.12	0.25
2007	0.25	0.06	0.56	0.65	0.23	-0.10	0.14	0.22	0.13	0.12	0.14	0.17
2008	0.21	-0.04	0.79	-0.64	0.41	0.16	0.35	-0.20	0.37	-0.29	0.40	-0.17
2009	0.22	0.0001	0.98	-0.55	0.36	0.47	0.21	-0.81	0.32	-0.58	0.36	-0.58
2010	0.18	-0.03	0.82	0.74	0.23	-0.02	0.10	0.07	0.09	0.05	0.17	0.07
2011	0.18	-0.03	0.89	0.20	0.31	0.04	0.13	0.08	0.13	0.04	0.22	0.09
2012	0.18	0.004	0.61	-0.12	0.33	0.15	0.15	-0.22	0.10	-0.12	0.21	-0.13
Time series variation (Standard deviation / sample average)												
Austria	0.17	0.005	0.66	0.38	0.23	0.01	0.44	-0.07	0.40	-0.06	0.37	-0.05
Belgium	0.15	-0.02	0.63	0.32	0.41	0.02	0.44	-0.07	0.40	-0.06	0.39	-0.06
Canada	0.05	0.03	0.65	0.49	0.28	0.01	0.45	-0.08	0.44	-0.08	0.30	-0.05
Switzerland	0.06	0.002	0.61	0.42	0.19	0.02	0.33	-0.05	0.38	-0.03	0.38	-0.03
Germany	0.06	0.01	2.31	0.01	0.26	-0.05	0.44	-0.07	0.40	-0.06	0.42	-0.09
Denmark	0.16	0.03	1.21	0.14	0.34	0.05	0.47	-0.07	0.45	-0.07	0.34	-0.04
Spain	0.11	0.04	0.69	0.38	0.67	0.27	0.44	-0.07	0.40	-0.06	0.33	-0.01
France	0.08	0.02	0.55	0.27	0.27	0.02	0.44	-0.07	0.40	-0.06	0.38	-0.04
U.K.	0.15	0.03	0.80	0.36	0.22	0.04	0.47	-0.11	0.45	-0.10	0.48	-0.11
Italy	0.18	0.02	0.79	0.03	0.32	0.02	0.44	-0.07	0.40	-0.06	0.41	-0.02
Japan	0.05	0.02	1.16	0.17	0.17	-0.01	0.07	0.005	0.07	0.001	0.11	0.01
Netherlands	0.14	0.02	0.72	0.26	0.22	0.05	0.44	-0.07	0.40	-0.06	0.28	-0.001
Portugal	0.09	0.01	0.90	0.02	0.37	0.24	0.44	-0.07	0.40	-0.06	0.50	-0.04
Sweden	0.11	0.03	1.09	0.54	0.30	0.04	0.45	-0.06	0.54	-0.01	0.41	-0.03
U.S.	0.10	0.03	0.68	0.45	0.36	0.07	0.54	-0.11	0.50	-0.11	0.54	-0.11

Notes: The average ratios (and the standard deviations for the first two variables) in Panel A are computed by using annual data for the 2000 to 2011 period. The cross sectional variables in Panel B are obtained by first measuring the standard deviations and the means across the sample countries in each quarter and then averaging these quarterly measures to obtain the annual variables. The time series variation ratios in Panel B are obtained by measuring the standard deviation and the mean of the variables for each country and then dividing the two variables.

Table 2. Baseline results

	Local balance sheets		Banks' cost of capital			
	GDP growth rate	Unemployment rate	3-month rates	24-hour rates	Deposit rates	Euro rates
$\sum_{k=1}^{4}\gamma_k$	0.2223	-0.2529	-0.0187	-0.0144	-0.0069	-0.1077
	(14.582)***	(626.199)***	(40.431)***	(50.656)***	(30.956)***	(1748.422)***
$\sum_{k=1}^{4}\beta_k$	-0.553	-0.564	-0.495	-0.476	-0.478	-0.340
	(32,055.4)***	(27,874.7)***	(11,177.7)***	(11,439.6)***	(11,791.8)***	(13,682.7)***
Lender's GDP growth	-3.858	4.074				
	(3.222)	(3.106)				
Lender's 3 month interbank rate	0.026	-0.035				
	(3.924)	(7.684)				
Borrower's GDP growth			-4.633	0.958	-3.571	4.895
			(3.398)	(0.326)	(4.457)	(495.515)***
Borrower's 3 month interbank rate			0.079	-0.002	0.031	-0.009
			(3.663)	(0.640)	(9.999)**	(122.287)***
Number of obs.	9,076	9,076	8,851	9,103	9,103	9,103
AR test, p-value	0.978	0.955	0.995	0.945	0.976	0.990
Chi2, Sargan	195.8	196.6	192.4	201.8	199.3	203.1
Chi2, 10%	8,887.9	8,887.9	8,665.1	8,914.7	8,914.7	8,914.7

Notes: This table reports the results obtained from the estimation of equations (3) and (6). The dependent variable in each regression is the bilateral, relative loan growth rate. The numbers in parentheses are the F-statistics corresponding to joint significance tests. Significance levels: *** = 1 percent; ** = 5 percent; * = 10 percent.

Table 3. Sensitivity comparison

	Local balance sheets		Banks' cost of capital		
	GDP growth rate	Unemployment	3-month rates	24-hour rates	Deposit rates
$\sum_{k=1}^{4}\gamma_k$	0.0010	-0.0007	-0.0033	-0.0049	-0.0032
	(14.582)***	(626.199)***	(261.987)***	(179.130)***	(30.956)***
$\sum_{k=1}^{4}\beta_k$	-0.554	-0.564	-0.479	-0.483	-0.478
	(17,068.9)***	(27,874.7)***	(16,329.7)***	(9453.4)***	(11791.8)***
Lender's GDP growth	-6.280	4.074			
	(5.990)	(3.106)			
Lender's 3 month interbank rate	0.084	-0.035			
	(6.534)	(7.684)			
Borrower's GDP growth			-5.225	-5.229	-3.571
			(3.631)	(1.617)	(4.457)
Borrower's 3 month interbank rate			0.073	0.064	0.031
			(5.107)	(1.792)	(9.999)**
Number of observations	9,076	9,076	8,851	9,103	9,103
AR test, p-value	0.919	0.955	0.881	0.899	0.976
Chi2, Sargan	193.2	196.6	198.6	202.2	199.3
Chi2, 10%	8,887.9	8,887.9	8,665.1	8,914.7	8,914.7

Notes: This table reports the results obtained from the estimation of equations (3) and (6). The dependent variable in each regression is the bilateral, relative loan growth rate. The main independent variables are standardized. The numbers in parentheses are the F-statistics corresponding to joint significance tests. Significance levels: *** = 1 percent; ** = 5 percent; * = 10 percent.

Table 4. Evidence from annual data and other indicators of banking condition

	$\sum_{k=1}^{2}\gamma_k$	F-Stat	Nobs	AR test p-value	Sargan-test p-value
Local balance sheets					
GDP growth rate	0.01741	(6.3930)**	1,382	0.9277	0.2878
Unemployment	-0.01385	(7.3189)**	1,382	0.9489	0.3035
Local bad loans	-0.01468	(3.5497)	1,188	0.6456	0.2975
GDP growth rate, levels	0.01406	(4.1592)	1,382	0.9304	0.3079
Banking variables					
3 month rates	-0.39911	(49.7436)***	1,345	0.2189	0.4036
24 hour rates	-0.26358	(13.2190)***	1,387	0.4051	0.3927
Deposit rates	-0.15621	(8.9270)**	1,387	0.3503	0.3993
Return on equity	0.10459	(6.0505)**	1,387	0.2339	0.4627
Net interest margin	0.07046	(4.8032)*	1,387	0.3577	0.3067
Costs to income ratio	-0.01410	(2.4911)	1,347	0.4069	0.4166
Liquid assets to deposits and short term funding	-0.06994	(1.8858)	1,387	0.5187	0.3438
Regulatory capital to risk weighted assets ratio	-0.34299	(11.2218)***	1,293	0.3681	0.3436

Notes: This table reports the results obtained from the estimation of equations (3) and (6). These estimations use annual observations of alternative balance sheet and banking variables. The dependent variable in each regression is the bilateral, relative loan growth rate. The main independent variables are standardized. The numbers in parentheses are the F-statistics corresponding to joint significance tests. Significance levels: *** = 1 percent; ** = 5 percent; * = 10 percent.

Table 5. The impact of competition

	Local balance sheets		Banks' cost of capital		
	GDP growth rate	Unemployment	3-month rates	24-hour rates	Deposit rates
$Competition * \sum_{k=1}^{4} \gamma_k$	-0.1676 (261.668)***	0.0006 (131.241)***	0.0017 (114.372)***	0.0025 (116.509)***	0.0009 (13.021)**
$\sum_{k=1}^{4} \gamma_k$	0.4556 (3.046)	-0.0117 (706.726)***	-0.1183 (53.713)***	-0.1872 (99.810)***	-0.0778 (14.362)***
$\sum_{k=1}^{4} \beta_k$	-0.589 (20,677.4)***	-0.568 (20,297.4)***	-0.515 (9,422.2)***	-0.506 (9,690.6)***	-0.526 (10,411.2)***
Lender's GDP growth	6.259 (6.837)	3.347 (6.153)			
Lender's 3 month interbank rate	-0.067 (11.540)**	-0.034 (7.185)			
Borrower's GDP			2.072 (4.786)	-6.648 (3.715)	-0.381 (0.673)
Borrower's 3 month interbank rate			-0.005 (5.919)	0.071 (3.785)	0.001 (3.070)
Number of obs.	8,462	8,462	8,237	8,489	8,489
AR test, p-value	0.624	0.403	0.548	0.441	0.460
Chi2, Sargan	189.5	184.5	191.7	193.0	202.5
Chi2, 10%	8,275.9	8,275.9	8,053.1	8,302.6	8,302.6

Notes: This table reports the results obtained from the estimation of equations (7) and (8). The dependent variable in each regression is the bilateral, relative loan growth rate. The numbers in parentheses are the F-statistics corresponding to joint significance tests. Significance levels: *** = 1 percent; ** = 5 percent; * = 10 percent.

Table 6. Alternative measures of competition

		Local balance sheets		Banks' cost of capital		
		GDP growth rate	Unemployment	3-month rates	24-hour rates	Deposit rates
5-bank concentration						
	$Competition * \sum_{k=1}^{4} \gamma_k$	-0.1625 (153.138)***	0.0004 (204.882)***	0.0008 (66.593)***	0.0019 (73.915)***	0.0006 (6.016)
	$\sum_{k=1}^{4} \gamma_k$	1.1164 (18.155)***	-0.0083 (420.919)***	-0.0684 (46.075)***	-0.1635 (48.569)***	-0.0557 (4.806)
	Number of obs.	8,462	8,462	8,237	8,489	8,489
	AR test, p-value	0.569	0.633	0.587	0.515	0.443
	Chi2, Sargan	196.1	185.4	194.0	196.4	193.4
	Chi2, 10%	8,275.9	8,275.9	8,053.1	8,302.6	8,302.6
Lerner Index						
	$Competition * \sum_{k=1}^{4} \gamma_k$	27.7076 (7.100)	0.6132 (133.213)***	0.3201 (76.672)***	0.3518 (121.940)***	0.0081 (53.369)***
	$\sum_{k=1}^{4} \gamma_k$	1.2843 (3.861)	-0.0170 (134.267)***	-0.1557 (75.739)***	-0.2082 (81.193)***	-0.0100 (89.816)***
	Number of obs.	7,905	7,905	7,716	7,926	7,926
	AR test, p-value	0.584	0.610	0.574	0.503	0.616
	Chi2, Sargan	190.9	183.6	197.7	200.2	198.7
	Chi2, 10%	7,724.5	7,724.5	7,537.4	7,745.3	7,745.3

Notes: This table reports the results obtained from the estimation of equations (7) and (8). The dependent variable in each regression is the bilateral, relative loan growth rate. The numbers in parentheses are the F-statistics corresponding to joint significance tests. Significance levels: *** = 1 percent; ** = 5 percent; * = 10 percent.

Table 7. Banks' lending share

		Local balance sheets		Banks' cost of capital		
		GDP growth rate	Unemployment	3-month rates	24-hour rates	Deposit rates
Lending share						
	$Share*\sum_{k=1}^{4}\gamma_k$	-0.0706 (14.048)***	0.0021 (246.170)***	-0.0019 (171.673)***	-0.0023 (167.586)***	-0.0003 (115.383)***
	$\sum_{k=1}^{4}\gamma_k$	1.0988 (10.152)**	-0.0333 (1,124.600)***	-0.0041 (91.642)***	-0.0051 (124.538)***	-0.0143 (70.072)***
	Number of obs.	8,425	8,425	8,200	8,452	8,452
	AR test, p-value	0.633	0.664	0.555	0.559	0.612
	Chi2, Sargan	193.7	187.3	194.0	196.5	199.5
	Chi2, 10%	8,239.3	8,239.3	8,016.5	8,266.0	8,266.0
Foreign share						
	$Share*\sum_{k=1}^{4}\gamma_k$	-3.9295 (59.114)***	0.0948 (172.870)***	0.0404 (299.841)***	0.0144 (66.887)***	0.0407 (95.334)***
	$\sum_{k=1}^{4}\gamma_k$	1.8542 (68.354)***	-0.0647 (58.864)***	-0.0282 (27.922)***	-0.0159 (40.968)***	-0.0350 (129.669)***
	Number of obs.	8,462	8,462	8,237	8,489	8,489
	AR test, p-value	0.616	0.598	0.540	0.453	0.532
	Chi2, Sargan	190.9	187.1	194.3	196.3	190.6
	Chi2, 10%	8,275.9	8,275.9	8,053.1	8,302.6	8,302.6

Notes: Lending share is the ratio of a lending country's loans in a specific country to the total BIS loans in that country. Foreign share is the share of foreign bank assets in the recipient countries. The dependent variable in each regression is the bilateral, relative loan growth rate. The numbers in parentheses are the F-statistics corresponding to joint significance tests. Significance levels: *** = 1 percent; ** = 5 percent; * = 10 percent.