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Multinational Banks and the Global Financial Crisis: Weathering the Perfect Storm?

We use data on the 48 largest multinational banking groups to compare the lending of their 199 foreign subsidiaries during the Great Recession with lending by a benchmark of 202 domestic banks. Contrary to earlier and more contained crises, parent banks were *not* a significant source of strength to their subsidiaries during 2008–09. When controlling for other bank characteristics, multinational bank subsidiaries had to slow down credit growth almost three times as fast as domestic banks. This was in particular the case for subsidiaries of banking groups that relied more on wholesale funding.

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OVER THE LAST TWO decades many countries have opened up their banking sectors to foreign investors with the aim of improving the quantity and quality of financial services available to domestic firms and households. This has led to the emergence of a few truly global banking groups, such as Citigroup and HSBC, and a large number of multinational banks with a more regional focus, such as UniCredit and Standard Chartered. What are the economic implications of multinational banking for the countries that opened up? In particular, has international

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banking integration made host countries more resilient or more susceptible to financial shocks?

This paper contributes to answering this question by analyzing a comprehensive data set on both multinational bank subsidiaries and stand-alone domestic banks. We compare the lending stability of both types of banks during the 2008–09 Great Recession (as well as during earlier crises) while also taking account of bank funding structure. In doing so, we build on De Haas and Van Lelyveld (2010) who use similar data to examine bank lending during previous, more contained bouts of financial turmoil. During such *local* crises, subsidiaries of financially strong parent banks did typically not rein in credit whereas domestic banks had to do so. Strong parent banks used their internal capital market to provide subsidiaries with capital and liquidity and this financial support stabilized local lending.

The 2008–09 crisis, which struck at the core of the international financial system and affected virtually all large banking groups (Acharya and Schnabl 2010), necessitates a reappraisal of the evidence on the stability implications of multinational banking. Just like strong parent banks supported subsidiaries during local crises, weak parent banks may have discontinued such support during the global crisis. Fragile parent banks hit by a freeze in short-term funding may even have used their internal capital markets to repatriate funds from subsidiaries to headquarters. For instance, according to the business press, subsidiaries in Russia and the Czech Republic used local liquidity to support their foreign headquarters in Italy and France in the wake of the Lehman Brothers collapse and during the Eurozone crisis.[1] If multinational bank subsidiaries are dependent on parent-bank funding and if such parental support was not forthcoming during the crisis, financial integration may have made host countries vulnerable to financial shocks that originated elsewhere.

Against this background, we ask whether multinational bank subsidiaries managed to keep up lending relatively well during the recent crisis or, alternatively, whether the absence of parental support meant that they had to stand on their own feet and were no longer in an advantageous position compared to stand-alone domestic banks. We find that multinational bank subsidiaries curtailed credit growth more aggressively than domestic banks, almost three times as much. Subsidiaries that relied to a greater extent on wholesale funding or whose parents depended on wholesale funding had to slow down credit growth the most. This suggests that parent banks that lost access to wholesale markets, which dried up at various points during the crisis, subsequently reduced funding to their foreign subsidiaries.

We also confirm the earlier finding that subsidiaries are relatively stable lenders during *local* crises and therefore conclude that while the presence of multinational banks mitigates domestic financial shocks, it also opens the door for the transmission of foreign shocks. Finally, we show that multinational banks performed

1. Bloomberg, "Foreign Banks in Russia Support European Owners since Mid-Year," October 27, 2011; ft.com/alphaville, "Honey, I Shrunk Emerging Europe," November 4, 2011.

better in their *home* country when compared to domestic competitors without foreign subsidiaries. Just like parent banks tend to be a source of strength to subsidiaries that experience a local idiosyncratic shock, a foreign subsidiary network may in turn provide some support when parent banks themselves experience funding problems.

Our paper contributes in three main ways to the banking literature. First, we use a geographically comprehensive data set to analyze the relationship between bank ownership and lending stability during the Great Recession. A small number of papers have assessed this link for specific countries or regions. De Haas et al. (2013) and Popov and Udell (2012) find that multinational bank subsidiaries in Emerging Europe cut lending more than domestic banks.[2] Fungácová, Herrala, and Weill (2011) and Aiyar (2012) find the same for Russia and the United Kingdom, respectively. Other studies provide evidence of a crisis-related credit crunch without focusing on the role of bank ownership.[3] Our comprehensive yet detailed data on the largest multinational banks cover all main geographical regions and the whole crisis period. This allows us to assess the external validity of earlier country-specific findings. More importantly, we not only identify the home country of each bank subsidiary—as in Micco, Panizza, and Yañez (2007) and Claessens and Van Horen (2014)—but also link it to its parent bank *and* to other subsidiaries in the same group. This complete organizational picture of the main banking groups is unique and allows us to track how shocks to one part of the group resonate in other parts.

Second, our paper adds to the literature on bank-funding structure and lending stability. During the Great Recession, banks that relied more on short-term wholesale funding reduced domestic credit more (see Ivashina and Scharfstein 2010, Cornett et al. 2011 for the U.S.; Yorulmazer and Goldsmith-Pinkham 2010 for the UK; Iyer et al. Forthcoming for Portugal), cut cross-border credit more (Cetorelli and Goldberg 2011),[4] were more often financially distressed (Cihák and Poghosyan 2009), and experienced a worse stock-price performance when Lehman Brothers collapsed (Raddatz 2010) and during the crisis in general (Beltratti and Stulz 2012). Relying on short-term wholesale funding made banks vulnerable to sudden liquidity shortages during which they could not roll over debt.[5] By comparing domestic and

2. In contrast to these papers, Barba Navaretti et al. (2010) argue that multinational banks were a stabilizing force in Europe as they displayed a stable loan-to-deposit ratio. However, their analysis is limited to the years 2007–08 while much of the reduction in bank lending only took place in 2008–09.

3. See Puri, Rocholl, and Steffen (2011) on Germany, Jimenéz et al. (2012) on Spain, and Presbitero, Udell, and Zazzaro (2014) on Italy.

4. Cetorelli and Goldberg (2011) also use data on multinational bank lending through local affiliates, but an important difference with our paper is that we use bank-level data whereas they use country-pair level data. This makes our analysis more detailed as we can analyze the role of various bank-specific characteristics as well as characteristics of parent banks and other subsidiaries in the same bank holding company.

5. Short-term wholesale markets freeze easily in response to noisy public signals about the quality of bank assets (Huang and Ratnovski 2011) whereas core deposits are less volatile, in particular when insured (Feldman and Schmidt 2001). Failed UK bank Northern Rock, which saw wholesale lenders run before

multinational banks, we can distinguish between the impact of banks' *ownership* and *funding* structure on lending stability.

Third, our paper adds to the more general literature on multinational banking. On the theoretical side, a number of papers model the relationship between banking integration and business cycle synchronization. The seminal contribution by Morgan, Rime, and Strahan (2004), a two-country version of Holmström and Tirole's (1997) "double-decker" moral hazard model, predicts that banking integration increases (decreases) output comovement after asymmetric shocks to the financial (real) sector. Kalemli-Ozcan, Papaioannou, and Perri (2013) arrive at similar predictions using a general equilibrium model of international business cycles with multinational banks.[6] The intuition is that multinational banks reallocate capital to countries where bank capital is in short supply (e.g., those experiencing a banking crisis) and away from countries where investment opportunities are scarce (e.g., countries in a downturn). Multinational banks consequently mitigate local financial shocks, transmit foreign financial shocks, and exacerbate shocks to the real economy.

A number of papers have confirmed these theoretical predictions by taking them to macro- and microeconomic data. At the macro level, Kalemli-Ozcan, Papaioannou, and Peydró (Forthcoming) show that when real productivity shocks dominate shocks to the financial sector, deeper financial integration leads to more divergent output fluctuations. As expected, this positive relationship weakened during 2007–09 as the cross-border transmission of financial shocks synchronized business cycles. Bruno and Hauswald (Forthcoming) show that financially dependent industries are less affected during local banking crises when multinational bank subsidiaries are present. This suggests that these subsidiaries act as a "safety net" by mitigating the adverse impact of a local credit crunch.

At the micro level, two key papers are Peek and Rosengren (1997, 2000) who demonstrate how the drop in Japanese stock prices in 1990 made Japanese bank branches in the U.S. reduce lending. In a similar vein, Schnabl (2012) analyzes how the 1998 Russian crisis spilled over to Peru as banks, including multinational bank subsidiaries, had to reduce local lending. Chava and Purnanandam (2011) find similar evidence for U.S. banks. Moreover, evidence for the U.S. (Morgan, Rime, and Strahan 2004 and Loutskina and Strahan 2011), Japan (Imai and Takarabe 2011), and the Netherlands (Cremers, Huang, and Sautner 2011) indicates that similar mechanisms are at play in the case of large banks that operate across several regions or states *within* one and the same country.

The remainder of this paper is structured as follows. Section 1 describes our data set and empirical approach, after which Section 2 presents our main results. Section 3 then provides a concise discussion of the country-level implications of our findings. Section 4 concludes.

retail depositors started to queue outside its offices, has perhaps become somewhat of a poster child for this literature.

6. See also Devereux and Yetman (2010) and Kollman, Enders, and Muller (2011).

1. DATA AND METHODOLOGY

1.1 Sample

We expand and update the data used in De Haas and Van Lelyveld (2010) to create a comprehensive sample of multinational banks based on the Top 1000 as published by *The Banker*. From the 150 largest banks (asset rank) we identify banks with more than one significant foreign bank subsidiary.[7] This results in a group of 48 holding companies, for which we then identify—on the basis of Bureau Van Dijk's BankScope database, websites, and correspondence with banks—all subsidiaries that account for at least 0.5% of parent-bank assets in 2009 and that are at least 50% owned by the parent. We therefore limit ourselves to relatively large foreign subsidiaries in which the parent has a controlling stake. A parent bank owns on average 4.3 of such significant subsidiaries. Table A3 in the Appendix contains a list of all banks in our sample.

If parent banks are the result of a merger or acquisition in year t we include them from $t+1$ onward. We disregard banks for which we have less than 3 consecutive years of data (all Chinese and most Japanese banks). For each subsidiary, we trace back in which year t it became part of the holding company as a result of a takeover. For greenfield subsidiaries that were established by the bank itself, we use data from year t onward, whereas we include take-over subsidiaries from $t+1$.

For each subsidiary (level 1) we check whether it owns sub-subsidiaries (level 2) that are larger than 0.5% of the ultimate bank holding company (level 0). If not, we include consolidated data for the level 1 subsidiaries. If it does, we include unconsolidated data for the level 1 subsidiary and include the sub-subsidiary as a separate entity (using consolidated data) of the parent bank. We use unconsolidated data for the parent banks.

Subsidiaries may also undertake some foreign activities of their own. A parent bank in country A may, for instance, operate a subsidiary in country B, which in turn undertakes activities in country C. Such business in country C is typically limited as parent banks tend to set up a separate subsidiary in county C in case of ample business opportunities. An interesting exception is Nordea, the Swedish bank holding company that resulted from the merger of Nordbanken (Sweden), Meritabanken (Finland), Unibank (Denmark), and Christiania Bank of Kreditkasse (Norway). Nordea's main foreign operations are subsidiaries in Denmark, Finland, Norway, and Russia (all in our data set). However, Nordea Bank Finland also comprises the group's activities in the Baltic countries Estonia, Latvia, and Lithuania. It does so through local branches that are an integral part of Nordea Finland's balance sheet.[8] If the Baltic activities were structured as subsidiaries, and if these would be large in terms of the balance

7. We include commercial, savings, mortgage, long-term credit, and cooperative banks and exclude investment and state banks, securities houses, and nonbank credit institutions.

8. This contrasts with the other large Swedish banking groups Swedbank and SEB. These banks have six independent *subsidiaries* in the Baltic region, which are included in our data set as separate entities under the Swedish holding companies.

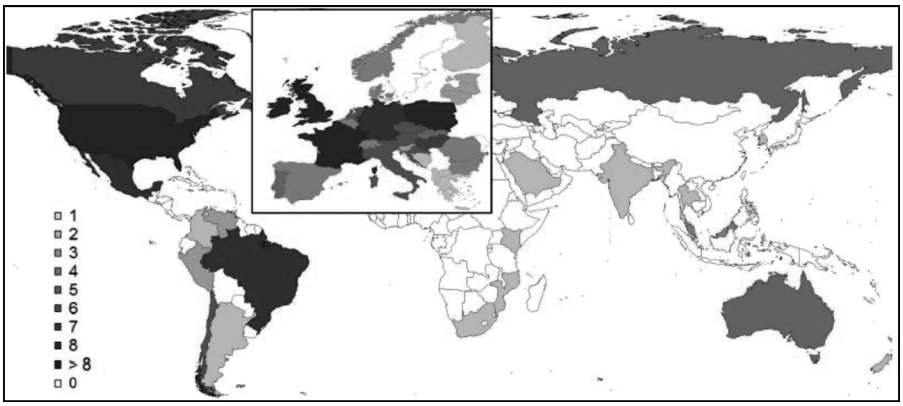

FIG. 1. Geographical Location of Multinational Bank Subsidiaries.

NOTE: This figure shows the geographical distribution of the 199 multinational bank subsidiaries in our data set. These include all subsidiaries for which we have at least 3 consecutive years of data during the 1992–2009 period. Darker shades indicate a larger number of subsidiaries in a country.
SOURCE: BankScope and banks' websites.

sheet of Nordea as a whole, we would have included them as separate entities in our data set. However, as they are branches we treat them as part of Nordea Finland.

We also create a benchmark set of domestic banks that consists of up to five of the largest domestically owned banks in each of the host countries in our sample. This results in a sample of 202 domestic banks. The panel of domestic and multinational banks covers 1992–2009 but is unbalanced as we do not have data for all years for each bank. Because not all banks report in the same currency we convert financial variables into U.S. dollars.

Figure 1 provides a graphical representation of our multinational bank sample, which consists of 48 parent banks from 19 home countries with 199 subsidiaries across 53 countries. Most parent banks and subsidiaries are European, reflecting the ownership links that were established between Western and Eastern European banks after the fall of the Berlin wall. Foreign banks now own 68% of all banking assets in Eastern Europe (source: Claessens and Van Horen 2014).

About 19% of our sample of parent banks and subsidiaries are based in North America. North American banks are less internationalized than European banks, which is not surprising given their substantially larger home market. Still, in 2009 almost 20% of all bank assets in the U.S. itself were owned by foreign financial institutions.

Figure 1 shows that multinational banks also hold significant positions in many other countries and regions. For instance, 62% of all banking assets in Eastern and Southern Africa are in foreign hands. Western groups like Standard Chartered as well as multinational African banks have made significant cross-border inroads in recent years.

TABLE 1

CREDIT AND DEPOSIT GROWTH BY BANK OWNERSHIP

		1992–97	1998	1999	2000–06	2007	2008	2009	Whole period
Δ Gross Loans %	Subsidiary	13.5	9.5	11.4	12.5	19.2	0.9	10.5	11.9
	Domestic	12.7	19.8	10.1	14.6	22.8	4.0	18.7	14.3
	All	12.9	17.8	10.3	13.9	21.2	3.1	15.0	13.5
Δ Deposits %	Subsidiary	19.8	21.6	14.0	10.6	15.3	5.1	16.4	12.1
	Domestic	13.7	18.9	9.6	15.3	20.4	2.7	23.9	14.7
	All	14.7	19.4	10.4	13.6	18.2	3.7	20.9	13.9

Correlation between deposit growth and loan growth

	Precrisis	Crisis
Subsidiary	0.43	0.39
Domestic	0.54	0.63

NOTES: This table compares, for various subperiods of our 1992–2009 sample period, the average annual credit and deposit growth of the multinational bank subsidiaries and the stand-alone domestic banks in our data set. The row "All" shows the averages over all banks independent of their ownership structure. The coefficients at the bottom of the table show the correlation between deposit growth and credit growth for both types of banks and for the precrisis and the crisis (2008–09) period. Table A1 in the Appendix contains all variable definitions and data sources.

In Central and South America, multinational banks of Spanish and North American origin own 53% and 31% of all banking assets, respectively. Our sample reflects the strong presence of these banks in Argentina, Brazil, Chile, Mexico, and Peru in particular. Foreign bank entry into Latin America accelerated during the 1990s and 2000s when state banks were privatized and weak private banks sold off, more conducive investment laws were passed, and the macroeconomic outlook stabilized.

While multinational banks also entered Asia, in particular after the 1997–98 crisis, strict regulation has forced banks to operate mainly in the form of branches or representative offices instead of locally incorporated subsidiaries. Yet even in Asia there are a number of countries, such as Malaysia, where foreign bank subsidiaries play an important role.

1.2 Descriptive Statistics

Our dependent variable is the percentage growth of gross loans and we measure gross loans by adding loan-loss reserves to net loans. This corrects for changes in net loans that are not caused by actual new loans but by loan loss provisioning. We check for outliers and remove observations with implausible values. To control for mergers and acquisitions we also remove observations where absolute annual loan growth exceeds 75%.

Table 1 provides basic descriptive statistics for credit and deposit growth, two of our main variables. The data show how after rapid growth in 2007—the peak of the credit cycle—financial intermediation slowed sharply in 2008–09. The reduction in credit growth was particularly pronounced for multinational bank subsidiaries in 2008. Moreover, whereas credit growth of domestic banks rebounded in 2009

and even exceeded its long-term average, credit dynamics remained subdued for multinational bank subsidiaries.

The table also shows how during 2000–07 deposit growth was persistently and significantly higher for domestic banks. This reflects that multinational bank subsidiaries typically have better access to alternative funding sources, such as the international bond and syndicated loan markets as well as parent-bank funding. They are therefore not as dependent on just deposit growth. Consequently, the data show a stronger correlation between deposit and loan growth for domestic banks than for multinational bank subsidiaries, in particular during the crisis (0.63 versus 0.39). Deposit growth halted for both types of banks in 2008 after which growth resumed.

It is interesting to compare the deposit and credit dynamics during the 2008–09 crisis with those exactly 10 years earlier, at the time of the Asian, Russian, and Latin American crises of 1998–99. Depositor confidence was shaken less at the time and compared to the average for the preceding period 1992–97, the reduction in credit growth was also less pronounced. This underlines the unique character of the Great Recession in terms of the strength of the shock to the global financial system.

Tables A1 and A2 in the Appendix provide an overview of the variable definitions, data sources, and further descriptive statistics. Both before and during the crisis the median liquidity and solvency of stand-alone domestic banks was slightly higher than that of multinational bank subsidiaries. The latter can rely on support from the bank group they belong to and therefore tend to hold a slightly lower liquidity and solvency buffer over and above the minimum levels required by local regulators (precrisis [crisis] differences are significant at the 1% [10%] level).

Profitability levels have been persistently higher for multinational bank subsidiaries compared to domestic banks and this holds true both before and during the crisis (1% level). This may indicate a focus on somewhat better clients[9] as well as more efficient operations (Martinez Peria and Mody 2004). Table A2 also shows that both multinational bank subsidiaries and their domestic competitors saw their profitability decline only marginally during the crisis. In sharp contrast, parent banks experienced a steep drop in profitability of 60% compared to the average 1992–2007 level. This provides a further indication that the Great Recession hit multinational banks mainly "at home."

Finally, Table A2 shows that compared to subsidiaries, parent banks make significantly more use of wholesale funding (1% level). This reflects that large and internationally diversified banks tend to have easier access to international wholesale markets compared to their locally incorporated subsidiaries (which may nevertheless benefit indirectly if part of this wholesale funding is allocated to them via the group's internal capital market).

9. On "cherry-picking" or "cream-skimming" by foreign banks, see Detragiache, Tressel, and Gupta (2008) and Degryse et al. (2011).

1.3 Methodological Approach

Our dependent variable is the credit growth of bank *i* in year *t* and the independent variables comprise host-country variables, characteristics of bank *i*—including lagged credit growth and an ownership dummy variable—and a crisis dummy for the years 2008 and 2009:

$$\Delta L_{it} = a + \gamma \Delta L_{it-1} + \sum_{K=1}^{l} \beta_k Host_{k,it} + \sum_{k=l+1}^{m} \beta_k Bank_{k,it} + \delta Crisis_t + \varepsilon_{it}, \tag{1}$$

where

- ΔL_{it} (ΔL_{it-1}) is the percentage credit growth of bank *i* in year *t* ($t-1$ if lagged);
- α is an intercept, γ and δ are coefficients and β_k are coefficient vectors;
- $Host_{it}$ is a matrix of host-country macroeconomic variables;
- $Bank_{it}$ is a matrix of characteristics of bank *i* itself, including a dummy to distinguish between multinational bank subsidiaries and domestic banks, and/or its parent bank;
- $Crisis_t$ is a dummy variable that is 1 for observations in 2008 or 2009;
- ε_{it} is an idiosyncratic error $\varepsilon_{it} \sim$IDD $(0, \sigma^2{}_{\varepsilon})$;
- $i = 1, \ldots, N$, where N is the number of banks in the sample;
- $t = 1, \ldots, T_i$, where T_i is the number of years in the sample for bank *i*.

The host-country macroeconomic variables reflect the attractiveness of expanding credit in a particular country. We expect a positive relationship with host-country GDP growth, a proxy for credit demand at the country level, as banks expand credit in a procyclical way. GDP growth is only a rough proxy for credit demand and we are careful not to interpret our findings as pure supply-side effects. To fully control for credit demand one would either have to match banks with individual borrowers or analyze firms that borrow from more than one bank (keeping credit demand constant).[10] This level of detail is not available in our data. We therefore need to assume either that banks grant credit to similar market segments[11] or that heterogeneity in credit demand across market segments is orthogonal to bank ownership and our other explanatory variables.

We expect a negative impact of inflation as rapid price increases may worsen market frictions and force banks to ration credit (Boyd, Levine, and Smith 2001).

10. See Beck, Ioannidou, and Schäfer (2012) and De Haas and Van Horen (2012, 2013) for examples of this approach. The first paper uses data on firms that borrow from both domestic and foreign banks to show that both types of banks may lend to the same clientele while using different lending techniques.

11. While evidence suggests that multinational banks focus more on large, foreign, and transparent borrowers than domestic banks—see Berger and Udell (1995) and the references in footnote 9—recent contributions indicate that over time foreign and domestic banks' client segments may converge (De Haas and Naaborg 2006). Multinational bank subsidiaries may amass local knowledge and successfully apply transaction technologies that use hard information, such as credit scoring, to lend to opaque borrowers (Petersen and Rajan 2002, Berger and Udell 2006).

Yet, as host-country inflation increases the nominal value of loan portfolios there will be a positive mechanical effect of inflation on bank lending. Since we convert our data to U.S. dollars, inflationary effects should disappear to the extent that purchasing power parity holds. We include the nominal exchange rate to ensure that our results for other macroeconomic variables are not driven by residual exchange-rate fluctuations.

We anticipate a negative sign for $Crisis_t$ as banks, regardless of their ownership structure, had to slow down credit growth during the crisis due to tighter funding constraints. To compare lending by multinational bank subsidiaries and domestic banks, we include a dummy variable that is one for domestic banks. To the extent that domestic banks were better able to continue lending than multinational bank subsidiaries, we expect a positive coefficient for this interaction term between $Crisis_t$ and *Domestic*. In contrast, if multinational bank subsidiaries were supported by their parent banks and if this support gave them a competitive advantage during the crisis, their lending would have been more stable than that of stand-alone domestic banks. We would then observe a negative interaction.

To analyze the impact of funding structure on the stability of bank lending, we first include deposit growth. Deposits are a relatively stable funding source as they are (partially) government insured in many countries (Song and Thakor 2007). We expect that access to a stable deposit base was particularly important during the crisis when wholesale funding dried up. Because banks differ substantially in the relative importance of their deposit base, we also include the variable *Wholesale*, the ratio between total loans and the bank's customer funding. This measure proxies for the amount of lending that the bank has funded from nondeposit sources. As a third funding measure, we include the ratio of internally generated income at the end of year t to total loans at the end of year $t - 1$. This variable captures the sensitivity of a bank's loan growth to internally generated cash flow (Campello 2002).

In addition to these ownership and funding variables, we include the following bank-specific control variables: profitability (return on average assets), solvency (equity to assets), and liquidity (liquid assets to customer deposits). On the one hand, high capital and liquidity ratios may reflect that a bank is risk averse and expands credit only slowly.[12] Vice versa, undercapitalized banks may be prone to moral hazard and rapidly expand (risky) lending (Black and Strahan 2002). Both effects imply a negative relationship between bank capital and loan growth. On the other hand, high capital and liquidity ratios may indicate that funding constraints are not binding, enabling banks to rapidly expand lending. The expected sign of the coefficients for these variables is therefore indeterminate.

We use two estimation methods for our panel regressions: fixed effects and a dynamic Generalized method of moments (GMM) panel estimator. The choice for fixed effects estimations is based on Hausman tests, which indicate that fixed effects

12. Degryse, Elahi, and Penas (2012) find that more liquid and better capitalized banks reduce regional banking fragility.

are preferred over random effects as the independent variables and bank-specific effects are correlated. Since lagged credit growth may be correlated with the panel-level effects and our time dimension is relatively limited, there is a risk that our estimator is inconsistent (Nickell 1981). We therefore also report the results of a GMM difference estimator, where the instruments consist of lags of the levels of the explanatory and dependent variables (Arellano and Bond 1991).[13]

To test whether the instruments are valid, we perform Hansen's *J*-test for overidentifying restrictions. If we cannot reject the null, the model is supported and this is the case throughout the paper (see the *p*-values at the bottom of the tables). These *p*-values are not exceptionally high (i.e., not above 0.9) which gives us some comfort that the instruments are not weak (Roodman 2009). We also report the outcomes of the Arellano and Bond (1991) test for autocorrelation of orders 1 and 2. These consistently show that we cannot reject the null hypothesis of no second-order autocorrelation (since the estimator is in first differences, first-order autocorrelation does not imply inconsistent estimates). Robust estimators are used to correct for heteroskedasticity.

2. EMPIRICAL RESULTS

2.1 Baseline Results

Table 2 summarizes our baseline results based on the full sample that includes both multinational bank subsidiaries and domestic banks. The first lines indicate that relatively solvent and liquid banks grow more slowly, possibly because these banks are more conservative. In terms of funding structure, we find that deposit growth is positively correlated with credit growth and that a higher proportion of wholesale funding in total liabilities has a positive impact on loan growth. Banks also grow faster when they generate more income internally (as measured by the income-to-loans ratio). As expected, lending is procyclical.[14]

In the bottom half of Table 2, we then distinguish between both ownership types through interaction terms with the *Domestic* dummy. Columns 1–4 indicate that banks had to reduce their credit growth quite substantially during the 2008–09 crisis. However, the interaction terms between the *Global crisis* dummy and *Domestic* show that this reduction was significantly smaller for domestic banks, all else equal. Domestic banks had to reduce their lending growth by only 4.6 percentage points: about a third of the credit slowdown by multinational bank subsidiaries.

In columns 3–4, we also interact *Domestic* with a *Local crisis* dummy, which we create using the updated data set by Laeven and Valencia (2012). This dummy

13. We also ran regressions using the Arellano and Bover (1995) or the Hausman and Taylor (1981) estimator. As the results are very similar to those obtained with the other estimators we do not report them for reasons of brevity.

14. A comparison of the odd and even columns shows that our fixed effects (FE) and Arellano–Bond GMM (AB) results are very similar. In the remainder of the paper we therefore present AB results only.

TABLE 2

CREDIT GROWTH OF MULTINATIONAL AND DOMESTIC BANKS—BASELINE RESULTS

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Bank-specific variables								
Δ Gross Loans$_{(t-1)}$	−0.08	−0.12	−0.08	−0.12	−0.09	−0.12	−0.08	−0.11
	(4.59)***	(4.84)***	(4.56)***	(4.79)***	(4.74)***	(4.96)***	(4.35)***	(4.50)***
Liquidity	−0.10	−0.31	−0.10	−0.30	−0.10	−0.26	−0.08	−0.28
	(3.73)***	(4.02)***	(3.79)***	(3.93)***	(3.53)***	(3.11)***	(3.02)***	(3.39)***
Solvency	−0.75	−0.79	−0.75	−0.83	−0.77	−0.77	−0.80	−0.59
	(5.15)***	(1.74)*	(5.15)***	(1.83)*	(5.28)***	(1.72)*	(5.46)***	(1.34)
Δ Deposits %	0.40	0.38	0.40	0.37	0.40	0.37	0.38	0.35
	(29.79)***	(11.33)***	(29.72)***	(11.25)***	(29.68)***	(11.25)***	(25.92)***	(10.19)***
Income/loans$_{(t-1)}$	1.24	1.31	1.24	1.25	1.22	1.27	1.29	1.34
	(5.84)***	(2.56)**	(5.83)***	(2.41)**	(5.73)***	(2.45)**	(6.04)***	(2.62)***
Wholesale	0.21	0.20	0.21	0.21	0.22	0.21	0.23	0.19
	(9.25)***	(2.26)**	(9.35)***	(2.46)**	(9.76)***	(2.43)**	(9.79)***	(2.05)**
Macro variables								
GDP growth host country	0.63	0.44	0.58	0.40	0.58	0.46	0.64	0.78
	(4.70)***	(1.99)**	(4.30)***	(1.86)*	(4.30)***	(2.08)**	(4.72)***	(3.08)***
Global crisis	−10.77	−14.42	−12.01	−15.91	−4.78	−5.87	−4.86	−0.59
	(6.78)***	(4.08)***	(6.61)***	(4.48)***	(1.51)	(0.92)	(1.21)	(0.04)
Domestic × Global crisis	6.53	9.00	8.46	11.75	8.69	12.76	8.43	11.81
	(3.67)***	(1.80)*	(4.18)***	(2.33)**	(4.30)***	(2.44)**	(4.16)***	(1.99)**
Local crisis			2.90	7.83	3.55	13.32	4.34	21.71
			(1.21)	(1.03)	(1.48)	(1.49)	(1.81)*	(1.79)*
Domestic × Local crisis			−5.70	−14.64	−6.45	−19.4	−6.79	−25.23
			(2.09)**	(1.74)*	(2.36)**	(1.85)*	(2.48)**	(1.91)*
Wholesale × Global crisis					−0.09	−0.14	−0.11	−0.22
					(2.79)***	(1.99)**	(2.89)***	(1.73)*
Liquidity × Global crisis							−0.07	−0.19
							(1.47)	(1.28)
Solvency × Global crisis							0.18	0.53
							(0.92)	(0.88)
Δ Deposits × Global crisis							0.14	0.20
							(3.85)***	(2.77)***
Constant	−0.24	7.77	−0.14	7.11	−1.20	5.22	−1.54	4.80
	(0.10)	(1.02)	(0.06)	(0.94)	(0.52)	(0.69)	(0.66)	(0.62)
R^2	0.34		0.34		0.34		0.35	
Observations	2,739	2,739	2,739	2,739	2,739	2,739	2,739	2,739
DW	1.605		1.608		1.603		1.602	
AB test AR1		0.000		0.000		0.000		0.000
AB test AR2		0.133		0.150		0.123		0.224
Hansen *J*		0.200		0.197		0.195		0.225
Estimation method	FE	AB	FE	AB	FE	AB	FE	AB

NOTES: This table shows the results of panel regressions to explain the change in bank lending before and during the 2008–09 financial crisis. Table A1 in the Appendix contains definitions of all variables. We show both fixed effects (FE) and a GMM difference estimator (Arellano and Bond 1991, AB). AB test AR1(2): *p*-value of the Arellano–Bond test that average autocovariance in residuals of order 1 (2) is 0. Hansen *J*: *p*-value of the Hansen *J*-test for overidentifying restrictions, asymptotically distributed as chi-square under the null of instrument validity. Standard errors are robust. *T*-statistics appear in parentheses. ***, **, * correspond to the 1%, 5%, and 10% levels of significance, respectively.

identifies (the timing of) *local* banking crises in the host countries in our data set. In line with De Haas and Van Lelyveld (2006, 2010) we find that domestic banks are *less* stable lenders during such local crises, exactly the opposite of what we find for the recent, global crisis. This is confirmed in the subsequent columns and in line with the theoretical results discussed in the introduction.

In columns 5–6 we then add an interaction term between *Global crisis* and *Wholesale funding*. This specification allows us to investigate the relative importance of bank *funding* structure and bank *ownership* structure for credit growth during the

crisis. In columns 7–8 we also add interaction terms between *Global crisis* and three other funding-related bank characteristics. This final step allows us to check whether any findings on ownership and funding structure are not spurious.[15] We find that even when we interact *Global crisis* with a number of bank characteristics, the interaction term between *Domestic* and *Global crisis* remains significantly positive. In addition, we find that banks that depended less on wholesale funding grew faster. The economic significance of this result is substantial. A one standard deviation decrease in a subsidiary's wholesale funding corresponds to 2.5 percentage points higher credit growth during the crisis.

Once we add the interaction term between *Global crisis* and *Wholesale funding*, the global crisis dummy itself becomes insignificant, further underlining the importance of funding structure as a driver of lending behavior. Banks that were able to generate more deposits during the crisis grew faster too. When wholesale funding was increasingly difficult to roll over, access to deposits became an even stronger determinant of credit growth.

We conclude that *both* funding structure and ownership structure mattered during the crisis. In other words, we find a separate ownership effect on lending stability over and above the impact of banks' funding structure. Foreign-bank subsidiaries are not simply different because of a different balance-sheet structure but also because they are part of a multinational bank holding company.

Finally, we perform a robustness test where we consecutively rerun the two main specifications of Table 2 while each time omitting the observations of one particular region (Emerging Europe, North America, South America, and Asia). Table A4 in the Appendix shows that our findings are robust to this consecutive elimination of geographic regions. In particular, the table indicates that domestic banks were relatively stable lenders across regions and that the negative relationship between wholesale funding and lending stability during the global crisis also holds across regions. Our findings do not just apply to emerging Europe, with its exceptional level of banking integration, but also reflect multinational banks' operations in other parts of the world.

2.2 Group Characteristics and Subsidiary Lending

In Table 3 we focus specifically on multinational bank subsidiaries. We consecutively add a number of variables—both on their own and as part of interaction terms with *Global crisis*—that measure characteristics of the parent bank (columns 1–3) and of the other subsidiaries of that parent (columns 4–7). In this way we analyze whether group characteristics partially explain the variation in the credit decline among multinational bank subsidiaries.

15. We are limited in the number of interactions we can include by our degrees of freedom and the potential for instrument proliferation in the GMM regressions. We experimented by including different sets of interaction terms and our findings on the impact of ownership and funding structure are robust to such variations.

TABLE 3

GROUP CHARACTERISTICS AND MULTINATIONAL BANK LENDING

	Group: Parent bank			Group: Other subsidiaries			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Δ Gross Loans$_{(t-1)}$	−0.21	−0.20	−0.22	−0.19	−0.18	−0.19	−0.21
	(5.48)***	(4.77)***	(5.37)***	(4.38)***	(3.90)***	(4.17)***	(4.81)***
GDP growth host country	0.54	1.34	0.61	0.66	0.92	0.43	0.28
	(1.43)	(2.81)***	(1.49)	(1.46)	(1.91)*	(1.04)	(0.71)
Global crisis	−13.37	−47.89	31.34	−26.22	−48.97	−18.04	−11.92
	(1.74)*	(2.76)***	(1.47)	(5.82)***	(5.00)***	(1.37)	(3.35)***
Liquidity	−0.03	−0.03	−0.02	−0.08	−0.14	−0.08	−0.11
	(0.38)	(0.28)	(0.18)	(1.23)	(1.75)*	(1.20)	(1.75)*
Solvency	−0.86	−0.94	−0.92	−1.96	−0.74	−1.56	−1.62
	(0.81)	(0.84)	(0.87)	(1.58)	(0.67)	(1.31)	(1.32)
Δ Deposits	0.24	0.23	0.23	0.18	0.19	0.20	0.19
	(6.43)***	(6.39)***	(6.36)***	(5.54)***	(5.45)***	(5.81)***	(4.68)***
Income/loans$_{(t-1)}$	1.88	2.11	2.30	2.02	2.24	1.99	2.21
	(3.33)***	(3.32)***	(3.56)***	(3.32)***	(3.62)***	(3.60)***	(2.95)***
Wholesale	0.49	0.50	0.52	0.18	0.23	0.21	0.24
	(3.61)***	(3.62)***	(3.57)***	(1.32)	(1.73)*	(1.53)	(1.74)*
Group liquidity	0.01			−0.17			
	(0.14)			(2.90)***			
Group liquidity × Global crisis	−0.01			0.37			
	(0.06)			(2.90)***			
Group solvency		0.08			−1.05		
		(0.04)			(1.66)*		
Group solvency × Global crisis		7.20			5.97		
		(1.99)**			(3.28)***		
Group wholesale			−0.19			0.13	
			(0.96)			(1.66)*	
Group wholesale × Global crisis			−0.50			0.04	
			(2.07)**			(0.26)	
Other subs × Local crisis							−11.30
							(1.91)*
Constant	−17.40	−20.75	−4.80	19.41	7.06	−0.57	9.30
	(1.41)	(1.49)	(0.28)	(1.93)*	(0.65)	(0.05)	(0.84)
Observations	734	734	734	751	755	749	687
AB test AR1	0.001	0.000	0.002	0.006	0.001	0.000	0.000
AB test AR2	0.173	0.301	0.434	0.430	0.858	0.419	0.342
Hansen *J*	0.886	0.893	0.836	0.908	0.891	0.857	0.808
Estimation method	AB	AB	AB	AB	AB	AB	AB

NOTES: This table shows the results of panel regressions to estimate the relationship between shocks to parent banks and other subsidiaries and lending by multinational bank subsidiaries. The "Group" variables refer to characteristics of the parent bank (other subsidiaries) in columns 1–3 (4–7). Table A1 in the Appendix contains definitions of all variables. Results are based on a GMM difference estimator (Arellano and Bond 1991, AB). AB test AR1(2): *p*-value of the Arellano–Bond test that average autocovariance in residuals of order 1 (2) is 0. Hansen *J*: *p*-value of the Hansen *J*-test for overidentifying restrictions, which is asymptotically distributed as chi-square under the null of instrument validity. Standard errors are robust. *T*-statistics appear in parentheses. ***, **, * correspond to the 1%, 5%, and 10% levels of significance, respectively.

While there is no apparent relationship between parent-bank liquidity and subsidiary lending (column 1), we find that lending was more stable during the crisis by subsidiaries that belong to banks that were better capitalized at the group level (column 2). In contrast, subsidiaries of wholesale-funded parent banks had to rein

in credit more strongly, all else equal (column 3).[16] Interestingly, when we account for differences in the level of wholesale funding at the group level, we no longer find a significant impact of the *Global crisis* dummy itself. The negative impact of the global crisis on subsidiary lending can be largely explained by the extent to which parent banks had funded themselves in the wholesale market. This mirrors our previous finding for subsidiary-level wholesale funding and reflects that wholesale funding at the parent and subsidiary level is positively correlated.

The results in columns 4–7 indicate that subsidiaries were also more stable lenders during the crisis in case *other* subsidiaries in the *same* group were more liquid, held more capital, and (at the 10% level) did not experience a banking crisis in their own respective host countries. These results are all in line with multinational banks operating an internal capital market through which they reallocate liquidity and capital in response to shocks. In particular, parent banks may allocate funding and capital from the periphery to the core in case of a financial shock in the latter.

In unreported regressions, we also experimented with a dummy variable *Parent support* that indicates whether a parent bank received government support during the crisis. To create this dummy, we developed a comprehensive database of financial support measures (capital injections, loan guarantees, and removals of toxic assets) taken since the start of the crisis. We pull this information from various publications by the European Commission and the IMF, Reuters news service, and bank websites. State support is an indicator of bank fragility and thus a proxy for the bank's need to deleverage, both at home and through its foreign subsidiaries. Kamil and Rai (2010) suggest that rescue programs may also have *caused* banks to reduce foreign lending.

Yet, when controlling for a battery of subsidiary and parent-bank characteristics we do not find an independent effect of parent support. When we split our support variables into specific dummies for support through capital injections, bank-specific guarantees, and asset sales to the government we do not find an impact of these specific support measures either. Moreover, we do not find an impact of banks' participation in the European Bank Coordination ("Vienna") Initiative, which is not too surprising as this international crisis response focused on five countries only, all in Emerging Europe.

2.3 Multinational Bank Heterogeneity: Size and Distance

Our results in Table 2 indicate that during the Great Recession multinational bank subsidiaries had to rein in credit growth more than domestic banks. This difference remains when we control for a battery of bank characteristics, including funding structure. In Table 3 we saw that the financial strength of the parent bank and of other subsidiaries can partly explain why multinational banks are different: they are financially connected to operations in other countries. This raises the question

16. Düwel and Frey (2012) show that short-term funding by foreign subsidiaries of German banks made them more vulnerable during the 2008–09 crisis. Subsidiaries that relied on intrabank funding had to rein in credit more as well, although less so in the case of parent banks that had access to more deposits and long-term wholesale funding.

TABLE 4

CREDIT GROWTH OF MULTINATIONAL BANK SUBSIDIARIES HETEROGENEITY

	[1]	[2]	[3]	[4]	[5]
Bank-level variables					
Δ Gross Loans$_{(t-1)}$	−0.20	−0.18	−0.19	−0.19	−0.19
	(5.03)***	(4.20)***	(5.00)***	(4.58)***	(4.86)***
Liquidity	−0.15	−0.15	−0.18	−0.13	−0.16
	(2.09)**	(1.93)*	(2.44)**	(1.69)*	(2.07)**
Solvency	−1.22	−0.99	−1.46	−1.28	−1.36
	(1.04)	(0.87)	(1.33)	(1.19)	(1.27)
Δ Deposits	0.21	0.22	0.21	0.21	0.22
	(6.01)***	(5.69)***	(6.31)***	(5.95)***	(6.25)***
Income/loans$_{(t-1)}$	2.03	1.82	2.06	2.09	2.12
	(3.20)***	(2.84)***	(2.84)***	(3.17)***	(2.96)***
Wholesale	0.21	0.13	0.18	0.24	0.22
	(1.75)*	(1.06)	(1.38)	(1.87)*	(1.73)*
Macro variables					
GDP growth host country	0.29	0.12	0.10	0.29	0.17
	(0.68)	(0.28)	(0.22)	(0.67)	(0.40)
Global crisis	−12.70	−12.18	−43.05	−16.63	−38.81
	(4.30)***	(4.27)***	(3.67)***	(6.11)***	(3.33)***
Size sub to group	0.02				
	(0.03)				
Size sub to group × Global crisis	−0.25				
	(0.47)				
Size sub to country		0.14			
		(1.39)			
Size sub to country × Global crisis		−0.06			
		(0.14)			
Distance (log)			−39.1		−43.94
			(1.49)		(1.35)
Distance (log) × Global crisis			3.96		3.13
			(2.51)**		(1.93)*
Shared language × Global crisis				10.15	7.01
				(2.84)***	(1.76)*
Constant	7.41	10.18	308.1	4.95	339.47
	(0.77)	(1.02)	(1.53)	(0.53)	(1.37)
Observations	767	700	767	767	767
AB test AR1	0.001	0.010	0.000	0.000	0.000
AB test AR2	0.362	0.231	0.373	0.409	0.356
Hansen *J*	0.821	0.837	0.789	0.857	0.918
Estimation method	AB	AB	AB	AB	AB

NOTES: This table shows the results of panel regressions to explain the change in bank lending by different types of multinational bank subsidiaries before and during the 2008–09 financial crisis. Table A1 in the Appendix contains definitions of all variables. Results are based on a GMM difference estimator (Arellano and Bond 1991, AB). AB test AR1(2): *p*-value of the Arellano–Bond test that average autocovariance in residuals of order 1 (2) is 0. Hansen *J*: *p*-value of the Hansen *J*-test for overidentifying restrictions, which is asymptotically distributed as chi-square under the null of instrument validity. Standard errors are robust. *T*-statistics appear in parentheses. ***, **, * correspond to the 1%, 5%, and 10% levels of significance, respectively.

whether the strength of such connections varies across subsidiaries, a question we address in Table 4.

We differentiate between subsidiary types along two dimensions: size and distance to the parent bank. In columns 1 and 2 we first focus on subsidiary size, which we measure either as assets relative to total group assets or relative to total assets of the banking sector in the host country. Cetorelli and Goldberg (2012a) show that during the recent crisis U.S. parent banks shielded their "core" (relatively large) foreign

affiliates when they had to reduce internal funding, while Cetorelli and Goldberg (2012b) find a similar pecking order among the branches of foreign banks in the U.S. Berrospide, Black, and Keeton (2011) show that within the U.S. banks transmitted shocks by reducing mortgage lending in lower-delinquency markets in response to losses in high-delinquency markets. Such spillovers affected in particular more peripheral operations that accounted for a small share of the bank's overall lending. At the international level, Claessens and Van Horen (2014) show that lending by foreign bank subsidiaries during the recent crisis was more stable in countries where foreign banks (jointly) dominate the banking system. We therefore expect a positive relationship between subsidiary size and lending stability.

Yet, the results in columns 1 and 2 indicate that credit growth during (and before) the financial crisis was unrelated to subsidiary size. This holds regardless of whether we calculate size as a percentage of the group's balance sheet or of total banking assets in the host country. A likely explanation is that our data set comprises the main ("core") subsidiaries of each multinational banking group but not smaller ones. This means that by construction the variation in (relative) size is limited, making it harder to pick up any residual correlation between bank size and lending stability.

Next, in columns 3–5 we analyze the role of the geographical and cultural distance between parent bank and subsidiary. We measure geographical distance as the log of the great-circle distance (in km) between the location of the parent headquarters and the location of the subsidiary. A longer "within-bank" or hierarchical distance makes it more difficult to efficiently pass along (soft) borrower information from the subsidiary to headquarters (Aghion and Tirole 1997, Stein 2002). This may also impede the efficient operation of an internal capital market across borders.[17] Moreover, if the incentives of distant loan officers and local management are not aligned with those of the parent bank, internal agency costs may hamper lending as well (Scharfstein and Stein 2000).

Based on this literature we expect that more distant subsidiaries displayed a sharper decline in bank lending as the crisis exacerbated agency problems between parents and distant subsidiaries in particular. Interestingly, however, the interaction term between *Distance* and *Global crisis* in column 3 shows that distant bank subsidiaries were *more* stable lenders during the crisis, all else equal. A one standard deviation increase in distance, which corresponds to an additional 4,561 km, implies a 5.7 percentage point *higher* credit growth during the crisis (4.5 percentage points when based on column 5 where we also control for cultural distance). There are three main explanations for this finding.

First, distant subsidiaries may simply be less integrated into the group' internal capital market and therefore better able to evade its financial discipline (i.e., they are less likely to be asked to provide financial support to the parent bank). Parent bank's

17. Alessandrini, Presbitero, and Zazzaro (2009) show for Italy that a greater distance between loan officers and headquarters adversely affects credit availability of local firms. Presbitero, Udell, and Zazzaro (2014) find that during the recent crisis the supply of Italian bank credit was reduced, in particular, in provinces with branches of distantly managed banks. De Haas and Van Horen (2013) show that after the Lehman Brothers default cross-border credit was reduced more to distant destinations.

senior management may find it difficult to manage junior management in far-away places (Rajan, Servaes, and Zingales 2000). While in good times a long distance to the parent may hamper subsidiary growth—as distant subsidiaries are less successful in lobbying for internal funding (Carlin, Charlton, and Mayer 2006)—a "safe" distance to a troubled parent bank that is in need of financial support may turn out to be a blessing during a financial crisis.

Second, distant subsidiaries may have a special status within the bank holding company. Setting up distant subsidiaries typically involves high fixed costs, and while these costs were already sunk when the Great Recession erupted, they signal the strategic commitment of a parent bank to a distant market. Indeed, senior management of expanding banks may temporarily focus more on recently purchased remote subsidiaries and less on nearby subsidiaries that have been part of the holding for longer (Berger and DeYoung 2001).

Third, the higher lending stability of distant subsidiaries may also reflect that the crisis erupted in the West, where many parent banks are based, while many distant subsidiaries are located in emerging markets. To the extent that we do not fully control for local demand conditions (via GDP growth), higher lending by these remote subsidiaries may also reflect that the crisis hit many emerging markets later and to a lesser extent compared to Western and nearer countries.

Another "distance" measure is cultural or social affinity. Proximity in this respect may foster lending stability as (re-)negotiations are facilitated and the costs of contracting and information gathering are lower (Giannetti and Yafeh 2012). If social interactions between parent banks and subsidiaries are facilitated, as in the case of a common language, such interactions may also gradual bias banks toward socially close subsidiaries and their borrowers (Landier, Nair, and Wulf 2009).[18] To measure these effects we include an interaction term between *Global crisis* and cultural proximity (column 4), which we proxy by *Shared language*, a dummy that is 1 if a significant share of the population of the home and host country share a common language.[19]

As expected, we find that subsidiary lending is more stable if the home and host country share a common language: subsidiaries in countries where a significant part of the population speak the same language as in the parent bank's country of incorporation grew on average 10.2 percentage points faster during the crisis than subsidiaries in culturally more distant countries. Column 5 shows that when we

18. Galindo, Izquierdo, and Rojas-Suarez (2010) find for Latin America that the interest rates charged and amount of loans supplied by foreign banks respond more to external shocks than those supplied by domestic banks. Yet, the culturally close Spanish banks form an exception as they did *not* amplify the impact of foreign shocks on the price and amount of credit.

19. In columns 3–5 we include *Distance* but not *Shared language* as a separate main effect (in addition to the interaction term). This is because *Shared language* is time invariant and therefore omitted from the AB model that is fitted in first differences. *Distance*, however, is not fully time invariant as a number of banks changed ownership during our sample period and this changed the distance between these subsidiaries and their (new) parent banks. Since in all of these cases both the new and the old parent banks were based in home countries where the main language was different from that in the host country, these ownership changes did *not* lead to time variation in the variable *Shared language*.

interact both geographical and cultural distance with the crisis dummy both findings remain (although estimated somewhat less precisely).

2.4 Multinational Banks "At Home"

Our findings so far indicate, in line with both theoretical predictions and anecdotal evidence, that when bank holding companies needed more funding "at home," subsidiaries could rely less on parental support. A logical follow-up question is whether as a result parent banks themselves managed to (partially) stabilize their lending in their home countries. To look into this, we compare the lending behavior of a sample of large domestic banks *without* foreign subsidiaries with the lending behavior of the parent banks whose subsidiary networks we have thus far analyzed.

Columns 1 and 2 of Table 5 compare the lending behavior of internationally undiversified domestic banks and multinational banks, respectively. This comparison shows that the former appear to be more sensitive to the global crisis. In the multinational bank regression the crisis-dummy coefficient is insignificant. It appears that large internationally diversified banks managed to somewhat shield their home-country operations from the global turmoil (to the detriment of lending by their foreign subsidiaries, Table 2).

In columns 3–5 we push this idea further by interacting the global-crisis dummy with a number of characteristics of multinational banks' foreign subsidiaries. This does not produce much evidence to the effect that certain types of parent banks were more or less sensitive to the crisis. The last column seems to indicate, however, that groups with more liquid subsidiaries did better during the crisis (presumably because such subsidiaries were easier to "milk" by the parent; see also the results in column 4 of Table 3). When differentiating between multinational banks with more and less liquid subsidiaries, the coefficient of the *Global crisis* dummy itself is also more precisely estimated. While on average multinational banks had to contract home-country lending less than similar domestic banks, this relative stability was due to those multinational banks with more liquid subsidiaries abroad.

3. SOME MACROECONOMIC IMPLICATIONS

The bank-level evidence provided in the previous sections begs the question whether countries with more foreign banks also suffered sharper declines in aggregate credit growth when compared to countries where foreign banks are less prominent. That is, do our micro findings add up to a macroeconomic impact, or was the deleveraging by foreign banks offset by faster domestic bank lending? While a complete discussion of such equilibrium effects is beyond the scope of the paper, this section provides a concise analysis of the relationship between foreign bank penetration and aggregate lending during the crisis.

For our analysis we combine data on foreign bank ownership (based on Claessens and Van Horen 2014), on cross-border funding of banking systems (BIS Locational

TABLE 5

MULTINATIONAL BANK LENDING AT HOME

	Domestic banks	Multinational bank groups			
	[1]	[2]	[3]	[4]	[5]
Bank-level variables					
Δ Gross Loans$_{(t-1)}$	−0.17	−0.10	−0.10	−0.09	−0.16
	(4.04)***	(2.07)**	(1.76)*	(1.59)	(2.84)***
Liquidity	−0.1	0.01	−0.08	−0.08	−0.09
	(1.17)	(0.11)	(0.64)	(0.66)	(0.68)
Solvency	−1.24	2.90	1.13	1.01	1.64
	(1.26)	(1.96)*	(0.71)	(0.63)	(1.02)
Δ Deposits	0.36	0.41	0.39	0.39	0.35
	(7.34)***	(3.52)***	(2.70)***	(2.71)***	(2.58)***
Income/loans$_{(t-1)}$	2.14	0.93	1.14	1.10	1.28
	(2.25)**	(0.86)	(0.98)	(0.83)	(1.13)
Wholesale	0.07	0.13	0.10	0.08	0.17
	(0.96)	(1.60)	(1.06)	(0.79)	(1.46)
Macro variables					
GDP growth host country	0.66	0.72	0.35	0.30	0.32
	(1.74)*	(1.33)	(0.57)	(0.58)	(0.67)
Global crisis	−8.00	−2.57	−10.23	−5.39	−14.92
	(3.91)***	(0.98)	(1.40)	(0.46)	(2.85)***
Subs solvency			−0.27		
			(1.23)		
Subs solvency × Global crisis			0.49		
			(0.53)		
Subs wholesale				0.05	
				(1.13)	
Subs wholesale × Global crisis				−0.01	
				(0.10)	
Subs liquidity					−0.19
					(2.15)**
Subs liquidity × Global crisis					0.38
					(2.43)**
Constant	9.53	−20.23	−2.29	−5.06	−6.43
	(1.13)	(1.82)*	(0.30)	(0.68)	(0.92)
Observations	1,215	467	348	348	334
AB test AR1	0.001	0.012	0.000	0.000	0.008
AB test AR2	0.085	0.278	0.322	0.348	0.753
Hansen *J*	0.897	0.912	0.897	0.932	0.892
Estimation method	AB	AB	AB	AB	AB

NOTES: This table shows the results of panel regressions to compare the lending behavior of domestic banks and multinational bank groups in their (home) country of incorporation. Table A1 in the Appendix contains definitions of all variables. Results are based on a GMM difference estimator (Arellano and Bond 1991, AB). AB test AR1(2): *p*-value of the Arellano–Bond test that average autocovariance in residuals of order 1 (2) is 0. Hansen *J*: *p*-value of the Hansen *J*-test for overidentifying restrictions, which is asymptotically distributed as chi-square under the null of instrument validity. Standard errors are robust. *T*-statistics appear in parentheses. ***, **, * correspond to the 1%, 5%, and 10% levels of significance, respectively.

Statistics), and macroeconomic data from the IMF's International Financial Statistics. In Figure 2A, we first plot foreign bank penetration before the crisis, as measured by the percentage of banking assets owned by foreigners in 2007, against nominal credit growth at the height of the crisis. The fitted line indicates that countries with higher levels of foreign bank penetration experienced lower credit growth during the crisis. An example can illustrate this. While within Emerging Europe foreign bank penetration is high on average, there is substantial cross-country variation. For

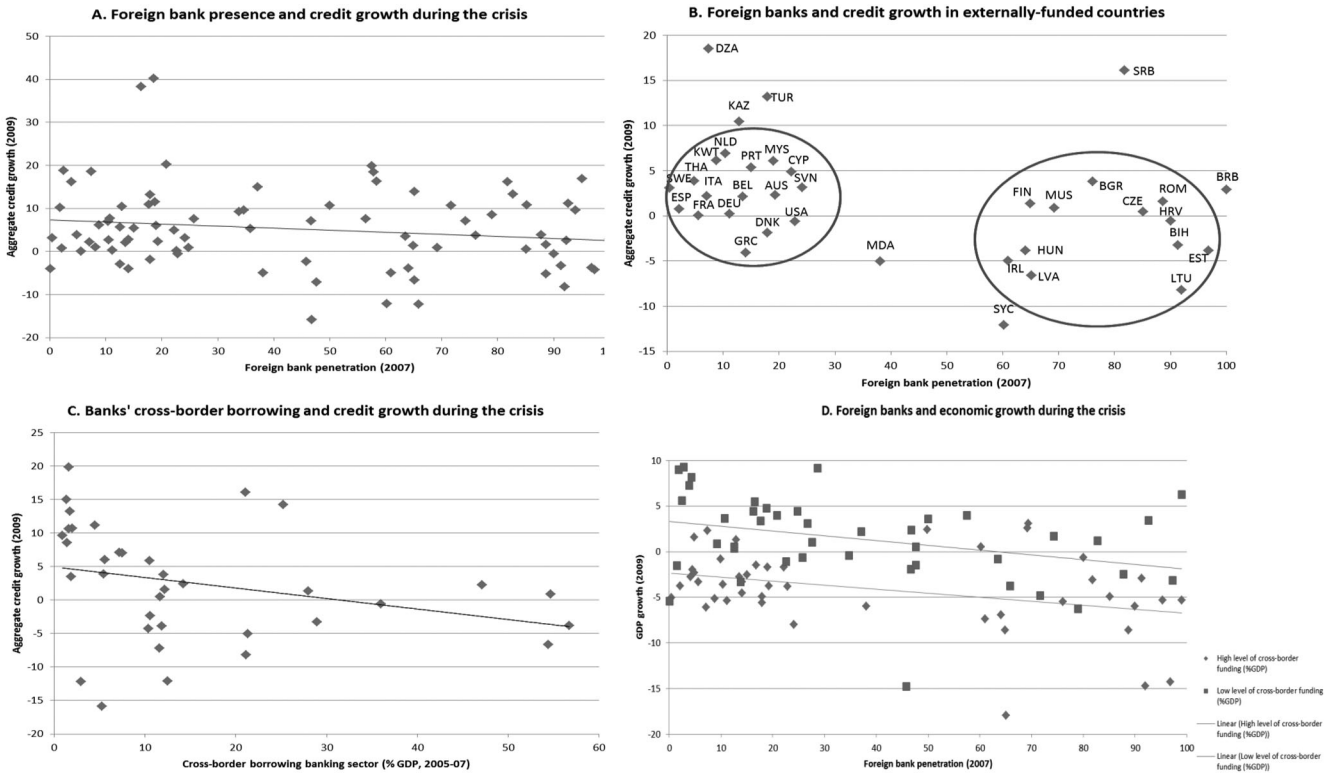

FIG. 2. Multinational Banking and Lending Stability—Aggregate Evidence.

NOTE: The four panels in this figure show country-level statistics on the relationship between a country's pre-crisis financial structure and credit and economic growth during the crisis. Panels A and B plot foreign bank penetration in 2007 against aggregate credit growth in 2009. Panel A shows all 82 countries for which data are available whereas Panel B shows those 36 countries where the average ratio of the banking sector's cross-border funding to GDP over the period 2005–07 was above the median. Panel C plots total cross-border borrowing by the banking sector over 2005–07 against credit growth in 2009. Panel D plots foreign bank penetration in 2007 against GDP growth in 2009 and distinguishes between countries where banking systems had a high (low) level of precrisis cross-border funding indicated by small panes (squares).

SOURCES: International Monetary Fund, Bank for International Settlements, and Claessens and Van Horen (2014).

instance, in 2007 the foreign share of banking assets in Estonia was 96% while in Slovenia it was only 24%. Credit growth in Estonia was affected dramatically by the crisis, falling from 32% in 2007 to 8% in 2008 and −4% in 2009. In contrast, Slovenia—while hardly immune to the crisis—saw credit growth rates fall from 33% in 2007 (virtually the same as in Estonia) to 17% in 2008 and a still positive 3% in 2009.

Figure 2B shows a similar graph but we now limit the sample to countries where the banking system was relatively dependent on cross-border borrowing before the crisis. We use the BIS Locational Statistics to calculate for each country total cross-border borrowing by the banking system as a percentage of GDP. We then select all countries where the average ratio over 2005–07 exceeded 30%. When we now plot the relationship between foreign bank presence and credit growth during the crisis, we find two clusters of countries. On the left there are mainly Western European countries (and the U.S.) with low foreign bank ownership and sustained credit growth during the crisis. In these developed countries high precrisis cross-border borrowing was mainly intermediated via domestic banks. In contrast, on the right we find a cluster of countries, many in Central and Eastern Europe, where foreign banks were dominant and responsible for the high level of precrisis wholesale borrowing. In these countries, credit growth was low or even negative during the crisis.

Next, Figure 2C focuses on countries where at least 30% of all bank assets are in foreign hands. As expected, within this group of countries dominated by foreign banks, those with more precrisis cross-border borrowing, often in the form of intrabank funding from their parent banks, show lower credit growth during the crisis. In countries with a ratio of cross-border funding to GDP of less than 10%, credit grew at 9.3%. This compares to an average of 2.7% in countries above the 10% threshold (difference statistically significant at the 5% level).

Finally, in Figure 2D we split our sample into countries with above/below median levels of precrisis use of cross-border funding. For each group, we then plot the relationship between foreign bank presence and GDP growth during the crisis. The result is striking. In both cases, we find a negative relationship between foreign bank assets and GDP growth, mirroring the earlier negative relationship between foreign bank presence and credit growth in Figure 2A. However, the fitted line for the "heavy" borrowers is significantly below the fitted line for the "light" borrowers. For a given level of foreign bank presence, we find that countries that relied heavily on cross-border borrowing before the crisis had a 5.2 percentage point lower growth (stronger recession) during the crisis compared to countries where the banking sector relied more on local funding.

In all, this brief analysis shows that countries with higher levels of foreign bank penetration experienced lower credit growth during the crisis. This was in particular the case for those banking systems that were largely owned by foreign banks *and* relied more on cross-border wholesale funding. These countries not only experienced sharper credit contractions but also lower GDP growth.

4. CONCLUSIONS

We use bank-level data on a large group of multinational bank subsidiaries and stand-alone domestic banks to compare the stability of their lending during the 2008–09 financial crisis. Contrary to earlier and more contained crisis episodes, we find that parent banks were not a significant source of strength to their subsidiaries. As a result, multinational bank subsidiaries had to slow down lending growth about three times as fast as domestic banks.[20] Multinational bank subsidiaries' access to parent bank and wholesale funding, one of their main competitive advantages before the crisis, turned out to be a mixed blessing when these alternative funding sources dried up in the wake of the Lehman Brothers collapse. Indeed, we find that subsidiaries whose parent banks made greater use of wholesale funding had to reduce credit growth more during the crisis. These results provide further evidence on the negative impact that banks' excessive reliance on wholesale funding may have on financial stability. Moreover, we show that these bank-level results hold for a variety of regions across the world and that our main findings on the relationship between bank ownership, bank funding structure, and lending stability are also reflected in a concise country-level analysis.

We also confirm earlier results that show that multinational bank subsidiaries did not have to reduce their lending when a *host* country was hit by a banking crisis (while unaffiliated domestic banks had to do so). Both findings can be understood within a framework in which multinational banks allocate capital and liquidity to that part of the group that is hit by a financial shock. When a subsidiary experiences a shock, capital will flow from the parent to the subsidiary. However, the flipside of the operation of an internal capital market is that when a banking group is hit at its core, parental support may no longer be forthcoming and internal funding may even flow from the periphery to the core.

In all, our results indicate that financial integration is more of a double-edged sword than previously thought. The organizational and financial structure of global banks facilitates the cross-border transmission of shocks and therefore requires effective coordination and cooperation between national supervisory authorities to prevent the international spillover of financial shocks. That such coordination is not yet well established was made clear during the recent crisis, when an *ad hoc* coordination mechanism, the Vienna Initiative, had to be set up to ensure a continued commitment of Western banks to their Eastern European subsidiaries.

Improved supervisory coordination is necessary for two other reasons as well. First, bank regulation itself may have significant cross-border spillovers. Banks that face tighter restrictions and higher minimum capital requirements at home may loosen their lending standards in host countries, in particular when faced with

20. Alfaro and Chen (2012) compare a global data set of *nonbank* multinational subsidiaries and domestic firms, and conclude that multinational subsidiaries performed *better* during the Great Recession. This greater resilience was especially apparent for establishments with strong production and financial linkages with their parents. This may indicate that overall nonbank parents were less affected by the financial crisis than banks and thus able to continue to support foreign subsidiaries.

lenient supervisory regimes.[21] Better cooperation between home and host authorities can limit such arbitrage where national regulators are played off against each other.

Second, the alternative to enhanced international cooperation is to force banking groups to hold more capital and liquidity in each subsidiary and this will prove costly.[22] "Ring-fencing" subsidiaries is costly to multinational banks themselves, because the sum of ring-fenced pools of capital will exceed current capital as banks can no longer exploit international diversification benefits. At the macroeconomic level there may be costs, too, as full ring-fencing would prevent multinational banks from moving scarce capital and liquidity across borders to the most worthy investment projects.

Ideally, an integrated supervisory regime would continue to allow multinational banks to operate a network of branches and subsidiaries through which they allocate capital and liquidity to its most productive use. At the same time, supervisors should be able to adequately respond to local shocks that hit a banking group and that may have knock-on effects on other parts of the group. Better supervisory cooperation could include, at a minimum, a strengthening of the role of colleges of supervisors and (*ex ante*) burden-sharing agreements. Moreover, supervisors could cushion the international transmission of financial shocks by imposing prudential limits on subsidiaries' reliance on foreign wholesale and parent-bank funding ("partial" ring-fencing). This is a process that is already well underway, with multinational banking groups themselves rebalancing the funding structure of their subsidiaries toward local sources.

Whether enhanced supervisory cooperation will be able to limit regulatory arbitrage and reduce the international transmission of financial shocks will largely determine to what extent multinational banks can be expected to foster local economic growth in the years to come. Compared to the counterfactual of an autarchic banking system, an integrated banking sector will boost economic growth if it leads to more—and more efficient—financial intermediation without undoing these benefits by an excessive increase in economic volatility. Evidence from before the Great Recession indicates that this net impact of multinational banks on host countries has been positive: the direct positive effect of financial liberalization on long-run growth has outweighed the indirect negative effect of a higher probability of occasional financial crises.[23] Further research is necessary to analyze *how* countries that want to benefit from financial integration should open up their banking system. A particularly interesting question is to what extent a country's exposure to foreign shocks can be diversified away by allowing entry of banks from a variety of home countries.

21. See Ongena, Popov, and Udell (2013), Barth, Caprio, and Levine (2006), and Acharya, Wachtel, and Walter (2009).

22. See Cerutti et al. (2010) for an analysis of the costs in regards to (partial) ring-fencing of subsidiaries in Emerging Europe and Van Lelyveld and Spaltro (2011) for the cost associated with burden sharing.

23. Rancière, Tornell, and Westermann (2008), Levchenko, Rancière, and Thoenig (2009), and Bruno and Hauswald (Forthcoming).

APPENDIX

TABLE A1

VARIABLE DEFINITIONS AND DATA SOURCES

Variable	Definition	Data source	Unit
Loan growth	Growth of (net loans plus loan loss reserves)	BankScope	%
Deposit growth	Percentage growth of total deposits	BankScope	%
Solvency	Equity/total assets	BankScope	%
Liquidity	Liquid assets/customer deposits	BankScope	%
Income to loans	Net current income t/total loans ($t-1$)	BankScope	%
Profitability	Return on average equity	BankScope	%
Wholesale	Net loans as a perc. of cust. funding	BankScope	%
Size sub to group	Total assets subsidiary/total assets parent bank	BankScope	%
Size sub to country	Total assets subsidiary/total assets banking sector host country	BankScope; IFS	%
Distance	Distance in km between parent bank and subsidiary according to the great circle distance formula (in log)	CIA World Factbook (2005)	Log km.
Shared language	Dummy that is 1 if the same language is spoken by at least 9% of the population in both countries	GeoDist at www.cepii.fr	0/1
GDP growth	Yearly change in GDP in host country	IMF-IFS	%
Inflation	Annual inflation rate in host country	IMF-IFS	%
Global crisis	Yearly dummy. 1 in 2008 and 2009	–	0/1
Local crisis	Yearly dummy. 1 in case of banking crisis	Laeven and Valencia (2012), Carstens et al. (2004)	0/1

NOTES: This table presents variable definitions and data sources of the variables used in the paper. BankScope is Bureau van Dijk's database of bank balance sheet and income statement data. IFS are the International Financial Statistics provided by the International Monetary Fund.

TABLE A2

DESCRIPTIVE STATISTICS

		1992–2007		2008–09		1992–2009			
Variable	Bank type	Mean	Median	Mean	Median	Obs.	St. dev.	Min	Max
Loan growth	Parent	12.02	10.24	7.71	4.19	536	13.88	−37.22	67.74
	Subsidiary	13.74	11.35	5.64	4.01	1,112	20.38	−65.41	72.07
	Domestic	14.96	13.16	9.31	6.92	2,335	19.51	−73.16	74.09
Deposit growth	Parent	11.89	10.43	5.57	3.04	536	18.13	−50.01	120.37
	Subsidiary	11.71	9.70	9.64	6.56	1,083	28.73	−72.63	186.92
	Domestic	14.95	12.37	10.87	6.80	2,330	23.34	−64.67	195.94
Solvency	Parent	5.13	4.67	5.28	5.02	536	2.59	0.86	21.68
	Subsidiary	8.35	7.36	8.41	7.90	1,117	5.29	0.35	88.54
	Domestic	9.13	7.71	9.44	8.03	2,337	5.95	0.50	68.74
Liquidity	Parent	36.00	33.92	37.83	30.82	536	18.92	0.88	98.54
	Subsidiary	24.55	19.06	22.40	17.81	1,051	21.84	0.01	95.12
	Domestic	27.88	23.34	25.21	21.02	2,329	19.78	0.03	99.97
Income to loans	Parent	1.77	1.38	0.78	0.71	536	1.81	−2.75	17.16
	Subsidiary	1.94	1.22	2.02	1.43	1,117	2.45	−11.79	23.07
	Domestic	2.25	1.62	1.79	1.25	2,337	2.94	−11.48	38.41
Profitability	Parent	13.72	14.48	5.46	6.29	536	9.09	−29.78	45.92
	Subsidiary	13.71	13.03	12.52	11.26	1,117	10.48	−29.87	48.42
	Domestic	11.47	10.61	10.11	9.73	2,337	9.58	−29.83	48.55
Wholesale	Parent	77.86	71.37	89.38	82.93	536	28.59	29.42	192.5
	Subsidiary	70.30	67.85	80.42	81.89	1,103	27.88	10.63	200.14
	Domestic	73.21	71.95	78.66	77.23	2,318	26.74	10.59	193.85
GDP growth		3.54	3.30	0.18	0.40	3,982	2.84	−6.40	18.30
Inflation		3.79	2.40	4.47	3.50	3,987	2.50	−3.90	100.01
Local crisis		0.05	0.00	0.42	0.00	3,990	0.30	0.00	1.00

NOTES: This table presents basic descriptive statistics, by bank type and before versus during the global crisis, of the variables used in the paper.

TABLE A3

OVERVIEW OF MULTINATIONAL BANK SUBSIDIARIES

Bank group name	Home country	Number of subsidiaries	Host countries
ABN AMRO Holding	nl	2	br, us
Allied Irish Banks	ie	2	pl, gb
Banca Monte dei Paschi di Siena	it	2	be, fr
Banco Bilbao Vizcaya Argentaria	es	12	ar, cl, co, mx, pe, pt, us, ve
Banco do Brasil	br	1	at
Banco Popular Espanol	es	3	fr, pt, us
Banco Santander	es	13	br, cl, de, mx, pt, gb, us, ve
Bank of America	us	2	br, gb
Bank of Nova Scotia	ca	8	cl, sv, jm, mx, pe, gb, us
Barclays Bank	gb	2	es, za
Bayerische Hypo-und Vereinsbank	de	9	hr, cz, hu, pl, ru, at
Bayerische Landesbank	de	1	hu
BNP Paribas	fr	3	it, us
Citigroup	us	5	br, ca, my, mx, pl
Commerzbank	de	3	nl, pl, sk
Crédit Agricole Group	fr	3	de, it
Danske Bank	dk	1	no
Deutsche Bank	de	6	au, it, es, us
Deutsche Zentral-Genossenschaftsbank	de	1	ie
Dexia	be	9	fr, de, it, nl, es
Erste Group Bank	at	5	hr, cz, hu, ro, sk
FIA Card Services	us	2	ca, gb
Fortis Bank	be	1	nl
HBOS	gb	1	ie
HSBC	gb	12	br, ca, fr, de, hk, ind, my, mx, sa, us
ING Bank	nl	5	au, be, ca, fr, pl
Intesa Sanpaolo	it	7	hr, fr, hu, ie, pe, sk
Itau Unibanco	br	1	pt
KBC Bank	be	5	cz, de, hu, ie, pl
Millennium bcp-Banco Comercial Portugues	pt	6	fr, gr, mz, pl, us
Mitsubishi UJF	jp	3	us
National Australia Bank	au	2	nz, gb
National Bank of Greece	gr	6	bg, ca, cy, us, ro, mk
Nordea Bank	se	5	dk, fi, no, ru
Rabobank	nl	1	ie
Raiffeisen Zentralbank Oesterreich	at	12	bg, hr, cz, hu, pl, ru, si, ro, sk, al, ba, rs
Royal Bank of Canada	ca	2	gb, us
Royal Bank of Scotland	gb	3	ie, us
SanPaolo IMI	it	1	si
Skandinaviska Enskilda Banken	se	5	dk, ee, de, lv, lt
Société Générale	fr	4	au, ca, cz, de
Standard Chartered	gb	5	hk, ke, kr, my, th
Swedbank	se	3	ee, lv, lt
Toronto Dominion Bank	ca	3	au, nl, us
UBS	ch	2	gb, us
UniCredit	it	10	bg, hr, cz, de, hu, ie, pl, ru
WestLB	de	6	be, br, fr, ie, pl, ru
Westdeutsche Genossenschafts-Zentralbank	de	1	ie

NOTES: The average number of subs: 4.31. Country names are according to ISO 3166-2 classification.

TABLE A4

ROBUSTNESS—REGIONAL HETEROGENEITY

	Base		Excl. CEE		Excl. North America		Excl. South America		Excl. Asia	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Bank-specific variables										
Δ Gross Loans$_{(t-1)}$ %	−0.12	−0.12	−0.12	−0.11	−0.12	−0.12	−0.11	−0.12	−0.13	−0.14
	(4.84)***	(4.96)***	(4.46)***	(4.59)***	(4.54)***	(4.73)***	(4.43)***	(4.55)***	(5.12)***	(5.38)***
Liquidity	−0.31	−0.26	−0.30	−0.27	−0.14	−0.11	−0.15	−0.11	−0.15	−0.10
	(4.02)***	(3.11)***	(3.88)***	(3.53)***	(1.94)*	(1.61)	(1.83)*	(1.43)	(1.75)*	(1.28)
Solvency	−0.79	−0.77	−0.68	−0.60	−1.54	−1.6	−1.52	−1.5	−1.61	−1.53
	(1.74)*	(1.72)*	(1.19)	(1.11)	(3.53)***	(3.70)***	(3.48)***	(3.56)***	(3.78)***	(3.85)***
Δ Deposits %	0.38	0.37	0.37	0.38	0.36	0.36	0.35	0.35	0.35	0.35
	(11.33)***	(11.25)***	(9.98)***	(10.07)***	(12.21)***	(12.51)***	(10.55)***	(10.56)***	(10.95)***	(10.95)***
Income/loans$_{(t-1)}$	1.31	1.27	1.38	1.41	1.26	1.2	1.21	1.19	1.27	1.19
	(2.56)**	(2.45)**	(2.64)***	(2.72)***	(3.39)***	(3.32)***	(3.04)***	(3.08)***	(3.27)***	(3.17)***
Wholesale	0.2	0.21	0.17	0.20	0.22	0.23	0.18	0.19	0.21	0.22
	(2.26)**	(2.43)**	(1.84)*	(2.25)**	(3.23)***	(3.36)***	(2.61)***	(2.90)***	(3.13)***	(3.31)***
Macro variables										
GDP growth host	0.44	0.46	0.53	0.55	0.27	0.34	0.37	0.37	0.6	0.76
	(1.99)**	(2.08)**	(2.45)**	(2.49)**	(1.29)	(1.59)	(1.51)	(1.45)	(2.50)**	(3.20)***
Global crisis	−14.42	−5.87	−12.83	−2.00	−14.55	−6.28	−13.74	−1.54	−14.91	−4.60
	(4.08)***	(0.92)	(4.07)***	(0.32)	(5.12)***	(1.14)	(5.08)***	(0.30)	(5.64)***	(0.85)
Domestic × Global crisis	9.00	12.76	8.70	6.62	8.13	9.86	7.71	6.49	8.79	7.72
	(1.80)*	(2.44)**	(2.05)**	(1.79)*	(2.25)**	(2.47)**	(2.24)**	(1.79)*	(2.57)**	(2.22)**
Local crisis		13.32		1.04		9.20		4.19		10.45
		(1.49)		(0.23)		(1.77)*		(1.00)		(2.03)**
Domestic × Local crisis		−19.40		1.36		−10.82		−5.42		−10.86
		(1.85)*		(0.23)		(1.73)*		(0.87)		(1.87)*
Wholesale × Global crisis		−0.14		−0.12		−0.12		−0.14		−0.12
		(1.99)**		(2.01)**		(2.35)**		(2.82)***		(2.33)**
Constant	7.77	5.22	7.12	3.15	9.34	8.28	11.09	9.07	9.70	6.73
	(1.02)	(0.69)	(0.86)	(0.41)	(1.32)	(1.22)	(1.62)	(1.37)	(1.40)	(1.01)
Observations	2,739	2,739	2,433	2,433	2,457	2,457	2,465	2,465	2,375	2,375
AB test AR1	0.000	0.000	0.001	0.000	0.000	0.002	0.003	0.000	0.000	0.001
AB test AR2	0.133	0.123	0.143	0.153	0.333	0.383	0.111	0.119	0.233	0.293
Hansen *J*	0.200	0.195	0.529	0.557	0.234	0.389	0.351	0.453	0.333	0.332
Estimation method	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB

NOTES: This table replicates the base results from columns 2 and 6 of Table 2 in columns 1 and 2. The subsequent columns then replicate the baseline model while each time leaving out the observations in one particular geographic region. Table A1 in the Appendix contains definitions of all variables. Results are based on a GMM difference estimator (Arellano and Bond 1991, AB). AB test AR1(2): *p*-value of the Arellano–Bond test that average autocovariance in residuals of order 1 (2) is 0. Hansen *J*: *p*-value of the Hansen *J*-test for overidentifying restrictions, which is asymptotically distributed as chi-square under the null of instrument validity. Standard errors are robust. *T*-statistics appear in parentheses. ***, **, * correspond to the 1%, 5%, and 10% levels of significance, respectively.

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