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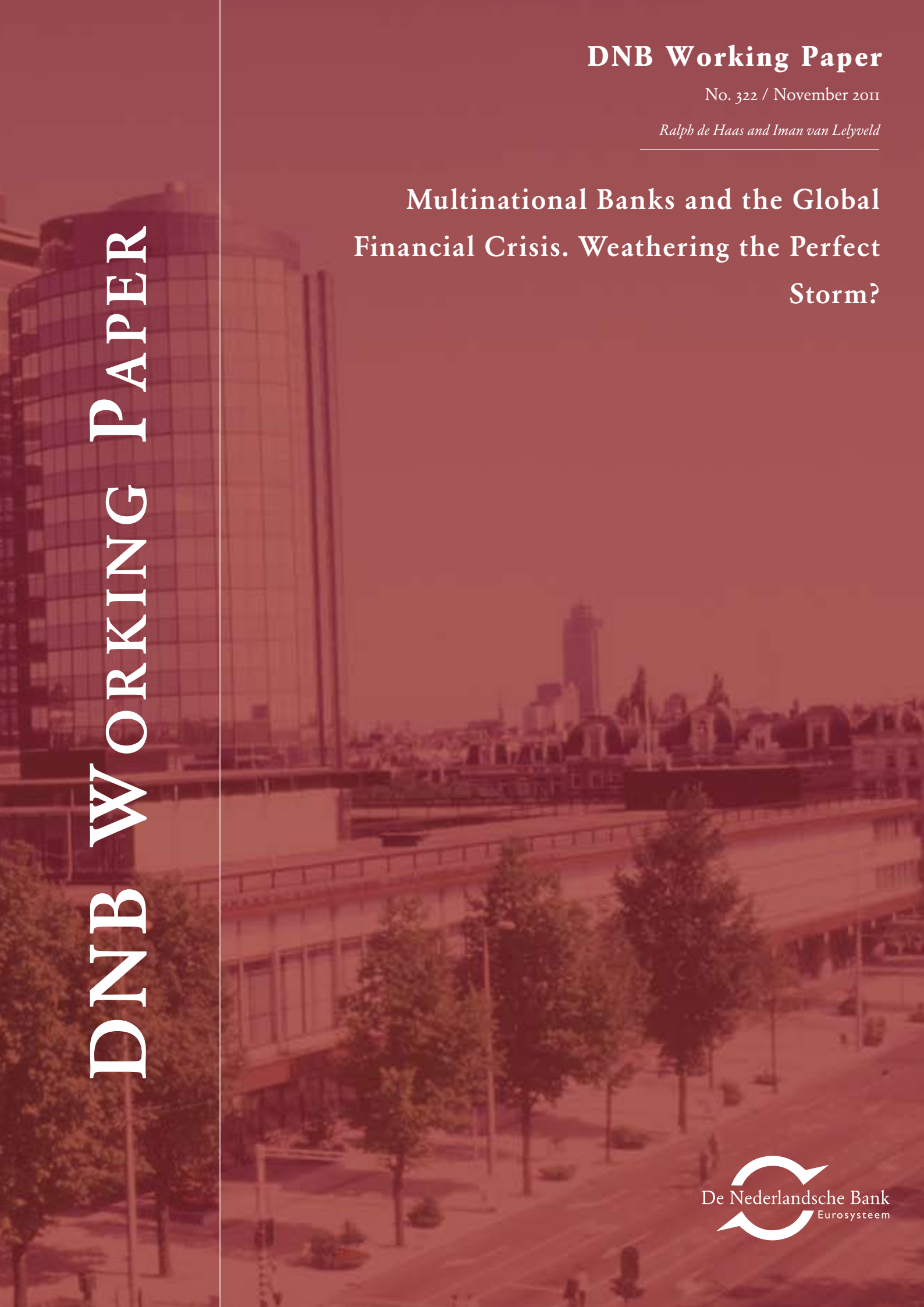

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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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

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Abstract

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 group of 202 domestic banks. Contrary to earlier, more contained crises, parent banks were *not* a significant source of strength to their subsidiaries during the 2008-09 crisis. As a result, multinational bank subsidiaries had to slow down credit growth about twice as fast as domestic banks. This was in particular the case for subsidiaries of banking groups that relied more on wholesale market funding. Domestic banks were better equipped to continue lending because of their greater use of deposits, a relatively stable funding source during the crisis. We conclude that while multinational banks may contribute to financial stability during local crisis episodes, they also increase the risk of 'importing' instability from abroad.

Keywords: Multinational banks, financial stability, crisis transmission, funding structure
JEL classifications: F15; F23; F36; G21

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1. Introduction

Over the last two decades many countries have opened up their banking sectors to foreign-bank entry with the aim of improving the quantity and quality of banking 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 banking integration made host countries more resilient or more susceptible to financial shocks?

This short paper contributes to answering this question by analyzing a comprehensive dataset on both multinational bank subsidiaries and stand-alone domestic banks. We compare the lending stability of both types of banks during the Great Recession. In doing so, we follow De Haas and Van Lelyveld (2010) who use similar data to examine bank lending during previous, more contained bouts of financial turmoil. The authors find that during such *local* crises, subsidiaries of financially strong parent banks did typically not rein in their credit supply 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 helped stabilize local lending. This empirical finding underlines that financial integration can mitigate local financial shocks, a result in line with theoretical work by Morgan et al. (2004).

The 2008-09 global financial crisis, which struck at the core of the international financial system and affected virtually all large banking groups, 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. Weakened parent banks, hit by a reduction in inter-bank liquidity and other funding, may even have used their internal capital market to repatriate funds from subsidiaries to headquarters. For instance, according to publications in the business press, multinational bank subsidiaries in Russia and the Czech Republic used local liquidity to support their foreign headquarters in Italy and France at the end of 2008 (in the wake of the Lehman Brothers collapse) and in mid-2011 (during the Eurocrisis). [1] If multina-

[1] See for instance Bloomberg, 27-10-2011, '*Foreign banks in Russia support European owners since mid–year*'and ft.com/alphaville, 04-11-2011, '*Honey, I shrunk Emerging Europe*'.

tional 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 (note that this would be equally in line with Morgan et al., 2004).

Against this background, this paper asks whether, compared to stand-alone domestic banks, multinational bank subsidiaries were able to keep up lending relatively well during the recent crisis or, alternatively, whether the absence of sufficient parental support meant that subsidiaries had to stand on their own feet and were no longer in a privileged position compared to domestic banks.

We find that multinational bank subsidiaries had to curtail credit growth more aggressively than domestic banks (about twice as much) during the recent crisis, which was wide-spread and affected the core of the global financial system. Domestic banks, which relied more on local deposits to fund credit growth, were better positioned to continue to lend. Multinational bank subsidiaries of groups that relied to a greater extent on wholesale funding, which effectively dried up at various points during the crisis, had to slow down credit growth the most. Parent banks that could not access external (wholesale) markets were apparently no longer in a position to allocate liquidity to their subsidiary network via the group's internal capital market. In all, we conclude that while the presence of multinational banks mitigates local financial shocks, it also opens the door for the transmission of foreign shocks.

This paper builds on earlier empirical work on the role of multinational banks as shock absorbers and transmitters. As regards the former, De Haas and Van Lelyveld (2006) find for Emerging Europe that during local crises lending by foreign banks has typically been more stable than lending by domestic banks. De Haas and Van Lelyveld (2010) present similar evidence for a broader set of countries and banks. As regards the latter, Peek and Rosengren (1997) and Peek and Rosengren (2000) demonstrate how the drop in Japanese stock prices in 1990 led Japanese bank branches in the U.S. to reduce lending. Schnabl (2011) analyzes how the 1998 Russian crisis spilled over to Peru as banks, including multinational bank subsidiaries, saw their foreign funding decline and had to reduce local lending. Chava and Purnanandam (2011) find similar evidence for U.S. banks.

In the wake of the 2008-09 global financial crisis, various authors have reassessed the impact of multinational bank subsidiaries on host-country lending

stability in specific countries or regions. De Haas et al. (2011) find that multinational bank subsidiaries in Emerging Europe cut lending more than domestic banks. Popov and Udell (2010) find similar results for the same region and show that multinational bank lending declined in particular when parent banks were financially weak. In contrast, 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, as we show in this paper, much of the reduction in lending took place in 2008-09.

For the United Kingdom, Aiyar (2011) shows how the decline in British banks' foreign funding caused a contraction in their local lending after the Lehman Brothers default. This contraction was stronger for foreign-owned than for domestic banks. More specifically, Rose and Wieladek (2011) find that in particular nationalized foreign banks reduced their lending in the UK during the Great Recession.

Finally, a number of papers have focused on the role of banks' pre-crisis funding structure on the stability of their lending during the crisis. Cetorelli and Goldberg (2011) use data at the level of national banking sectors and find that banks that were more vulnerable to U.S. dollar funding shocks cut cross-border credit and lending through foreign subsidiaries more. Huang and Ratnovski (2009) focus on the funding structure of Canadian banks and show that a lower share of wholesale funding in total liabilities made bank lending more resilient during the crisis. The authors confirm this stabilizing effect of a higher deposit share for a sample of commercial banks in other OECD countries. In a similar vein, Kamil and Rai (2010) show for Latin America that multinational bank subsidiaries that mainly used domestic deposits were a relatively stable source of credit during the recent crisis.

Our paper is the first to systematically analyze the behavior of multinational banks during the Great Recession on the basis of a comprehensive sample of large multinational banking groups, covering both the main geographical regions and the whole crisis period. Our analysis is based on bank-level data which allows us to disentangle the impact of banks' ownership and funding structure, while controlling for other bank characteristics. In particular, we can compare the lending behavior of multinational bank subsidiaries with that of their domestic competitors.

The remainder of this paper is structured as follows. Section 2 describes our dataset and empirical approach, after which Section 3 presents our main results. Section 4 concludes.

2. Data and methodology

2.1. Data

We expand and update the data used in De Haas and Van Lelyveld (2010) to create a sample of multinational banks based on the Top 1000 of the largest banks (asset rank) as published by The Banker. From the 150 largest banks on this list we identify banks with more than one significant foreign bank subsidiary. [2] This results in a group of 48 bank holdings, for which we then identify – on the basis of Bureau Van Dijk's BankScope database, banks' websites, and correspondence with banks – all subsidiaries that account for at least 0.5 per cent of the parent bank's assets in 2009 and that are at least 50 per cent owned by the parent. We therefore limit ourselves to relatively large foreign subsidiaries in which the parent has a controlling stake. [3] A parent bank in our sample owns on average 4.3 of such significant subsidiaries. Annex A-2 contains a list of all banks in our sample.

For each subsidiary (level 1) we check whether it owns sub-subsidiaries (level 2) that are larger than 0.5 per cent of the ultimate bank holding (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 separately include consolidated data for the sub-subsidiary. We use unconsolidated data for the parent banks.

If parent banks are the result of a merger or acquisition in year t we include them from $t+1$ onwards. We disregard banks for which we have less than three 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 as a result of a takeover. For greenfield subsidiaries that were established by the bank itself, we use data from year t onwards, whereas we include take-over subsidiaries from $t+1$.

Figure 1 provides a graphical representation of our sample of multinational bank subsidiaries. The sample consists of 48 multinational banks from 19 home countries with 199 subsidiaries across 53 countries. Most parent banks (77 per cent) and subsidiaries (61 per cent) are based in Europe, reflecting the numerous ownership

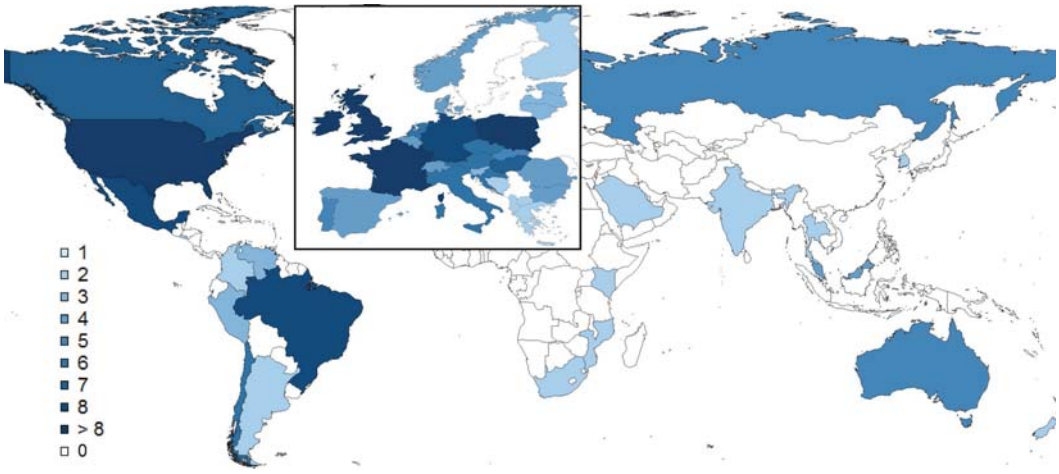
[2] We include commercial, savings, mortgage, long-term credit, and cooperative banks and exclude investment and state banks, securities houses, and non-bank credit institutions.

[3] We exclude subsidiaries in Luxembourg and Switzerland as their activities depend more on the deposit supply of (foreign) residents than on local economic developments.

links between Western European banks and their subsidiaries in Emerging Europe. Only 19 per cent of our sample of parent banks and subsidiaries are based in North America. North American banks are clearly less internationalized than European banks, which is not surprising given their substantially larger home market.

We also create a benchmark set of domestic banks that consists of the five 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.

Fig. 1. Geographical location of multinational bank subsidiaries



This figure shows the geographical distribution of the 199 multinational bank subsidiaries in our dataset. These include all subsidiaries for wich we have at least three consecutive years of data during the 1992-2009 period. Darker colours indicate a larger number of subsidiaries in a country. Source: BankScope and banks' websites.

We obtain financial data on parent banks, their foreign subsidiaries, and domestic banks from Bureau van Dijk's BankScope database. Our dependent variable is the percentage growth of gross loans. 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 remove observations where absolute annual loan growth exceeds 75 per cent.

Table 1 provides basic descriptive statistics for credit and deposit growth, two of our main variables. The data show how after very rapid growth in 2007 - the peak of the credit cycle - financial intermediation slowed down 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 sharply in 2009 and even exceeded its long-term average, credit dynamics remained more 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 (foreign) funding sources, such as the international bond and syndicated loan markets as well as parent-bank funding. In line with this, the data show a much 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). During the crisis, deposit growth halted for both types of banks in 2008 after which growth resumed in 2009.

Table 1: Average annual credit and deposit growth of multinational and domestic banks

		1992-1997	1998	1999	2000-2006	2007	2008	2009	Whole period
Δ 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
		Pre-crisis		Crisis					
Correlation Δ Loans and Δ Deposits	Subsidiary	.43		.39					
	Domestic	.54		.63					

Note: The row 'All' shows the averages over all observations.

It is also interesting to compare the deposit and credit dynamics during the 2008-09 global financial crisis with those exactly ten years earlier, at the time of the consecutive Asian, Russian, and Latin American crises of 1998-1999. This shows how, compared to the current crisis, depositor confidence was shaken much less at the time, in particular for multinational bank subsidiaries. Compared to the average for the preceding period 1992-97, the reduction in credit growth was also less pro-

nounced. This underlines the unique character of the Great Recession in terms of the strength of the shock to the global financial system.

Finally, Table A-1 in the Annex provides an overview of the definitions and statistical characteristics of the variables that we use in the paper. This shows that 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.

2.2. Methodological approach

Our dependent variable is the credit growth of bank i in year t and the independent variables comprise a set of 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:

$$\Delta L_{it} = \alpha + \gamma \Delta L_{it-1} + \sum_{k=1}^{l} \beta_k Host_{k,it} + \sum_{k=l+1}^{m} \beta_k Bank_{k,it} + \delta Crisis_t + \varepsilon_{it} \qquad (1)$$

where

- $\Delta L_{it} (\Delta L_{it-1})$ 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 $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$
- $i = 1, ..., N$ where N is the number of banks in the sample
- $t = 1, ..., T_i$ 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 and a negative impact of inflation. GDP growth acts as a proxy for credit demand at the country level and we expect banks to expand their

credit in a procyclical way in reaction to demand.

Inflation may increase market frictions and force banks to ration credit more (Boyd et al., 2001). Yet, to the extent that host-country inflation increases the nominal value of loan portfolios there will be a positive mechanical effect of inflation on bank lending. As we convert our data to U.S. dollars, inflationary effects should disappear to the extent that PPP holds. We also include the nominal exchange rate to ensure that our results for the other macroeconomic variables are not driven by residual exchange-rate fluctuations.

We expect a negative sign for $Crisis_t$ as banks, regardless of their ownership structure, had to slow down credit growth during the crisis due to tightening 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 interaction term between $Crisis_t$ and this dummy. 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 term.

To analyze the impact of banks' funding structure on the stability of their lending, we first include annual deposit growth. Deposits tend to be 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 as regards 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 non-deposit 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 from operations (Campello, 2002).

In addition to these ownership and funding variables, we also 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. 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 be a sign of non-binding funding constraints that enable banks to rapidly expand lending. The expected sign of the coefficients for these variables is therefore indeterminate.

We use three estimation methodologies for our panel regressions: fixed effects, a Hausman-Taylor (1981) instrumental variable estimator, and a dynamic GMM panel-data estimator. The choice for fixed effects estimations is based on Hausman tests, which indicate that fixed effects are preferred over random effects as the independent variables and bank-specific effects are correlated. Since fixed effects wipe out time-invariant bank characteristics, we also report the results of Hausman-Taylor (1981) regressions for the full sample. This allows us to apply fixed effects while still being able to estimate the parameter of the time-invariant bank-ownership dummy.

We are worried that lagged credit growth may be correlated with the panel-level effects, thus leading to an inconsistent estimator as our time dimension is relatively limited (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). [4] To test whether the instruments are valid, we perform the Hansen's J test for overidentifying restrictions. If we cannot reject the null, the model is supported. This is the case throughout the paper (see p-values in the tables). We also report the outcomes of the Arellano and Bond (1991) test for autocorrelation of order 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). We use robust estimators to correct for heteroscedasticity.

[4] We also ran regressions based on the Arellano and Bover (1995) estimator. As the results are very similar to those obtained with the other estimators we do not report them for reasons of brevity

3. Empirical results

Table 2 summarizes our main empirical results. We first present three regression specifications that are based on the full sample that includes both multinational bank subsidiaries and domestic banks (columns 1-3). We distinguish between both ownership types by using the *Domestic* dummy. In columns 4 and 5 (6 and 7) we then show regression results for domestic banks (multinational bank subsidiaries) separately. The first lines of Table 2 indicate, in line with De Haas and Van Lelyveld (2010), that relatively solvent and liquid banks grow more slowly, possibly because these banks are more conservative. As expected, lending by both multinational bank subsidiaries and domestic banks is also procyclical.

In terms of banks' funding structure, we find that deposit growth is positively correlated with credit growth and that this correlation is about twice as high for domestic banks, reflecting their more limited access to alternative funding. Second, a higher proportion of wholesale funding in total liabilities has a positive impact on loan growth and this is the case regardless of bank ownership. Interestingly, both domestic banks and multinational bank subsidiaries also grow faster when they generate more income internally (as measured by the income to loans ratio). For multinational bank subsidiaries the correlation between internally generated funds and lending growth is even somewhat higher, indicating that parent-bank funding does not fully alleviate funding constraints at the subsidiary level. [5]

We find that banks had to reduce credit growth substantially during the 2008-09 crisis. On average lending expanded by 12.7 percentage points less. [6] The interaction terms between the *Crisis* and the *Domestic* ownership dummies - in columns 1, 2, and 3 - show that this reduction was significantly smaller for domestic banks. These banks had to reduce their lending growth by only 6.0 percentage points: less than half of the credit slowdown by multinational bank subsidiaries. This difference in the magnitude of the crisis impact is confirmed when comparing columns 4 and 5 (domestic banks) with columns 6 and 7 (subsidiaries).

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[5] We also ran (unreported) regressions where we distinguish between greenfield multinational bank subsidiaries and subsidiaries that are the result of a take-over. To the extent that the former are more strongly integrated into the group's internal capital market, we expect that their lending is less sensitive to changes in deposits or internally generated income. However, our results indicate no differences between both subsidiary types.

[6] This is the average of the coefficients for the *Crisis* dummy in columns 1, 2 and 3.

We also find that during the crisis years 2008-09, when wholesale funding became increasingly difficult to roll over, access to deposits became an even stronger determinant of credit growth. The interaction term between deposit growth and the crisis dummy is significant in all specifications. The *relative* increase in the importance of deposits as a funding source is particularly high for multinational bank subsidiaries, as can be seen in columns 6 and 7.

Table 2: Credit growth of multinational and domestic banks (1992-2009)

Sample	All			Domestic banks		Multinational subsidiaries	
Bank-specific variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Gross Loans$_{(t-1)}$	-0.08	-0.04	-0.12	-0.06	-0.11	-0.13	-0.19
	(4.41)***	(2.55)**	(5.60)***	(2.83)***	(4.08)***	(3.77)***	(5.01)***
Profitability	0.05	0.09	0.00	0.07	0.05	0.01	0.07
	(1.14)	(2.07)**	(0.01)	(1.37)	(0.73)	(0.13)	(0.56)
Liquidity	-0.11	-0.10	-0.15	-0.11	-0.22	-0.09	-0.08
	(4.18)***	(3.99)***	(3.34)***	(3.60)***	(3.79)***	(1.91)*	(1.39)
Solvency	-0.83	-0.76	-1.11	-0.74	-0.94	-1.34	-1.70
	(6.00)***	(5.77)***	(3.79)***	(4.99)***	(3.09)***	(3.70)***	(2.22)**
Δ Deposits	0.23	0.25	0.22	0.44	0.43	0.23	0.22
	(11.15)***	(12.02)***	(6.58)***	(24.46)***	(10.25)***	(9.75)***	(6.32)***
Δ Deposits * Global crisis	0.15	0.15	0.16	0.13	0.15	0.18	0.16
	(4.08)***	(4.31)***	(2.73)***	(3.16)***	(2.27)**	(2.57)**	(1.81)*
Δ Deposits * Domestic	0.20	0.20	0.22				
	(7.71)***	(7.73)***	(4.59)***				
Income/loans$_{(t-1)}$	1.91	2.00	1.69	1.06	1.34	2.00	2.17
	(5.13)***	(5.46)***	(3.45)***	(5.50)***	(3.84)***	(4.93)***	(4.60)***
Income/loans$_{(t-1)}$ * Domestic	-0.77	-0.94	-0.18				
	(1.87)*	(2.32)**	(0.29)				
Wholesale	0.18	0.18	0.22	0.17	0.20	0.23	0.32
	(9.78)***	(10.08)***	(4.55)***	(8.42)***	(3.68)***	(5.26)***	(4.75)***
Macroeconomic variables							
GDP growth host country	0.44	0.46	0.36	0.40	0.47	0.55	0.32
	(3.84)***	(4.19)***	(2.08)**	(3.14)***	(2.33)**	(2.17)**	(1.21)
Inflation	0.04	0.13	0.24	0.10	0.36	-0.43	-0.15
	(0.34)	(1.32)	(1.16)	(0.90)	(1.61)	(1.48)	(0.32)
Global crisis	-12.56	-11.23	-14.20	-5.65	-6.69	-12.60	-13.04
	(7.99)***	(7.64)***	(6.52)***	(4.86)***	(4.47)***	(6.34)***	(6.15)***
Domestic * Global crisis	6.78	5.91	7.39				
	(3.84)***	(3.56)***	(3.16)***				
Domestic bank		-0.59					
		(0.34)					
Constant	1.89	0.21	2.90	1.02	3.01	5.30	0.51
	(0.91)	(0.09)	(0.64)	(0.42)	(0.59)	(1.22)	(0.06)
N	2,862	2,862	2,862	2,050	2,050	812	812
R^2	0.35			0.35		0.34	
DW	1.62			1.64		1.56	
AB test AR1			0.00		0.00		0.00
AB test AR2			0.32		0.73		0.14
Hansen J			0.86		0.67		0.55
Estimation method	FE	HT	AB	FE	AB	FE	AB

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Estimation methods are Fixed effects (FE), Hausman-Taylor (HT) and Arellano-Bond (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 χ^2 test under the null of instrument validity.

Next, Table 3 shows six regression specifications based on the sub-sample of multinational bank subsidiaries. We now also add a set of parent-bank characteristics, shown at the bottom of the table, to analyze whether parent-bank health can explain the variation in the credit decline among multinational bank subsidiaries.

In each specification we add GDP growth in the parent bank's home country. We expect that GDP growth in the home country exerts a negative influence on subsidiaries' credit growth as parent banks trade off lending opportunities in various countries (Morgan et al., 2004 and De Haas and Van Lelyveld, 2010). In addition, we include three parent level balance-sheet variables: *Liquidity* (columns 1 and 2), *Solvency* (columns 3 and 4), and *Wholesale* (columns 5 and 6).

We also include a dummy variable *Parent supported* that indicates whether a parent bank received government support during the crisis. To create this dummy, we develop a comprehensive database of financial support measures (capital injections, loan guarantees, and removals of toxic assets) that have been taken since the start of the crisis. State support can be seen as an indicator of a bank's financial fragility and thus as a proxy for the bank's need to deleverage, both at home and through its foreign subsidiaries. Kamil and Rai (2010) suggest that public rescue programs may also have *caused* banks to reduce their foreign lending. Anecdotal evidence suggests that rescue packages came with strings attached as banks were asked to refocus on domestic lending. For example, when the UK government decided to guarantee a substantial part of Royal Bank of Scotland's assets, the bank promised to lend GBP 50 billion more in the next two years, expanding its *domestic* loan book by a fifth (The Economist, February 28th 2009, p. 37, Italics added).

As expected, we find that home-country GDP has a negative impact on lending by foreign subsidiaries. Moreover, when controlling for a battery of subsidiary and parent-bank characteristics we do not find an independent effect of parent support. While the coefficient is negative, suggesting that subsidiaries of bailed-out parents grow more slowly, it is imprecisely estimated.

Importantly, we find a significant impact of parent banks' use of wholesale funding on the lending growth of their subsidiaries (columns 5 and 6). Note first that in columns 1-2 and 3-4 we do not find any impact of parent bank's liquidity or solvency, respectively, on the lending growth of foreign subsidiaries. In these regressions the impact of the *Global crisis* dummy also remains highly significant. However, when we control for parent banks' use of wholesale funding, we find that subsidiaries tend to grow faster if parent banks rely more on wholesale funding. Parent banks that can easily raise money on external (wholesale) markets can then distribute this funding to their subsidiaries via their internal capital market.

Moreover, we find that the interaction term between *Wholesale* and *Global*

crisis is significantly negative. During the crisis subsidiaries of wholesale-funded parent banks had to rein in credit more, all else equal. Interestingly, in these regressions we no longer find a significant impact of the global-crisis dummy itself. The negative impact of the global crisis on lending by multinational bank subsidiaries can be largely explained by the extent to which their parent banks had funded themselves in the wholesale market.

Table 3: Parent-bank health and credit growth of subsidiaries (1992-2009)

Firm specific variables	(1)	(2)	(3)	(4)	(5)	(6)
Δ Gross Loans$_{(t-1)}$	-0.14	-0.20	-0.13	-0.19	-0.14	-0.20
	(3.84)***	(4.99)***	(3.75)***	(4.81)***	(4.03)***	(5.12)***
Profitability	0.02	0.04	0.01	0.03	0.01	0.04
	(0.17)	(0.37)	(0.12)	(0.28)	(0.05)	(0.35)
Liquidity	-0.09	-0.07	-0.09	-0.08	-0.08	-0.08
	(1.83)*	(1.40)	(1.90)*	(1.49)	(1.67)*	(1.45)
Solvency	-1.43	-1.93	-1.44	-1.98	-1.47	-1.95
	(3.91)***	(2.51)**	(3.94)***	(2.63)***	(4.04)***	(2.64)***
Δ Deposits	0.23	0.22	0.23	0.22	0.23	0.22
	(9.83)***	(6.35)***	(9.79)***	(6.35)***	(9.89)***	(6.40)***
Δ Deposits * Global crisis	0.14	0.13	0.13	0.11	0.11	0.10
	(1.85)*	(1.38)	(1.81)*	(1.29)	(1.55)	(1.09)
Income/loans$_{(t-1)}$	2.04	2.11	2.02	2.14	1.92	2.12
	(4.95)***	(4.26)***	(4.94)***	(4.38)***	(4.66)***	(4.30)***
Wholesale	0.23	0.31	0.22	0.31	0.23	0.32
	(5.18)***	(4.52)***	(4.93)***	(4.49)***	(5.26)***	(4.71)***
Macro variables						
GDP growth host country	0.85	0.68	0.87	0.74	0.84	0.75
	(2.83)***	(2.28)**	(2.90)***	(2.47)**	(2.84)***	(2.49)**
Inflation	-0.21	0.06	-0.18	0.12	-0.11	0.14
	(0.67)	(0.11)	(0.57)	(0.24)	(0.35)	(0.27)
Global crisis 08-09	-15.57	-15.81	-17.14	-20.55	-5.05	-2.41
	(3.97)***	(3.91)***	(2.99)***	(3.79)***	(0.81)	(0.36)
Parent specific variables						
Parent GDP	-0.98	-0.97	-0.92	-0.84	-1.11	-1.19
	(1.86)*	(1.67)*	(1.73)*	(1.44)	(2.12)**	(2.06)**
Parent supported	-2.13	-1.34	-1.70	-0.67	-1.89	-1.87
	(0.62)	(0.30)	(0.48)	(0.15)	(0.55)	(0.42)
Liquidity parent	-0.00	0.04				
	(0.09)	(0.54)				
Liquidity parent * Global crisis	0.02	0.02				
	(0.25)	(0.31)				
Solvency parent			0.34	0.60		
			(0.58)	(0.93)		
Solvency parent * Global crisis			0.51	1.24		
			(0.49)	(1.21)		
Wholesale parent					0.11	0.10
					(1.94)*	(1.73)*
Wholesale parent * Global crisis					-0.13	-0.16
					(1.82)*	(2.05)**
Constant	6.85	2.65	5.48	1.01	-1.05	-3.46
	(1.47)	(0.30)	(1.07)	(0.12)	(0.18)	(0.44)
N	802	802	802	802	802	802
R^2	0.34		0.34		0.35	
DW	1.57		1.575		1.568	
AB AR1 pval		.0000		.0000		.0000
AB AR2 pval		.2540		.2870		.2280
Hansen pval		1		1		1
Estimation method	FE	AB	FE	AB	FE	AB

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Estimation methods are Fixed effects (FE), Hausman-Taylor (HT) and Arellano-Bond (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 χ^2 under the null of instrument validity.

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 global 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 twice as fast as domestic banks. Domestic banks were also better equipped to continue lending because of their greater use of deposit funding, a relatively stable funding source during the crisis.

Multinational bank subsidiaries' access to parent bank and wholesale funding, one of their main competitive advantages before the crisis, turned out to be 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. Our results thus provide further evidence on the negative impact that banks' excessive reliance on wholesale funding may have on financial stability.

Our findings both contrast with and complement those of De Haas and Van Lelyveld (2010) who use data for the same group of banks *before* the Great Recession. They find that multinational bank subsidiaries did not have to reduce their lending when a *host* country was hit by a banking crisis whereas 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. In the case of a shock to a host country, 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 not be forthcoming to the subsidiary. Internal capital flows may even be redirected in the opposite direction, from subsidiaries to headquarters.

In all, our results indicate that financial integration is more of a double-edged sword than previously thought. Because subsidiaries are integrated into a group structure, their lending reacts to developments in other parts of the group. This underlines the importance of adequate cross-border coordination and cooperation between national supervisory authorities. That such coordination is not yet well-established was made clear by the European experience during the recent crisis,

when an ad hoc coordination mechanism, the so-called Vienna Initiative, had to be set up in order to ensure a continued commitment of Western European multinational banks to their Eastern European subsidiaries. The recent shocks to the global financial system, with many European banks struggling due to their exposure to Greek sovereign debt, has further underlined that parental support is unlikely to be forthcoming when parent banks themselves are hit by large balance-sheet shocks.

Better coordination and information-exchange between supervisors is not only necessary to limit the international spillover of financial shocks, but also because the alternative –forcing banking groups to hold more capital and liquidity in each subsidiary– may be costly.[7] '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 can 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 as well as the setting up of (ex ante) burden-sharing agreements. Within the strongly integrated European market, the role of the European Banking Authority could be strengthened by letting it take the lead in the supervision of large multinational banking groups.

Moreover, supervisors could cushion the international transmission of financial shocks by imposing prudential limits on subsidiaries' reliance on foreign wholesale and parent-bank funding (i.e. through *partial* ring-fencing). This is a process that is already well underway, with multinational banking groups themselves starting to rebalance the funding structure of their subsidiaries towards self-financing from local sources.

[7] See Cerutti et al. (2010) for an analysis of the costs for European multinational banks in case of (partial) ring-fencing of their subsidiaries in Emerging Europe. See van Lelyveld and Spaltro (2011) for the cost associated with burden sharing.

Whatever policy option will be chosen, forced 'subsidiarization' through full-scale ring-fencing –basically splitting up multinational banks into strings of independent banks– may be a second-best option that reflects the inability of supervisors to reach a satisfactory level of cross-border cooperation and burden sharing.

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Appendix

Table A-1: Descriptive statistics (1992-2009)

Variable	Definition	Data source	Unit	Bank type	Obs.	Mean	Median	St. dev.	Min	Max
Loan growth	Growth of (net loans plus loan loss reserves)	BankScope	%	Parent	590	11.01	9.69	14.02	-37.22	67.74
				Subsidiary	1277	11.28	9.66	21.34	-69.05	72.07
				Domestic	2460	14.23	12.52	19.85	-73.16	74.09
Deposit growth	Percentage growth of total deposits	BankScope	%	Parent	590	10.82	9.45	18.02	-50.01	120.37
				Subsidiary	1238	11.69	8.83	29.53	-72.63	186.92
				Domestic	2455	14.62	11.77	23.98	-64.67	195.94
Solvency	Equity/Total Assets	BankScope	%	Parent	590	5.08	4.65	2.50	0.86	21.68
				Subsidiary	1282	8.13	7.25	5.21	0.16	88.54
				Domestic	2462	9.24	7.76	6.30	0.50	69.11
Liquidity	Liquid assets/customer deposits	BankScope	%	Parent	590	36.81	33.87	19.77	0.88	99.54
				Subsidiary	1215	26.15	20.34	23.57	0.06	97.10
				Domestic	2454	28.47	23.55	20.91	0.07	99.81
Income to loans	Net current income t / total loans $(t-1)$	BankScope	%	Parent	590	12.45	13.68	9.48	-29.78	45.92
				Subsidiary	1282	13.11	12.37	10.46	-29.87	48.42
				Domestic	2462	11.26	10.44	9.66	-29.83	48.55
Profitability	Return on average equity	BankScope	%	Parent	590	1.58	1.30	1.77	-2.75	17.16
				Subsidiary	1282	2.26	1.33	3.72	-11.79	43.84
				Domestic	2462	2.30	1.58	3.19	-11.48	38.41
Wholesale	Net loans as a perc. of cust. funding	BankScope	%	Parent	590	79.45	72.53	28.57	29.42	192.50
				Subsidiary	1282	72.89	70.56	36.40	0.13	390.31
				Domestic	2462	76.00	73.04	37.03	4.07	399.81
GDP growth	Yearly change in GDP in host country	IMF-IFS	%		4326	2.90	3.00	3.20	-18.50	18.30
Inflation	Annual inflation rate in host country	IMF-IFS	%		4331	3.93	2.50	5.29	-3.90	123
Crisis dummy	Yearly dummy variable which is '1' in case of banking crisis	Laeven and Valencia (2008); Carstens et al. (2004)	0/1		4334	0.07	0.00	0.26	0	1

Table A-2: Overview of multinational bank subsidiaries

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

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

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