Banking across Borders

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Abstract

This paper develops and tests a theoretical model that allows for the endogenous deci-
sion of banks to engage in international and global banking. International banking, where
banks raise capital in the home market and lend it abroad, is driven by differences in fac-
tor endowments across countries. In contrast, global banking, where banks intermediate
capital locally in the foreign market, arises from differences in country-level bank ef-
ficiency. Together, these two driving forces determine the foreign assets and liabilities of
a banking sector. The model provides a rationale for the observed rise in global banking
relative to international banking. Its key predictions regarding the cross-country pattern
of foreign bank asset and liability holdings are strongly supported by the data.

Key words: international banking, cross-border lending, capital flows, trade in
banking services

1 Introduction

Banks have substantially expanded their activities across borders over the past two decades. This has happened in two ways. First, banks have invested more domestic capital in foreign countries, an operation which is defined as *international banking*. Second, they have to a much larger extent intermediated capital locally in foreign markets, an activity which is denoted as *global banking*. While growth in banking across borders has been similar in many countries, there has been significant heterogeneity in the extent to which banking sectors engage in international versus global banking.[1] The reasons for this have remained largely unexplored. This paper presents a theoretical model based on first principles which can explain these facts.

In the model, banks are the vehicles of international capital flows and provide intermediation services. When countries differ in their factor endowments and in banking technology, global and international banking both arise endogenously. The analysis reveals that *international banking* is driven by differences in rates of return to capital across countries. In contrast, *global banking* arises from differences in country-level bank efficiency. Together, the two driving forces determine the foreign asset and liability holdings of a banking sector. These key predictions, regarding the cross-country pattern of foreign asset and liability holdings, are strongly supported by the empirical evidence presented.

By providing a model that matches stylized facts and that is supported by the data, this paper proposes a new answer to the question why banking across borders occurs. It complements the portfolio view of international banks, where foreign bank activities result from a motive to diversify lending.[2] While most of the recent research focus has been on the risks of international and global banking,[3] this paper shows how the liberalization of banking across borders can foster the efficient allocation of capital and can increase aggregate banking sector efficiency.

In the model, symmetric entrepreneurs produce a single consumption good under constant returns to scale using capital and labor. Markets for production factors are perfectly competitive. As a non-standard element, there are financial frictions, which stem from two facts. First, the amount of external funds that an entrepreneur can raise and thus the size of a single firm are limited due to moral hazard. Second, entrepreneurs cannot obtain external financing from investors directly. Instead banks act as intermediaries channeling capital from depositors to firms. For this service, they collect an exogenous fee, which characterizes the efficiency of the banking sector in the economy.

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[1]Section 2 presents these stylized facts in detail.

[2]Aviat and Coeurdacier (2007) and Buch, Koch, and Koetter (2009) test the portfolio model empirically. They find contrasting empirical evidence detecting a "correlation puzzle".

[3]See e.g. Cetorelli and Goldberg (2010), Loranth and Morrison (2007).

These financial frictions drive a wedge between the gross return to capital (which is equal to one plus the marginal product of capital (MPK) under perfect competition) and the financial interest rate (that is, the expected gross return net of costs). The lower the efficiency of a country's banking sector, the more depressed its financial interest rate relative to its marginal product of capital.

When two countries integrate that differ with respect to their relative endowments of capital and labor and their banking sector efficiency, banking across borders occurs. As a consequence of differences in endowments and differences in efficiency, the service fee and the autarky financial interest rate vary between domestic and foreign banks. When entrepreneurs have a choice between raising capital from domestic or foreign banks, they prefer banks that demand a low interest rate and a low service fee. Banks therefore have an advantage if they are located in a capital abundant country, which gives them access to cheap capital, and if they are more efficient.

The volume of trade in banking services can be either measured in terms of the fees that a banking sector collects from foreigners or in terms of the foreign assets that it has on its aggregate balance sheet. The exact magnitude of differences in efficiency and differences in endowments between countries determines which banking sector exports banking services and holds foreign assets. Ceteris paribus, a country's foreign asset holdings are higher, the higher its efficiency advantage and the more capital abundant it is relative to the foreign country. Banking across borders enhances the efficient allocation of capital between countries and improves overall banking sector efficiency.

Two phases of integration are considered: capital account liberalization and subsequent banking sector liberalization. When capital accounts are liberalized, banks are allowed to raise capital in the domestic market and lend it to the foreign market but they cannot raise capital from foreign depositors. As a consequence, trade in banking services is limited and differences in banking sector efficiency across countries cannot be fully exploited. This is because the banking services exporting country necessarily exports capital at the same time. The interest rate therefore rises in the exporting country and declines in the importing country with the volume of trade. In equilibrium, advantages in terms of efficiency of one banking sector are offset by a higher financial interest rate and vice versa until entrepreneurs are indifferent between domestic and foreign banks.

When banking sectors are liberalized, banks are also allowed to raise capital in foreign markets. This eliminates any advantage for banks located in a capital abundant country. As a result, only banking sector efficiency matters for trade in banking services. The conflict between equalizing marginal products of capital and exploiting differences in banking sector efficiency disappears. Without any limiting force, the most efficient banking sector takes over the entire market and its foreign asset holdings expand.

While under capital account liberalization all banking across borders is *international banking*, banking sector liberalization allows banks to engage also in *global banking*. International banking is defined as the case where banks raise capital in the home market and lend it to a foreign market. In contrast, global banking denotes the case where banks raise capital abroad and intermediate it locally in the foreign market. This paper will employ these definitions throughout. *Banking across borders* is used to refer to both types of activities.[4] The relative importance of global and international banking depends on the efficiency and endowment characteristics of the integrating countries. The analysis shows that while international banking occurs if there are differences in endowments between countries, global banking arises from differences in the efficiency of banking sectors. Thus the two driving forces trigger two different activities and imply different internationalization strategies for banks. Together they determine the aggregate foreign assets and liabilities of a banking sector.

The empirical analysis of this paper finds strong support for the model based on information on foreign bank assets and liabilities from the Consolidated Banking Statistics of the Bank for International Settlements comprising a set of 25 mostly developed source countries and 90 recipient countries. Differences in endowments are proxied by differences in lagged capital-labor ratios. As a measure for bank efficiency, the lagged average ratio of overhead costs to total assets of a country's banking sector is employed. The regression results confirm three key implications of the model: (i) foreign assets are positively correlated with the relative capital abundance and banking sector efficiency of the source country; (ii) capital raised in a host market is larger the relatively more efficient the banking sector of the home country; and (iii) the extent to which foreign assets are financed by foreign liabilities decreases with the relative capital abundance of the source country. Comparative statics show that differences in endowments and in banking sector efficiency across countries are major determinants of foreign bank asset and liability holdings. A 10% decrease in the overhead costs of the source country relative to the recipient country increases foreign asset holdings by approximately 4.1%. At the same time, an increase in the source country's capital-labor ratio of 10% increases foreign assets by 3.5%.

In an extension, bank-to-bank lending as opposed to direct bank-to-firm lending is studied within the framework of the model. The related empirical findings that banking sectors engage more in bank-to-firm than in bank-to-bank lending in countries where the banking sector is relatively less efficient and where barriers to capital account transactions are low suggest further avenues for research.

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[4]There is no common usage of terms in the literature. The distinction between international and global banking is also found e.g. in McCauley, Ruud, and Wooldridge (2002).

2 Stylized Facts

There are six facts which a model of international and global banking should be able to match. First, there has been an enormous rise in the foreign asset holdings of banks over the past two decades.[5] Second, banks have been operating increasingly through foreign affiliates. Figure 1 shows the evolution of average bilateral asset holdings for a group of 25 source countries and a large set of recipient countries (solid line).[6] The dotted line illustrates that the share of local assets (local currency) in foreign assets, i.e. the share of foreign assets held through affiliates in the host market in the currency of the host market, has been steadily increasing over time.[7] Targets of the expansion were countries from all income groups, which can be seen from Figure 2.

Third, an increasing fraction of international bank business consists of intermediating capital locally in foreign markets. Figure 3 shows foreign assets and liabilities of different banking sectors split into assets and liabilities on the balance sheets of banks located in the home country or a third country (cross-border assets) and on the balance sheets of affiliates located in the respective recipient country (local assets).[8] The graphs illustrate that local assets of foreign affiliates are approximately matched by local liabilities. Foreign affiliates intermediate foreign capital to a large extent locally within the foreign market. The literature distinguishes two different forms of banking across borders: *international banking* and *global banking*. International banking denotes the case where a bank raises capital in its domestic market and lends it to a foreign market. Global banking, in contrast, describes the situation in which a bank raises funds in a foreign market and lends them to the same (foreign) market. In this context, the increase in activities by foreign affiliates reflects an increased importance of global banking relative to international banking.[9]

Forth, the modes of international operations differ considerably across source countries, which is also apparent from Figure 3. While Spanish banks operate mainly through foreign affiliates (more than 65% of all assets are held by foreign affiliates), Japanese banks conduct international business predominantly from home; more than 80% of all foreign assets are held by banks located in Japan. Given the arguments made before, this suggests that the extent to which banking sectors engage in

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[5]Bruno and Shin (2012) argue that part of this expansion was due to an increase in the balance sheet capacity of banks, i.e. in global liquidity, as a result of lower perceived risk.

[6]While the figure plots the average USD value of bilateral foreign assets, the increase in foreign assets has been substantial even as a fraction of world GDP or compared to the increase in international trade during the same period. See Comittee on the Global Financial System (2010b).

[7]Researchers at BIS have pointed this out: e.g. McCauley, Ruud, and Wooldridge (2002) and McCauley, McGuire, and von Peter (2010).

[8]The data that underlies the two graphs in Figure 3 was kindly provided by the Bank for International Settlements.

[9]McCauley, Ruud, and Wooldridge (2002) were the first to argue that there has been a move from international towards global banking, a phenomenon they call the "globalisation of international banking". See also McCauley, McGuire, and von Peter (2010) and McCauley, McGuire, and von Peter (2012).

global banking versus international banking is heterogeneous across countries: Spanish banks engage more in global banking, while Japanese banks do more international banking.[10]

Figure 3 also illustrates the fifth stylized fact: some banking sectors are net lenders, some are net borrowers. The German banking sector for example is a net exporter of capital as it holds net claims. It has more foreign assets than foreign liabilities. The US banking sector, in contrast, is a net importer of capital as its foreign liabilities exceed its foreign assets.

Finally, banking sector and capital account liberalization in the recipient country have differential effects on foreign bank assets. Figure 4 plots the level of foreign bank assets for a large set of country pairs as a function of Financial Freedom, which measures the openness of the banking sector in the recipient country. In each panel, the degree of capital account openness of the recipient country varies. It increases from the left to the right.[11] Note that the range of the y-axis is different in each panel. The figure indicates that for the same level of financial freedom, a reduction in restrictions to capital account transactions in the recipient country increases foreign asset holdings. At the same time, banks hold more assets in countries that exhibit lower bank entry barriers; this positive effect is higher, the more open these countries to financial flows.

The model presented in this paper can accommodate and explain these six facts simultaneously: the surge in foreign asset holdings and in activities by foreign affiliates; the increased importance of global banking relative to international banking; heterogeneity in the extent of international and global activities across banking sectors; the pattern of net bank-intermediated capital imports and exports and the differential effects of capital account and banking sector liberalization.

3   Literature

The existing literature has focused on several different aspects of banking across borders. A large strand of the literature analyzes the implications of multinational banking for regulation[12] and financial stability.[13] In this context, several papers study the role of internal capital markets for multinational banks (see Cetorelli and Goldberg (2009), de Haas and van Lelyveld (2010)). Cerutti, Dell'Ariccia, and Martinez Peria (2007) and Dell'Ariccia and Marquez (2010) investigate the organizational choice of banks. Lehner (2009), Buch, Koch, and Koetter (2009) and Blas and Russ (2010) are concerned

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[10]This interpretation of the data underlies the assumption that global banking requires a physical presence abroad and mainly occurs through foreign affiliates while international banking can be more easily conducted from the home country. Note that the notion of international banking includes carry trade where banks trade assets in order to exploit interest rate differentials across countries.

[11]The sample is the cross-section of the year 2005 as described in the empirical part of this paper.

[12]See e.g. Calzolari and Loranth (2010) and Loranth and Morrison (2007).

[13]Navaretti, Calzolari, Pozzolo, and Levi (2010) and Cetorelli and Goldberg (2010) for example discuss the role of multinational banks during the recent financial crisis.

with the modes of foreign bank entry.

Only few theoretical papers, however, explore the determinants of banking across borders.[14] Most models derive positive foreign asset holdings by banks from a motive to diversify the lending portfolio (e.g. Buch (2003), Buch, Koch, and Koetter (2009)). Ennis (2001) assumes that information problems are reduced when banks operate across regions. In Blas and Russ (2011), firms borrow from abroad as they randomly obtain a cheaper cost draw.[15] In Eaton (1994), financial centers emerge because authorities differ in their preferences to protect debtors versus creditors and in their need for seignorage revenues.

This paper also relates to the international finance and portfolio literature (see e.g. Martin and Rey (2004), Portes and Rey (2005), Aviat and Coeurdacier (2007)). First, it shows that a gravity relationship for bank assets, where foreign assets increase one to one with the GDP of the source and the recipient country, does not hold in general: when banking sectors engage in global banking, the link between domestic market size and foreign asset holdings is weakened. This is also in contrast to a recent paper by Brueggemann, Kleinert, and Prieto (2011), who obtain a gravity equation for foreign bank loans in a partial-equilibrium model where a country's interest rate and its demand for bank loans are exogenous. Moreover, this paper confirms recent empirical findings by Alfaro, Kalemli-Ozcan, and Volosovych (2011) that private capital flows downstream as it provides evidence that banks from capital abundant countries invest in the private sector in capital scarcer countries.

More broadly, this paper adds to the growing literature on services trade.[16] It also relates to works on international capital flows and financial frictions. The theoretical framework builds on Ju and Wei (2010) who are concerned with circular capital flows, a topic outside the scope of this paper. In their paper, financial underdevelopment of a country is circumvented in that capital leaves a country as investor capital and reenters as production FDI. In Antras and Caballero (2009) in contrast, trade in goods helps alleviate financial frictions. Here, it is trade in banking services that allows more capital to flow into less financially developed countries suggesting that with banking sector liberalization, the mechanisms presented in the above papers become less important.

Many papers investigate the factors that determine foreign bank entry, the mode of bank entry and the consequences of bank entry for host countries empirically. A review of the literature is provided by Goldberg (2007) and by Cull and Martinez-Peria (2010). The empirical relations which are derived explicitly from the theoretical model, however, have not been investigated before. Confirming earlier

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[14]Early works that discuss the internationalization strategies of banks are Aliber (1984) and Grubel (1989). See Williams (1997) for a literature review on two opposing theories: eclectic versus internationalization theory.

[15]In Blas and Russ (2010), an earlier version, banks offer differentiated products just as manufacturing firms.

[16]See Francois and Hoekman (2010) for a review of recent development in services trade research.

empirical findings that institutions matter for foreign bank assets (see Papaioannou (2009)) and that banks engage more in foreign countries that have higher GDPs, fewer capital controls, lower bank entry barriers and that are closer in terms of distance and culture (see e.g. Buch (2003), Focarelli and Pozzolo (2005), Buch and Lipponer (2007)), this paper examines the omitted effects of differences in endowments and differences in banking sector efficiency between countries on bilateral foreign asset and liability holdings.

4 Empirics

The empirical part of this paper tests three key hypotheses of the model.

Testable implication A *Foreign assets of banks from country j invested in firms in country i are positively correlated with $\Delta(K^a/L) = K_j^a/L_j - K_i^a/L_i$ and $\Delta c = c_i - c_j$.*

Foreign assets should be higher, the more capital abundant country j and the more efficient the banking sector of country j relative to country i (see Propositions **??** and **??**).

Testable implication B *Foreign liabilities of banks from country j towards depositors in country i are positively correlated with $\Delta c = c_i - c_j$.*

If banking sectors are liberalized, the more efficient banking sector expands. Therefore, deposits raised by banks from country j in country i are higher if the banking sector of country j is more efficient than the one of country i (see Proposition **??**).

Testable implication C *The ratio of foreign liabilities to foreign assets held by banks from country j in country i is negatively correlated with $\Delta(K^a/L) = K_j^a/L_j - K_i^a/L_i$.*

The ratio of foreign liabilities to foreign assets is a function of endowments. Given that banks from country j have an efficiency advantage over banks from country i, the share of loans/assets that are funded through deposits raised locally in country i decreases with the relative capital abundance of country j (see Proposition **??**).

The empirical analysis is split into two parts. First, implication A is tested based on data on foreign bank assets. In a separate section, evidence on the validity of testable implications B and C is provided using additional information on foreign bank liabilities.

4.1 Results on testable implication A

4.1.1 Empirical strategy, data and variables

The baseline regression to test implication A is as follows:

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\begin{aligned}
\log(\text{assets}_{ijt}) \quad = \quad & \delta_1 \Delta \log(K/L_{ijt}) + \delta_2 \Delta \log(c_{ijt}) \\
+ \quad & \delta_3 \text{ openness to foreign bank entry}_{it} \\
+ \quad & X'_{jt}\beta_j + X'_{it}\beta_i + X'_{ij}\beta_{ij} + [\alpha_t + \alpha_i + \alpha_j] + \epsilon_{ijt}.
\end{aligned} \tag{1}
$$

The dependent variable measures assets held by banks from source country j in recipient country i at time t. The right hand side variables of the regression can be categorized broadly into four groups. The first group comprises the two key variables of interest, which measure differences in endowments and differences in banking sector efficiency between countries. Both enter the regression as log differences, which allows to interpret coefficients as elasticities.[17] Δ stands for the difference in variables between countries i and j, not for differences over time. Explicitly, $\Delta \log(K/L_{ijt}) = \log(K/L_{jt}) - \log(K/L_{it})$ and $\Delta \log(c_{ijt}) = \log(c_{it}) - \log(c_{jt})$. From testable implication A, both coefficients δ_1 and δ_2 are expected to be positive. The higher the capital endowment of country j relative to country i, the larger foreign asset holdings of country j in country i. Moreover, the more efficient the banking sector in country j relative to country i, the larger the participation in lending of banks from country j in country i. The regression also includes a proxy for barriers to bank entry in the recipient country. Banking sector liberalization should increase bank asset holdings of country j in recipient country i, i.e. $\delta_3 > 0$.

The second group of variables, subsumed under X_{ijt}, consists of country-pair specific variables that proxy transaction and information costs: the log of distance, a dummy for colonial relationship and dummies for a shared official language, currency and legal system. The third and fourth group collect source country (X_{it}) and recipient country variables (X_{jt}), which comprise the log of population and the log of GDP, a dummy for systemic banking crisis as well as measures of financial openness and of institutional quality.[18]

One of the biggest challenges in testing implication A is to find good proxies for rates of return to capital and banking sector efficiency for a large set of countries. According to the theory, foreign asset holdings are driven by differences in marginal products of capital between countries at autarky

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[17]The coefficients are estimated using log differences because this facilitates their interpretation. Results are qualitatively the same if absolute difference are used.

[18]Detailed information on control variables and data sources can be found in the Data Appendix.

capital-labor ratios. These are not observable however. Observed contemporaneous capital-labor ratios, in turn, are endogenous to international capital flows and therefore to foreign bank assets. The strategy pursued in this paper is to proxy differences in rates of return to capital by differences in 10-year lagged capital-labor ratios. These are obtained from the Penn World Tables 6.2 and are adjusted for differences in human capital following Hall and Jones (1999).[19] This is close to what the theory prescribes, but attenuates endogeneity and reverse causality concerns. In order to control for factors that affect country-level productivity, proxies for institutional quality are added. The main specification includes a measure of property rights protection.[20]

The preferred measure of banking sector efficiency comes from the Financial Structure Database provided by the World Bank (see Beck, Demirguc-Kunt, and Levine (2000)). It is the variable *overhead*, which is based on bank-level data and computed as the unweighed average of overhead costs to total assets over all banks resident in a given country. Overhead costs collect the cost of renting and maintaining office space, computers etc. and are independent of the cost of capital. The proxy therefore preserves the sharp distinction between funding costs and the costs of providing banking services of the theoretical model.[21] However, it includes foreign owned banks, which implies that contemporaneous values of a country's average overhead costs are endogenous to the operations of foreign banks and thus to foreign bank asset holdings in that country. To address endogeneity and reverse causality concerns in this context, the variable is also lagged by ten years. Therefore, past differences in capital-labor ratios and in banking sector efficiency are to explain current foreign bank asset holdings, which relies on the presumption that convergence and adjustments take time.

Info1rmation on foreign bank assets and liabilities comes from the Consolidated Banking Statistics (CBS) maintained by the Bank for International Settlements (BIS). Foreign bank assets are proxied by the so-called international claims vis-a-vis the non-bank private sector. These assets comprise the consolidated claims of all deposit taking corporations whose headquarters are located in country j towards residents of country i with one exception: they exclude the claims of foreign affiliates denoted in the currency of the host market, which constitute about 16% of total foreign assets.[22] Claims cannot be distinguished by asset class, but information from other BIS statistics indicates that about two thirds of the assets are loans and deposits (see Aviat and Coeurdacier (2007)).

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[19]For more information see the Data Appendix.

[20]In the theoretical model, institutional quality is captured by the parameter λ which reflects the success probability of the firm. Ju and Wei (2010) interpret λ as a country's degree of property rights protection. Empirically, institutions have been shown to matter for bank flows by Papaioannou (2009).

[21]It is also close to the notion of efficiency that emerges in a framework with two-sided moral hazard as formulated in Holmstrom and Tirole (1997). There the lower the monitoring cost c of a bank, the larger its lending volume for a fixed amount of equity capital.

[22]A breakdown by sector is not available for total foreign assets. See the Data Appendix for more details.

Omitted variable bias is a key issue in most cross-country regressions. A standard remedy is to include both source country and recipient country fixed effects in the cross-sectional analysis or to only exploit the time variation in the data. The endowment and the efficiency coefficient, however, cannot be estimated on the cross-section when source country and recipient country fixed effects are controlled for at the same time.[23] Furthermore, within estimates are not meaningful as 10-year lagged values are employed in order to solve the endogeneity issue of contemporaneous differences in MPKs and contemporaneous differences in banking sector efficiency.[24] Also, the model is designed to explain long-run developments and the cross-sectional variation in the data. Equation 1 is therefore estimated on the cross-section where source and recipient country fixed effects are included separately. As a check, it is also estimated on the pooled dataset where source country and recipient country fixed effects (plus year fixed effects) can be accounted for simultaneously.

The CBS data is reported on a quarterly basis in current \$US. For the analysis, yearly averages are taken. After merging data from the different sources and excluding non-positive observations[25] as well as offshore centers as recipients, the panel dataset comprises a set of 25 source and 90 recipient countries, which cover all income groups. It spans the period from 1999 until 2007 and yields 8,163 observations.[26] For the cross-sectional analysis, the year 2005 is chosen. It is the most recent year for which the Schindler Index (see Schindler (2009)), a measure of capital account openness, is available and provides 1,249 observations. Summary statistics are provided in the Data Appendix.

4.1.2 Evidence from simple statistics

Table 1: 4 Bins

# Bin	Parameters	Expected asset levels	Expected marginal effects	
			$\Delta(K/L_{ij})$	Δc_{ij}
Bin 1	$\Delta(K/L_{ij}) \geq 0$, $\Delta c_{ij} \geq 0$	large	positive	positive
Bin 2	$\Delta(K/L_{ij}) < 0$, $\Delta c_{ij} > 0$	intermediate	positive	positive
Bin 3	$\Delta(K/L_{ij}) > 0$, $\Delta c_{ij} < 0$	intermediate	positive (zero)	zero (positive)
Bin 4	$\Delta(K/L_{ij}) < 0$, $\Delta c_{ij} < 0$	zero	zero	zero

The theoretical model developed in this paper identifies two reasons why banking across borders

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[23]Note that log differences are a linear combination of characteristics of country i and country j. When the log of differences in efficiency and of differences in endowments is used, variation in the data is not enough to estimate the coefficients.

[24]An IV approach is also taken to estimate the efficiency coefficient. Exports of ICT services serve as the instrument. The estimated efficiency coefficient is significantly larger. For details see the Online Appendix available under http://www.eui.eu/Personal/Researchers/Niepmann/OnlineAppendix.

[25]Zeros constitute approximately 5% of all observations in the sample on assets, a share that is much lower than found in most trade data.

[26]For more information on the sample, see the Data Appendix.

occurs. First, if a country's banks are more efficient than those in a given recipient country, they expand abroad by intermediating capital locally in the foreign market. Second, if a country is capital abundant, its banks invest in capital scarce countries where the return to capital is higher. Asset holdings of a country in a given recipient country are therefore expected to be larger, the more efficient the banking sector of the source country and the more capital abundant the source country relative to the recipient country. Simple statistics already suggest a strikingly strong relationship in line with these predictions.

In Figure 5 country pairs are grouped into four bins with different characteristics. The bars reflect the average foreign bank assets for each bin in 2005.[27] Bin 1 collects country pairs for which $\Delta(K/L_{ij}) > 0$ and $\Delta c_{ij} > 0$, i.e. the source country is relatively capital abundant and has the more efficient banking sector than the recipient country. In Bin 2, $\Delta(K/L_{ij}) < 0$ and $\Delta c_{ij} > 0$ and vice versa in Bin 3. Bin 4 includes country pairs where the source country is relatively capital scarce and hosts the less efficient banking sector, i.e. $\Delta(K/L_{ij}) < 0$ and $\Delta c_{ij} < 0$. Therefore, Bin 1 is expected to show the highest level of foreign bank assets, with Bins 2 and 3 taking intermediate values. In Bin 4, average foreign bank assets should be lowest. Table 1 summarizes bins and expected levels. The observed levels as displayed in Figure 5 are fully in line with these predictions.

4.1.3 Baseline regression results

To start with, Equation 1 is run on the cross-section. This is a litmus test for the two driving forces of foreign bank asset holdings. Column (1) of Table 2 shows the results. The efficiency and the endowment coefficient are both positive and highly significant taking a value of 0.41 and 0.35 respectively. The signs of all other coefficients are also in line with expectations. In particular, asset holdings increase in financial freedom of the recipient country and in capital account openness of the source country. The effect of capital account openness of the recipient country is smaller and the standard error related to the respective coefficient large, but this is likely due to a multi-collinearity problem as financial freedom and openness of the recipient country are highly correlated. When the Schindler Index, which provides separate measures for inflow and outflow restrictions, is used instead of the Chinn & Ito Index, financial freedom and openness of the recipient country are both highly significant.[28] The dummy that indicates a systemic banking crisis in the recipient country is positive, which confirms earlier findings in the literature that foreign banks have stabilizing effects during crises in the host market (see de Haas and van Lelyveld (2006), Cetorelli and Goldberg (2010) and de Haas

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[27]Assets are normalized by dividing them through the product of the GDPs of the source and the recipient country.

[28]See the Online Appendix for more details.

and van Lelyveld (2010)).[29] The magnitude of the other dummies and the estimated effect of distance are similar to estimates reported in related studies.

Columns (2) and (3) include source country and recipient country fixed effects, respectively. When source country fixed effects are included in the regression, only variation across recipient countries is used to estimate coefficients. The regression therefore tests whether recipient countries with lower banking sector efficiency and lower capital labor ratios are a bigger target for foreign banks. With recipient country fixed effects, only the variation across source countries is employed. The regression thus estimates whether source countries with higher capital-labor ratios and higher banking sector efficiency hold more assets abroad. In Column (2), where source country fixed effects are included, the estimates of δ_1 and δ_2 are lower in magnitude and their standard errors are larger. Note that the endowment coefficient is significant at a 1% significance level when it is estimated in absolute rather than log differences.[30] When recipient country fixed effects are controlled for, coefficients increase in magnitude and in significance. This suggests that variation across source countries helps identifying the effects and that unobserved recipient country heterogeneity biases estimates downward.

When the data is pooled across years, source and recipient country fixed effects can be controlled for simultaneously. Column (4) of Table 2 includes year fixed effects and Column (5) year, source and recipient country fixed effects. The efficiency coefficient is robust to these alternative specifications. It remains positive and significant at a 1% significance level taking a value of 0.174, which is similar to the estimate reported in Column (2). The point estimate of the endowment coefficient remains stable, but turns insignificant when all three types of fixed effects are included. This may be due to the fact that capital-labor ratios are persistent over time so that only little variation is added by pooling the data. While precise estimation of the effects is difficult, the results clearly suggest that foreign bank assets increase with the capital abundance of the source country and its advantage in terms of banking sector efficiency relative to the recipient country.

4.1.4   Comparative statics

How large are the effects of endowments and efficiency differences on bank assets? The following quantifications are based on the estimates presented in Column (1) of Table 2 implying an efficiency coefficient of 0.41 and an endowment coefficient of 0.35.

If the German banking sector (35% quantile in 1995) was as efficient as the Dutch (1% quantile in 1995), then bank asset holdings of German banks would increase by around 112%. If, in contrast, the

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[29]The dummy for systemic banking crisis in the source country is excluded in Columns (1) to (3) as there was no banking crisis in the set of source countries in 2005.

[30]The results for absolute differences are reported in the Online Appendix.

Netherlands were as capital abundant as Germany, foreign assets of Dutch banks would increase by 8.25%. A similar comparison can be made for Spain and Brazil. If Spanish banks had the efficiency of Brazilian banks, asset holdings by Spanish banks (92% quantile versus 29% quantile in 1995), would decline by around 28%. If Brazil had the same endowments as Spain (54% quantile versus 85% quantile in 1995), foreign assets of Brazilian banks would show a 58% increase.

Next, consider the effect of banking sector liberalization in the recipient country. The financial freedom index of Mexico increased from 30 in 1995 to 70 in 2005. With a financial freedom coefficient of 0.01, the change in the index explains an increase in foreign asset holdings of around 40%. These quantifications suggest that differences in banking sector efficiency and differences in endowments across countries together with the degree of banking sector liberalization in the recipient country are major determinants of banks's foreign asset holdings.

4.1.5 Robustness

In the following, the robustness of the results is explored. First, it is shown that results do not change when differences in banking sector efficiency and differences in endowments are proxied by alternative measures. Second, the action in the data is shown to be where it is expected. Third, competing theories are excluded as an explanation for the empirical findings.

In Column (1) of Table 3, information on marginal products of capital from Caselli and Feyrer (2007) is used to proxy differences in rates of return to capital. Caselli and Feyrer (2007) take the income share of reproducible capital and relative prices of capital and consumption goods into account when calculating marginal products of capital. Despite the considerable reduction in sample size, the endowment coefficient hardly changes in terms of magnitude and remains significant at a 10% significance level when this alternative measure is used.

As an additional robustness check, differences in banking sector efficiency between countries are proxied by 10-year lagged differences in net interest rate margins. In contrast to overhead costs over total assets, the net interest rate margin is a blurred measure of efficiency because it is affected by funding costs and the degree of competition in the banking market. In order to correct for this, information on the concentration of the banking sector in the source and the recipient country as well as the log difference in lending interest rates (also 10-year lagged values) are included in the regression. Estimates reported in Column (2) of Table 3 are very similar to previous results.[31]

Next, country pairs are grouped into bins as in Section 6.1.2 and the constant, the endowment and the efficiency coefficient are estimated separately for each bin. This allows to check whether differences

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[31]The lending interest rate is the rate charged by banks on loans to prime customers (Source: WDI).

in the level of foreign assets across groups as detected in Figure 5 are statistically significant and whether marginal effects across bins are consistent with the model (see Table 1 for the description of the four bins and the expected marginal effects). Table 4 displays the results. The dummies for Bins 2, 3 and 4 are negative and statistically significant which confirms what was apparent from Figure 5. More interestingly, the efficiency coefficient is not significant for Bins 3 and 4, i.e. if $\Delta c_{ij} < 0$. As long as the source country's banking sector is less efficient than the one of the recipient country, there seems to be no effect of changes in $\Delta \log(c_{ij})$ on foreign assets, similar to what the theoretical model suggests. The marginal effects of differences in endowments merely differ across bins and have the correct signs. Foreign assets are the lower, the capital scarcer a source country relative to the recipient country. Overall, the action in the data is where the mechanisms discussed in the theoretical part of this paper suggest it should be.

In order to see how the regression performs across income groups, the sample is divided into low, lower middle, upper middle and high income recipient countries. Results of the regressions on the four sub-samples are shown in Columns (3) to (6) of Table 3. Both the efficiency and the endowment coefficient are positive and significant for high income recipients whereas effects are hard to identify for low income recipients where the number of observations is considerably smaller.[32] While differences in endowments seem to play a large role for foreign assets invested in upper middle income countries, differences in efficiency appear to be more important for the expansion of banks into lower middle income countries. This explains why coefficients change in the following when the sample of recipient income countries is truncated. Overall, the picture is largely similar across recipient income groups.

The literature has argued that banks follow their customers abroad.[33] Firms, which are active abroad are likely to operate in locations with cheap labor, i.e. low capital labor ratios.[34] At the same time, they mostly come from developed countries where banking sector efficiency is high. The estimation results could therefore simply reflect the fact that banks serve domestic clients in foreign countries. To check the validity of this hypothesis, the log of the flow of foreign direct investment from country j to country i is included in the baseline regression. It should be correlated with the financing needs of firms from country j operating in country i and therefore with the volume of lending that arises because banks serve their domestic clients abroad. There is an obvious reversed causality problem: FDI flows may be affected by how much money firms are able to borrow from their home

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[32]The negative effect of financial freedom on assets in upper middle income countries goes away when information on inflow and outflow restrictions from Schindler (2009) is used instead of the Chinn & Ito Index.

[33]Evidence in line with the follow-your-customer hypothesis is presented in e.g. Goldberg and Saunders (1981), Grosse and Goldberg (1991).

[34]Differences in labor costs are the factor driving vertical FDI. See e.g. Brainard (1993), Hanson, Mataloni, and Slaughter (2005).

banks. To address this issue, lagged values (3-year lags) of FDI flows instead of current ones are used.[35] Column (7) shows the results. The coefficient on FDI flows indicates a positive relationship between foreign direct investment and bank asset holdings. At the same time, the efficiency and endowment coefficient are both significant. Thus the follow your customer motive may be relevant, but is probably only a part of the story.[36]

According to portfolio theory, banks should invest in countries that exhibit assets returns that are negatively correlated with domestic returns (see e.g. Martin and Rey (2004)). In order to account for this, the baseline regression is estimated controlling for the correlation in stock market returns between country i and j.[37] Column (8) of Table 3 reports the results. As information on stock market correlations is only available for a smaller set of countries, the number of observations is more than halved. This, together with the fact that the reduced sample excludes many lower middle income countries, might be the reason why the efficiency coefficient turns insignificant. Regressions that sequentially include the variable $correlation_{ij}$ and information on differences in endowments and on differences in efficiency show that the interaction between these variables is negligible.

Several other robustness checks are performed, e.g. the dependent variables is replaced by total foreign assets including all sectors as counter parties and overhead costs and capital-labor ratios are lagged by an alternative number of years. See the Online Appendix for more details and more results. None of these checks alter the conclusion that both differences in rates of return to capital and differences in banking sector efficiency across countries are important determinants of foreign bank assets.

4.2   Evidence on testable implications B and C

Testable implications B and C make predictions about the liability structure of internationally active banks. The extent to which these can be tested is limited by the available information on liabilities. The Consolidated Banking Statistics only contain data on the liabilities of foreign affiliates, whose headquarters are in country j and which are located in country i, towards residents of the host country in local currency (so called local liabilities in local currency). These only partially represent the aggregate foreign liabilities of a banking sector. Local liabilities in local currency are likely to reflect those funds that are invested locally and may therefore capture global banking activities. Whether

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[35]The quality of the FDI data is not very good, which limits the econometric techniques that can be applied. There are a lot of missing observations in the data. The three-year lag is the one that preserves the largest number of observations.

[36]The presence of firms from the home country in a foreign market may give banks an advantage in going international. However, once established in a foreign market, banks start to also serve customers from countries other than their home country. See e.g. Seth, Nolle, and Mohanty (1998).

[37]A description of the variable $correlation_{ijt}$ can be found in Coeurdacier and Guibaud (2011).

differences in endowments do also drive local liabilities depends on the extent to which banks use foreign affiliates to access foreign funding markets and in how far those liabilities are denoted in local currency.

There are two more drawbacks. The sample is not split by sector. Borrowing from banks and the public sector, which is likely to be driven by additional factors and which is an important component of banking across borders, is also included in foreign liabilities.[38] In this respect, the data may be blurred. Third, the number of observations is small as fewer countries report on liabilities. The empirical analysis is based on the cross-section of the year 2005, which yields 493 positive observations.[39] Summary statistics for the liability sample and information on included source and recipient countries are given in the Data Appendix.[40]

4.2.1 Foreign liabilities and efficiency advantages

Testable implication B states that foreign liabilities are the larger, the more efficient the source country relative to the recipient country. To test this prediction, the following equation is estimated:

$$\log(\text{liabilities}_{ij}) = \delta_2 \Delta \log(c_{ij}) + X'\beta + [\alpha_i + \alpha_j] + \epsilon_{ij}. \tag{2}$$

The dependent variable comprises the liabilities of banks from country j in country i. The key interest lies in the effect of differences in banking sector efficiency on foreign liabilities. The model predicts $\delta_2 > 0$, i.e. the larger the source country's efficiency advantage, the more its banks expand abroad by raising capital in the foreign market. X includes the same set of controls as before plus a dummy for a common border.[41]

Column (1) of Table 5 reports the baseline results. Consistent with the theoretical model, the efficiency coefficient δ_2 is positive and highly significant. It takes a value of 0.526, which implies that a 10% decrease in overhead costs to total assets in the source country increases its liabilities towards residents in country i by 5.26%. The endowment coefficient is insignificant suggesting that endowment differences do not play a major role and that local liabilities mainly reflect the magnitude of local intermediation in the foreign market. The effect of capital account openness of the source

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[38]For the set of countries contained in the liability sample, interbank lending amounts on average to 34% of total international assets in 2005. Assets vis-a-vis the non-bank private sector represent approximately 45% leaving around 20% for the public sector.

[39]Due to data limitations, the analysis is not conducted on the panel.

[40]Around 22% of observations are lost because zeros are excluded from the sample. When a selection model is estimated, the second-stage estimate of the efficiency coefficient is essentially the same as without the adjustment. See the Online Appendix for details.

[41]This dummy was excluded from previous regressions as it turned out insignificant in all regressions with assets as dependent variable.

country approximately triples compared to previous estimations. It increases from a point estimate of 0.361 (see Table 4 Column (1)) up to 1.215.

Column (2) includes source country fixed effects, Column (3) recipient country fixed effects. The number of observations is not enough to compute the F-statistics when recipient country fixed effects are included. Therefore, reported standard errors have to be treated with care. Still, as before, source country fixed effects tend to lower the effect and the significance of the coefficients, while recipient country fixed effects have the opposite effect.

In Column (4) and (5), results of regressions performed on two different subsamples are reported. Column (4) includes only high income recipient countries, Column (5) excludes them. The efficiency coefficient takes a similar positive value and is significant for both groups. Interestingly, the endowment coefficient becomes large and highly significant for high income recipients. This indicates that among this group of countries, the more capital abundant the source country relative to the recipient country, the more foreign liabilities in local currency it has. This may be explained by the fact that foreign liabilities comprise liabilities towards all sectors and that high income countries are more financially integrated reflected in increased borrowing also from foreign banks and the public sector.

4.2.2 International versus global banking

Testable implication C states that the share of foreign liabilities to foreign assets decreases with the relative capital abundance of the source country. The more capital abundant it is, the more it is involved in international banking relative to global banking, which raises its foreign assets relative to its foreign liabilities. This hypothesis is tested based on the following regression:

$$\log(\frac{\text{liabilities}}{\text{assets}}_{ij}) = \delta_1 \Delta \log(K/L_{ij}) + X'\beta + [\alpha_i + \alpha_j] + \epsilon_{ij}. \tag{3}$$

The dependent variable is the ratio of foreign liabilities to foreign assets. The regressors consist of a set of controls X as well as $\Delta \log(K/L_{ij})$, the variable of interest here. The model predicts $\delta_1 < 0$. By taking the ratio, the dependent variable should be normalized with respect to size and transaction costs that affect cross-border lending and local borrowing symmetrically. Therefore, distance as well as variables related to economic size (population, GDP) are excluded as controls. GDP per capita is included instead in order to account for the fact that the share of local liabilities in local currency to foreign assets varies systematically with income as Figure 2 indicates.

Column (1) of Table 6 shows the baseline results. The endowment coefficient is negative and significant at a 5% significance level which indicates that the ratio of foreign liabilities to foreign

assets declines with the relative capital abundance of the source country, just as predicted. More specifically, a 10% increase in the capital-labor ratio of the source country lowers its foreign liabilities relative to its foreign assets by around 5%. The effect of efficiency differences is insignificant, which is also in line with the theoretical model. Column (2) includes source and Column (3) recipient country fixed effects. As before, standard errors in Column (3) are problematic because of the small sample size and the large number of estimated coefficients. Again effects become weaker when source country fixed effects are included and stronger with recipient country fixed effects. The negative efficiency coefficient in Column (3) indicates that differences in banking sector efficiency impact foreign assets and liabilities asymmetrically.

In Columns (4) and (5) results are presented for lower income and high income recipient countries separately. The regression performs much worse between high income countries with an R^2 of only 0.067 in contrast to 0.279 for lower income recipients. Furthermore, the coefficient δ_1 is only significant when the regression is based on the sample of lower income countries. While this cannot be interpreted as direct evidence, it is fully in line with the theoretical predictions. Differences in capital-labor ratios are especially stark between countries of different income groups. Therefore, international banking in addition to global banking should play a major role between them. It should play less of a role between countries with similar capital-labor ratios so that the ratio of foreign liabilities to foreign assets should not be driven by $\Delta(K/L_{ij})$ for them.

In Column (6), the dependent variable is modified. International assets vis-a-vis the non-bank private sector are replaced by total foreign assets, which comprise assets invested in all sectors, i.e. also loans to banks and the public sector. The sample, as in Column (4), only includes lower income recipients. The endowment coefficient remains negative and highly significant. The effect of financial freedom on the ratio of foreign liabilities to foreign assets is positive and highly significant in Columns (4) and (6), which suggests that barriers to bank entry harm the access to foreign funds more than the possibility to invest abroad. This vindicates the assumption made in the model that barriers to bank entry prohibit local deposit taking, but do not harm lending to foreign firms. As a robustness check, the above equation is also estimated with alternative sets of controls. Including GDP per capita as regressor is not crucial. If GDP per capita is exchanged for controls of institutional quality or for the whole set of gravity controls, results do not change qualitatively.

Fixed effects estimation on the liability sample is difficult due to the small number of observations and results are less robust to the inclusion of alternative controls in that standard errors become large. Despite these limitations, the presented regression results strongly support the validity of testable implications B and C.

5 Conclusions

The model developed in this paper explains banking across borders based on differences in endowments and differences in banking sector efficiency across countries. It shows how these two driving forces jointly determine the foreign assets and liabilities of a banking sector. The analysis reveals that international banking is driven by differences in rates of return to capital while global banking arises from differences in country-level bank efficiency. Key predictions of the model are strongly supported by the empirical evidence presented.

This paper presents a coherent theoretical framework that matches key stylized facts of banking across borders. It can explain cross-country heterogeneity in global and international banking and provides a rationale for the rise in global banking relative to international banking over the past twenty years. First principles of international trade theory go far in explaining the cross-country pattern of foreign bank asset and liability holdings.

This suggests that, as a complement to the traditional portfolio view, an international trade and investment perspective can be fruitful for the study of international and global banking. The approach taken in this paper could be useful for analyzing several related aspects in more detail. The paper indicates a strong relationship between the two identified driving forces of banking across borders and the extent of FDI in the banking sector. Similarly, the organizational choice (branch versus subsidiary) of banks and their business models may be systematically linked to the different underlying driving forces.

In the framework developed, international and global bank activities arise endogenously when capital accounts and banking sectors are liberalized. Capital is allocated more efficiently and differences in banking sector efficiency across countries are exploited. In this, the paper shows that there is a natural role for internationally active banks in the global economy.

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A   Appendix B: Data Appendix

$\mathbf{\Delta}\log(\mathbf{K}/\mathbf{L_{ijt}})$: The preferred proxy for differences in rates of return to capital is the log difference in capital-labor ratios between source country j and recipient country i adjusted for differences in human capital. Capital stocks and data on the labor force are from Penn World Tables 6.2.[42] Average years of schooling for the population aged over 25 used for the adjustment are from Barro and Lee (2010). The adjustment for human capital follows Hall and Jones (1999):

$$H_i = e^{\phi(E_i)}L_i, \tag{4}$$

where L_i stands for the labor force and E_i are average years of schooling. The function $\phi(E)$ is the efficiency of a unit of labor with E years of schooling relative to one with no schooling ($\phi(0) = 0$). As Hall and Jones (1999), it is assumed that $\phi(E)$ is piecewise linear, with a slope of 0.134 up to 4 years of schooling, a slope of 0.101 for the years of schooling between 4 and 8, and 0.068 for any year beyond that. Data on average years of schooling comes in 5-year frequencies. Linear interpolation is used to generate missing data. Denoting the capital stock of country i by K_i, the proxy for differences in rates of return to capital is precisely calculated as:

$$\Delta\log(K/L)_{ijt} = \log(K_{j\ t-10}/H_{j\ t-10}) - \log(K_{i\ t-10}/H_{i\ t-10}). \tag{5}$$

Consolidated Banking Statistics: The Consolidated Banking Statistics does not provide a sectoral breakdown for total foreign assets, which comprise all claims of banks whose headquarters are in country i vis-a-vis residents of country j in all currencies. As the model is set up to explain lending to foreign firms, foreign assets are proxied by those assets that are broken down by sector, the so-called international claims vis-a-vis the non-bank private sector. As a robustness check, total foreign assets are used as the dependent variable. Foreign liabilities are proxied by the so-called local liabilities in local currency, the only information on liabilities that is available.

Financial Freedom: The index of Financial Freedom provided by the Heritage Foundation (see http://www.heritage.org/index/financial-freedom) is used to measure barriers to foreign bank entry as previously done by Beck, Demirguc-Kunt, and Levine (2006) and Buch and Lipponer (2007). The index is based on five criteria: the extent of government regulation of financial services, the degree of state intervention in banks and other financial firms through direct and indirect ownership, the

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[42]Capital stocks for the base year 2000, which are not publicly available yet, were kindly provided by Penn World Tables.

extent of financial and capital market development, government influence on the allocation of credit, and openness to foreign competition. It takes values between 0 and 100, where 100 represents the highest degree of financial freedom. There have been attempts to construct more direct measures from information contained in the Bank Regulation and Supervision database of the World Bank (see Beck, Demirguc-Kunt, and Levine (2006)). Barth, Marchetti, Nolle, and Sawangngoenyuang (2009) for example provide a measure of discrimination against foreign bank entry for a large set of countries and one point in time. This measure, however, does not perform well in a cross-sectional analysis, which could be due to the coarse information upon which it is based.

Chinn & Ito Index: Capital account openness is proxied by the Chinn & Ito Index (see Chinn (2008), http://web.pdx.edu/ĩto/Chinn-Ito_website.htm). In contrast to de facto measures of financial openness, which infer the degree of openness from observed capital flows and are therefore endogenous to bank flows, this measure is based on de jure restrictions on cross-border financial transactions documented by the IMF. It increases in capital account openness.

Gravity controls: Bilateral distance and the dummies for colonial relationship, common official language, common border, common legal system and common currency come from datasets provided by CEPII (Mayer and Zignago (2005) and Head, Mayer, and Ries (2010)).

Dummy for systemic banking crisis: Information collected by Laeven and Valencia (2008) is used to construct a dummy variable which takes value 1 if there was a banking crisis in a country in any given year.

$\mathbf{\Delta}\log(\mathbf{MPK_{ij}})$: An alternative measure for differences in rates of return to capital comes from Caselli and Feyrer (2007). The authors compute MPKs for the year 1996 for 62 countries taking differences in relative prices of investment and consumption goods between countries into account. In the regression, the log differences of these calculated marginal products of capital are used (values of "PMPKL").

GDP in current \$US, GDP per capita in current \$US, population and information on lending interest rates are from the World Development Indicators. Data on the net interest rate margin and banking sector concentration are from the Financial Structure Data Base provided by the World Bank.

FDI data comes from the OECD International Direct Investment Statistics: Organisation for Economic Cooperation and Development, International Development Statistics, ESDS, University of Manchester.

Sample selection: The set of recipient countries reported in the CBS was enlarged in 1998, which is why years before 1999 are discarded. Also data on overhead costs before 1989 is only available for a very limited set of countries. The years of the recent financial crisis are excluded.

Table B.1: Summary statistics, sample of foreign assets

Variable	Mean	Std. Dev.	Min	Max
$\log(\text{assets}_{ij})$	4.69	2.85	-1.39	12.75
$\Delta\log(K/L_{ij})$	.842	1.27	-2.70	5.00
$\Delta\log(c_{ij})$	.195	.762	-2.29	2.54
financial freedom$_i$	55.00	21.71	10	90
openness$_j$	2.08	.941	-1.13	2.53
openness$_i$	1.18	1.45	-1.81	2.53
property rights$_j$	79.11	15.71	30	90
property rights$_i$	58.23	23.66	10	90
banking crisis$_i$	.015	.123	0	1
$\log(\text{distance}_{ij})$	8.44	.943	5.15	9.86
common currency$_{ij}$	.080	.272	0	1
common legal system$_{ij}$	.328	.470	0	1
common language$_{ij}$	.147	.354	0	1
colony$_{ij}$	.059	.236	0	1
$\log(\text{GDP}_j)$	27.42	1.26	23.46	30.16
$\log(\text{GDP}_i)$	25.70	1.92	20.94	30.16
$\log(\text{population}_j)$	17.29	1.47	14.99	20.81
$\log(\text{population}_i)$	16.85	1.53	12.91	20.99
Number of observations= 1249				

Table B.2: Summary statistics, sample of foreign liabilities

Variable	Mean	Std. Dev.	Min	Max
$\log(\text{liabilities}_{ij})$	5.87	3.21	-1.39	13.37
$\Delta\log(K/L_{ij})$	.668	1.10	-2.70	4.56
$\Delta\log(c_{ij})$	.093	.746	-2.29	2.29
financial freedom$_i$	57.99	21.91	10	90
openness$_j$	2.21	.796	-1.13	2.53
openness$_i$	1.38	1.37	-1.81	2.53
property rights$_j$	81.48	12.96	50	90
property rights$_i$	64.28	22.86	10	90
banking crisis$_i$	.008	.090	0	1
$\log(\text{distance}_{ij})$	8.21	1.10	5.15	9.83
common currency$_{ij}$	.128	.334	0	1
common legal system$_{ij}$	.351	.478	0	1
common language$_{ij}$	.181	.385	0	1
colony$_{ij}$	.120	.325	0	1
$\log(\text{GDP}_j)$	27.90	1.23	25.98	30.16
$\log(\text{GDP}_i)$	26.52	1.78	20.94	30.16
$\log(\text{population}_j)$	17.58	1.38	15.24	20.81
$\log(\text{population}_i)$	17.26	1.48	12.91	20.99
Number of observations = 493				

Source Countries j:[43] Australia, (Austria), Belgium, Brazil, Canada, (Chile), Denmark, (Finland), France, Germany, Great Britain, Greece, India, Ireland, Italy, Japan, (Mexico), (Panama), Portugal, Spain, Sweden, Switzerland, The Netherlands, Turkey, United Stats of America

Recipient Countries i:[44] Algeria, Argentina, Australia, Austria, Bangladesh, Belgium, (Benin), Bolivia, Botswana, Brazil, (Burundi), Cameroon, Canada, Chile, China, Columbia, Costa Rica, Ivory Cost, Cyprus, Denmark, (Ecuador), Egypt, El Salvador, Finland, France, (Gabon), Germany, Ghana, Great Britain, Greece, Guatemala, Haiti, Honduras, Hungary, India, Indonesia, (Iran), Ireland, Israel, Italy, Japan, Jordan, Kenya, Kuwait, (Mali), (Malawi), Malta, Malaysia, Mauritania, Mexico, Morocco, (Mozambique), Nepal, (New Zealand), (Nicaragua), (Niger), Norway, Pakistan, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, (Republic of Congo), (Romania), (Rwanda), Saudi Arabia, Senegal, Sierra Leone, South Africa, South Korea, Spain, (Sri Lanka), (Swaziland), Switzerland, Sweden, Thailand, The Netherlands, (Togo), Trinidad & Tobago, Tunisia, Turkey, Uganda, United Arab Emirates, United States of America, Uruguay, Venezuela, Zambia, Zimbabwe

Summary statistics for the asset sample and the liability sample are given in Tables B.1 and B.2, respectively.

More results of **robustness checks** are available in an online appendix under the following link: http://www.eui.eu/Personal/Researchers/Niepmann/OnlineAppendix .

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[43]Source countries that are not included in the liability sample are in parentheses.

[44]Recipient countries that are not included in the liability sample are in parentheses.

Figure 1: Evolution of foreign assets over time
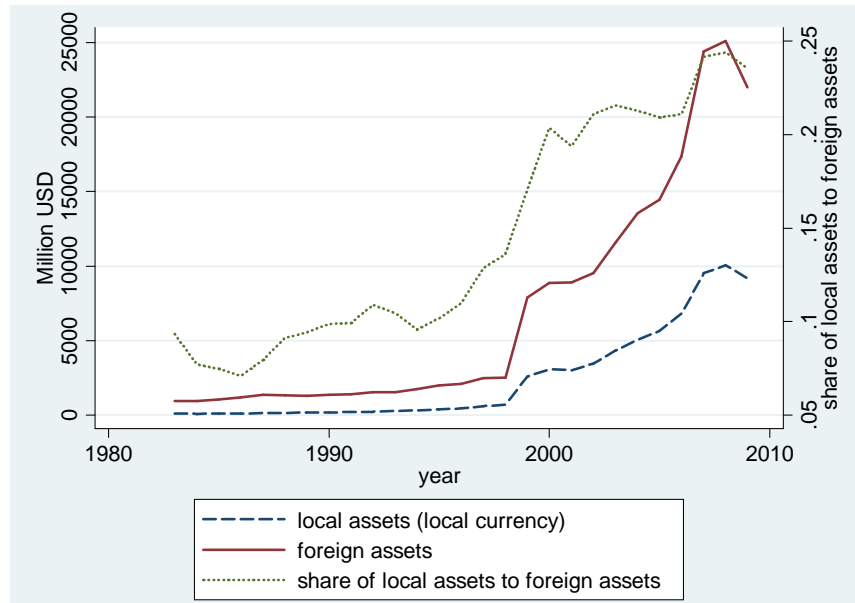
The graph shows the evolution of foreign asset holdings of BIS reporting countries over time. The solid line depicts the USD valued average foreign assets (y-axis on the left). They include the claims of all banks whose headquarters are in one of the BIS reporting countries towards a large set of foreign countries. The dashed line shows the USD value of average assets on the balance sheets of foreign affiliates towards residents of the host market which are denoted in the currency of the host market (local assets, y-axis on the left). These are included in foreign assets. The dotted line is the ratio of local claims to foreign assets (y-axis on the right). There is a break in the series in 1998.

Figure 2: Evolution of foreign assets across recipient income groups
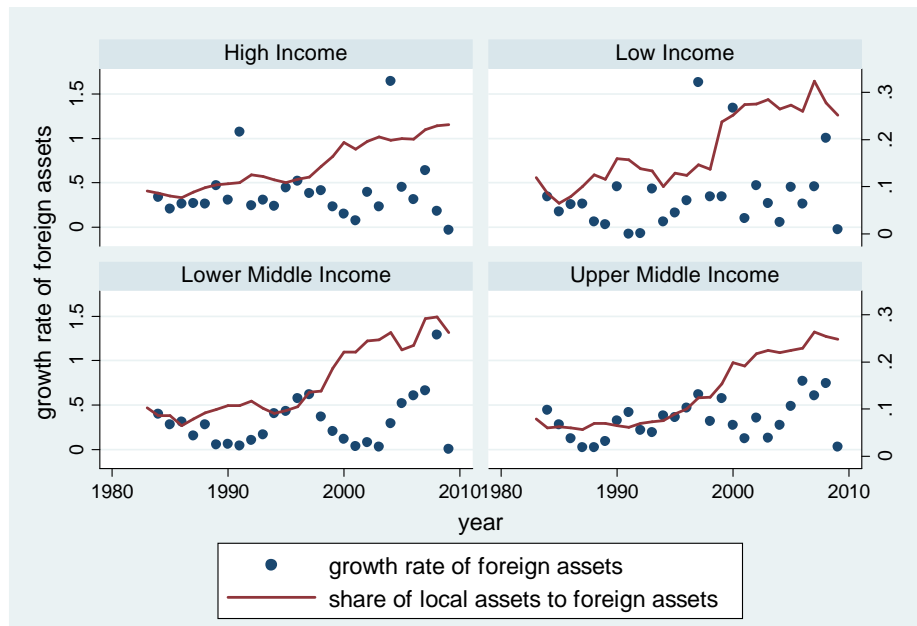
The figure shows that developments have been similar across recipient income groups. The line depicts the average ratio of local assets to foreign assets of BIS reporting countries held in high income, upper middle income, lower middle income and low income countries (y-axis on the right). The points correspond to the average yearly growth rates of foreign assets in those countries (y-axis on the left).

Figure 3: Modes of foreign bank operations
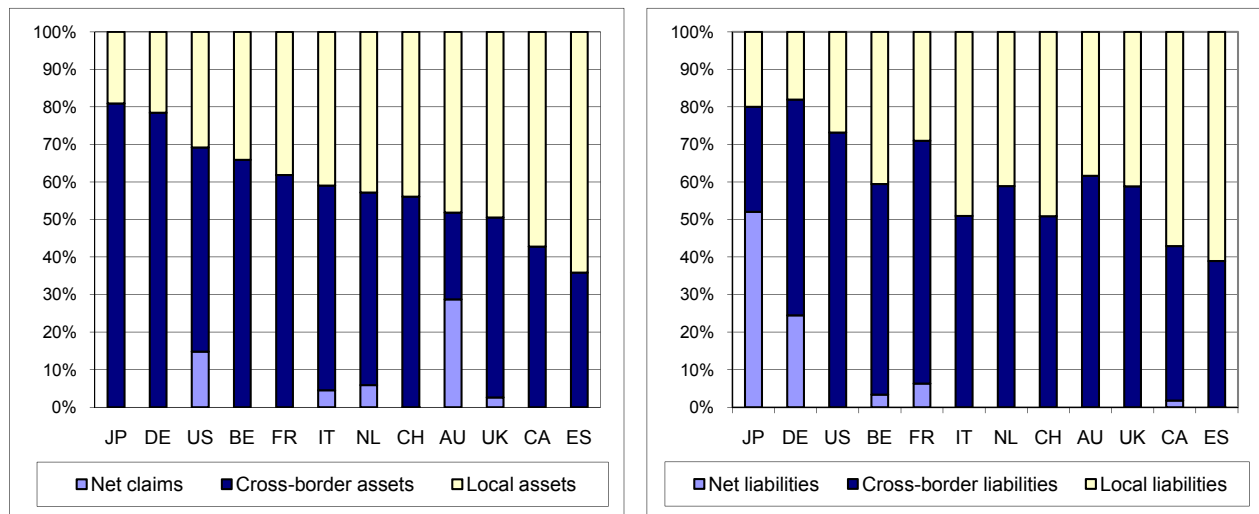
The modes of international operations differ between countries. The panel on the left shows foreign assets of different banking sectors split into foreign assets on the balance sheets of banks located in the home country or a third country (cross-border assets) and on the balance sheets of affiliates located in the respective host market (local assets). The panel on the right shows the equivalent split for foreign liabilities. If foreign liabilities are larger than foreign assets, a banking sector has net claims. It has net liabilities if foreign assets are larger than foreign liabilities. For a detailed description of the data construction see Comittee on the Global Financial System (2010a) and McGuire and Peter (2009).

Figure 4: Foreign assets as a function of capital account openness and financial freedom
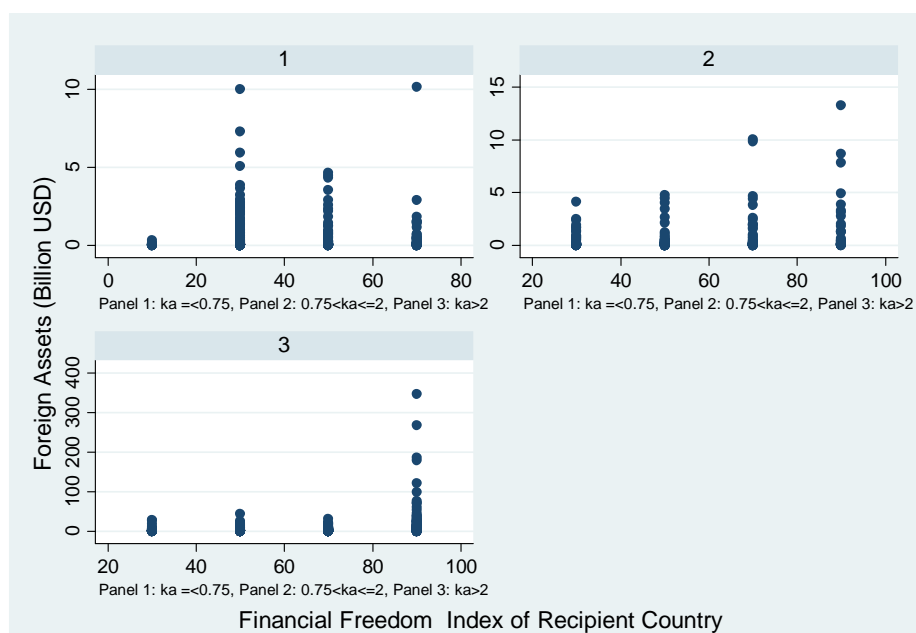
The figure shows foreign assets (international claims vis-a-vis the non-bank private sector) of BIS reporting countries in 2005 as a function of financial freedom of the recipient country for increasing degrees of capital account openness of the recipient country (measured by the Chinn & Ito Index). The upper left panel (1) collects recipient countries for which the Chinn & Ito Index takes values below or equal to 0.75. The upper right panel (2) includes recipient countries whose index is between 0.75 and 2. In the lower left panel (3) recipient countries have index values that are greater than 2. Note that the range of the y-axis differs across panels.

Figure 5: Average foreign assets by bin
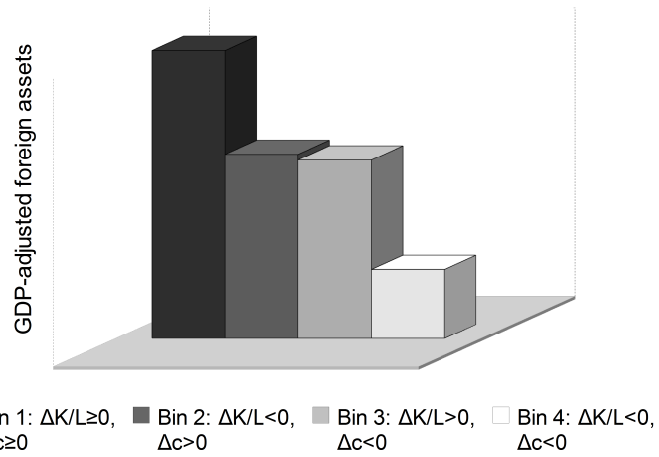
The graph shows average foreign bank assets in 2005 for four different groups of country pairs with the following characteristics (from left to right): Bin 1: $\Delta(K/L_{ij}) \geq 0$, $\Delta c_{ij} \geq 0$; Bin 2 $\Delta(K/L_{ij}) < 0$, $\Delta c_{ij} > 0$; Bin 3: $\Delta(K/L_{ij}) > 0$, $\Delta c_{ij} < 0$; Bin 4: $\Delta(K/L_{ij}) < 0$, $\Delta c_{ij} < 0$. Bank assets have been normalized with respect to size by dividing them through the product of the GDPs of the source and the recipient country.

Table 2: The effect of differences in endowments and differences in banking sector efficiency on foreign assets

	Cross-section			Panel	
	(1)	(2)	(3)	(4)	(5)
$\Delta \log(\text{K/L}_{ijt})$	0.354***	0.136	1.283***	0.175*	0.153
	(0.121)	(0.123)	(0.232)	(0.0988)	(0.258)
$\Delta \log(c_{ijt})$	0.409***	0.145*	0.980***	0.383***	0.174***
	(0.0766)	(0.0835)	(0.104)	(0.0541)	(0.0489)
financial freedom$_{it}$	0.00970***	0.0123***		0.0100***	0.00103
	(0.00342)	(0.00297)		(0.00258)	(0.00189)
openness$_{jt}$	0.361**		0.215	0.206*	0.0236
	(0.161)		(0.140)	(0.109)	(0.0826)
openness$_{it}$	0.0484	0.0398		0.0114	-0.0151
	(0.0539)	(0.0460)		(0.0378)	(0.0388)
property rights$_{jt}$	0.0331***		0.0341***	0.0220***	0.0208***
	(0.00689)		(0.00666)	(0.00500)	(0.00633)
property rights$_{it}$	0.00481	0.00651*		0.00939***	0.00669*
	(0.00419)	(0.00369)		(0.00323)	(0.00358)
banking crisis$_{jt}$				-0.405***	-0.000494
				(0.129)	(0.0870)
banking crisis$_{jt}$	0.754**	0.832***		0.824***	0.412***
	(0.347)	(0.283)		(0.126)	(0.0692)
$\log(\text{distance}_{ij})$	-0.867***	-0.742***	-1.259***	-0.793***	-0.961***
	(0.0630)	(0.0584)	(0.0810)	(0.0517)	(0.0637)
common currency$_{ij}$	0.312*	0.247	-0.101	0.160	0.0794
	(0.174)	(0.160)	(0.204)	(0.148)	(0.137)
common legal system$_{ij}$	0.160	0.519***	-0.0733	0.325***	0.418***
	(0.124)	(0.119)	(0.119)	(0.100)	(0.0857)
common language$_{ij}$	0.379**	0.197	0.579***	0.428***	0.249*
	(0.178)	(0.166)	(0.183)	(0.148)	(0.135)
colony$_{ij}$	1.261***	1.228***	1.294***	1.082***	1.206***
	(0.230)	(0.236)	(0.223)	(0.193)	(0.184)
$\log \text{GDP}_{jt}$	0.501**		0.0319	1.008***	0.304
	(0.199)		(0.231)	(0.137)	(0.263)
$\log \text{GDP}_{it}$	1.118***	1.030***		0.974***	0.623***
	(0.104)	(0.0965)		(0.0871)	(0.146)
$\log \text{population}_{jt}$	0.302		0.842***	-0.118	1.097
	(0.198)		(0.229)	(0.140)	(2.033)
$\log \text{population}_{it}$	-0.349***	-0.215**		-0.189**	-0.0643
	(0.105)	(0.0946)		(0.0887)	(0.768)
R^2	0.627	0.727	0.704	0.636	0.790
N	1249	1249	1249	8163	8163
Year FE	-	-	-	yes	yes
Source country FE	-	yes	-	no	yes
Recipient country FE	-	-	yes	no	yes

* $p < 0.1$,** $p < 0.05$, *** $p < 0.01$.
Robust standard errors in parentheses in Columns (1) to (3).
Columns (4) and (5) clustered standard errors (country pairs).
Dependent variable: $\log(\text{assets}_{ijt})$. Constant not reported.

Table 3: Robustness

	Alt. Proxies		Low	Low. Middle	Up. Middle	High	FDI	Diversification
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta\log(\text{K/L}_{ij})$		0.339**	0.324	0.290	0.844**	0.957***	0.611***	0.976***
		(0.145)	(0.240)	(0.246)	(0.329)	(0.217)	(0.177)	(0.219)
$\Delta\log(\text{MPK}_{ij})$	0.406*							
	(0.219)							
$\Delta\log(c_{ij})$	0.380***		-0.038	0.621**	0.113	0.503***	0.150*	0.118
	(0.109)		(0.298)	(0.268)	(0.196)	(0.112)	(0.084)	(0.108)
$\Delta\log(\text{net interest margin}_{ij})$		0.453***						
		(0.136)						
financial freedom$_i$	0.019***	0.004	-0.014	-0.001	-0.030***	0.017***	0.010***	0.015***
	(0.004)	(0.004)	(0.015)	(0.009)	(0.011)	(0.005)	(0.004)	(0.004)
openness$_{jt}$	0.859***	-0.043	-0.746	0.560	0.646**	0.227	-0.073	0.583***
	(0.269)	(0.186)	(0.791)	(0.375)	(0.309)	(0.203)	(0.074)	(0.296)
openness$_{it}$	0.053	-0.064	-0.011	0.242**	0.786***	0.001	-0.030	0.189**
	(0.076)	(0.062)	(0.131)	(0.094)	(0.163)	(0.141)	(0.074)	(0.0864)
banking crisis$_i$	0.763	-0.081			0.396		0.990**	
	(0.436)*	(0.407)			(0.486)		(0.394)	
$\Delta\log(\text{lending interest rate}_{ij})$	0.454***							
	(0.129)							
concentration$_j$	-0.736							
	(0.503)							
concentration$_i$	-0.849**							
	(0.353)							
correlation$_{ij}$								0.502
								(0.388)
log(FDI flow$_{ij}$)							0.032**	
							(0.014)	
R^2	0.67	0.67	0.38	0.45	0.52	0.66	0.63	0.68
N	655	940	111	285	256	597	702	562

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses.
Dependent variable: $\log(\text{assets}_{ij})$. Constant and gravity variables not reported.

Table 4: Estimation of asset levels and marginal effects by bin

# Bin	Parameters	Dummy	$\Delta \log(c_{ij})$	$\Delta \log(K/L_{ij})$
Bin 1	$\Delta(K/L_{ij}) \geq 0, \Delta c_{ij} \geq 0$	-	0.392***	0.132
			(0.149)	(0.130)
Bin 2	$\Delta(K/L_{ij}) < 0, \Delta c_{ij} > 0$	-0.832***	0.781**	0.539**
		(0.272)	(0.330)	(0.214)
Bin 3	$\Delta(K/L_{ij}) > 0, \Delta c_{ij} < 0$	-0.480*	0.347	0.364***
		(0.263)	(0.320)	(0.135)
Bin 4	$\Delta(K/L_{ij}) < 0, \Delta c_{ij} < 0$	-0.964***	-0.058	0.651**
		(0.284)	(0.355)	(0.267)

* $p < 0.1$,** $p < 0.05$; *** $p < 0.01$. Robust standard errors in parentheses.
Dependent variable: $\log(\text{assets}_{ij})$. Controls not reported. $N = 1249$, $R^2 = 0.64$

Table 5: The effect of differences in efficiency on foreign liabilities

	Baseline (1)	Source FE (2)	Recipient FE (3)	Lower Inc. (4)	High Inc. (5)
$\Delta\log(\mathrm{K/L}_{ij})$	0.324	0.383	-0.481	-0.435	1.862***
	(0.273)	(0.290)	(0.572)	(0.320)	(0.460)
$\Delta\log(c_{ij})$	0.526***	0.292	0.797***	0.471**	0.533**
	(0.156)	(0.212)	(0.226)	(0.239)	(0.220)
financial freedom$_i$	0.016**	0.018**		0.015	0.002
	(0.008)	(0.008)		(0.011)	(0.011)
openness$_j$	1.215***		1.169***	2.409**	0.784***
	(0.260)		(0.283)	(1.214)	(0.290)
openness$_i$	0.040	0.089		-0.096	0.063
	(0.120)	(0.111)		(0.133)	(0.325)
property rights$_j$	0.040***		0.020	0.012	0.063***
	(0.012)		(0.015)	(0.022)	(0.018)
property rights$_i$	0.007	0.003		0.015	0.010
	(0.010)	(0.010)		(0.014)	(0.017)
banking crisis$_i$	1.045	1.071		0.472	
	(0.661)	(0.722)		(0.911)	
$\log\mathrm{distance}_{ij}$	-0.493***	-0.431***	-1.072***	0.423	-0.642***
	(0.157)	(0.155)	(0.185)	(0.317)	(0.196)
common currency$_{ij}$	0.229	0.185	0.080		0.087
	(0.409)	(0.419)	(0.451)		(0.455)
common legal system$_{ij}$	0.658**	0.740***	0.748**	0.007	0.989**
	(0.307)	(0.281)	(0.323)	(0.434)	(0.427)
common language$_{ij}$	0.109	0.132	0.289	0.214	-0.031
	(0.383)	(0.335)	(0.469)	(0.442)	(0.618)
colony$_{ij}$	2.415***	2.121***	1.985***	2.994***	1.992***
	(0.346)	(0.405)	(0.371)	(0.416)	(0.565)
common border$_{ij}$	0.905**	0.948**	0.443	2.755***	0.334
	(0.451)	(0.457)	(0.470)	(0.674)	(0.552)
$\log\mathrm{GDP}_{jt}$	-0.065		0.850**	-0.896	-0.669
	(0.341)		(0.429)	(1.262)	(0.414)
$\log\mathrm{GDP}_{it}$	0.935***	0.941***		0.352	1.734***
	(0.231)	(0.240)		(0.306)	(0.567)
$\log(\mathrm{population}_{jt})$	1.029***		0.263	1.997	1.575***
	(0.322)		(0.414)	(1.236)	(0.391)
$\log(\mathrm{population}_{it})$	0.096	0.053		0.503	-0.494
	(0.237)	(0.237)		(0.330)	(0.578)
R^2	0.48	0.55	0.60	0.52	0.51
N	493	493	493	201	292

* $p < 0.1$,** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses.
Dependent variable: $\log(\mathrm{liabilities}_{ij})$. Constant not reported.

Table 6: Global banking versus international banking

	Baseline (1)	Source FE (2)	Recipient FE (3)	Lower Inc. (4)	High Inc. (5)	Alt. Dep. Var (6)
$\Delta \log(\mathrm{K/L}_{ij})$	-0.472**	0.281	-2.599***	-0.979***	0.179	-0.789***
	(0.240)	(0.244)	(0.415)	(0.311)	(0.397)	(0.229)
$\Delta \log(c_{ij})$	0.0653	0.280	-0.466**	-0.0719	0.267	0.0725
	(0.137)	(0.187)	(0.196)	(0.195)	(0.197)	(0.153)
financial freedom$_i$	0.005	-0.002		0.029***	-0.008	0.027***
	(0.007)	(0.006)		(0.010)	(0.009)	(0.009)
openness$_{jt}$	0.708*		1.268***	3.234**	0.207	2.510**
	(0.373)		(0.357)	(1.431)	(0.379)	(1.037)
openness$_{it}$	0.0273	-0.0195		-0.155	-0.0447	-0.0791
	(0.111)	(0.0935)		(0.132)	(0.262)	(0.0985)
common currency$_{ij}$	-0.248	0.213	0.431		-0.443	
	(0.336)	(0.330)	(0.394)		(0.362)	
common legal system$_{ij}$	0.107	0.147	0.556**	-0.367	0.491	-0.449
	(0.274)	(0.234)	(0.266)	(0.456)	(0.345)	(0.342)
common language$_{ij}$	0.488	0.458	0.0498	1.503***	-0.101	0.923***
	(0.350)	(0.278)	(0.405)	(0.450)	(0.501)	(0.308)
colony$_{ij}$	1.052***	0.943***	0.704**	0.466	1.038**	0.515*
	(0.297)	(0.333)	(0.305)	(0.451)	(0.437)	(0.306)
common border$_{ij}$	0.725**	0.916***	0.885**	2.038***	0.774**	1.130**
	(0.346)	(0.299)	(0.363)	(0.548)	(0.389)	(0.444)
log(GDP per capita$_j$)	-0.398		0.550	-2.142*	-0.342	-1.782*
	(0.354)		(0.358)	(1.272)	(0.361)	(0.923)
log(GDP per capita$_i$)	-0.576***	0.0292		-1.166***	-0.286	-0.990***
	(0.183)	(0.198)		(0.273)	(0.448)	(0.209)
R^2	0.111	0.308	0.366	0.279	0.067	0.268
N	490	490	490	200	290	201

*** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors in parentheses.
Dependent variable: log(liabilities/assets$_{ij}$). Constant not reported.