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Abstract

Studies of the determinants of cross-border bank claims are based on the economic situations of the lending and borrowing countries - the traditional push/pull macroeconomic factors - but fail to take into account the situation of the international banks that are at the origin of these flows and the presence of their subsidiaries in emerging countries. They also fail to explain the huge decrease in cross-border bank flows after the 2008 global financial crisis. In this paper, we analyze the determinants of cross-border bank claims on a panel of 28 emerging countries for three cases and transitional countries (claims on all sectors, claims on the nonbank sector, and interbank loans) and explicitly integrate banking determinants. Thus, we account for the financial situation of international lender banks and the existence of foreign locations in emerging countries as a potential pull stabilizing factor. We show that the presence of foreign banks in emerging countries is clearly a factor of attraction for cross-border bank claims. It remains when we explicitly take into account the 2008 crisis but to a lower extent and in favor of interbank loans. This may be proof of support from the international parent banks to their affiliates. Last, the financial situation of international banks, notably their liquidity and ability to respect prudential rules, also plays a role in their financing strategies in emerging countries.

Classification JEL: F23, F32, F36, G01, G21

Keywords: cross-border bank claims; subsidiaries, global banks; emerging countries; Lasso method

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1. INTRODUCTION

Further to the collapse of Lehman Brothers in September 2008, many emerging countries suffered from withdrawals of capital, particularly by way of a fall in cross-border claims held by international banks[1]. The liquidity and solvency crisis between 2007 and 2009 that hit the major international banks poses many questions regarding the international spillover effects of financial shocks (Cetorelli and Goldberg [2011]; Takats [2010]; Kamil and Rai [2010]; Hoggarth et al. [2010]; Affinito and Pozzolo [2017]). In particular, it raises the question of the vulnerability of emerging countries to the rationing of cross-border bank financing by global banks in distress and the potentially destabilizing role of parent companies in difficulty, which may or may not maintain financial support for their subsidiaries located in emerging countries. Consequently, the 2007/08 financial crisis actually showed the necessity of more specifically taking into account the international bank situation (Hryckiewicz and Kowalewski [2010], Claessens & Van Horen [2014], Bonin and Louie [2016], Claessens [2017], Park and Shin [2020]). Furthermore, it highlighted the relevance of considering the presence of foreign-owned banks in host countries.

The objective of this paper is to study the determinants of cross-border bank claims on emerging countries by considering the situation of global banks and the presence of their subsidiaries in emerging countries. The research question is threefold. First, has the presence of subsidiaries been a factor in attracting cross-border bank claims, and did it protect host countries from disengagement during the 2008 global financial crisis? Second, what is the effect of global banks' health on capital inflows? Third, did an intermediation channel exist between global banks and banks in emerging countries, and did the 2008 crisis specifically have an impact on interbank lending?

The literature on the determinants of capital flows usually classifies them into push and pull variables (Calvo et al. [1993], Fernandez-Arias [1996], Jeanneau & Micu [2002]). Traditionally, push variables are the global economic and financial conditions in industrial countries that drive capital flows to emerging countries. The pull variables are the fundamentals of emerging countries that attract capital flows. In this traditional literature, very little space is given to the global bank-related explicative variables: our objective is to fill this gap.

[1] On average, between September 2008 and March 2009, these claims fell by 12% across the emerging Europe zone (Slovakia down by 41.9%, the Czech Republic 18.4%, Poland 16.7% and Latvia 13.2%). The drop was 15% in Latin America (Argentina down by 21%, Venezuela 30% and Brazil 20%) and 24% in the emerging Asia zone (China down by 32%, Malaysia 26% and Korea 30%). Calculations are made by the authors based on data from the Bank for International Settlements (BIS) (*Locational banking statistics)*.

The existence of bank subsidiaries can have a dual impact on cross-border bank capital flows. On the one hand, the significant presence of foreign bank subsidiaries in an emerging country can be an attractive factor for capital. It can be seen by foreign investors as a positive signal about the health and development of the domestic banking system and, more generally, of the country. The presence of foreign banks is generally seen as a factor of greater efficiency for the local banking system due to the transfer of banking techniques and skills (Claessens et al. [2001]; Maechler et al. [2009]; Mihaljek [2006]). The presence of subsidiary banks also facilitates capital flows through parent-subsidiary relationships. In particular, loans from the parent company to its subsidiary (cross-border interbank loans) take the form of financial support in times of crisis in the host country (Haselman 2006; de Haas and Van Lelyveld 2006, 2010; Arena et al. 2007). However, a parent company in difficulty may restrict financial support to its subsidiaries (McGuire and Tarachev [2008]). It may also arbitrate between its subsidiaries according to the economic situation of the host country and expected returns and not only have a role in supporting the most fragile ones (de Haas and Van Lelyveld [2006] and [2010]; Dinger [2009]). However, the existence of established bank subsidiaries can also have a restrictive effect on capital movements through a substitution effect. By developing local credit in local currency, bank subsidiaries can reduce the use of cross-border financing. The finding of Kamil and Rai [2010] that the countries least affected by the rationing of international banks in Latin America, following the 2007 crisis, are those whose foreign subsidiaries had strong local activity in local currency is consistent with this. The parent-subsidiary effect is, therefore, ambiguous.

This article studies the determinants of cross-border bank claims and cross-border loans to the banking sector for a panel of 28 emerging countries[2] between 1995 and 2014, basing our work on the traditional push and pull macroeconomic framework and BIS banking statistics and implementing the Lasso method. It considers the global financial crisis of 2008 as a breakpoint, when major international banks endured significant financial stress. Thus, to secure a comprehensive vision of the determinants of cross-border bank claims, in addition to the traditional push and pull macroeconomic drivers of capital inflows, we take into account banking variables and the presence of international banks in emerging countries as pull drivers. We show that the presence of foreign banks in emerging countries is clearly a factor of attraction for cross-border bank claims. It remains when we explicitly take into account the 2008 crisis but to a lower extent and in favor of interbank loans. This may be proof of support from the international parent banks to their affiliates. Last, the financial situation of international banks, notably their liquidity and ability to respect prudential rules, also plays a role in their financing strategies in emerging countries.

Our contribution is manifold. First, we propose three specific measures to address the situation of international banks; therefore, we update the literature on push and pull factors. The first measure is

[2] Argentina, Bulgaria, Bolivia, Brazil, Chile, China, Colombia, Czech Republic, Estonia, Hungary, India, Indonesia, Korea, Latvia, Lithuania, Malaysia, Mexico, Peru, Paraguay, the Philippines, Poland, Romania, Slovakia, Slovenia, Thailand, Uruguay, Venezuela and Vietnam.

the presence of foreign bank subsidiaries in emerging countries through the percentage of the local banking system's assets held by foreign banks. The second assesses the health of international banks by constructing several weighted indicators for each emerging country. Finally, we study the impact of the compliance of these banks with regulatory prudential constraints.

Second, we implement the Lasso (*Least Absolute Shrinkage and Selection Operator)* method that allows the model to select the most pertinent control variables in terms of information to explain the dependent variable as well as time effects to analyze the impact of the 2008 crisis. Lasso regression is one of the methods that overcome the shortcomings (instability of the estimate and unreliability of the prediction) of linear regression in a high-dimensional context. The main advantage of the Lasso regression lies in its ability to perform variable selection, which is valuable in the presence of a large number of variables. To our knowledge, this method has not been used previously on this research topic.

Finally, because we use cross-border claims where intragroup positions are not consolidated (via the BIS *Locational banking statistics*), we highlight an international intermediation channel through interbank lending.

The reminder of this paper is as follows. Section 2 provides a literature review focusing on the determinants of capital inflows. Section 3 describes the data and the construction of variables. Section 4 describes the methodology and analytical framework. Section 5 presents the empirical results, and Section 6 concludes.

2. REVIEW OF LITERATURE

Traditionally, the determinants of foreign capital inflows are analyzed through push and pull macroeconomic factors. Since the pioneering articles on this topic (Calvo et al. [1993] and Fernandez-Arias [1996]), the determinants of capital inflows[3] into emerging economies have been classified into two categories. The first includes the "push" factors, or factors outside the emerging country, i.e., unfavorable conditions for domestic investment in industrialized countries, which push capital into emerging countries (for example, low GDP growth or interest rates in lending countries). The second concerns the "pull" factors inside or specific to the emerging country, i.e., positive fundamentals that pull or draw capital into the country (for example, positive GDP growth and high yields of financial markets in borrowing countries). Following Calvo et al. [1993], who studied the role of traditional push factors during the 1982 debt crisis, many empirical studies have confirmed the push role of lower interest rates or economic growth in developed countries (see Claessens [2017], Koepke [2018], Hannan [2018] for a review). Some authors, however (Jeanneau and Micu [2002]), have shown that

[3] In initial empirical studies, capital inflows are generally measured by portfolio investments (Fernandez-Arias [1996]; Chuan et al. [1998]).

the evolution of the business cycle in lending countries may have a procyclical role for capital inflows in emerging countries.

Following the Asian crisis of 1997, the literature has also taken into account contagion effects to explain financial flows, notably through changes in the sentiments of foreign investors (Masson [1999]; Forbes and Rigobon [2002]). Thus, alongside the traditional push and pull variables, variables related to risk aversion (such as the VIX, CDS, rate spreads) appear to be significant push factors. The most common proxy for investor risk aversion used in the literature is U.S. implied equity volatility (measured by the VIX index) (Takats [2010], Ghosh et al. [2014], Byrne and Fiess [2016], Choi and Furceri [2019]). In addition to the VIX, the Ted spread, the high-yield spread (Brana and Lahet [2010]), the slope of the U.S. yield curve, the U.S. dealer bank leverage (Cerutti and al [2020]), and the sovereign or bank CDS spread (Shim and Shin [2021]) are sometimes also used. The literature remains inconclusive, and the results in terms of sign, magnitude, and significance are indeed dependent on the composition of the panel, the period and the type of capital flows. When the VIX is significant, its sign is negative, indicating that periods of financial stress coincide with reduced capital flows.

Most of the recent articles on the determinants of capital inflows into emerging countries take an interest in international bank loans or claims, following the 2007/08 crisis and the implication of global banks in the shock transmission. Nevertheless, few of them introduce bank-related variables as determinants for these loans. While some articles test the soundness of international banks at the origins of these flows (McGuire and Tarashev [2008]; Kamil and Rai [2010]; Avdjiev et al. [2012]; Hermann and Mihaljek [2013]; Cerutti [2015]), they do so indirectly through a stock market index or CDS indices. In that respect, Hermann and Mihaljek [2013] measure bank soundness by the percentage of deviation of the banking industry sub index from the overall equity price index, whereas Avdjiev et al. [2012] use the home country financial sector equity price volatilities and the lending banking system CDS spreads. In the same way, McGuire and Tarashev [2008] introduce bank equity returns, banks' average expected default frequencies (as Kamil and Rai [2010]) and the volatility of the market value of banks' assets, as well as foreign banks' funding conditions via the Ted spread.

Other tests for this purpose include macroprudential policy indices in lending countries (Beirne and Friedrich [2017], Cerutti, Claessens and Laeven [2017], Cerutti and Zhou [2018], Takats and Temesvary [2019]). The respect of macroprudential rules by global banks would reduce or slow down cross-border bank claims, as shown, for example, by Cerutti and Zhou [2018].

Few articles include the soundness of banks in the host country (Hermann and Mihaljek [2013]), the good health of the banking sector in the borrower country may help to attract cross-border inflows. With regard to the effectiveness of macroprudential policies in managing cross-border bank flows, the results are contradictory. While Beirne and Friedrich [2017] do not find significant results for a panel of emerging and advanced economies, Takats and Temesvary [2019] show that prudential

measures in the host country have reduced the negative shock of the U.S. 2013 tantrum. Cerutti and Zhou [2018] show that direct cross-border inflows are higher in borrower countries with stronger macroprudential policies and are linked to circumvention motives.

Moreover, to our knowledge, the presence of foreign banks in the host banking system is seldom included as an attractive determinant of international bank claims (McGuire and Tarashev [2008]; Shirota [2015]. This presence, measured by the market share of foreign banks in lending activities, is not significant in Shirota [2015]. McGuire and Tarashev [2008] use the one-period lag of the overall rate of foreign bank participation in the borrower country only as a macroeconomic control variable to measure banking system openness.

The 2008 crisis and postcrisis period are scarcely apprehended. If it is, the role of risk aversion, mainly through the negative sign of the VIX, is highlighted (Hermann and Mihaljek [2013], Cerutti [2015], Choi and Furceri [2019]). Other authors (Bruno and Shin [2015]; Hannan [2017]; Cerutti, Claessens and Ratnovski [2017]; Cerutti and Buitron [2020]; Avdjiev et al. [2020]) try to highlight a global banking channel of liquidity propagation on cross-border bank claims by testing the impact of global factors (such as U.S. interest rates, global liquidity, the leverage of international banks in industrialized countries (notably the U.S.), and the TED spread) on a panel of developed and emerging countries. The main way these studies account for international banks is through the leverage of global banks, with a higher leverage meaning a higher capacity to lend abroad.

A consensus has emerged on the role of U.S. monetary policy, global liquidity supply and risk aversion in explaining the synchronization of capital flows in emerging countries. During the global financial crisis, the decline in cross-border bank lending is explained by global rather than specific factors (Hermann and Mihaljek [2013]). Avdjiev et al. [2012] also find, in the context of the Eurozone crisis, that home country factors play a major role over the period, in particular the deleveraging by euro area banks. Cerutti et al. [2019] infer that “knowing one's lender” is more important than host country fundamentals. Cerutti et al. [2017] show that the lender characteristics (VIX, Bank leverage) have a greater cross-border effect on the banking sector than on the nonbank sector, suggesting that cross-border flows to banks are more sensitive to financial conditions compared to flows to the real sector. In the same way, Shim and Shin [2021] find strong evidence that bank-loans flows are much more susceptible than debt-security flows to financial stress.

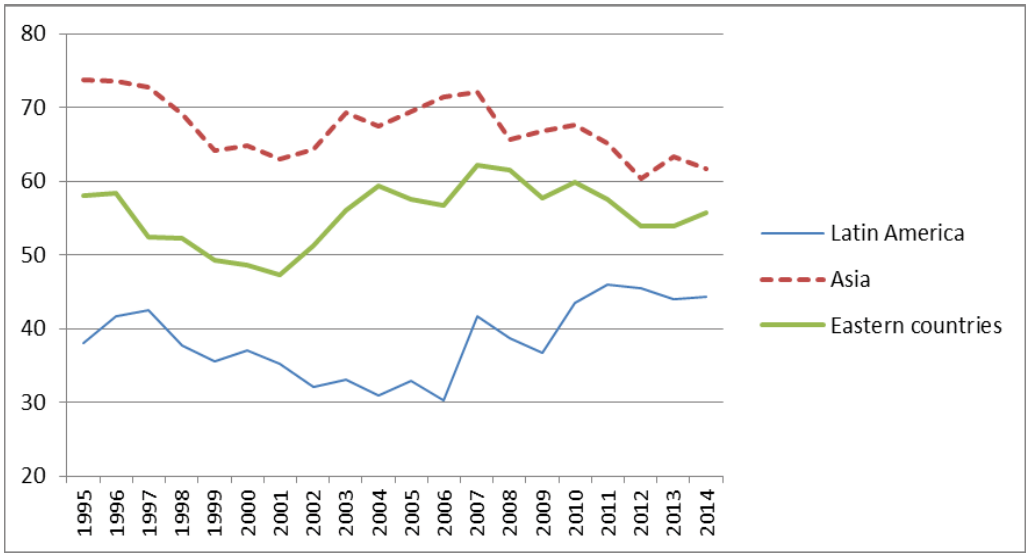
Overall, the presence of foreign banks operating in host countries is scarcely taken into account. If it is, it is usually measured by the amount of bank credit granted by these institutions. This variable is often used as an explanatory factor for all external bank claims, a point that raises a problem of endogeneity given that external bank claims include loans made by affiliates in foreign currency or in local currency. Furthermore, some studies use cross-border claims on all sectors of emerging countries and, consequently, overlook interbank channels between global banks and their counterparts in emerging countries.

3. DATA

We analyze the determinants of cross-border bank claims on emerging countries by distinguishing three dependent variables, all constructed from the *Locational international banking statistics* of the BIS (Bank for International Settlements): the gross amounts of total cross-border bank claims on all sectors of an emerging country, the gross amounts of cross-border bank claims on the nonbanking sector, and cross-border lending to the banking sector of the borrowing country only, an approach that, to our knowledge, has not yet been studied in the literature.

We analyze interbank lending for several reasons. First, we know that 80% of total cross-border bank claims are composed of loans (Hermann and Mihaljek [2013]). Of these, the share of interbank loans is significant (Figure 1). In 2014, interbank lending accounted for 44 percent of cross-border bank lending in Latin America, 62 percent in Asia, and 56 percent in CEE. Second, this allows us to assess a channel of interbank intermediation between global banks and banks in emerging markets. Since positions between global parent banks and their subsidiaries located in emerging countries are not netted out in BIS *Locational banking statistics*, studying the determinants of interbank lending allows us to estimate the existence of possible financial support, in the form of loans, from the parent bank to its subsidiaries in times of crisis.

Figure 1. The share of interbank loans in total cross-border loans (%)



Source: Authors' calculation with BIS data

The presence of foreign locations in the host banking sector may be important in some emerging countries. This is particularly so in central and eastern European countries (CEECs), where toward the end of the 1990s, massive privatization programs aimed at national banks at a time when few domestic private banks existed and when few local investors could afford to buy them out left the

door wide open to foreign investors. On average, foreign banks own three-quarters of CEEC banking assets. The presence of foreign banks in Latin America and Asia came about much earlier (in the mid-19th century) and is generally less marked, except in Mexico, Paraguay, Peru, Uruguay and Indonesia. Furthermore, in 2014, cross-border banking claims appear to have accounted for 31.2% of the GDP of CEECs, 14.3% of the GDP of emerging countries in Asia and 9.4% of GDP in Latin America (Table A1, Appendix).

As explanatory factors[4], pull factors are represented by the host country's fundamentals. These variables are estimated through the sovereign rating built using the numerical values of indices published by Standard & Poor's and Moody's[5] and by calculating the average rating. This variable has the advantage of being a good summary indicator of a country's fundamentals, monitored by international investors in their investment strategies (*Rating Host*). We have also considered a more cyclical variable, namely, the real GDP growth rate for each country i (*Growth Host*). The expected sign for these variables is positive.

Capital inflows may also be explained by push factors. Traditionally, these factors include the economic and financial situation of the country of origin of international lending banks. Given that more than 70% of foreign bank funding invested in emerging countries originates from Europe, North America or Japan, we have introduced a variable representing the weighted growth of these different zones (*Growth Home*). The weights are host country specific and depend on the home countries of the cross-border bank claims received. In a push-pull analysis, the expected sign for the growth variable for home countries is negative, implying a countercyclical effect. Because growth prospects in the home country are disappointing, international banks turn to cross-border investments with a more favorable economic outlook (Calvo et al. [1993]). We also test *US* and *UE interest rates* as measures of returns and monetary policy actions and take into account the *VIX* (CBOE volatility index) as a measure of risk aversion to test the potential presence of speculation and of any crisis-related contagion effect. The expected signs are negative.

To account for the strategies of international banks, we test the impact of the presence of foreign banks via their local subsidiaries. We add a "foreign banks" variable to the pull factors, a variable that measures the share (%) of the host country's banking system assets held by foreign banks (*Foreign Assets*). To construct this variable, we rely in particular on Claessens and Van Horen [2014], data from the World Bank, the OECD and central banks. The expected sign is ambiguous, even if the relationship between the presence of subsidiaries and cross-border bank claims seems to be positive in our sample (Figure A1, Appendix).

As push factors, we also incorporate other explanatory factors, such as the health of banks in the lending country. We use data from the Bankscope database. These variables (as in de Haas & Van

[4] The description of the variables, the statistics and sources are presented in Table A2 in Appendix.
[5] Long-term ratings and in foreign currency for the sovereign debt.

Lelyveld [2006], Haselmann [2006], Derviz et al. [2007], Arakelyan [2018]) measure the degree of capitalization of banks (*capitalization* variable assessed via the capital-to-assets ratio), the degree of liquidity of assets (*liquidity* variable computed via the ratio of liquid assets to total assets), and the quality of the credit portfolio (percentage of nonperforming loans (*NPL* variable)). We also calculated a *Z score* variable to assess the solvency of banks. The Z score measures the distance to insolvency, with a higher Z score indicating a lower probability of insolvency in the banking system. Finally, we use a composite macroprudential policy indicator based on data from Cerutti Claessens Laeven (2017) (*Prud Home*). For each emerging country, we obtain specific indicators of international banks' soundness based on the nationality of their main creditor banks. These indicators are calculated by weighting the position of international banks by their share of total cross-border claims[6]. The expected sign may be ambiguous. One can think, of course, that banks with healthier financial situations will have more resources and capacity to lend internationally, which implies procyclical behavior. However, it is also possible to think that an improvement in their financial situation, thanks to the good health of their domestic markets, may encourage them to remain in their domestic markets and temper any incentive to prospect internationally.

Concerning the host country, we also consider the health of the banks as pull determinants. Healthy banks are an attractive factor for cross-border claims, but at the same time, healthy local banks can make a country less dependent on external financing, including interbank financing. As with international banks, we test indicators for capitalization, liquidity, profitability (ROA), impaired loans and a Z score variable[7].

4. EMPIRICAL STRATEGY

For model selection and prediction and as a component of estimators to perform inference, we use the Lasso method. The Lasso method allows the model to select the most pertinent control variables in terms of information to explain the dependent variable as well as time effects to analyze the impact of the 2008 crisis. The Lasso regression is one of the methods that overcomes the shortcomings (instability of the estimate and unreliability of the prediction) of linear regression in a high-dimensional context. The main advantage of Lasso regression lies in its ability to perform variable selection, which can be valuable in the presence of a very large number of variables (which is

[6] It represents the amount of claims on an emerging country from banks of the same nationality, divided by the amount of total claims for all banks reporting to the BIS on that emerging country. For each emerging country, we have calculated the weight of each creditor by selecting the most important lender countries (Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the UK, the United States and Spain), i.e., 14 countries from the 17 registered with the BIS. These statistics also include Australia, Ireland and Portugal, which we have omitted because their exposure values were very low, nil or not given. European banks (especially Austrian and German) are thus the most important lenders for CEECs and have been regularly since 1995. In Asia, Japanese banks held the upper hand until 2001 but have since been supplanted by British and American banks. In Latin America, American banks are still very heavily exposed but Spanish banks are gaining ground, even overtaking American and British banks from 2001 onward (for comments on the common lenders, see Sbracia and Zaghini, 2003).

[7] Given the construction of the Z score, this variable will be tested alternately with the capital ratio and ROA.

our case) but also to identify nonlinearities in the relationships between variables, which may be multiple.

Usually, within the framework of linear regressions, Equation (1) permits us to estimate the response variable Y:

$$Y_i = X_i\beta + \varepsilon_i,\ i = 1, \cdots, n \quad (1)$$

With $\beta = (\beta_1, - - -, \beta_p)$, which is the p-vector containing the parameters associated with each of the covariates. ε_i is the (i.i.d) error term. $X = (X_1, \cdots, X_n)$ is the $n \times p$ size covariates matrix. The problem of interest is to estimate the parameter vector under the assumption that it is sparse.

β is estimated by minimizing the mean square error (RSS) with the following expression:

$$\hat{\beta} = \arg\min \frac{1}{n} \|Y - X\beta\|_2^2$$

If $(\mathbf{X}^T\mathbf{X})$ is invertible, the least squares estimator is $\hat{\beta} = (\mathbf{X}^T\mathbf{X})^{-1}$ Y.

According to the Gauss–Markov theorem, the least squares estimate has the smallest variance among all linear unbiased estimates of β under certain assumptions. However, the method induces many problems when p is large, the matrix $\mathbf{X}^T\mathbf{X}$ is not invertible and the number of degrees of freedom of the system is such that the estimator is not uniquely defined. Furthermore, if some covariates are correlated (even weakly), the calculation of the inverse of $\mathbf{X}^T\mathbf{X}$ may be unstable, resulting in estimators with large variances that give rise to wide confidence intervals.

When the quality of the prediction is measured using the expectation of the squared deviation of Y and its prediction (MSE), the following decomposition is observed:

$$E[(Y - \widehat{Y})^2)] = \sigma^2 + \left[E(\hat{Y} - Y)^2\right] + E[(\hat{Y} - E(\widehat{Y})^2]$$

The penalized regression method consists of accepting a slight increase in bias due to the model's weakness ($\left[E(\hat{Y} - Y)^2\right]$) to obtain a more than proportional reduction in the variance of the prediction $E[(\hat{Y} - E(\widehat{Y})^2]$, where σ^2 is the incompressible error due to Y's variance (bias-variance trade-off). This involves imposing constraints on the estimated parameters to reduce the expected prediction error and make the model more efficient. The shrinkage method allows controlling the magnitude of the parameter values. Penalized regression methods keep the predictor variables in the model but regularize (constrain) the regression coefficients by shrinking them toward zero. If the amount of shrinkage is large, these methods can also perform variable selection by shrinking some coefficients to zero, which is what the Lasso method is all about.

According to the norm imposed as a constraint on the coefficients (L1-norm, L2-norm or a combination of the two), several solutions are possible to estimate the sparse parameter vector in Eq.

(1): Ridge selection[8], Lasso (Tibshirani, 1996)[9], Adaptative Lasso (Zou, 2006), Elastic-net (Zou and Hastie, 2005)[10], and Square root (Belloni and Chernozhukov and Wang, 2011)[11]. Lasso shrinks the regression coefficients toward zero by penalizing the regression model with a penalty term called the L1-norm, which is the sum of the absolute coefficients. In the case of Lasso regression, the penalty has the effect of forcing some of the coefficient estimates, with a minor contribution to the model, to be exactly equal to zero. This means that Lasso can also be seen as an alternative to the subset selection methods for performing variable selection to reduce the complexity of the model.

With Lasso, the lost function (1) is minimized by imposing a constraint on the L1-norm of the parameters, i.e.,:

$$\min \frac{1}{n} \|Y - Z\beta\|_2^2$$

Subject to $\|\beta\|_1 \leq \tau$

where Z is the vector of standardized X variables. Indeed, the method assumes that the covariates integrated in the model are standardized, while Y is only centered. τ is a positive parameter that is to be fixed. It represents the constraint or the intensity of the restriction.

The Lasso method (contrary to Ridge, which maintains all the variables in the model but by shrinking the value of the coefficients) allows the selection of the set of m (≤ p) variables relevant in information terms (some variable coefficients are reduced to zero) and therefore is the most relevant model for prediction. The penalty function, in a Lagrangian form, is written as:

$$\hat{\beta}(\lambda) = Arg\ min \frac{1}{n} \|Y - Z\beta\|_2^2 + \quad \text{with } \lambda > 0, \beta \in R^p \qquad (2)$$

λ is the penalty parameter. We can move from τ to λ as follows. If τ= 0, which indicates a strong constraint, then λ → +∞ and all β are zero. However, if τ→+∞, then the constraint is weak, λ =0, and we find the OLS (Eq. (1)). Therefore, given a dataset, a λ_{max} that shrinks all the coefficients to zero exists, and no variables are introduced in the model, but the greater the lambda values decrease, the more variables are selected. The penalty function $\lambda * \|\beta\|_1$ is the term that causes Lasso to omit variables (covariates with $\hat{\beta}j=0$ are excluded from the model) and to select another (covariates with $\hat{\beta}j \neq 0$ are included in the model).

Lasso minimizes Eq. (2) for different values of λ and, therefore, proposes different models: $M_{\lambda 0}$, $M_{\lambda 1}$,…, $M_{\lambda max}$. In this series, $M_{\lambda max}$ is the least complex model, for which the maximum amount of penalty is imposed on the regression coefficients, and $M_{\lambda 1}$ is the most complex model for which no

[8] Ridge regression shrinks the regression coefficients, so that variables, with minor contribution to the outcome, have their coefficients close to zero. Ridge regression uses the L2-norm : $\|\beta\|_2^2 = \sum|\beta_j|^2 \leq \tau$.

[9] Least Absolute Shrinkage and Selection Operator.

[10] With Elastic-net regression, the norms L1 and L2 are both included. This method is between Ridge (where there is no selection of parameters) and Lasso (where the selection is drastic).

[11] In the square-root formulation, the standard deviation of the error term becomes a multiplicative constant that drops out of the minimization (there is no need to estimate the standard deviation of the error term).

penalty is imposed and the regression coefficients are estimated by OLS[12]. When all models are estimated, it is necessary to choose the best based on the criterion of the out-of-sample prediction error.

Therefore, it is a question of determining the value of λ, which specifies all the variables useful for prediction according to the sparsity principle (the most relevant M model[13]). Lasso provides various ways of selecting λ, such as CV (K-fold cross-validation), Adaptive Lasso, and a plugin estimator. With CV, data are resampled, and CV permits the selection of λ that minimizes an estimate of the out-of-sample prediction error. Adaptive Lasso performs multiple lassos, each with CV. After each Lasso, the variables with zero coefficients are removed, and the remaining variables receive penalty coefficients to reduce the small coefficients to zero[14]. Thus, Adaptive Lasso selects fewer covariates than CV. The plugin method was designed to achieve an optimal sparsity rate. It tends to select a larger λ than CV and, therefore, fewer covariates in the final model.

In our study, the estimated equation takes the following form:

$$CBC_{it} = \Omega + \Psi_{it}\,\eta + \mathbf{X_{1}}_{it}\,\alpha_1 + \mathbf{X_2}_{t}\,\alpha_2 + \mathbf{Z}_{it}\,\beta + H_{it}\,\theta + I_{it}\,\varphi + u_i + v_t + \varepsilon_{it} \qquad (3)$$

with CBC_{it}, the cross-border bank claims on country i in period t.

X (X_1 and X_2) is a vector of traditional pull and push factors. This vector is assumed to be a vector of control variables (X_1 includes variables for each country i: *Growth host, growth home, rating;* and X_2 includes global variables: *VIX, US interest rate, EU interest rate*).

H includes host country bank health variables (*domestic bank capitalization, liquidity, NPL, Z score, ROA*), while Z includes variables reflecting foreign country bank health variables for each emerging country (*International bank capitalization, liquidity, NPL, Z score, macroprudential index*).

I is a vector of interactive terms. To consider possible nonlinearities, all covariates are multiplied by each other and are included in the model. All these interactive terms are introduced as instruments as well as controls.

Ψ is our variable of interest: the presence of foreign banks in the host country*, Foreign Assets.*

$u_i + v_t$ are individual and time fixed effects, respectively.

ε_{it} is the white noise.

Index i relates to the host country (i = 1 to 28), and index t relates to the period (t = 1 to 20). The period of estimation ranges from 1995 to 2014[15]. The countries under study are Argentina, Brazil,

[12] This series of models can be calculated by using specialized algorithms such as the Efron et al. (2004) Least Angle Regression (LARS) algorithm.

[13] The method consists in keeping the variables with significant or nonsignificant coefficients as long as they improve the prediction.

[14] With Adaptative Lasso, the penalty function is written as : $\left\| \left(\frac{\beta}{\tilde{\beta}}\right) \right\|_1 < \tau$

[15] The sample size is restricted by the availability of data, notably for foreign bank presence.

Bolivia, Chile, Colombia, Mexico, Paraguay, Peru, Uruguay and Venezuela for Latin America, China, India, Indonesia, South Korea, Malaysia, the Philippines, Thailand and Vietnam for the Asia zone, and finally Bulgaria, Hungary, the Czech Republic, Estonia, Latvia, Lithuania, Poland, Romania, Slovenia and Slovakia for East European countries.

To estimate Eq. (3), we develop the three usual steps of the method.

- Step 1: *Yeo-Johnson power transformation (YJT) (stationarity and normality)*

We use YJT to transform the original data as a first stage for making the series stationary in the variance, and then we calculate the differences to achieve the stationarity of the series in the mean (Dittmann and Granger, 2002). This method permits us to improve forecastability and to stabilize the variance[16].

- Step 2: The post double-selection Lasso approach to choose control variables (*omitted variable bias*)

We include these controls to overcome omitted variable bias. To select control variables, we use the post double-selection Lasso (PDS) approach (Belloni et al., 2014; Belloni et al., 2016). The goal is to identify controls that are strong predictors for the dependent variable in the first step (set Θ) and that are strong predictors of the independent variable (*Foreign Assets*) in the second step (set Λ). Finally, $\boldsymbol{\omega} = \Theta \; U \; \Lambda$, the union of the selected controls from stages 1 and 2, is used for the estimate[17]. We confirm our result by using the Double-Orthogonalization proposed by Chernozhukov-Hansen-Spindler [2015] (CHS)[18].

- Step 3: Instrumental variables (*endogeneity*)

We choose the instruments by using the Lasso on the first-stage regression ($\Psi_{it} = f(I_{it}) + \chi_{it,}$ where χ is a noise). We use the selected IVs in a standard IV estimation (controls + instruments) with a PDS-type approach. Once again, we confirm our result by using the CHS approach.

5. RESULTS

The results in Table 1 are proposed for all the periods, for the whole sample (Column 1) and for the two subsamples: cross-border claims on the nonbank sector (Column 2) and interbank loans (Column 3).

A major result of these tests is that the presence of foreign banks (*Foreign Assets*) in emerging countries is clearly linked to the increase in cross-border bank claims, regardless of the borrowing sector. This finding shows that the presence of foreign banks operating in local markets, measured by

[16] Between Boxcox (BCT) and YJT, we prefer YJT because we have variables with negative values and because it is a better solution for stabilizing the variance in stationary series.
[17] The PDS method is equivalent to Frisch-Waugh-Lovell partialing-out all selected controls from both dependent and interest variables.
[18] See also Chernozhukov et al. [2018].

the percentage of assets they hold, is a pull factor for foreign bank financing. They finance the nonbank sector and the banking sector, which then finances the private sector in the host country; international banks are involved in the setting of an intermediation channel. In doing so, foreign banks implement a pull strategy. This is an important result of our article. Then, it is effectively the economic conditions of the host country and not the adverse conditions of the home country of international banks (contrary to Calvo et al. [1993]; the growth of the home countries is not retained by the method) that determine the investment strategies of international banks: the emerging country *Rating* is a significant factor of attraction for cross-border bank financing. These results, confirmed by the fact that the VIX is not retained by the method, support the conclusion whereby foreign banks seem to be implementing long-term strategies (as in Haselmann [2006] or Claessens [2017]). This is favorable to emerging countries and relies on the financial integration of these countries and their openness to foreign investments.

The situation of the host country's banking system also appears to be a significant determinant of external bank financing. When the financial situation of domestic banks improves, reflected by an increase in ROA, the external financing of the emerging country also tends to increase.

Table 1. Determinants of the growth rate of cross-border bank claims (1995-2014)–Estimate cluster Robust

Number of observations: 560 Number of clusters:28		Cross-border bank claims - all sectors (1)	Cross-border bank claims-nonbank sector (2)	Cross-border interbank loans (3)
Traditional Push & Pull factors	Rating Host	.0125909*** (3.46)	.0166147*** (3.44)	.0173166 *** (3.56)
Domestic bank health (Pull)	ROA Host	.0096636 *** (2.74)	-	.0125149*** (2.96)
International bank health (Push)	Prud Home	-.091655 *** (-4.14)	-.092464*** (-3.37)	-.0804755*** (-2.96)
The role of located affiliates (Pull)	Foreign Assets	.0142112 *** (3.56)	.0121562 *** (2.02)	.0134268 *** (3.15)
Interactive terms	Growth Host *Rating Host	.0001659 *** (4.80)	.0001354 *** (3.98)	.0001984 *** (4.31)
	Growth Home *Rating Host	.0008647* (1.83)	-	.0019025*** (2.88)
	Liquidity Home* Rating Host	.0002234*** (2.63)	.0001826 *** (2.14)	.0003038 *** (3.65)
High-dim controls EBIC R2		150 -1982.0825 0.44	152 -1829.1564 0.33	152 -1714.96582 0.32

*Significant at 8%; ** at 5%; *** at 1%. t-Student in parentheses.
Standard errors and test statistics valid for *Foreign Assets* variable. Coefficients can be compared.

The situation of international banks, then, matters. A higher macroprudential index (*Prud Home*) may result in a decrease in foreign claims for all sectors. Compliance with regulatory constraints has led international banks to restrict foreign lending, confirming the literature.

Finally, the results of the Lasso method indicate that there are some nonlinearities between some control variables or cumulative effects, as the coefficients of the interactive terms are positive and significant. There is a cumulative effect between economic growth and the rating of the host country. Moreover, all things being equal, the positive pull impact of the rating on foreign bank claims is all the stronger as the growth in home countries is high/solid or as the liquidity of international banks is important. This is further evidence of the crucial role of international banks' health (as in Hermann and Mihaljek [2013], McGuire and Tarashev [2008], De Haas and Van Lelyveld [2006, 2010], Kamil and Rai [2010] and Arakelyan [2018]). Thus, there is some dependency on foreign banks' health and some vulnerability to financial openness.

We now want to capture the impact of the 2007/2008 crisis. The subprime crisis was triggered in August 2007 in the United States, and then, through different channels, affected other developed countries. Emerging countries, considered less risky than developed countries, received considerable capital flows until the Lehman Brothers bankruptcy in September 2008. Because we do not have enough observations after 2008, we cannot share the sample in two subperiods. We choose to analyze the impact of the crisis with two variables: the time effect *Year_2008* not penalized in the Lasso method and *After crisis*, which takes the value 1 for the years after 2008 and 0 before[19]. The results are shown in Table 2.

Table 2 confirms the results of Table 1. Some determinants remain significant with the expected sign: Rating Host, some interactive terms, liquidity Home, Prud Home, and ROA host. Regarding the latter, the impact of the domestic bank better health (ROA) on interbank loan is amplified when the emerging country rating is stable or high. This still enhances the role of good fundamentals to pull foreign investors.

The two variables representing the crisis are significant with the expected negative sign: capital flows were negatively impacted by the crisis regardless of the borrowing sector. The coefficients are high for the variable *Year_2008*, which may reflect the global stress and the overreaction of outflows following the collapse of Lehman Brothers. The financial crisis of 2008 was a powerful factor in the withdrawal of funds regardless of the sector.

A major result lies in the *Foreign Assets* variable of interest, which is still significant with a positive sign but with smaller coefficients than in Table 1. Moreover, the variable is no longer

[19] These two variables do not include the same periods. The first only refers to the year 2008, while the second variable covers the years after 2008. They do not overlap, so they can be included together in the model.

significant for the nonbanking sector. When controlling for crisis or postcrisis periods, the presence of foreign banks continues to attract interbank lending generated by international banks, although less than in good times and no longer attracts cross-border bank claims on the nonbank sector. The presence of banks is, thus, less stabilizing or protective for emerging countries in times of crisis.

Table 2. Determinants of the growth rate of cross-border bank claims (1995-2014)–Estimate cluster Robust–With 2008 crisis variables

Number of observations: 560 Number of clusters:28		Cross-border bank claims-all sectors (1)	Cross-border bank claims-nonbank sector (2)	Cross-border interbank loans (3)
Traditional Push & Pull factors	Rating Host	.0186088*** (5.14)	.0232542*** (4.85)	.0143697*** (3.76)
	Growth Host	-	.0009347*** (2.56)	-
Domestic bank health (Pull)	ROA Host	.0127967 *** (2.81)	.0136031*** (2.55)	-
International bank health (Push)	Prud Home	-.0716329*** (3.64)	-.0637782*** (-3.05)	-.072901*** (-2.50)
	Z Score Home	-.0017619*** (-3;94)	-.0020349*** (-2.98)	-.0009064* (-1.75)-
The role of located affiliates (Pull)	Foreign Assets	.0080255*** (1.99)	.0029256 (0.69)	.0116368*** (2.05)
Interactive terms	Growth Host *Rating Host	.0001871*** (5.63	-	.0002023*** (5.23)
	Liquidity Home* Rating Host	.0002213 *** (2.64)	.0001971*** (2.49)	-
	VIX * Z Score Home	-	-	-.000046*** (-2.48)
	ROA Host * Rating Host	-	-	.001959*** (2.97)
Crisis variables	Year_2008	-.1022088*** (-3.59)	-.096775*** (-3.36)	-.1016529*** (-3.98)
	After crisis	-.0179042 (-0.94)	-.0320933* (-1.80)	-.0349121* (-1.80)
High-dim controls EBIC R2		150 -1962.14129 0.46	152 -1842.14100 0.37	152 -1682.59730 0.32

*Significant at 8%; ** at 5%; *** at 1%.(t-Student in parentheses).
Standard errors and test statistics valid for *Foreign Assets* variable. Coefficients can be compared.

However, as parent companies' financial support to subsidiaries is included in the cross-border claims data, it can be concluded that international banks adjust their foreign activities in times of crisis while maintaining support for their subsidiaries (Column 3) (as in Haselmann [2006]; de Haas and Van Lelyveld [2006, 2010]; Arena et al. [2007]) but restricting credit to firms (Column 2). There is actually a crisis effect.

Nevertheless, the growth of the host country is a pull determinant of foreign financing to the nonbank sector when taking the crisis into account. This is a variable that international banks look after to decide and adjust their financing strategies. Moreover, in times of crisis and financial stress (represented by the VIX), the negative impact of the Z score of international banks on interbank loans is amplified: the coefficient of the interactive term is significant and negative. All things being equal, in a high stress period, international banks with a better Z score (a lower probability of failure) would favor security and home activities rather than interbank activities abroad. This result enhances the dependency of emerging countries on international banks' health and makes them somewhat vulnerable to financial openness.

To better analyze the impact of the 2008 financial crisis, we test several time effects. Insofar as a differentiated treatment by period makes it possible to refine the analysis, we choose to estimate the model by not penalizing the temporal effects to evaluate their impacts on capital flows (Table 3 and Figure 2). As indicated in the empirical strategy section, Lasso mechanically selects only a limited number of predictors. From a group of variables, Lasso selects the most related to the target, often masking the influence of the others. This disadvantage is always inherent to techniques incorporating a variable selection mechanism. According to the principle of parsimony, the narrowing algorithm retains only the most significant variables in terms of information and excludes those that are less significant. Therefore, to analyze the impact of temporal effects that do not appear as first rank determinants in the first estimation, it is possible, in the Lasso technique, not to penalize them to specify their impact. Moreover, in the period of study 1995–2014, the method only produces significant time effects[20].

The results confirm the previous tests, notably for the attracting role of *Foreign Assets* which is a major result of our article. Moreover, the tests show that there were outflows from all the activity sectors in 2008. The huge coefficients for the *Year-2007* attest to the run of foreign investors and of international banks on emerging countries as safe haven investments. After 2008, international banks resumed their financing activities abroad, notably interbank loans. In that case, the coefficients are positive and the highest (Column 3). In this postcrisis period and time of return of capital flows in emerging countries, international banks favor interbank loans[21]. The intermediation channel is reactivated/restored. This could mean that they finance their subsidiaries that were weakened by the crisis and help them to have a contracyclical loan activity in the host emerging country.

[20] That's why all the time effects cannot be reported in Table 3.

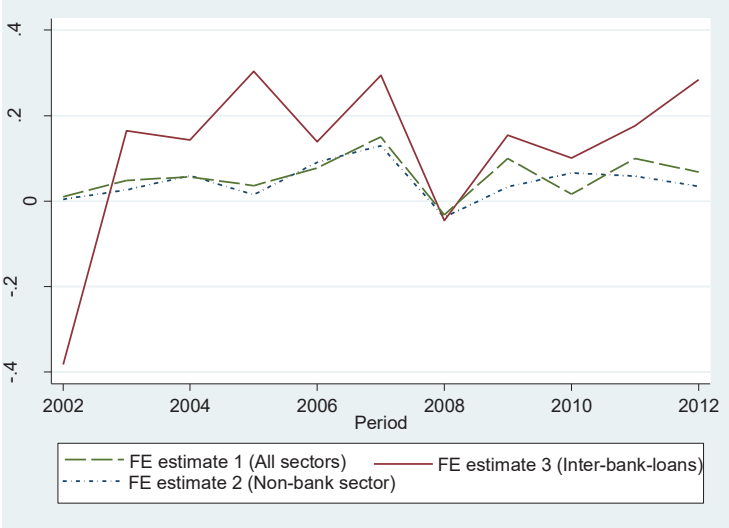
[21] Figure 2, that represents the estimated coefficients of the time effects in Table 3, shows this tendency.

Table 3. Determinants of the growth rate of cross-border bank claims (1995-2014)–Estimate cluster Robust–Temporal effects

Number of observations: 560 Number of clusters:28		Cross-border bank claims- all sectors (1)	Cross-border bank claims- non-bank sector (2)	Cross-border interbank loans (3)
Traditional Push & Pull factors	Rating Host	.0137312 *** (4.11)	.0160443*** (3.46)	.0104636 *** (2.53)
Domestic bank health (Pull)	ROA Host	.0127967 *** (2.81)	.0099806*** (2.36)	.008808 (1.60)
International bank health (Push)	Prud Home	-.0716329*** (3.64)	-.0797359*** (-3.77)	-.072354*** (-2.84)
	Z Score Home	-.0017619*** (-3.94)	-	-.0007307 (-0.42)-
The role of located affiliates (Pull)	Foreign Assets	.0135729 *** (3.50)	.0108994 ** (2.16)	.0143305 *** (3.22)
Interactive terms	Growth Host *Rating Host	.0001702 *** (5.38)	.0001088 *** (3.62)	.0001786 *** (4.16)
	Liquidity Home* Rating Host	.0002032 *** (2.75)	.0001829 *** (2.50)	.0002835*** (3.77)
	VIX * Z Score Home	-	-	-.0001311 (-1.57)
	ROA Host * Rating Host	-	-	.0021176 (1.72)
Time effects	Year_2002	.0097815 (0.79)	.0041606 (0.30)	-.3820687*** (-3.42)
	Year_2003	.0486102 *** (2.44)	.0261687 (1.45)	.1648012*** (5.20)
	Year_2004	.0566879 *** (3.21)	.0597295*** (3.15)	.1431799*** (4.84)
	Year_2005	.0361679 *** (2.36)	.0145999 (0.90)	.303269*** (4.40)
	Year_2006	.0770969*** (4.45)	.0907793*** (3.98)	.1386369 *** (5.46)
	Year_2007	.1502267*** (7.19)	.1296685*** (5.07)	.2943025*** (7.10)
	Year_2008	-.0323294* (-2.00)	-.0376121* (-1.90)	- .0459342* (-1.85)
	Year_2009	.0996095*** (3.10)	.0332361** (1.99)	.1541616*** (3.60)
	Year_2010	.0161823 (0.54)	.0657634*** (2.16)	.1003592*** (4.39)
	Year_2011	.099609*** (3.12)	.0585185*** (4.11)	.1756734*** (3.33)
	Year_2012	.0678023*** (2.83)	.0347094 (1.45)	.2842297*** (5.07)
High-dim controls		150	152	152
EBIC		-1996.18308	-1859.27402	-1715.0616
R2		0.44	0.32	0.32

*Significant at 8%; ** at 5%; *** at 1%.(t-Student in parentheses).
Standard errors and test statistics valid for *Foreign Assets* variable. Coefficients can be compared.

Figure 2. The time effects



Source: authors based on the estimations in Table 3

Figure 2 confirms the overreaction effect of interbank lending compared to real sector lending and its higher sensitivity to financial conditions, as in Cerutti et al. [2017]. The leverage cycle of the global bank was a key determinant of global liquidity before 2008. Following the Lehman Brothers collapse, in times of an aggregate liquidity shortage, foreign banks dropped their relative volume of interbank lending. In the years that followed, the system progressively recovered its initial patterns of integration among banks, which coincided with monetary policy interventions (Affinito and Pozzolo, 2017).

Thus, our results show that the presence of foreign banks is a pull factor for capital inflows in emerging countries regardless of the borrowing sector, and an intermediation channel is established. This is in line with the literature on global banks and relies on the positive aspects of the financial integration of these countries. Nevertheless, the downside is that in times of crisis, they are dependent on the health of gobal banks. Our results, based on the time effects, may indicate that global banks finance their subsidiaries that could have been weakened by the crisis and help them to have contracyclical loan activity in the host emerging country. The intermediation channel is restored following the crisis. This is an important contribution of our article.

6. CONCLUSIONS

The aim of the article is to document the determinants of cross-border bank claims and interbank loans vis-à-vis a panel of 28 emerging countries in the 1995–2014 period, taking into account banking determinants and crisis effects. Our results provide evidence of the role of both domestic determinants and international bank strategies that are impacted by crisis effects. Because we have a high number of potentially explanatory variables, we use the Lasso method, which allows the

model to select the most pertinent control variables in terms of information to explain the dependent variable as well as time effects to analyze the impact of the 2008 crisis. With this method, it is also possible to identify nonlinearities in the relationships between variables, which may be multiple.

Decisions by international banks to invest in emerging countries are essentially grounded in pull strategies: the macroeconomic outlooks of host countries are crucial factors in their strategies, much more so than the prospects of their home countries. This emphasizes the importance for an emerging country to introduce sound economic policies.

However, our study shows that it is indispensable to additionally consider the situation of international banks. On the one hand, the presence of foreign banks is a determinant of cross-border claims in a pull context. The presence of foreign banks attracts cross-border bank claims and reflects the host country's economic and financial development. The nonbank sector receives foreign financing, and local affiliates benefit from interbank loans from their parent banks. Global banks also finance national banks (included in interbank loans) and, consequently, indirectly finance nonfinancial agents in the emerging country that are clients of the national banks. This gives support to the existence of an intermediation channel. On the other hand, the constraints weighing on these banks (macroprudential ratios, liquidity, solvency) have a significant impact on cross-border claims.

When we consider times of crisis, international banks retain a financing role but to a lesser extent. They maintain their business in emerging countries only via interbank loans. This may be evidence of support by parent banks in a crisis context. Moreover, openness to cross-border bank claims also renders emerging countries more sensitive to the health of international banks and more vulnerable to global financial stress and international financial crises.

Our findings have important implications for policy recommendations. International banks are *Systemically Important Financial Institutions* (SIFIs) with global strategies, and their health impacts cross-border financing. Consequently, emerging countries must develop sound policies to attract foreign capital flows and to better deal with crises and outflows. Moreover, improving the supervision and regulation of these international institutions is a major objective, as Basel 3 and the European Banking Union aim to do in Europe. It is also necessary to increase the harmonization of new banking regulations between the major developed countries (U.S., UK, Japan, EU) to create healthy competition between global banks (Choi, Kodres and Lu, 2018; Agenor, Pereira da Silva, 2018).

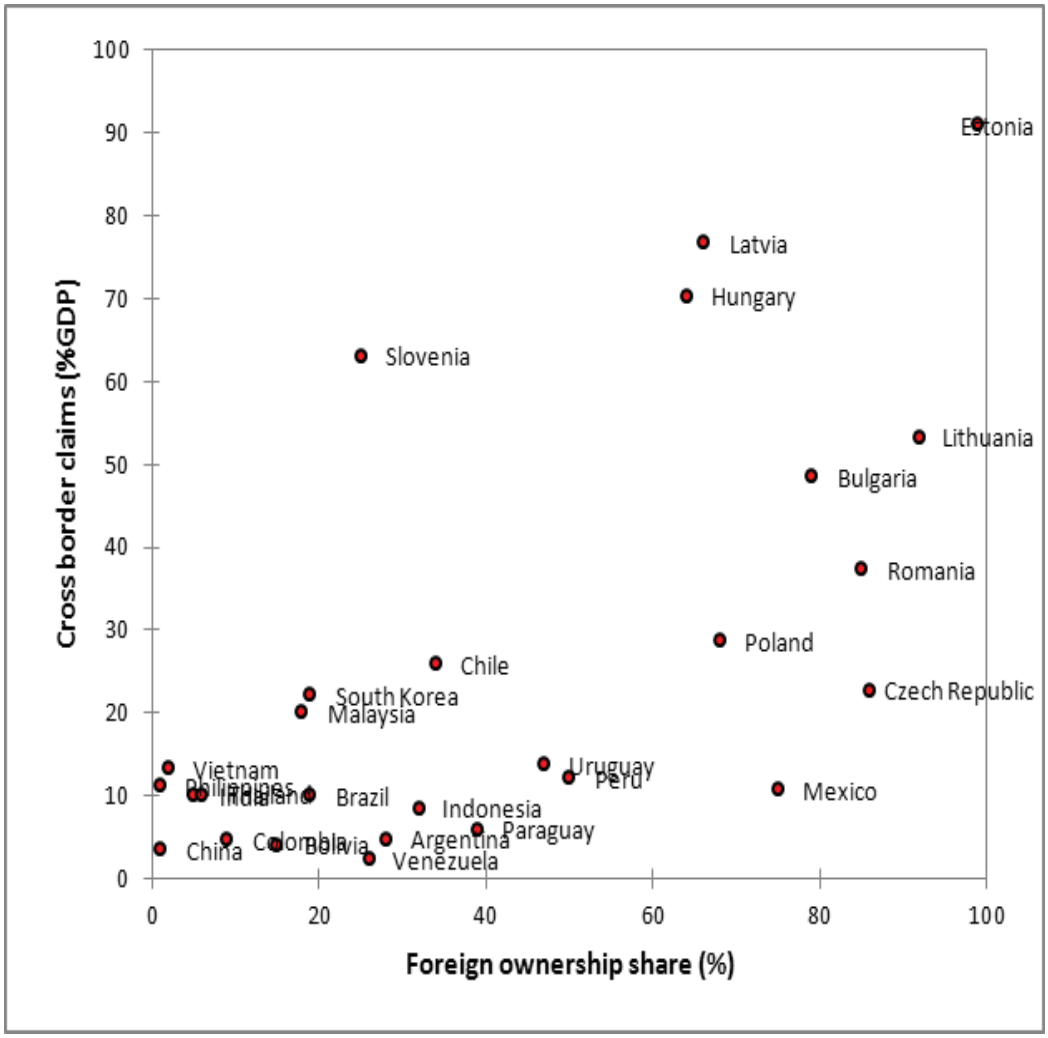
APPENDIX

Table A1. Characteristics of banking systems in emerging countries (2014)

Countries	Share of foreign banks (% of banking system assets)	Total cross- border bank claims (% GDP)	…of which for banks (% of GDP)	Cross border loans… (% of GDP)	…of which for banks (% of GDP)
Argentina	27	2.1	0.6	1.8	0.4
Bolivia	16	1.8	0.3	1.7	0.2
Brazil	12	12.3	6.1	8.8	4.4
Chile	20	17.5	7.8	14.1	6.4
Colombia	15	6.4	2.7	5.4	2.3
Mexico	70	9.7	2.6	6.7	2.4
Paraguay	51	6.8	4.5	4.9	2.7
Peru	51	13.7	6.2	12.8	5.8
Uruguay	92	15.6	4.0	13.0	2.3
Venezuela	16	4.2	1.8	3.8	1.7
India	3	9.5	4.9	7.4	3.4
Indonesia	37	10.8	4.0	9.0	2.8
South Korea	7	12.4	9.4	8.1	6.9
Malaysia	18	21.2	15.5	15.3	12.2
Philippines	1	10.2	5.0	7.9	3.9
Thailand	8	16.8	12.0	13.6	9.5
Vietnam	4	14.6	5.3	12.3	4.1
Bulgaria	62	24.5	12.0	18.3	6.8
Czech Republic	85	19.6	12.0	11.0	5.6
Estonia	97	31.1	22.5	20.0	12.7
Hungary	58	23.5	10.6	16.8	7.6
Latvia	58	24.7	17.0	17.9	12.1
Lithuania	91	22.2	16.3	13.8	11.2
Poland	61	18.2	10.4	9.8	5.8
Romania	80	18.1	11.2	13.8	8.2
Slovenia	25	24.7	11.1	16.6	7.7
China	1	9.9	6.7	7.6	4.9

Source: authors. Columns 1 is based on data from Claessens and van Horen [2014], Claessens et al. [2008], Jeon et al [2011], and the OECD. Columns 2-5 are based on authors' own calculation from BIS data, *Locational banking statistics*.

Figure A1. Relationship between the presence of international banks* and cross-border bank claims



* Foreign ownership share is defined as banks with assets of foreign ownership of more than 50%.
Source : authors' calculations.

Table A2: Description of variables

			Mean	Std. Dev.	Min	Max
Dependent variables						
Cross-border bank claims vis-à-vis all sectors	Gross amount of total cross- border bank claims ($ billions) vis-à-vis all sectors	*Locational Banking Statistics*, External positions (claims, deposits, loans…) of BIS reporting banks vis-à-vis all sectors in an individual emerging country, amounts outstanding BIS	41689.09	79808.79	62	1035967
Cross-border interbank loans	Gross amount of cross-border bank loans ($ billions) to banks	*Locational Banking Statistics*: cross-border loans of BIS reporting banks vis-à-vis bank sector in an emerging country, amounts outstanding BIS	17900.34	38806.26	9	506244
Cross-border bank claims vis-à-vis nonbank sector	Gross amount of cross-border bank claims ($ billions) vis-à-vis non-bank sector	*Locational Banking Statistics:* cross-border claims of BIS reporting banks vis-à-vis non-bank sector in an emerging country, amounts outstanding BIS	18596.99	30509.91	37	338076
Pull or domestic explanatory variables						
Rating Host	Long-term rating in foreign currency of the sovereign debt	Standard & Poor's, Moody's	10.90	3.49	.01	18
Growth host	Growth rate of real domestic GDP in dollars (%)	Calculation from Datastream data	4.04	4.08	-14.81	18.28
Foreign assets	Assets of located branches and subsidiaries out of total assets of the host country's banking system (%)	Calculated from Claessens & van Horen [2014], central bank data, OECD data, World Bank data	37.38	31.08	0	99
Domestic bank	Capital/Total assets	Bankscope	9.64	3.79	-43.33	24.93

capitalisation						
Domestic bank liquidity	Liquid assets/total assets		24.53	11.90	5.23	71.97
Domestic bank NPL nonperforming loans	Impaired loans / Gross loans		7.56	7.81	.27	56.49
Domestic bank profitability	ROA		1.01	2.62	-41.04	10.39
Domestic bank Z score	Sum of the ratio of capital at t and the average ROA over the period, divided by the ROA standard deviation over the period	Authors' own calculation from Bankscope based on Lepetit & Strobel (2013)	11.67	8.12	-4.100	46.58
Push or external explanatory variables						
Global factors						
VIX	Chicago Board of Options Exchange (CBOE) volatility index. It measures the implicit volatility from option prices on the S&P 500 equity index	Datastream	20.37	6.90	10.13	44.92
US interest rate	Fed Funds Rate		2.85	2.30	0.089	6.23
UE interest rate	ECB main refinancing operations interest rate		2.76	1.60	0.16	6.46
Weighted push factors *For each emerging country, the variable is weighted by the importance of the creditor country (lender banks). The weighting is: claims received by the emerging country from the home country of international banks divided by total claims received by the emerging country (weighting calculated based on BIS data). Authors' own calculations*						
Growth home (Euro zone, United States, Japan)	The weighted average of the three growth rates (%).	Calculation from Datastream data	1.22	1.53	-4.62	3.87
International bank capitalisation	Capital/ Total assets		5.22	2.55	1.78	18.62
International bank liquidity	Liquid assets/total assets		18.15	6.18	2.91	55.29
International bank NPL nonperforming loans	Impaired loans/Gross loans	Bankscope	2.53	1.43	.34	46.58
International bank Z score	Sum of the ratio of capital at t and the average ROA over the period, divided by the ROA standard deviation over the period. Authors' own calculation		17.80	2.62	3.56	65.70

	from Bankscope based on Lepetit & Strobel (2013)					
International bank macroprudential index: Prud Home	Global index	Cerutti, Claessens, Laeven (2017)	1.25	0.63	0.01	2.70

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