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Foreign Bank Subsidiaries' Default Risk during the Global Crisis: What Factors Help Insulate Affiliates from their Parents?

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Abstract

This paper examines the association between the default risk of foreign bank subsidiaries in developing countries and their parents during the global financial crisis, with the purpose of determining the size and sign of this correlation and, more importantly, understanding what factors can help insulate affiliates from their parents. We find evidence of a significant and robust positive correlation between parent banks' and foreign subsidiaries' default risk. This correlation is lower for subsidiaries that have a higher share of retail deposit funding and that are more independently managed from their parents. Host country bank regulations also influence the extent to which shocks to the parents affect the subsidiaries' default risk. In particular, the correlation between the default risk of subsidiaries and their parents is lower for subsidiaries operating in countries that impose higher capital, reserve, provisioning, and disclosure requirements, and tougher restrictions on bank activities.

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I. INTRODUCTION

Since the late 1990s, the importance of multinational banks has grown dramatically. Between 1999 and 2009 the average share of bank assets held by foreign banks in developing countries rose from 26 percent to 46 percent.[1] The bulk of the pre-global financial crisis evidence analyzing the consequences of this significant transformation in bank ownership suggests that foreign bank participation brought many benefits to developing countries including financial stability.[2] In contrast, by highlighting the role of multinational banks in the transmission of shocks across countries, the recent Global Financial Crisis (GFC), reignited the debate on the benefits of having global banks operating in the domestic banking sector and on how jurisdictions where such banks operate should deal with them.

In this context, our paper focuses on two specific related policy relevant questions. First, we investigate whether there was a significant positive correlation during the global financial crisis between parent banks' default risk (i.e., the likelihood that a bank would fail and not be able to meet its debt obligations) and the default risk of their foreign affiliates in developing countries. This association is at the center of much of the policy debate surrounding the destabilizing impact of parent banks on host countries' banking systems. A priori, there are a number of reasons to expect this association to be positive. Given the evidence on the existence of an internal capital market, where a global bank can "move" capital and liquidity across the locations where it operates (de Haas and van Lelyveld 2010, Cetorelli and Goldberg 2012, Cerutti and Claessens 2016), we would expect that when the default risk of the parent rises, in order to cover the losses and meet regulatory capital requirements at home, the global bank might channel funds and capital from its subsidiaries and, in the process, weaken the financial health of subsidiaries, causing their default risk to rise. Furthermore, even if subsidiaries' capital and liquidity remain intact, when the parent bank faces a shock, the perception that the subsidiaries no longer could obtain support from the parent if it were needed (i.e., the loss of the implicit guarantees) could lead to a drop in the market value of the subsidiaries and a corresponding rise in their default risk. Also, the default risk of a parent and that of its subsidiaries might be correlated if these institutions share a common business model or focus and are exposed to similar shocks. Although the aforementioned factors suggest a positive relationship between the default risk of parent banks and their subsidiaries, the magnitude and the significance of this relationship remain unclear. The GFC represents a unique opportunity for corroborating the existence of a potential positive correlation between the default risk of the

[1]Data from the World Bank Regulation and Supervision surveys at http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20345037~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

[2] For a review of the literature on the impact of foreign bank participation see Cull and Martinez Peria (2010). Specifically, a number of studies before the global financial crisis showed that foreign banks contributed to banking sector stability either because their presence was negatively associated with the occurrence of banking crises (Demirguc-Kunt et al. 1998) or because foreign banks were less likely, relative to domestic banks, to retrench their lending during host crises (Crystal et al. 2001, 2002, De Haas and van Lelyveld 2006, Detragiache and Gupta 2006).

parent and that of its subsidiaries, and for measuring its size. In this sense, our paper provides empirical evidence that helps shed light on this important policy question.

Second, we investigate the factors that amplify or dampen the correlation between the foreign bank parents' and their subsidiaries' changes in default risks. In particular, we analyze the role of subsidiary financial characteristics (such as capital and funding structure) and the impact of host country bank regulations (such as bank capital, reserve requirements, bank activities). The question of how host regulators can limit the transmission of shocks to the affiliates of foreign banks that operate in their countries is very important given the significant presence of foreign banks in many developing economies and the issue is related to the recent discussion on ring-fencing (see Song 2004, Cerutti et al. 2010, Cerutti and Schmieder 2014, and D'Hulster 2014). In cross-border banking, ring-fencing refers to restrictions (whether regulatory or supervisory) on internal transfers of banks' capital, liquidity, and profitability across jurisdictions within the same international banking group. To our knowledge, this is the first paper to examine the association between the default risk of foreign parents and their subsidiaries and the impact of subsidiary characteristics and host country regulations in limiting this correlation.

We use data for 93 publicly listed foreign bank subsidiaries, operating in 36 host developing countries and owned by 41 parent bank groups, headquartered in 24 home countries, during the period from September 2008 to December 2009, to compute the measure of default risk for global banks and their affiliates. In particular, we estimate the weekly correlation between parents' and subsidiaries' distance to default and investigate the factors that affect this correlation. Distance to default, which is based on Merton's (1974) structural credit risk model, is the difference between the market asset value of the bank and the face value of its debt, scaled by the standard deviation of the bank's asset value. Hence, distance to default is inversely related to default risk. Our focus on developing countries as hosts of foreign bank subsidiaries is driven by the fact that these countries were not at the core of the global financial crisis, allowing us to better identify factors that might help insulate affiliates from their parents potentially in trouble.

Our empirical findings show that foreign bank subsidiaries' distance to default are significantly correlated with their parent banks' distance to default, even when we account for the distance to default of other banks and firms in the home and host countries, as well as for global factors that may influence subsidiaries' distance to default. In particular, the correlation in the distance to default between foreign subsidiaries and their parents ranges between 0.3 and 0.2, after we include subsidiary fixed effects, macro factors, and controls for distance to default of other banks and firms in the home and host countries. This finding is robust to the sample of banks considered and to the way we calculate the distance to default measure. Also, we find that certain subsidiary characteristics influence the correlation in the distance to default between subsidiaries and parents. In particular, this correlation is lower for subsidiaries that have a higher share of retail deposit funding and for those that are more independently managed from their parents. These results hold even after controlling for host country – parent distance to default interactions, which capture the impact of the institutional/regulatory environment. Finally, the regulatory regime in place in the host countries also affects the extent to which shocks to the parents' distance to default influence subsidiaries. In particular, the correlation between the distance to default of the subsidiaries and the parents is lower for subsidiaries operating in host

countries that impose higher capital, reserve, provisioning and disclosure requirements, and tougher restrictions on bank activities.

Our paper is related to the literature that explores how foreign banks transmit shocks. Most of the existing studies have examined the transmission of shocks through the lending channel: i.e., how shocks to the parent banks lead foreign bank subsidiaries to reduce the loans they make in host jurisdictions during a crisis. In particular, a number of papers, including some before the recent global crisis, have documented that lending by foreign bank affiliates' declines when parent banks' financial conditions deteriorate. Peek and Rosengren (2000) offer evidence based on the behavior of Japanese banks operating in the US during the 1990s Japanese crisis. Schnabl (2012) studies the lending behavior of foreign bank affiliates in Peru in the aftermath of the 1998 Russian crisis. In the context of the recent global crisis, Claessens and van Horen (2013), Choi et al. (2013), and de Haas and van Horen (2013), among others, show that foreign bank lending across countries declined more than domestic bank lending during the period 2008-2009. The last two studies, in particular, find that foreign bank affiliates whose parents' relied more on wholesale funding (in the case of de Haas and van Horen 2013) and had lower capital ratios (in the case of Choi et al. 2013) experienced a sharper decline in lending.

Our paper contributes to the literature that examines the extent to which foreign banks transmit external shocks by focusing on a previously unexamined mechanism: the correlation in default risks between a global bank and its subsidiaries. This is an important channel because default risk is arguably the ultimate risk that matters for banking stability and the risk that supervisors are likely to care about the most. Default risk has implications for both bank debtors and borrowers since a failing bank is one that will not be able to pay its depositors or to continue to make loans. Similarly, bank failures can have significant implications for governments that have to shoulder the cost of paying insured depositors if a bank fails or of recapitalizing the bank if it is deemed too large to fail. Regardless of how a bank failure is resolved, the economic losses associated with such an event are likely to be larger than those caused by a bank that temporarily diminishes its lending as a result of a shock. Hence, our analysis of the correlation between the default risk of global banks and their subsidiaries and the factors that can affect this correlation is very relevant and makes a useful contribution to the existing literature. Moreover, since we measure default risk based on daily stock market data, we are able to use high frequency and forward-looking information to analyze the transmission of shocks, which is also another advantage relative to the literature that uses lower frequency loan data.

The rest of the paper is structured as follows. Section 2 describes our data. Section 3 details the empirical methodology we use to (a) calculate the distance to default of parent banks and, separately, their subsidiaries, (b) estimate the correlation between the distance to default of the parents and their subsidiaries, and (c) investigate the factors that affect the correlation between the default risk of parent banks and subsidiaries. Section 4 presents results from our econometric analysis. Section 5 concludes.

II. DATA

We assembled an original and extensive database of stock market prices and balance sheet characteristics for both publicly traded parent banks and their publicly traded subsidiaries in developing countries. Our sample consists of 93 publicly listed foreign subsidiaries, operating in 36 host developing countries and owned by 41 parent bank groups, headquartered in 24 home countries (see Table 1). Our period of analysis is the peak of the global crisis: from September 2008 to December 2009.

Even though the presence of foreign banks has increased in recent decades, the final sample of subsidiaries that we were able to include in the analysis is smaller as the result of two constraints. First, most foreign subsidiaries are not listed in the stock market, since they are privately held. To identify the sample of foreign bank subsidiaries listed in developing countries' stock markets, we checked Bloomberg, Compustat, and also conducted many web-searches (including the webpages of the bank regulators and the stock markets in developing countries), and then identified their controlling groups (using Bankscope, Bankers' Almanacs, central banks/regulatory agencies' information, and web-searches). As a result, we were able to identify about 167 listed banks operating in about 44 host countries where foreign banks held important ownership stakes. Second, of the banks that are listed in host countries' stock markets, there are several cases that are not traded often, since parent banks control most shares (e.g., 98 percent or more ownership), reducing the final sample to only 93 subsidiaries. The median ownership stake in the sample is about 61 percent.[3] The limitations to fulfilling the necessary data requirements for our analysis does not seem to bias the representation of the final sample, which covers 36 host countries.

The dataset used in the analysis also includes stock market prices for all other banks and firms in the home and host countries that are used to construct default risk control variables in the regressions. We use daily stock market information from Compustat Global for international banks and firms and stock market information from CRSP for U.S. banks and firms. Bank level variables are constructed from Bankscope, a commercial database of banks' financial statements produced by Bureau Van Dijk.[4] Since we are interested in how bank characteristics affect the correlation between parents' and their foreign subsidiaries' default risks, and since there have been significant changes to bank balance sheets during the crisis, we construct and use bank-level variables measured prior to the crisis (as of December 2006). For each bank, we calculate relative bank *size* (bank assets to total system assets), *capital ratio* (regulatory capital to risk weighted assets), *equity ratio* (equity to total assets), *provisions* (loan loss provisions divided by total loans), *deposit funding* (deposits divided by total funding), *profitability* (net income divided

[3] In 28 of the 93 foreign subsidiaries included in the sample, the identified parent banks seem to directly control less than 50 percent of the shares. We include them in the analysis because the identified parent banks are portrayed as strategic partners, and they often have indirect control of the subsidiaries. In unreported results, we verify that the degree of ownership is not a significant factor explaining the relative strength of transmission of default risk from parents to affiliates.

[4] Using Bankscope data can sometimes introduce biases in the sample since its coverage of banks is not universal. However, we do not experience this problem in our case because we are working with stock market listed banks for which data is widely available in Bankscope.

by total assets), and *liquidity* (liquid assets divided by total assets).[5] We winsorize all financial variables at the 1st and 99th percentile level of their distributions to reduce the influence of outliers and potential data errors.

Host country-level variables are collected from a number of sources. We use data from the World Bank 2007 Bank Regulation and Supervision survey to construct different indexes of bank regulation and supervision, following the methodology proposed by Barth et al. (2001, 2013).[6] *Capital regulation* captures the amount of capital banks must hold and the stringency of regulations on the nature and source of capital. It is an index ranging in value from 0 to 10, with higher values indicating greater stringency. *Activity restrictions* is an index that measures the degree to which the national regulatory authorities restrict banks from engaging in securities, insurance, and real estate activities. Securities activities refer to underwriting, brokering, dealing and all aspects of the mutual fund industry. Insurance activities include underwriting and selling, and real estate activities refer to investment, development, and management. The activities restrictions index takes values from 3 (where each of the three activities is permitted) to 12 (where each activity is prohibited). *Disclosure requirements* is an index that captures the type of information banks must disclose about their financial condition. It indicates whether the income statement includes accrued or unpaid interest or principal on nonperforming loans, whether banks are required to produce consolidated financial statements, and whether bank directors are legally liable if information disclosed is erroneous or misleading. The variable ranges from 0 to 3, with higher values indicating greater bank disclosure. *Diversification requirements* is an index which measures whether regulations support geographical asset diversification. It is based on two variables: whether there are explicit, verifiable, and quantifiable guidelines for asset diversification and whether banks are prohibited from making loans abroad. The index takes values from 0 to 2 with higher values indicating more diversification. *Loan classification stringency* measures the actual minimum number of days beyond which a loan in arrears must be classified as sub-standard, doubtful, or loss. *Provisioning stringency* measures the minimum provisions (as a percentage of loans) required as a loan is successively classified as sub-standard, doubtful, and lastly as loss. *Supervisory powers* is an index measuring supervisory authorities' power and authority to take specific preventive and corrective actions. The measure ranges from 0 to 14, where larger numbers indicate greater supervisory powers. *Prompt corrective powers* measures the extent to which the law establishes predetermined levels of bank solvency deterioration that force automatic enforcement actions such as intervention, and the extent to which supervisors have the requisite suitable powers to do so. The index ranges from 0 to 6 with higher values indicating more promptness in responding to problems. *Reserve requirements* is the average level of reserves that banks are required to hold relative to their deposits and other short-term liabilities. *Financial outflow restrictions* is the average of three binary variables measuring bank restrictions on lending to non-residents, maintaining accounts abroad, and on banks' investment abroad. This variable comes from the IMF Annual Report on Exchange Arrangements and Restrictions.

[5] Note that in the ratios mentioned here assets and equity are measured as book values. We also tried running regressions using the market value of assets and equity computed from the Merton model discussed above and found similar results.

[6] The 2007 survey covers the 2005-2006 period.

In some estimations, we also control for macro factors that may affect the changes in default risk of the parents and their subsidiaries. Δ*VIX* is the change in the Chicago Board Options Exchange Volatility Index, which measures the 30-day expected volatility calculated from implied volatilities from S&P 500 index options. VIX data is obtained from the Chicago Board Options Exchange (CBOE). Δ*DEF* is the change in the default spread measured as the difference in Baa-Aaa yields of US firms. Data comes from the interest rate data releases from the Federal Reserve Board**.** Table 2 lists all the variables used in our analysis, provides their definition, data sources and descriptive statistics.

III. EMPIRICAL METHODOLOGY

3.A. Computing distance to default measures between parents and subsidiaries

Our main measure of default risk is the distance to default that comes from the structural credit risk model of Merton (1974). Distance to default is computed as the difference between the market asset value of the bank and the face value of its debt, scaled by the standard deviation of the bank's asset value.[7] In the Merton (1974) model, the market equity value of a bank is modeled as a call option on the company's assets:

$$V_E = V_A e^{-DivT} N(d_1) - X e^{-rT} N(d_2) + \left(1 - e^{-DivT}\right) V_A$$

$$d_1 = \frac{\log\left(\frac{V_A}{X}\right) + \left(r - Div + \frac{s_A^2}{2}\right) T}{s_A \sqrt{T}}; d_2 = d_1 - s_A \sqrt{T} \quad (1)$$

In equation (1), V_E is the market value of a bank's equity. V_A is the market value of the bank's assets. X is the face value of debt maturing at time T.[8] r is the risk-free rate and *Div* is the dividend rate expressed in terms of V_A. s_A is the volatility of the value of assets, which is related to equity volatility (S_E) through the following equation:

$$s_E = \frac{V_A e^{-DivT} N(d_1) s_A}{V_E} \quad (2)$$

We simultaneously solve the above two equations to find the values of V_A and s_A. We use the market value of equity for V_E and total liabilities to proxy for the face value of debt X. Since the accounting information is on an annual basis, we linearly interpolate the values for all dates

[7] The Merton (1974) distance to default measure has been shown to be a good predictor of defaults, outperforming accounting-based models (Campbell, Hilscher and Szilagyi 2008, Hillegeist, Keating, Cram, and Lundstedt 2004, and Bharath and Shumway 2008).

[8] In the event of default, equity holders receive nothing. If the company does not default, equity holders receive the market value of the assets conditional on no default and pay the face value of liabilities. In equation (1), N(*d2*) is the risk-neutral probability of default and $Xe^{-rT}N(d_2)$ is the discounted face value of the liabilities. $V_A N(d_1)$ is the discounted value of assets conditional on the firm not defaulting.

over the period, using beginning and end of year values for accounting items. The interpolation method has the advantage of producing a smooth implied asset value process and avoids jumps in the implied default probabilities at year end (Bartram et al. 2007). s_E is the standard deviation of daily equity returns over the past 3 months. In calculating the standard deviation, we require each bank to have at least 45 non-missing daily returns over the previous three months. T is the horizon over which default risk is computed and is set to one year. r is the one year US treasury yield, which we take to be the risk free rate. We use the Newton method to simultaneously solve the two equations above. For starting values for the unknown variables, we use $V_A = V_E + X$ and $s_A = s_E V_E/(V_E+X)$. We winsorize s_E and $V_E/(V_E+X)$ at the 1st and 99th percentile levels to reduce the influence of outliers. After we determine asset values V_A, we follow Campbell, Hilscher and Szilagyi (2008) and assign asset return m to be equal to the equity premium (6%).[9] Merton's distance to default (*dd*) is finally computed as:[10]

$$dd = \frac{log\left(\frac{V_A}{X}\right) + \left(m - Div - \frac{s_A^2}{2}\right)T}{s_A\sqrt{T}} \tag{3}$$

As a robustness check, we compute a simplified version of the Merton formula following Byström (2006). This measure does not rely on distributional assumptions and makes the default risk less sensitive to the leverage ratio at very high levels equity volatility. Byström (2006) shows that, when applied to a sample of US firms, the simplified model provides the same relative default risk rankings as the Merton model.[11] The simplified formula we use is given by:

$$log\ (X/(V_E+X)) \,/\, (X/(V_E+X)\text{-}1) \times s_E. \tag{4}$$

3.B. Estimating the size and determinants of the correlation between parents and subsidiaries

To examine the correlation between the foreign bank parents' and their subsidiaries' changes in distance to default, we estimate equation (5) below:

[9] Since during recessions and market downturns the risk premium increases, as a robustness check we also computed distance to default values using a 12% equity risk premium. The correlation in levels of distance to default values using the two different equity premium values is 96%. The correlation in changes of distance to default is 99%.

[10] The default probability is the normal transform of the distance to default measure and is defined as PD = F (–dd), where F is the cumulative distribution function of a standard normal.

[11] For large values of leverage, the formula further simplifies to $1/s_E$. Atkeson, Eisfeldt and Weill (2014) show theoretically that one can approximate a firm's distance to insolvency using data on the inverse of the volatility of that firm's equity returns.

$$\Delta dd\_Sub_{i,t} = \beta^0 + \beta^1 \Delta dd\_Parent_{i,t} + \beta^2 \Delta dd\_Home_t + \beta^3 \Delta dd\_Host_t + \beta^4 \Delta DEF_t + \beta^5 \Delta VIX_t + \gamma_i + \varepsilon_{i,t} \quad (5)$$

where $\Delta dd\_Sub_{i,t}$ is the weekly change in distance to default of the subsidiary *i* in week t; $\Delta dd\_Parent_{i,t}$ is the weekly change in distance to default of the parent of subsidiary i; Δdd_Host_t and dd_Home_t are changes in average distance to defaults of all the publicly traded banks and companies in the host country and home or parent bank country (excluding the foreign subsidiary and parent banks in question), respectively. These variables are included to control for the overall financial health of host and home companies, respectively. ΔDEF_t is the change in interest rate spread between Bbb and Aaa rated companies and is included to capture innovations in the default risk premium. ΔVIX_t is the weekly change in the VIX volatility index. This variable is included to capture innovations in macro volatility that affect all banks in our sample. In some estimations, we replace ΔDEF_t and ΔVIX_t with time dummies that are able to capture the impact of global factors that can influence parent banks and their subsidiaries throughout the world. Finally, we also include subsidiary fixed effects, γ_i, to control for time invariant heterogeneity across subsidiaries.

Since we are interested in uncovering factors that may amplify or dampen the correlation between the foreign bank parents' and their subsidiaries' changes in distance to default, we include firm level characteristics and country level regulations in the regression specified in (5) and interactions of these variables with $\Delta dd\_Parent_{i,t}$. In particular, we estimate equation (6) below:

$$\Delta dd_{Sub_{i,t}} = \beta^0 + \beta^1 \Delta dd_{Parent_{i,t}} + \beta^2 \Delta dd_{Home_t} + \beta^3 \Delta dd_{Host_t} + \beta^4 \Delta DEF_t + \beta^5 \Delta VIX_t + \beta^6 X_i \times \Delta dd_{Parent_{i,t}} + \beta^7 M_c \times \Delta dd\_Parent_{i,t} + \gamma_i + \varepsilon_{i,t} \quad (6)$$

where X_i are foreign subsidiary characteristics (size, liquidity, funding structure, capital, etc.) computed as of December 2006, as described above. M_c are host country regulations measured as of 2006. The errors are clustered at the host country level.

As discussed in the introduction, either due to the existence of an internal capital market by which a failing parent might reallocate capital and funding from its subsidiaries, weakening their financial heath, or because of the perception that a weaker parent will be less able to support a subsidiary in trouble down the line, or because both subsidiaries and parents might share a similar business model and be similarly affected by shocks, we expect to find a positive correlation between foreign banks' subsidiaries and parent banks' distance to default. The size of this correlation is an empirical question that we hope to address. At the same time, we hope to ascertain the extent of cross-sectional heterogeneity in the default correlation between the parents and their subsidiaries. In particular, we consider the role of subsidiary financial characteristics as well as host country bank regulations in dampening the effect of shocks from the parent banks.

Following the theoretical literature on financial contagion, we focus on four sets of bank characteristics that can potentially influence the default correlation between the parents and their subsidiaries. In particular, a number of theoretical papers emphasize the role of bank size in the transmission of liquidity and economic shocks. Others emphasize the role of capital, profitability and liquidity as potential buffers in absorbing these shocks.[12] We expect subsidiaries that are more profitable and that have high quality assets on their balance sheets prior to the financial crisis to be better positioned to absorb shocks from their parents. We use provisions to proxy for asset quality and return on assets to proxy for profitability. We also expect larger banks in host countries to exhibit a lower correlation with the default risk of their parents, as they are more likely to benefit from potential too-big-to-fail guarantees (Acharya, Anginer and Warburton 2014) and more likely to be subject to more stringent oversight by local supervisors.[13] We use total assets as a measure of bank size.

Theoretical papers emphasize the importance of both asset and funding liquidity in the transmission of shocks in banking systems. Reliance on non-deposit funding has been shown to be a significant driver of systemic fragility (Adrian and Brunnermeir 2016, Anginer and Demirguc-Kunt 2014a). The volume and price of wholesale funding can adjust quickly resulting in liquidity problems especially for banks that hold significant amount of illiquid assets on their balance sheets (Brunnermeir and Pederson 2009).[14] We use local deposit funding and liquid assets as a percentage of total assets to proxy for funding and asset liquidity, respectively. Theoretical papers also emphasize the role of capital as a buffer in absorbing earnings and liquidity shocks (Repullo 2004 and Von Thadden 2004).[15] We use both tangible equity and regulatory capital over risk-weighted assets as measures of capital.[16]

In addition to the subsidiary financial characteristics, we also explore the importance of two measures of distance/proximity between the subsidiary and the parent: *geographical distance* (log of distance, measured in kilometers, between the parent/home country and the host country) and *cultural proximity* (as measured by whether the subsidiary and the parent have a common official language).[17] A priori, we expect geographical distance to reduce the correlation

[12] See for instance: Allen and Gale (2000), Cifuentes et al. (2004), Repullo (2004), Von Thadden (2004), and Diamond and Rajan (2005),

[13] Supervisors tend to be especially worried about large banks because these tend to be more interconnected, more likely to operate in a greater number of markets, and engage in non-traditional banking activities (Demirguc-Kunt and Huizinga 2013), which could make them more vulnerable to shocks.

[14] The importance of local deposit funding for foreign subsidiaries is reflected in the recent measures introduced by the Austrian National Bank and the Financial Market Authority, which has placed minimum requirement on the ratio of new loans to be financed with local deposits (D'Hulster and Otker-Robe 2015).

[15] Consistent with the theoretical literature, a number of papers have found beneficial effects of higher bank capital on bank performance and risk-taking during the crisis (Demirguc-Kunt, Detragiache and Merrouche 2013, Berger and Bouwman 2013) and on systemic stability (Anginer and Demirguc-Kunt 2014a).

[16] Demirguc-Kunt, Detragiache and Merrouche (2013) and Anginer and Demirguc-Kunt (2014a) show that that higher quality forms of capital reduce systemic risk contribution of banks and increase performance, whereas lower quality capital can have a destabilizing impact, particularly during crisis periods.

[17] Both variables, geographical distance and cultural proximity, were taken from Mayer and Zignago (2011). See http://www.cepii.fr/anglaisgraph/bdd/distances.htm

between the parent and subsidiary distance to default, since geographically distant subsidiaries may be less integrated into the parent group and the parent bank might find it difficult to exercise control over the local management of the subsidiary (Rajan, Servaes, and Zingales 2000; de Haas and van Horen 2013). When it comes to cultural proximity, the impact might be more ambiguous. On the one hand, cultural distance might operate like geographical distance and reduce the correlation between subsidiaries' and parents' default risk because more distant subsidiaries might be harder to monitor. On the other hand, cultural proximity might reduce the correlation between subsidiaries and parents if these subsidiaries are granted more independence because the parent is more comfortable decentralizing some control when it is more familiar with the culture and business environment in the host country.[18]

In addition to the bank level characteristics described above, we also investigate the influence of measures of the host country regulatory environment on the default correlation between the parent banks and their subsidiaries. Prior literature suggests that countries with efficient supervision and monitoring of financial institutions respond better to shocks to their banking systems (Anginer and Demirguc-Kunt 2014b, and Demirguc-Kunt and Detragiache 1999). In this sense, we expect the default risk correlation between the subsidiary and the parent to be lower for subsidiaries operating in countries where the regulatory authorities impose tighter regulatory regimes, which de jure or de facto help to ring fence the foreign subsidiary from a parent in distress. In particular, we examine the influence of four sets of regulatory and supervisory rules that were in place prior to the financial crisis.

The first set of host country regulations we examine relate to the stringency of capital, provisioning, and bad loan classification rules, as well as those pertaining to reserve requirements. Empirical evidence suggest that more stringent capital rules increase bank holdings of equity (Cihak et al. 2013), reduce bank risk-taking (Barth et al. 2004, and Laeven and Levine 2008) and attenuate systemic risk in financial systems (Anginer and Demirguc-Kunt 2014b). We expect more stringent capital and related rules to reduce the default risk correlation between the parent banks and their subsidiaries.

The second set of regulatory variables we consider relate to activity restrictions, diversification requirements, and restrictions on financial outflows from the host country. Financial contagion can be influenced by the extent to which host regulators restrict banks from engaging in certain business activities. Non-traditional banking activities such as trading, underwriting and investment banking can cause conflicts of interest (John et al. 1994) and increase risk-taking (Boyd et al. 1998, and Brunnermeier et al. 2012), making banks more fragile to outside shocks. Lack of guidelines to diversify risk and assets (Anginer, Demiguc-Kunt and Zhu 2014b) and lack of restrictions on intra-group cross-border asset outflows (or inflows of doubtful assets from the parent) can also increase the fragility of subsidiaries.

[18] Related to the idea that cultural proximity might result in better treatment for some subsidiaries, Giannetti and Yafeh (2012) show that cultural proximity affects financial contracts in a large dataset of international syndicated bank loans. For example, they find that lead banks offer larger loans at a lower interest rate to more culturally close borrowers.

The quality and effectiveness of supervisors in host countries can also have an influence on the severity of outside shocks on local banks.[19] More powerful supervisors can insert modularity into the financial system by allowing subsidiaries to operate on a standalone basis or by protecting subsidiaries against cross-border risks (Schwarcz 2013). Effective monitoring and supervision, however, requires authorities to have the ability to take timely corrective action (Barth et al 2004). Hence, our third set of regulatory variables relate to supervisory power as well as the legal authority of supervisors to take prompt corrective action.

Finally, information asymmetry provides a potential channel in which shocks can be propagated through the banking system.[20] We expect shocks from the parent to have a less severe effect on host banks that have more transparent and informative balance sheets. Greater information availability and transparency would also allow for better private monitoring of financial institutions (Djankov, McLiesh and Shleifer 2007).[21] We use disclosure requirements as a measure of transparency and of the information content of bank financial statements.

IV. RESULTS

4.1. The correlation between the parent and subsidiary distance to default

Figure 1 shows the median changes in Merton's distance to default for all parent banks and, separately, for all subsidiaries over the period September 2008 to December 2009. It is clear from the figure that there is a very high correlation between changes in parent and subsidiaries distance to default. Because this figure does not control for other factors that can jointly influence these variables, we turn next to our empirical estimations that control for global factors and for changes in the distance to default of all firms operating in the corresponding parent and host countries.

Columns (2.1)-(2.4) in Table 3 show that foreign bank subsidiaries' distance to default, measured following Merton (1974), is significantly correlated with parent banks' distance to default, even when we control for the average distance to default of all companies in the home and host countries, respectively, and when we account for global factors like the VIX and the corporate credit spread. The correlation between the distance to default of foreign subsidiaries and their parents varies between a maximum of 0.45, when only subsidiary fixed effects are added, and a minimum of 0.27, when we include time and subsidiary dummies. This correlation is not only statistically and economically significant, but also it is almost twice as large as the

[19] Anginer and Demirguc-Kunt (2012) and Hoque et al. (2015) show that strong supervision and monitoring reduces systemic fragility in the banking sector.

[20] A number of papers, for instance, have used a constrained information asymmetry framework to explain risk contagion and crises (see for instance Genotte and Leland 1990, Kodres and Pritsker 2002, Barlevy and Veronesi 2003, Hong and Stein 2003, Yuan 2005).

[21] Consistent with this view, Anginer, Demiguc-Kunt and Zhu (2014) show that information availability and information asymmetry in the banking sectors are important drivers of systemic risk.

correlation of the distance to default of the foreign subsidiaries vis-à-vis all companies in the home and host countries. When we use the simplified measure of distance to default proposed by Byström (2006) the correlation between foreign subsidiaries and their parents is still highly significant and ranges between 0.2 and 0.3.

In unreported regressions, we assess whether excluding some parents banks, which own multiple subsidiaries in our sample and account for many of the observations (e.g., Barclays, BNP Paribas, Citibank, HSBC, ING, Society General, and Standard Charter among others), affects our results. We find that the estimates of the association between the distance to default of foreign bank subsidiaries and their parents do not change much when we exclude parent banks with multiple subsidiaries. The correlation varies between 0.26 and 0.29.

4.2 The factors that affect the correlation between the parent and subsidiary distance to default

Table 4 explores whether the association between the Merton distance to default of foreign bank subsidiaries and that of their parents changes depending on the value of different subsidiary characteristics, namely: size, capitalization, funding structure, liquidity, profitability, provisioning, and distance from the parent (both geographical and cultural). We find that parent banks' distance to default is less correlated with the subsidiaries' distance to default when subsidiaries have higher deposit funding ratios.[22] Also, the association between the parents and the subsidiaries distance to default is lower for countries that are physically distant or culturally closer. In economic terms, we find that a one standard deviation increase in the deposit funding ratio (geographical distance) lowers the association between the distance to default of the parents and the subsidiaries from 0.28 (0.32) to 0.21 (0.27). Similarly, for subsidiaries that are culturally close to the parents the correlation between the parents and the subsidiaries is 0.33, while it is 0.13 for those that are not culturally similar.

How should we interpret the significance of geographical distance and cultural proximity? We view geographical distance and cultural proximity as proxies for more independent management of the subsidiaries from the parents. Though, we are unable to conclusively confirm this hypothesis, we are able to offer some suggestive evidence for a subset of banks. In particular, for 47 subsidiaries, using information obtained from banks' annual reports, we were able to construct a proxy for subsidiary management independence from the parent: the *share of declared independent board members* (i.e., ratio of members identified as being independent because they own no or a small number of shares in the bank, are not clients or suppliers of the bank and do not have family members working in the bank). The share of

[22] This also agrees with Ongena, Peydro and Van Horen (2013), which find that foreign banks in Eastern European countries reduced the supply of credit more compared to locally-funded domestic banks, but not compared to domestic banks that funded themselves more from international capital markets before the crisis. Similarly, De Haas and Van Lelyveld (2014) find that multinational bank subsidiaries relying on wholesale funding had to slow down credit growth much faster than domestic banks. In addition, in the previous World Bank working paper version of this paper, where we did not include time dummies but instead controlled for global factors like the default premia and the VIX, we also found that subsidiaries with higher capital and profitability exhibited a lower correlation between their distance to default and that of their parent.

independent board members interacted with the parent distance to default is positively and significantly correlated with the interaction of parent distance to default with the measures of geographical distance and cultural proximity: the correlation is 0.92 with geographical distance and 0.65 with cultural proximity. Hence, we interpret the negative interaction of the geographical distance and cultural proximity measures with the distance of default of the parent as suggestive of the fact that more independently managed subsidiaries exhibit a lower correlation between the measures of distance to default of the subsidiaries and parents.

Table 5 allows us to corroborate the significance of the subsidiary characteristics, even when we control for host country dummies-parent distance to default interactions, which are included but not reported. These interactions are intended to account for any host country factors that are non-time varying over our period of analysis (e.g., features of the institutional/regulatory environment) that can reduce the effect of the parent distance to default. As before, we find that for subsidiaries that have higher retail deposit funding ratios and that are culturally closer to the parent, the correlation between the subsidiaries' and the parents' distance to default is lower.

Table 6 investigates how the correlation between foreign subsidiaries' and parents' distance to default changes depending on the banking regulations adopted by host jurisdictions. We find that in host countries where regulators impose greater disclosure, capital, reserve, and provisioning requirements and where the range of activities banks can undertake is more limited,[23] the correlation between the parent banks' and the subsidiaries' distance to default is lower. For example, a one standard deviation increase in the index of capital regulation lowers the correlation of the distance to defaults from 0.29 to 0.18. The economic impact for all other statistically significant variables is roughly of the same magnitude.

V. CONCLUSIONS

While many papers have examined how foreign bank parent conditions affect lending by their overseas subsidiaries, this paper is the first to analyze the correlation between parents' and subsidiaries' default risk. More importantly, we also analyze the subsidiary characteristics and policies that can dampen or amplify this correlation. These issues are important because they allow host countries to assess how exposed they are to shocks affecting multinational banks and what factors can help reduce this exposure.

Our analysis shows that there is a statistically and economically significant positive correlation between parents' and subsidiaries' distance to default. This finding is robust to the way we calculate the distance to default and to the sample of banks considered. Also, we find that the correlation in the distance to default between subsidiaries and parents varies with certain

[23] We have also conducted estimations looking separately at restrictions on specific bank activities such as securities, investments, and real estate and have found that regulations restricting banks' ability to engage in securities underwriting are the most significant in terms of lowering the correlations between the subsidiary and parent distance to default.

subsidiary characteristics. In particular, this correlation is lower for subsidiaries that have higher deposit funding ratios and that are more independently managed from the parent. Finally, the regulatory system in place in the host country also influences the extent to which shocks to the parents distance to default influence subsidiaries. In particular, the correlation between the distance to default of the subsidiary and the parent is lower for subsidiaries operating in countries that impose higher capital, reserve, provisioning, and disclosure requirements and tougher restrictions on bank activities.

From an individual host country's policy perspective, our findings indicate that tighter host banking regulations seem to help insulate foreign subsidiaries from changes in the default risk of parent banks during crises. This could lead domestic regulators towards trying to minimize default correlations with the parent banks, while, at the same time, trying to minimize the costs from more regulation in the host country. This tradeoff would be present especially if the tighter regulation needed to insulate foreign subsidiaries from the parent also needed to cover domestic banks (e.g. due to uniformity of treatment principles). However, it is important to note that this solution may not necessarily be optimal from a global perspective. First, ring fencing measures taken by authorities in one country could increase stress on the banking group's legal entities in other jurisdictions or for the banking group as a whole. Second, ring fencing may create inefficiencies in the allocation of capital and liquidity within multinational bank groups. These potential downsides from ring fencing practices by host regulators have been highlighted in the Basel Committee's *Report and Recommendations of the Cross-Border Bank Resolution Group* (CBBRG). Furthermore, in light of the concerns about ring fencing practices, the CBRG has called for the establishment of a credible framework for cooperation across national supervisors and for uniform mechanisms for the resolution of cross-border banking groups to help avoid unilateral and likely more costly solutions.

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VII. TABLES

Table 1: List of foreign bank parents and subsidiaries in the sample

This table lists the subsidiary banks, their host countries, their parents and the parents' home countries used in the analysis.

Parent Bank Name	Home Country	Subsidiary Bank Name	Host Country
Abu Dhabi Islamic Bank - Public Joint Stock Co.	UNITED ARAB EMIRATES	National Development Bank/Egyp	EGYPT
Albaraka Banking Group B.S.C.	BAHRAIN	Al Baraka Bank Egypt ESC	EGYPT
Albaraka Banking Group B.S.C.	BAHRAIN	Albaraka Turk Katilim Bankasi	TURKEY
Allied Irish Banks plc	IRELAND	Bulgarian American Credit Bank	BULGARIA
Arab Bank Plc	JORDAN	Arab Tunisian Bank	TUNISIA
Arab Banking Corporation BSC	BAHRAIN	Banco ABC Brasil SA	BRAZIL
Attijariwafa Bank	MOROCCO	Attijari Bank	TUNISIA
Australia & New Zealand Bankin	AUSTRALIA	Bank Pan Indonesia Tbk PT	INDONESIA
Australia and New Zealand Banking Group	AUSTRALIA	AMMB Holdings Bhd	MALAYSIA
Banco Bilbao Vizcaya Argentaria SA	SPAIN	Banco Bilbao Vizcaya Argentaria	CHILE
Banco Bilbao Vizcaya Argentaria SA	SPAIN	BBVA Banco Frances SA	ARGENTINA
Banco Bilbao Vizcaya Argentaria SA	SPAIN	BBVA Colombia SA	COLOMBIA
Banco Bilbao Vizcaya Argentaria SA	SPAIN	Banco Continental-BBVA Banco Continental	PERU
Banco Bilbao Vizcaya Argentaria SA	SPAIN	Banco Provincial	VENEZUELA
Banco Comercial Português S.A.	PORTUGAL	Bank Millennium	POLAND
Banco Santander SA	SPAIN	Banco Santander Rio S.A.	ARGENTINA
Banco Santander SA	SPAIN	Banco Santander (Brasil) S.A.	BRAZIL
Banco Santander SA	SPAIN	Banco Santander Brasil SA/Braz	BRAZIL
Banco Santander SA	SPAIN	Banco Santander Chile	CHILE
Banco Santander SA	SPAIN	Banco Santander Colombia SA	COLOMBIA
Banco Santander SA	SPAIN	Attijariwafa Bank	MOROCCO
Bank of East Asia Ltd	HONG KONG	Affin Holdings Bhd	MALAYSIA
Bank of New York Mellon	UNITED STATES	Wing Hang Bank Ltd	HONG KONG
Bank of Nova Scotia - Scotiabank	CANADA	Scotiabank Sud Americano	CHILE
Bank of Nova Scotia - Scotiabank	CANADA	Scotia Group Jamaica Ltd	JAMAICA
Bank of Nova Scotia - Scotiabank	CANADA	Scotiabank Peru SAA	PERU
Bank of Nova Scotia - Scotiabank	CANADA	Scotiabank Trinidad & Tobago Limited	TRINIDAD AND TOBAGO
BARCLAYS PLC	UNITED KINGDOM	Barclays Bank of Botswana	BOTSWANA
BARCLAYS PLC	UNITED KINGDOM	Barclays Bank of Kenya Ltd	KENYA
BARCLAYS PLC	UNITED KINGDOM	ABSA Group Limited	SOUTH AFRICA
BNP Paribas	FRANCE	Banque Internationale pour le Commerce et l'Industrie de la Côte d'Ivoire SA - BICICI	IVORY COAST
BNP Paribas	FRANCE	Bank of Nanjing	CHINA
BNP Paribas	FRANCE	Banque Marocaine pour le Commerce et l'Industrie BMCI	MOROCCO
BNP Paribas	FRANCE	Union Bancaire pour le Commerc	TUNISIA

Table 1: List of foreign bank parents and subsidiaries in the sample (continued)

Parent Bank Name	Home Country	Subsidiary Bank Name	Host Country
BNP Paribas	FRANCE	Turk Ekonomi Bankasi A.S.	TURKEY
BNP Paribas	FRANCE	BNP Paribas Bank Polska SA	POLAND
BTA Bank JSC	KAZAKHSTAN	Sekerbank TAS	TURKEY
Caixabank	SPAIN	Bank of East Asia Ltd	HONG KONG
Canadian Imperial Bank of Commerce	CANADA	FirstCaribbean International Bank Limited	BARBADOS
CIMB Group Holdings Bhd	MALAYSIA	Bank CIMB Niaga Tbk PT	INDONESIA
Citigroup Inc.	UNITED STATES	Banco de Chile	CHILE
Citigroup Inc.	UNITED STATES	Bank Handlowy w Warszawie S.A.	POLAND
Citigroup Inc.	UNITED STATES	Akbank TAS	TURKEY
Commerzbank AG.	GERMANY	BRE Bank SA	POLAND
Commerzbank AG.	GERMANY	Bank Forum	UKRAINE
Crédit Agricole S.A.	FRANCE	Credit Agricole Egypt	EGYPT
Crédit Agricole S.A.	FRANCE	Crédit du Maroc	MOROCCO
Deutsche Bank AG	GERMANY	Hua Xia Bank co., Limited	CHINA
Dexia	BELGIUM	Denizbank A.S.	TURKEY
Dubai Bank PJSC	UNITED ARAB EMIRATES	Bankislami Pakistan Ltd	PAKISTAN
Hang Seng Bank Ltd	HONG KONG	Industrial Bank Co Ltd	CHINA
HSBC Holdings Plc.	UNITED KINGDOM	Shenzhen Development Bank Co., Ltd	CHINA
HSBC Holdings Plc.	UNITED KINGDOM	Hang Seng Bank Ltd.	HONG KONG
HSBC Holdings Plc.	UNITED KINGDOM	Bank Ekonomi Raharja Tbk PT	INDONESIA
HSBC Holdings Plc.	UNITED KINGDOM	HSBC Bank Malta Plc	MALTA
ING Groep NV	NETHERLANDS	Bank of Beijing Co Ltd	CHINA
ING Groep NV	NETHERLANDS	ING Vysya Bank Ltd	INDIA
ING Groep NV	NETHERLANDS	ING Bank Slaski S.A. - Capital Group	POLAND
ING Groep NV	NETHERLANDS	TMB Bank PCL	THAILAND
Intesa Sanpaolo	ITALY	Privredna Banka Zagreb d.d- Privredna Banka Zagreb Group	CROATIA
Intesa Sanpaolo	ITALY	Vseobecna Uverova Banka a.s.	SLOVAKIA
Intesa Sanpaolo	ITALY	Banco Patagonia SA	ARGENTINA
Ithmaar Bank B.S.C.	BAHRAIN	Faysal Bank Ltd	PAKISTAN
KBC GROEP NV/ KBC GROUPE SA	BELGIUM	Kredyt Bank SA	POLAND
Malayan Banking Bhd	MALAYSIA	MCB Bank Ltd	PAKISTAN
Mitsubishi UFJ Financial Group Inc.	JAPAN	Chong Hing Bank Limited	HONG KONG
Mitsubishi UFJ Financial Group Inc.	JAPAN	Dah Sing Banking Group Limited	HONG KONG
National Bank of Greece SA	GREECE	Stopanska Banka a.d. Skopje	MACEDONIA FYROM
National Bank of Greece SA	GREECE	Finansbank A.S.	TURKEY
Nomura Holdings Inc	JAPAN	Silkbank Ltd	PAKISTAN
Nordea Bank AB (Publ)	SWEDEN	Nordea Bank Polska SA	POLAND

Table 1: List of foreign bank parents and subsidiaries in the sample (continued)

Parent Bank Name	Home Country	Subsidiary Bank Name	Host Country
Oversea-Chinese Banking Corporation Limited OCBC	SINGAPORE	Bank of Ningbo	CHINA
Oversea-Chinese Banking Corporation Limited OCBC	SINGAPORE	Bank OCBC Nisp Tbk PT	INDONESIA
Raiffeisen Bank International AG	AUSTRIA	Raiffeisen Bank Aval	UKRAINE
Société Générale	FRANCE	Société Générale de Banques en Côte d'Ivoire - SGBCI	IVORY COAST
Société Générale	FRANCE	Komercni Banka	CZECH REPUBLIC
Société Générale	FRANCE	National Societe Generale Bank SAE	EGYPT
Société Générale	FRANCE	SG-SSB Limited	GHANA
Société Générale	FRANCE	Societe d'Equipement Domestique et Menager	MOROCCO
Société Générale	FRANCE	Ohridska Banka ad Ohrid	MACEDONIA FYROM
Société Générale	FRANCE	BRD-Groupe Societe Generale SA	ROMANIA
Société Générale	FRANCE	JSC Rosbank	RUSSIAN FEDERATION
Société Générale	FRANCE	Union Internationale de Banques	TUNISIA
Standard Chartered Plc.	UNITED KINGDOM	Standard Chartered Bank Botswana Ltd	BOTSWANA
Standard Chartered Plc.	UNITED KINGDOM	Bank Permata Tbk PT	INDONESIA
Standard Chartered Plc.	UNITED KINGDOM	Standard Chartered Bank Kenya	KENYA
Standard Chartered Plc.	UNITED KINGDOM	Standard Chartered Bank (Pakistan)	PAKISTAN
Standard Chartered Plc.	UNITED KINGDOM	Standard Chartered Bank Zambia Plc-SCBZ Plc	ZAMBIA
Unicredit Spa	ITALY	Zagrebacka Banka dd	CROATIA
Unicredit Spa	ITALY	Bank of Valletta PLC	MALTA
Unicredit Spa	ITALY	Bank Polska Kasa Opieki SA-Bank Pekao SA	POLAND
Unicredit Spa	ITALY	Yapi ve Kredi Bankasi AS	TURKEY
Unicredit Spa	ITALY	Joint-Stock Commercial Bank for Social Development - Ukrsotsbank	UKRAINE

Table 2: Variable definition and descriptive statistics

This table lists the definitions, sources and the summary statistics for the variables used in this study

Variable	Definition	Source	Mean	Standard deviation
Δdd_Sub	Change in subsidiaries' Merton distance to default.	Authors' calculation using bank data from Bankscope and stock return information from Compustat/CSRP/Datastream	-0.0019	0.0266
Δdd_Parent	Change in parent banks' Merton distance to default.	Authors' calculation using bank data from Bankscope and stock return information from Compustat/CSRP/Datastream	-0.0054	0.0276
Δdd_Home	Change in home countries' average Merton distance to default. This country average includes all listed firms and banks except for the parent bank.	Authors' calculation using bank data from Bankscope and stock return information from Compustat/CSRP/Datastream	-0.0025	0.0222
Δdd_Host	Change in host countries' average Merton distance to default. This country average includes all listed firms and banks except for the foreign bank subsidiary.	Authors' calculation using bank data from Bankscope and stock return information from Compustat/CSRP/Datastream	-0.0016	0.0346
ΔDEF	Change in Bbb - Aaa spread	Interest rate data releases from the Federal Reserve Board	-0.0067	0.1413
ΔVIX	Change of the CBOE VIX index, implied volatility index on the S&P 500.	Chicago Board Options Exchange	-0.0006	0.0597
Size	Subsidiaries' assets to banking systems' assets ratio	Bankscope	0.0579	0.0584
Capital ratio	Subsidiaries' capital ratio	Bankscope	0.1484	0.0459
Equity assets	Subsidiaries' equity to total assets ratio	Bankscope	0.0929	0.0388
Dep. Funding	Subsidiaries' deposits to total funding ratio	Bankscope	0.8245	0.1229
Profitability	Subsidiaries' return on average assets (ROAA)	Bankscope	0.0157	0.0146
Liquidity	Subsidiaries' liquid assets to total assets ratio	Bankscope	0.2336	0.0998
Provisions	Subsidiaries' loan loss provisions to total loans ratio	Bankscope	0.0082	0.0141
Geographical distance	Log of the distance between the capital cities of the parent and subsidiary countries	CEPII	8.0759	0.9032
Cultural distance	Dummy=1 if home and host share a common language	CEPII	0.3653	0.4816
Reserve Requirements	Average reserve requirements	Data come from World Bank Regulation and Supervision Survey.	14.481	15.713
Disclosure requirements	Index variable that indicates whether the income statement includes accrued or unpaid interest or principal on nonperforming loans, whether banks are required to produce consolidated financial statements, and whether bank directors are legally liable if information disclosed is erroneous or misleading. The variable ranges from 0 to 3, with higher values indicating more informative bank accounts.	Data come from World Bank Regulation and Supervision Survey. Index is constructed following Barth, Caprio, and Levine (2001, 2013)	2.751	0.443
Activity restrictions	Index variable that ranges from 3 to 12, with 12 indicating the highest restrictions on bank activities such as securities, investment, and real estate. (For each type of activity: Unrestricted=1, Permitted=2, Restricted=3, and Prohibited=4).	Data come from World Bank Regulation and Supervision Survey. Index is constructed following Barth, Caprio, and Levine (2001, 2013)	8.417	2.344

Table 2: Variable definition and descriptive statistics (continued)

Variable	Definition	Source	Mean	Standard deviation
Capital regulation	Index captures the amount of capital banks must hold and the stringency of regulations on the nature and source of capital. Ranges in value from 0 to 10, with higher values indicating greater stringency	Data come from World Bank Regulation and Supervision Survey. Index is constructed following Barth, Caprio, and Levine (2001, 2013)	5.359	2.099
Loan classification	Measures the actual minimum number of days beyond which a loan in arrears must be classified as sub-standard, doubtful, or loss.	Data come from World Bank Regulation and Supervision Survey. Index is constructed following Barth, Caprio, and Levine (2001, 2013)	475.722	164.39
Provisioning	Measures the minimum provisions (as a percentage of loans) required as a loan is successively classified as sub-standard, doubtful, and lastly as loss.	Data come from World Bank Regulation and Supervision Survey. Index is constructed following Barth, Caprio, and Levine (2001, 2013)	164.684	33.175
Diversification	An index variable that ranges from zero to two, with higher values indicating more asset diversification.	Data come from World Bank Regulation and Supervision Survey. Index is constructed following Barth, Caprio, and Levine (2001, 2013)	1.326	0.558
Supervisory powers	An index variable that ranges from zero to fourteen, with fourteen indicating the highest power of the supervisory authorities	Data come from World Bank Regulation and Supervision Survey. Index is constructed following Barth, Caprio, and Levine (2001, 2013)	11.939	2.566
Prompt corrective action	Measures the extent to which the law establishes predetermined levels of bank solvency deterioration that forces automatic enforcement actions such as intervention, and the extent to which supervisors have the requisite suitable powers to do so. The index ranges from 0 to 6 with higher values indicating more promptness in responding to problems.	Data come from World Bank Regulation and Supervision Survey. Index is constructed following Barth, Caprio, and Levine (2001, 2013)	2.436	2.636
Financial outflows restrictions	Average of the financial sectors that involve mostly controlling outflows: lending to non-residents, maintenance of account abroad, and investment regulations, abroad by banks for the year 2007.	Authors' calculation using data from IMF AREAR	0.630	0.331

Table 3: The association between parent banks' and subsidiaries' distance to default

Regression results for the model $\Delta dd\_Sub_{i,t} = \beta^0 + \beta^1 \Delta dd\_Parent_{i,t} + \beta^2 \Delta dd\_Home_t + \beta^3 \Delta dd\_Host_t + \beta^4 \Delta DEF_t + \beta^5 \Delta VIX_t + \gamma_i + \varepsilon_{i,t}$ are reported in this table. $\Delta dd\_Sub_{i,t}$ is the weekly change in distance to default of the subsidiary *i* in week *t*; $\Delta dd\_Parent_{i,t}$ is the weekly change in distance to default of the parent of subsidiary *i*; Δdd_Host_t and Δdd_Home_t are changes in average distance to defaults of all the publicly traded banks and companies in the host country and parent bank country (excluding the foreign subsidiary and parent banks in question), respectively. ΔDEF_t is the change in interest rate spread between Bbb and Aaa rated companies. ΔVIX_t is the weekly change in the VIX volatility index. Regressions also include subsidiary fixed effects, γ_i and estimations (2.4) and (2.8) replace ΔDEF_t and ΔVIX_t with time dummies to account for time fixed effects. Estimates (2.1) through (2.4) show estimations where the measure of distance to default follow Merton (1974), whereas estimations in column (2.5) through (2.8) use Byström (2006) distance to default measure. Standard errors are reported below coefficient estimates in parentheses and are clustered at the host country level. ***, ** and * indicate the 1%, 5%, and 10% level of significance, respectively.

Variables	Merton distance to default				Byström distance to default			
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)	(2.8)
Δdd_Parent	0.446***	0.292***	0.271***	0.266***	0.335***	0.191***	0.190***	0.169***
	(0.041)	(0.034)	(0.032)	(0.0333)	(0.0271)	(0.0244)	(0.0243)	(0.0240)
Δdd_Home		0.188***	0.175***	0.219***		0.184***	0.202***	0.236***
		(0.051)	(0.047)	(0.0561)		(0.0283)	(0.0286)	(0.0310)
Δdd_Host		0.142***	0.135***	0.149***		0.142***	0.148***	0.152***
		(0.028)	(0.027)	(0.0274)		(0.0351)	(0.0363)	(0.0350)
ΔDEF			-0.011***				0.00116	
			(0.004)				(0.00337)	
ΔVIX			-0.0270*				0.0148*	
			(0.0147)				(0.00812)	
Observations	3,786	3,663	3,581	3,663	4,326	4,172	4,008	4,172
Subsidiary fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	No	No	No	Yes	No	No	No	Yes
R-squared	0.216	0.276	0.288	0.300	0.134	0.180	0.188	0.204
Number of Subsidiaries	93	93	93	93	87	87	87	87

Table 4: The impact of subsidiaries' characteristics on the association between foreign subsidiaries' and parents' distance to default

Regression results for the model $\Delta dd\_Sub_{i,t} = \beta^0 + \beta^1 \Delta dd\_Parent_{i,t} + \beta^2 \Delta dd\_Home_t + \beta^3 \Delta dd\_Host_t + \beta^4 X_i \times \Delta dd\_Parent_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t}$ are reported in this table. $\Delta dd\_Sub_{i,t}$ is the weekly change in distance to default of the subsidiary *i* in week *t*; Δdd_Parent is the weekly change in distance to default of the parent of subsidiary *i*; Δdd_Host_t and Δdd_Home_t are changes in average distance to defaults of all the publicly traded banks and companies in the host country and parent bank country, respectively. X_i are foreign subsidiary characteristics computed as of December 2006. These variables are described in detail in Table 2. Regressions also include subsidiary fixed effects, γ_i and time (weekly) fixed effects δ_t. Standard errors are reported below coefficient estimates in parentheses and are clustered at the host country level. ***, ** and * indicate the 1%, 5%, and 10% level of significance, respectively.

Variables	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)
Δdd_Parent	0.278***	0.463***	0.352***	0.758***	0.330***	0.199***	0.324***	0.743***	0.337***
	(0.0416)	(0.116)	(0.0793)	(0.211)	(0.0457)	(0.0669)	(0.0408)	(0.267)	(0.0417)
Δdd_Home	0.217***	0.215***	0.218***	0.208***	0.216***	0.217***	0.197***	0.219***	0.224***
	(0.0577)	(0.0655)	(0.0566)	(0.0584)	(0.0592)	(0.0576)	(0.0550)	(0.0564)	(0.0559)
Δdd_Host	0.144***	0.142***	0.142***	0.144***	0.146***	0.142***	0.140***	0.149***	0.150***
	(0.0278)	(0.0334)	(0.0280)	(0.0272)	(0.0275)	(0.0277)	(0.0276)	(0.0273)	(0.0268)
Size×Δdd_Parent	-0.197								
	(0.556)								
Capital ratio×Δdd_Parent		-1.075							
		(0.634)							
Equity assets×Δdd_Parent			-0.903						
			(0.714)						
Cust. Dep./Fund.× Δdd_Parent				-0.578**					
				(0.252)					
Profitability×Δdd_Parent					-3.228				
					(1.994)				
Liquidity×Δdd_Parent						0.314			
						(0.339)			
Provisions×Δdd_Parent							-4.682		
							(2.782)		
Geo. distance×Δdd_Parent								-0.0591*	
								(0.0320)	
Cultural Prox.×Δdd_Parent									-0.196***
									(0.0546)
Observations	3,411	2,708	3,396	3,372	3,352	3,380	3,337	3,581	3,581
R-squared	0.301	0.324	0.302	0.309	0.307	0.310	0.307	0.307	0.313
Number of subsidiaries	88	66	87	87	86	87	86	93	93

Table 5: The impact of subsidiaries' characteristics controlling for host country dummies-parent distance to default interactions

Regression results for the model $\Delta dd\_Sub_{i,t} = \beta^0 + \beta^1 \Delta dd\_Parent_{i,t} + \beta^2 \Delta dd\_Home_t + \beta^3 \Delta dd\_Host_t + \beta^4 X_i \times \Delta dd\_Parent_{i,t} + \beta^5 \gamma_i \times \Delta dd\_Parent_{i,t} + \delta_t + \gamma_i + \varepsilon_{i,t}$ are reported in this table. $\Delta dd\_Sub_{i,t}$ is the weekly change in distance to default of the subsidiary *i* in week *t*; $\Delta dd\_Parent_{i,t}$ is the weekly change in distance to default of the parent of subsidiary *i*; Δdd_Host_t and Δdd_Home_t are changes in average distance to defaults of all the publicly traded banks and companies in the host country and parent bank, respectively. X_i are foreign subsidiary characteristics computed as of December 2006. These variables are described in detail in Table 2. Regressions also include host country dummies-parent distance to default interactions, $\gamma_i \times \Delta dd\_Parent_{i,t}$, which are included but not reported. Regressions also include subsidiary fixed effects, γ_i and time (weekly) fixed effects, γ_t. Standard errors are reported below coefficient estimates in parentheses and are clustered at the host country level. ***, ** and * indicate the 1%, 5%, and 10% level of significance, respectively.

Variables	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)	(4.7)	(4.8)	(4.9)
Δdd_Parent	0.394***	0.784***	0.559**	0.216	0.441***	0.346**	0.470***	0.475	0.301***
	(0.0926)	(0.115)	(0.216)	(0.185)	(0.106)	(0.154)	(0.117)	(0.408)	(0.0806)
Δdd_Home	0.218***	0.220***	0.221***	0.214***	0.218***	0.217***	0.201***	0.219***	0.220***
	(0.0603)	(0.0687)	(0.0597)	(0.0606)	(0.0620)	(0.0605)	(0.0587)	(0.0590)	(0.0584)
Δdd_Host	0.130***	0.128***	0.130***	0.131***	0.130***	0.131***	0.127***	0.138***	0.137***
	(0.0263)	(0.0310)	(0.0267)	(0.0262)	(0.0261)	(0.0264)	(0.0259)	(0.0265)	(0.0265)
Size×Δdd_Parent	0.622								
	(0.915)								
Capital ratio×Δdd_Parent		0.469							
		(0.643)							
Equity assets×Δdd_Parent			-0.924						
			(1.239)						
Cust. deposits/Funding×Δ dd_Parent				-0.657**					
				(0.300)					
Profitability×Δdd_Parent					-1.083				
					(2.023)				
Liquidity× Δdd_Parent						0.143			
						(0.213)			
Provisions× Δdd_Parent							-2.735		
							(1.970)		
Geographic distance×Δdd_Parent								-0.0366	
								(0.0507)	
Cultural Proximity× Δdd_Parent									-0.127**
									(0.0572)
Host Country Dummy xΔ dd_Parent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,411	2,708	3,396	3,372	3,352	3,380	3,337	3,581	3,581
R-squared	0.343	0.365	0.343	0.348	0.347	0.351	0.349	0.345	0.346
Number of subsidiaries	88	66	87	87	86	87	86	93	93

Table 6: The impact of host countries' regulations on the association between foreign subsidiaries' and parents' distance to default

Regression results for the model $\Delta dd\_Sub_{i,t} = \beta^0 + \beta^1 \Delta dd\_Parent_{i,t} + \beta^2 \Delta dd\_Home_t + \beta^3 \Delta dd\_Host_t + \beta^6 M_c \times \Delta dd\_Parent_{i,t} + \delta_t + \gamma_i + \varepsilon_{i,t}$ are reported in this table. $\Delta dd\_Sub_{i,t}$ is the weekly change in distance to default of the subsidiary i in week t; Δdd_Parent is the weekly change in distance to default of the parent of subsidiary i; Δdd_Host_t and Δdd_Home_t are changes in average distance to defaults of all the publicly traded banks and companies in the host country and parent bank country (excluding the foreign subsidiary and parent banks in question), respectively. M_c are subsidiary host country bank regulations measured as of December, 2006. These variables are described in detail in Table 2. Regressions also include subsidiary fixed effects, γ_i and time (weekly) fixed effects, δ_t. Standard errors are reported below coefficient estimates in parentheses and are clustered at the host country level. ***, ** and * indicate the 1%, 5%, and 10% level of significance, respectively.

Variables	(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)	(5.7)	(5.8)	(5.9)	(5.10)
Δdd_Parent	0.754***	0.601***	0.470***	0.468***	0.647***	0.291***	0.329	0.307***	0.303***	0.276***
	(0.240)	(0.108)	(0.105)	(0.151)	(0.0988)	(0.0888)	(0.206)	(0.0510)	(0.0604)	(0.0784)
Δdd_Home	0.223***	0.237***	0.234***	0.196**	0.211***	0.220***	0.230***	0.218***	0.277***	0.219***
	(0.0568)	(0.0662)	(0.0669)	(0.0738)	(0.0699)	(0.0568)	(0.0618)	(0.0605)	(0.0461)	(0.0563)
Δdd_Host	0.148***	0.136***	0.140***	0.150***	0.142***	0.149***	0.151***	0.141***	0.124***	0.149***
	(0.0281)	(0.0313)	(0.0316)	(0.0444)	(0.0401)	(0.0279)	(0.0327)	(0.0278)	(0.0381)	(0.0273)
Disclosure×Δdd_Parent	-0.176**									
	(0.0857)									
Activity Restr.× Δdd_Parent		-0.0394***								
		(0.0117)								
Capital Regulation× Δdd_Parent			-0.0380**							
			(0.0167)							
Loan Classification×Δ dd_Parent				-0.000405						
				(0.000292)						
Provisioning × Δdd_Parent					-0.00233***					
					(0.000618)					
Diversification× Δdd_Parent						-0.0163				
						(0.0575)				
Supervisory Powers× Δdd_Parent							-0.00565			
							(0.0153)			
Prompt Corrective×Δdd_Parent								-0.0122		
								(0.0128)		
Reserves Req.× Δ dd_Parent									-0.00389*	
									(0.00191)	
Financial Outflows×Δ dd_Parent										-0.0159
										(0.104)
Obs.	3,576	3,073	3,073	2,158	2,512	3,555	3,319	3,309	2,414	3,581
R-squared	0.309	0.310	0.307	0.294	0.295	0.306	0.310	0.299	0.333	0.304
Number subsidiaries	92	77	77	55	62	91	84	84	62	93

VIII. FIGURES

Figure 1: Changes in the distance to default of all multinational parent banks and their foreign bank subsidiaries, 2008-2009