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Ringfencing**

*By Anna L. Sobiech, Lechedzani
Kgari, Linh Nguyen, and John
O.S. Wilson*

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Implicit Guarantees and Cross-Border Bank Stability: Evidence from Geographic Ringfencing

Anna L. Sobiech*
asobiech@uni-koeln.de^{a,b}

Lechedzani Kgari^b
lmk20@st-andrews.ac.uk

Linh Nguyen^b
lhn2@st-andrews.ac.uk

John O.S. Wilson^b
jsw7@st-andrews.ac.uk

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Abstract

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Keywords: Implicit guarantees, Bank stability, Geographic ringfencing, Cross-border banking, Africa

*Corresponding author

^a Faculty of Management, Economics and Social Sciences, University of Cologne, Albertus-Magnus-Platz, 50923 Cologne, Germany.

^b Centre for Responsible Banking & Finance, Business School, University of St Andrews, The Gateway, KY16 9RJ, St Andrews, Fife, UK.

1. Introduction

The relationship between corporate parents and their constituent subsidiaries is fundamental to the governance, performance, and resilience of complex organizations. Cross-border banks routinely establish subsidiaries to conduct business in foreign countries subject to local regulation and supervision. In principle, the operation of stand-alone subsidiaries implies that the parent bank has limited liability toward affiliates. This allows the parent bank protection from any financial losses incurred by subsidiaries.¹ Despite the availability of this limited liability option, cross-border banks often choose to provide financial support to subsidiaries during times of stress or crisis.² The provision of financial support beyond any legal obligations implies the presence of implicit guarantees. These implicit guarantees pose challenges to regulators globally, given the potential impacts on the overall risk of cross-border banks. Consequently, there is considerable debate, but a paucity of evidence regarding the benefits and costs of implicit guarantees. Critics argue that implicit guarantees reduce market discipline, incentivize excessive risk-taking, and increase the fragility of the financial system. Advocates contend that implicit guarantees are a source of strength and conducive to prudent risk management. Ultimately, the extent to which implicit guarantees enhance or compromise bank stability remains an unanswered empirical question; one that we aim to answer in the present study.

Prior theoretical literature is ambiguous regarding the impacts of implicit parent bank guarantees on the risk-taking of foreign subsidiaries. On one hand, parent bank implicit guarantees may induce excessive risk-taking by reducing incentives for creditors to monitor and discipline subsidiaries (Boot and Schmeits, 2000; Brei and Winograd, 2018). Parent bank implicit guarantees may give rise to moral hazard, leading subsidiaries to engage in riskier behavior on the presumption of being rescued by the parent in the event of distress. In the absence of market discipline, the threat of liquidation may be lower and risk-taking incentives higher.³ On the other hand, parent

¹ The recourse of the parent is limited to any capital invested, and excludes responsibility for the liabilities of foreign subsidiaries.

² During the European sovereign debt crisis, numerous subsidiaries of European banking conglomerates received capital and liquidity assistance from elsewhere within the same banking group. For instance, in 2008, Royal Bank of Scotland (RBS) provided support to its foreign subsidiary Ulster Bank, which incurred significant losses following the collapse of the Irish real estate market.

³ Prior evidence suggests that market discipline is lower in the presence of implicit and explicit government guarantees (Gropp, Gruendl, and Guettler, 2014; Brandao-Marques, Correa and Sapriza, 2020).

bank implicit guarantees may moderate excessive risk-taking by enhancing charter value and reputational capital. Keeley (1990) shows (theoretically) that the threat of losing charter value deters excessive risk-taking. Banks that have more to lose from failing, behave more prudently. Segura and Zeng (2020) further posit that implicit guarantees incentivize banks' monitoring efforts and thereby reduce any excessive risk-taking associated with limited liability. Ueda and di Mauro (2013) provide evidence that access to parent bank guarantees provides sizeable funding cost advantages to subsidiaries. Ultimately, the net impact of parent bank implicit guarantees on the risk-taking behavior of foreign subsidiaries is likely to depend on the relative importance of the two aforementioned views.

Our empirical strategy is based on a regulatory geographic ringfencing intervention which removed parent banks' options to provide financial assistance to foreign subsidiaries in case of financial distress. The intervention, which effectively eliminated any implicit parent bank guarantees for affiliated foreign subsidiaries was instituted by the Central Bank of Nigeria (CBN) in 2012. A time when new regulatory capital requirements were introduced in many African countries. Several host country supervisors demanded that foreign subsidiaries, if in need of recapitalization, should seek assistance from their parent bank. To safeguard the capital of Nigerian parent banks, the CBN prohibited parent banks from providing financial assistance to their foreign subsidiaries. We use this intervention as a natural experiment in a difference-in-differences (DiD) framework to investigate the impact of a loss of implicit parent bank guarantees for the stability of affiliated foreign subsidiaries. We compare the risk of foreign subsidiaries of Nigerian parent banks with that of foreign subsidiaries of other cross-border banks before and after the ringfencing intervention.

Our baseline sample comprises 171 foreign bank subsidiaries based in 42 African host countries.⁴ We define "treatment" as the CBN ringfencing intervention, and divide our sample of foreign subsidiaries into two groups according to the treatment status of the parent bank. The treated group comprises 14 foreign subsidiaries owned by four Nigerian parent banks. The control group comprises 157 foreign subsidiaries owned by 55 parent banks, headquartered in countries other than Nigeria, and thus not subject to

⁴ We restrict our analysis to affiliates of the banking group that are commercial banks. For data-availability reasons, we exclude bank branches or non-bank affiliates.

the CBN ringfencing intervention.⁵ We saturate our DiD-model with a comprehensive set of host-country \times time fixed effects to control for any time-varying changes, and differences in host-country conditions. In order to alleviate potential concerns that differences in foreign subsidiaries or parent banks are driving our results, we also employ propensity score matching based on an extensive set of subsidiary and parent bank characteristics. All our results are robust in the matched samples.

By way of preview, the results of our econometric analysis suggest that the risk of foreign subsidiaries increases following the ringfencing of parent banks. This is evidenced by a substantial increase in overall default risk. We employ alternative risk measures to assess the impacts of the ringfencing intervention on capital, credit, and liquidity risk management behavior of foreign subsidiaries. We find that foreign subsidiaries become more leveraged, have higher credit risk, and are more exposed to liquidity risk following the intervention. Overall, these results are in line with the notion that parent bank implicit guarantees contribute to charter value, and as such moderate the risk-taking of foreign subsidiaries.

We perform a series of cross-sectional tests to explore heterogeneities arising from differences in supervisory oversight and market discipline across host countries. Our findings suggest that there is considerable heterogeneity in the response of foreign subsidiaries to the CBN intervention. We observe a more substantial increase in the risk of foreign subsidiaries in host countries with weaker private and supervisory oversight. The results imply that implicit parent bank guarantees contribute to the stability of foreign subsidiaries when external control is weak.

We perform a series of additional tests to rule out alternative explanations for the observed increase in risk. To disentangle whether the increase in risk stems from the removal of implicit parent bank guarantees or is influenced by other factors, we investigate whether capital constraints, internal capital market integration, or parent bank specific factors drive our findings. By eliminating these alternative factors that may prompt the increase in risk, we are confident that our econometric approach allows us to

⁵We scrutinise supervisory disclosures and newspaper articles to verify that the 55 parent banks headquartered in jurisdictions other than Nigeria were not subject to interventions that explicitly limited them from providing financial support to foreign subsidiaries. To the best of our knowledge, we are unaware of any such intervention that coincided with the CBN ringfencing intervention.

identify robustly, the impact of the ringfencing intervention on the risk of foreign subsidiaries.

The results of our study have relevance beyond Nigeria and Africa. For example, in Europe, the global financial crisis and various sovereign debt crises left a legacy of nationally based ringfencing interventions, which have slowed progress toward achieving a fully integrated banking market (Enria and Fernandez-Bollo, 2020). As a potential way to advance the integration of banking markets in Europe, moving from a subsidiary-based organizational model (where parent banks are protected by limited liability from losses of foreign affiliates) to a branch-based organizational model (where parent banks and foreign affiliates operate as a unified legal entity) has been proposed (Enria, 2023). The results of the present study show that enacting strict forms of subsidiarization (via geographic ringfencing) has negative implications for the stability of foreign subsidiaries.⁶ This suggests that organizational forms where parent banks provide implicit financial guarantees for foreign affiliates have important stability benefits.

Our paper contributes to several strands of literature. First, we contribute to empirical evidence regarding the impacts of guarantees on bank risk-taking. Most evidence produced to date focuses on the role of government guarantees. The results forming this evidence base are rather mixed, with some studies finding that government guarantees reduce market discipline and increase risk-taking, while others find evidence for lower risk-taking in line with the notion of government guarantees contributing to bank charter value.⁷ Our study both augments and complements this literature by evaluating the role of financial guarantees in the bank parent-foreign subsidiary context. Using an extensive cross-country panel of bank parents and foreign subsidiaries, we provide evidence regarding the importance of implicit parent bank guarantees for the risk-taking of foreign affiliated subsidiaries.

⁶ Subsidiarization refers to supervisory requirements imposed on cross-border banks to operate a subsidiary, rather than a branch-based organizational structure.

⁷ Gropp, Gruendl and Guettler (2014) find that German savings banks have lower credit and funding risk after the abolishment of government guarantees. In a similar vein, Hagendorff, Keasey, and Vallasca (2018) and Brandao-Marques, Correa and Saprizza (2020) find a positive link between government support and bank risk taking. These results support the notion that guarantees increase bank risk-taking through reduced market discipline. In contrast, Koerner and Schnabel (2013) and Fischer et al., (2014) find that the removal of government guarantees increases bank funding costs and risk-taking.

Owing in large part to an absence of suitable empirical settings, there is a paucity of empirical evidence regarding the impacts of geographic ringfencing on cross-border banks. Two earlier simulation based investigations by Cerutti et al., (2010) and Cerutti, and Schmieder (2014) find that ringfencing has a negative impact on the solvency of European banks. The authors find that stricter forms of ringfencing (such as fully restricted intra-group transfers) result in a greater need for capital at the parent and subsidiary level. Our results confirm these findings. However, by studying the CBN ringfencing intervention, we can examine actual, rather than simulated bank behavior. Our results suggest that subsidiaries' response to the ringfencing intervention is not homogenous, but rather depends on prevailing market discipline and supervisory oversight in host countries.

The remainder of the paper is organised as follows. Section 2 provides an historical background of cross-border banking in Africa and describes the setting used as the basis of the research design employed in the present study. The dataset and empirical model are presented in Section 3. Section 4 discusses the results, examines confounding factors and heterogenous effects. Section 5 concludes.

2. Background

2.1 Cross-border banking in Africa

Cross-border banks operating in Africa comprise foreign and Pan-African banks.⁸ Pan-African banks are indigenous to Africa and operate either under a widespread network spanning the continent, or are more regionally oriented, confining cross border activities in close proximity to their home country. Over the past two decades, Pan-African banks expanded to overtake long established European and American banks with presence in Africa (for a review see Beck and Cull, 2013; Beck, 2015; Beck, Senbet and Simbanegavi, 2015). At the forefront of this expansion were banks from Kenya, Nigeria and South Africa. In 2015, the operations of Pan-African banks were recognised as systemically important in 36 of the 52 African countries (Enoch, Mathie, and Mecagni, 2015).⁹

⁸ Beck et al., (2024) provide a review of the evolution of cross-border banking in Africa.

⁹ Prior studies investigating the impact of Pan-African bank expansion, provide evidence in support of: lower cyclicalities in lending (Zins and Weill, 2018a); efficiency improvements (Zins and Weill, 2018b); increased competition (Leon, 2016); and increased financial inclusion (Beck, 2015; Leon and Zins, 2020).

In many African countries, the subsidiary-based structure is the predominant organizational form. Foreign subsidiaries typically operate in host-countries with limited integration across the banking group (Beck et al., 2014; Zins and Weill, 2018b). Foreign and Pan-African banks offer a range of services including corporate and retail banking, investment banking, and trade finance. In comparison to non-African-owned banks, Pan-African banks focus more on traditional financial intermediation activities based on deposit taking and lending (Nguyen, Perera and Skully, 2016). Pan-African ownership of foreign subsidiaries is also associated with higher bank risk (Kanga, Murinde, and Soumare, 2020).

2.2 Geographic ringfencing by the CBN

Geographic ringfencing represents a common regulatory approach of imposing geographical constraints or limitations on the operations of cross-border banks to enhance financial stability and supervisory oversight. The aim is to contain risks within specific geographic regions, thus preventing the transmission of financial distress across borders. Thus ensuring the stability of the financial system. Geographic ringfencing measures range from short-term ad hoc restrictions to long-term structural changes that aim to contain capital and liquidity within national borders (Goldberg and Gupta, 2013; D'Hulster and Ötoker-Robe, 2015; Enria and Fernandez-Bollo, 2020). These may be implemented in response to acute crises or as a pre-emptive safeguarding measure to prevent instability. While geographic ringfencing is considered prudent for insulating domestic banks from foreign shocks (Claessens, 2019; Fillat, Garetto and Corea-Smith, 2023), this overlooks the potential strength of intra-group financial support during crises (e.g. DeHaas and Lelyveld, 2010; Cetorelli and Goldberg, 2012; Cerutti, and Schmieder, 2014).

The CBN geographic ringfencing intervention can be considered as an ad hoc, safeguarding measure that was implemented at a time of no acute banking crisis. In May 2012, the central bank prohibited Nigerian parent banks from providing financial support to foreign subsidiaries. The restriction applied to all Nigerian cross-border banks (Central Bank of Nigeria 2012a; 2012b). The policy was implemented in response to host

Pan-African bank expansion led to greater bank stability in some countries, and fragility in others (Kanga, Murinde and Soumare, 2021).

country supervisors urging parent banks to help in the recapitalization of their foreign subsidiaries to ensure compliance with new regulatory capital requirements set forth by the recently adopted Basel II (or in some cases Basel III) accords.¹⁰ Concerns that parent bank financial support to subsidiaries would leave insufficient capital to withstand significant balance sheet shocks, led the CBN to impose the ringfencing of parent banks. At the time of the geographic intervention, the capital adequacy ratio of Nigerian parent banks was slightly above the industry average, albeit lower than in previous years (Central Bank of Nigeria, 2011). Foreign subsidiaries of Nigerian parent banks were also generally better capitalised than foreign subsidiaries of other banks operating in host countries throughout Africa.¹¹

3. Method and Data

3.1 Model

We use a difference-in-differences approach to identify the impact of the CBN ringfencing intervention on the stability of foreign subsidiaries. Specifically, we compare the risk of treated and control foreign subsidiaries in the pre-regulatory intervention period and the post-regulatory intervention period. Treated foreign subsidiaries are owned by Nigerian parent banks which were subject to the intervention in 2012 and 2013. Control foreign subsidiaries are owned by parent organizations that were not affected by the intervention. We estimate the following regression:

$$y_{i,b,j,t} = \beta_1 \underbrace{(treated_i * post_t)}_{RINGF_{i,t}} + \beta_2 X_{i,t-1} + \beta_3 P_{b,t-1} + \theta_{j,t} + \gamma_i + \epsilon_{i,j,t} \quad (1)$$

where i , b , j , and t denote foreign subsidiary, parent bank, host country and time. The dependent variable, y , is the so-called Z-score, a measure applied widely in the salient literature (Laeven and Levine, 2009; Houston et al., 2010; Beck, De Jonghe and Schepens, 2013). The Z-score measures a bank's distance from insolvency (Roy, 1952), and is

¹⁰ See online appendix, Section A1, for a list of capital requirements by host country.

¹¹ Section A2 (online appendix) shows the pre-treatment capital ratios of foreign subsidiaries in the treated and control group.

defined as the sum of the return on assets and the capital asset ratio in relation to the standard deviation of asset returns. Specifically, we calculate the Z-score as:

$$Z_score_{it} = \frac{ROA_{it} + CAR_{it}}{\sigma ROA_{it}}$$

A higher Z-score implies that a bank is more stable (less risky) and further from default. In order to reduce the skewness of the distribution, we take the natural logarithm of the Z-score (Lepetit and Strobel, 2013). To allow for time variation in the denominator of the Z-score, we compute the standard deviation, σROA_i using a five-year rolling window.¹²

The variable *treated* is an indicator variable, which equals one if a foreign subsidiary has a Nigerian parent and zero otherwise. The indicator variable *post* equals one for the two-year period following enactment of the geographic ringfencing intervention, and zero for the two-year period preceding. The treatment indicator $RINGF_{i,t}$ equals one for Nigerian subsidiaries in the years after 2011, and zero otherwise. β_1 is our coefficient of interest, which captures the impact of the ringfencing intervention on risk.

We control for time-varying subsidiary-specific factors that are likely to affect foreign subsidiaries' stability. $X_{i,t-1}$ is a matrix that comprises affiliate- and parent-level control variables that vary over time and across subsidiaries. We use size (*Size*) as well as the ratio of loans to assets (*Loans*), and the ratio of loans to deposits (*Loan-to-deposit ratio*) to account for differences in bank size, the composition of bank assets and the loan and deposit profile of banks.¹³ *Liquidity* is included to account for subsidiaries' liquidity constraints. We also include *Earnings* defined as the ratio of non-interest operating income to total operating income to account for the share of income from activities other than lending.¹⁴ We also include the ratio of *non-deposit* to total assets to measure the

¹² Our results are robust to alternative windows of three and four year duration. Given that our data is at an annual frequency, we prefer to use five-year windows, so as to capture longer term variation in returns on assets.

¹³ Prior evidence (summarised in Bhagat, Bolton and Lu, 2015) suggests that there is a strong association between bank size and risk-taking.

¹⁴ Demirgüç-Kunt and Huizinga (2010) find that banks with mixed fee- and interest income have higher Z-scores than less diversified counterparts.

extent to which a bank is funded via non-deposits.¹⁵ *Merger* is an indicator variable that captures merger and acquisition activity of subsidiaries, and equals one in the year of a merger, and zero otherwise.¹⁶

Parent bank-level controls, $P_{i,t-1}$, are included to address concerns that the CBN ringfencing intervention may coincide with shocks related to the capital and liquidity of parent banks. We also add host-country fixed effects interacted with time fixed effects, $\theta_{j,t}$. In doing so, we control for any changes in host-country conditions (such as economic shocks or capital inflows) that may interfere with the CBN ringfencing intervention.¹⁷ By adding *host_country x time* fixed effects, $\theta_{j,t}$, we also control for any effects emanating from changes to regulatory capital requirements in host countries. Estimation of our model is executed using two-way-fixed effects. Robust standard errors clustered at the parent level are used to control for within-parent bank correlation (Arellano 1987).¹⁸ $\epsilon_{i,j,t}$ is a stochastic error term.

We complete our analysis by investigating whether factors specific to the host country mitigate or exacerbate the impact of the CBN ringfencing intervention. To do so, we estimate an augmented version of Equation (1) where we interact the dichotomous treatment effect variable *RINGF* with several host-country specific characteristics, *HostC*.

$$y_{i,j,t} = \beta_1 RINGF_{i,t} \times HostC_{j,2011} + \beta_2 RINGF_{i,t} + \beta_3 X_{i,t-1} + \theta_{j,t} + \gamma_i + \epsilon_{i,j,t} \quad (2)$$

We choose measures that capture ex-ante differences in supervisory oversight and market discipline in host countries..

3.2 Data

We collect balance sheet, income statement and ownership data for bank subsidiaries operating in Africa for the sample period from 2005 to 2014 from Fitch Connect. We limit the sample to affiliates that operate as foreign bank subsidiaries in Africa. We manually collect information regarding the ownership structure of each

¹⁵ Khan, Scheule and Wu (2017) provide evidence of a positive link between deposit funding and bank risk.

¹⁶ To allow for heterogenous responses to the CBN ringfencing intervention by foreign subsidiaries of different nature, we interact all control variables with the *post* indicator.

¹⁷ Dinger and te Kaat (2020) find that capital inflows are associated with riskier bank loan portfolios.

¹⁸ Abadie et al. (2023) show that the treatment assignment mechanism determines the correct level of clustering. Given that the treatment varies at the parent level, we choose to cluster at this level.

subsidiary during the sample period from bank websites and annual reports. Following established practice in prior literature on cross-border banking, we consider a foreign bank subsidiary as being owned by a Nigerian parent if 50% or more of its shares are owned by a Nigerian parent bank. We apply the same rule to control group subsidiaries that are owned by parent banks headquartered in jurisdictions other than Nigeria. For host country supervisory characteristics, we use indicators sourced from the Barth, Caprio and Levine (2013) supervisory dataset.¹⁹ Definitions of those indicators are provided in Section A3 (online appendix).

A key assumption underlying our research design is that foreign subsidiaries in the treated and control group are relatively homogenous in their financial characteristics prior to treatment. To alleviate concerns that pre-treatment differences in characteristics could drive our results, we use four different samples of banks as well as a propensity score matching approach. In Section A4 (online appendix), we provide a description of these four samples. Table A4.1 depicts the geographic composition of each sample and reports the number of control units. Summary statistics for each sample are provided in Table A4.2 Panel A.

4. Empirical results

4.1 Baseline results

Table 1, Columns 1 to 6 present the results from estimating Equation (1) with the Z-score as the dependent variable y_{ijt} . The first column shows the results of estimating the basic difference-in-differences specification with three subsidiary-level control variables and subsidiary fixed effects, as well as time effects for the baseline sample (*full*). The coefficient on the treatment variable, *RINGF*, is negative and statistically significant. In Column 2, we control for additional foreign subsidiary and parent bank characteristics, and add host-country \times time fixed effects. In order to allow for possible heterogeneous responses to the ringfencing intervention, we interact all foreign subsidiary-level and parent-level control variables with *post*. Column 3 reports the results. The coefficient in Column 3 is negative and takes the value of 0.831. This implies that the Z-score of foreign

¹⁹ The dataset compiles measures of bank regulatory and supervisory policies for 180 countries with the data spanning from 1999 to 2011. The indices in the dataset are based on responses by regulatory authorities to an array of questions (for a summary, see Barth, Caprio and Levine, 2013).

subsidiaries decreases. For comparison, the within-bank variation in the Z-score for the average foreign subsidiary in the full sample over the period from 2005 to 2011 is 0.633 (see Table 4.2 Panel B). In Columns 4, 5, and 6, we use the same regression specification as in Column 2, but utilize alternative samples. The estimated coefficient on *RINGF* is negative and remains statistically significant across various specifications. Overall, the negative coefficients on *RINGF* in Columns 1 through 6 suggest that subsidiaries owned by Nigerian cross-border banks have higher risk relative to control group subsidiaries after the CBN ringfencing intervention. Lower Z-scores imply a higher probability of bank insolvency, suggesting that foreign subsidiaries of Nigerian parent banks became less stable (riskier) after the enactment of the CBN ringfencing intervention. These results are in line with the notion that parent bank implicit guarantees add to bank charter value and mitigate excessive risk-taking of foreign subsidiaries.

4.2 Alternative risk measures and dynamics

From a policy perspective, there is merit in exploring how the CBN ringfencing intervention impacts several types of bank risk. We therefore employ three alternative risk measures that capture the credit, liquidity, and leverage risk of foreign subsidiaries. In Section A3 (online appendix), we provide specific details on the composition of the aforementioned risk proxies. We then estimate Equation (1) using the three alternative risk measures. From the results in Table 2, we observe that the CBN ringfencing intervention impacts credit, liquidity, and leverage risk. The coefficients in Columns 1, 2, and 3 for credit, liquidity, and leverage risk respectively, are positive and statistically significant. Columns 4 to 12 report the coefficients for the alternative samples. Notably, the coefficients remain positive and consistent throughout. The coefficients for credit risk, liquidity risk, and leverage risk are also economically significant. Credit risk increases by 56%, liquidity risk increases by 26% and leverage risk increases by 6%. For comparison, the within-bank variation for the average foreign subsidiary in the full sample over the period from 2005 to 2011 is 37% for credit risk, 18% for liquidity risk, and 4% for leverage risk (see Table 4.2 Panel B).

Next, we examine the dynamics for foreign subsidiary risk using the four risk measures. Figure 1 depicts the cumulative effects of the ringfencing intervention on the Z-score (Panel A), credit risk (Panel B), liquidity risk (Panel D), as well as leverage risk

(Panel D). We augment the policy variable *RINGF* in Equation (1) with relative time dummies. Dots represent point estimates, while grey vertical lines are uniform 90% confidence intervals. The results of the dynamic analysis suggest that the ringfencing intervention had an immediate impact on the stability of foreign subsidiaries. We observe similar patterns across all three measures of risk. Notably, the effects persist well into the third year following the ringfencing intervention, suggesting that the intervention had longer-term effects on risk.

4.3 Confounding factors

Next, we investigate the possibility that the observed increase in risk is driven by factors other than the loss in implicit parent bank guarantees. Such factors may include the introduction of new regulatory capital requirements. We also test if the increase in risk of foreign subsidiaries is driven by a loss in actual financial support from respective parent banks (rather than a loss in implicit guarantees), or the low capitalization of some foreign subsidiaries of Nigerian parent banks.

New regulatory capital requirements

We consider the possible role of new regulatory capital requirements adopted by host countries in driving the observed increase in risk. Hakenes and Schnabel (2011) predict an increase in risk-taking for smaller banks following the introduction of Basel II. To rule out the possibility that the observed increase in risk is driven by the adoption of Basel II, we estimate our baseline model (Equation 1) using a sample excluding all foreign subsidiaries that were subject to binding higher regulatory capital requirements in 2012. Table 3 Panel A presents the results. The coefficient for the Z-score is negative and statistically significant, while the coefficients for credit, liquidity, and leverage risk are positive and statistically significant. This suggests that our baseline results capture the impact of geographic ringfencing (rather than the introduction of new regulatory capital requirements) on the risk of foreign subsidiaries.

Placebo

In Section 4.2, we conduct an analysis of the dynamics of the effect of geographic ringfencing on bank stability. Here, we complement our analysis of the dynamics in

foreign subsidiaries' risk with a regression-based test in which we assume falsely that the CBN ringfencing intervention occurred a year prior to the actual intervention in 2012. In doing so, we can test for any anticipation effects. We replace $post_t$ in Equation (1) with a variable that takes the value of one in the year 2011 and 2010 and zero in the year 2009 and 2008. We name the amended interaction term $RINGF_{placebo}$ and re-estimate Equation (1). Table 3 Panel B reports the results. The coefficients are not statistically significant. The results indicate that there were no anticipation effects.

Capitalization

Insufficient capital may invoke gambling for resurrection behavior in banks. To rule out the possibility that low capitalization is driving the increase in risk of foreign subsidiaries, we limit the sample to foreign subsidiaries with pre-treatment capital ratios that are above the lower quartile of the capital ratio in the respective host countries in 2010 and 2011. Table 3 Panel C reports the results. The coefficient for the Z-score is negative and statistically significant, while the coefficients for credit, liquidity, and leverage risk are positive and statistically significant. The results suggest that our baseline results reflect the impact of geographic ringfencing of the parent banks rather than any effects arising from low (pre-treatment) capitalization of foreign subsidiaries.

Internal capital market flows

We also consider the role of internal capital market flows between parent banks and foreign subsidiaries in confounding our results. To rule out the possibility that an actual loss of liquidity rather than a loss in implicit parent bank guarantees is driving our results, we need to control for internal capital market flows. In the absence of information regarding actual financial flows, we focus on differences in the connectedness of parents and foreign subsidiaries. The literature on cross-border banking suggests that more distant foreign subsidiaries are managed more independently, and are thus less integrated with the parent bank. DeHaas and Lelyveld (2014) and Anginer, Cerutti, and Peria (2017) provide evidence that geographically more distant foreign subsidiaries reduce lending less, and show lower default risk during times of parent bank distress. We estimate Equation (2) by interacting $RINGF$ with a measure of the geographical distance between parent banks and their foreign subsidiaries. Using Google Maps, we hand-collect

information regarding the geographical distance between parent banks' headquarters and the location of foreign subsidiaries. If a mechanical loss in actual liquidity is driving our results, we would expect that risk increases with the level of internal capital market integration. In other words, we would expect that the ringfencing intervention primarily affects foreign subsidiaries that are closer to the parent bank, and as such more likely to receive liquidity access to the parent bank. Table 3 Panel D reports the results. The coefficients for the interaction terms are not statistically significant, suggesting that the ringfencing intervention leads to an increase in risk, regardless of internal capital market integration between parents and foreign subsidiaries. This is in line with the notion that the observed increase in risk is due to a loss in implicit parent bank guarantees rather than a loss in actual parent bank liquidity.

4.4 Heterogenous effects

The results reported in the previous sections suggest a strong link between implicit parent bank guarantees and the stability of foreign subsidiaries. In this section, we examine whether foreign subsidiaries respond differently depending on the level of external control. To do this, we analyse whether host-country characteristics such as market discipline and supervisory oversight mitigate or exacerbate the impacts of the CBN ringfencing intervention on the risk of foreign subsidiaries.

Prior evidence suggests that government guarantees weaken the threat of liquidation and lead to higher risk-taking, given that bank creditors have fewer incentives to monitor banks when their investments are protected (Gropp, Gruendl and Guettler, 2014; Berger and Turk-Ariss, 2015; Brandao-Marques, Correa and Saprizza, 2020). We conjecture that the prevailing level of private and public oversight of banks (either in the form of market discipline or banking supervision) at the host-country level is likely to play a role in foreign subsidiaries' risk-taking following the CBN ringfencing intervention. To explore heterogeneities in the responses to the intervention, we focus on host-country characteristics that capture differences market discipline and bank supervision. Using the database by Barth, Caprio and Levine (2013), we focus on the set of variables classified as *official supervisory action*, which capture the degree of supervisory power, independence, discretion and stringency. See Section A3 (online appendix) for variable definitions. We create binary dummies that are equal to one if our proxies show low

supervisory oversight or market discipline, and zero otherwise. We consider supervisory oversight and market discipline to be low, if the index values are below the mean. All variables are measured as of 2011, and as such capture ex-ante differences in private and supervisory oversight. As outlined in Section 3.1, we interact these dummy variables with *RINGF*, the dichotomous treatment effect variable (as defined in Equation 2).

Table 4 Columns 1 to 10 report the results from estimating Equation (2) with the Z-score as the dependent variable. We begin with variables related to supervisory oversight. The coefficients on the interaction terms are negative and statistically significant in Columns 1 through 5. The results suggest that the response of foreign subsidiaries to the CBN ringfencing intervention depends on ex-ante supervisory oversight. Foreign subsidiaries exhibit higher risk in countries where banking supervisors: have less power to deal with failing banks; are less independent from government; and show more leniency toward the credit riskiness of banks. Furthermore, in countries where supervisors have higher discretion and may engage in forbearance when confronted with violations of laws and imprudent bank behavior, we observe higher risk in foreign subsidiaries in response to the CBN ringfencing intervention. Moving to variables related to market discipline, we observe the following. The coefficients for the interaction terms (Column 6-10) are negative and statistically significant (except Column 10). This suggests that the impact of the CBN ringfencing intervention is more pronounced in host countries with lower private oversight.

Overall, the results of our analysis suggest that the response of foreign subsidiaries to the CBN ringfencing intervention depends on the level of market discipline and banking supervision in host countries. This highlights considerable heterogeneity in the responses to the CBN ringfencing intervention. The geographic ringfencing of the parent banks adversely affects the stability of foreign subsidiaries, in particular in host countries with less private and supervisory oversight.

5. Conclusion

Cross-border banks routinely create separate subsidiaries to operate in foreign countries. This provides the parent bank with a degree of financial protection in instances of financial distress experienced by a foreign subsidiary. However, despite this option, banks often choose to support subsidiaries during periods of financial distress, and thus

in effect providing implicit financial guarantees with resultant implications for the risk of foreign subsidiaries. We investigate the impact of a regulatory intervention in Nigeria in 2012, which strengthened the limited liability of parent banks by removing the option to provide financial support to foreign subsidiaries. We use this regulatory intervention to investigate the role of implicit parent bank guarantees for the risk of foreign subsidiaries. The results of our analysis suggest that the intervention led to increased risk across foreign subsidiaries, particularly in countries with weaker banking supervisory oversight. This finding holds across various risk measures.

The implications flowing from our findings have resonance beyond Nigeria and Africa. For example, in Europe, since the global financial crisis, regulatory ringfencing interventions have slowed progress toward a fully integrated banking industry. Transitioning from a subsidiary to a branch-based organizational form has been suggested to promote integration. The results of this study indicate that strict subsidiarization impacts negatively on the stability of foreign subsidiaries. This suggests that organizational forms that allow for implicit parent bank guarantees provide benefits in the form of greater stability of foreign subsidiaries.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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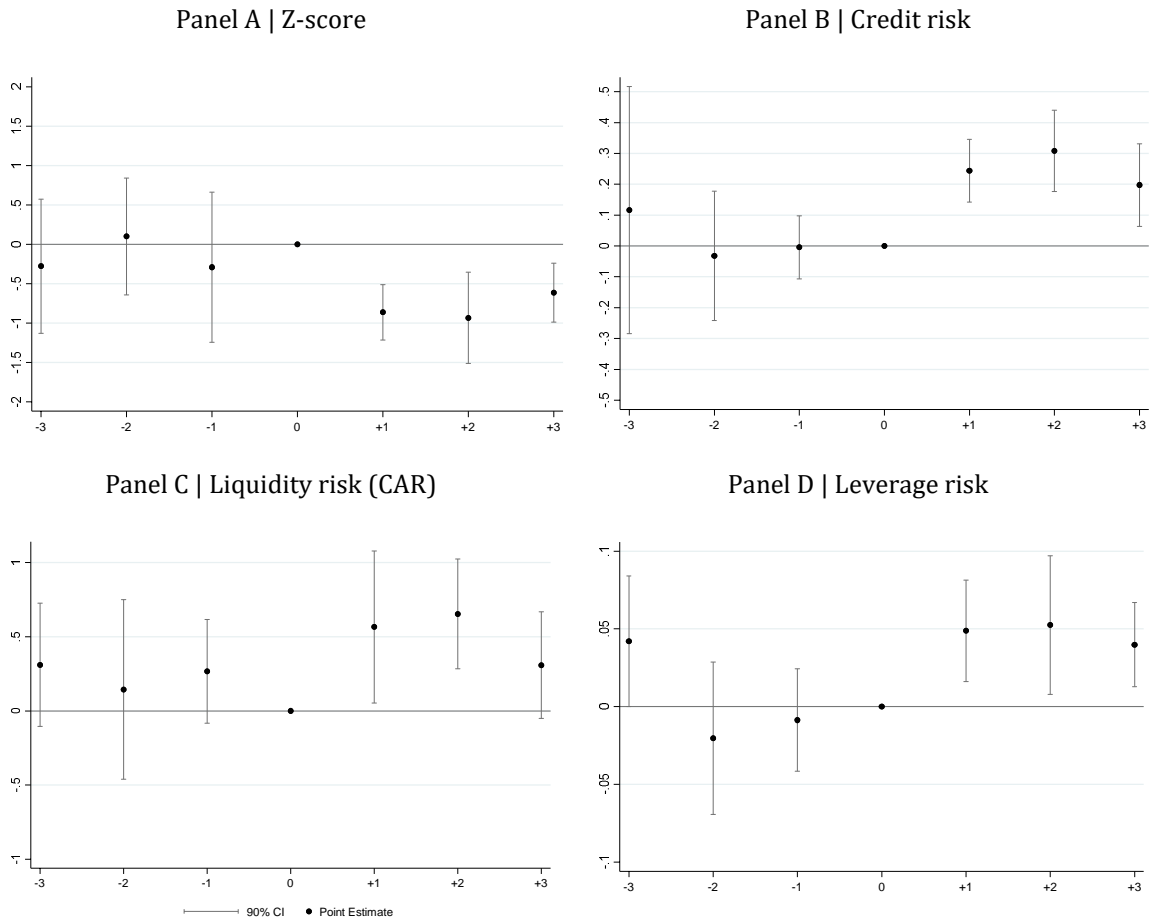
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Figures and Tables

Figure 1 | Dynamic effects



This figure depicts the cumulative effects of the ringfencing intervention on Z-score (Panel A), credit risk (Panel B), liquidity risk (Panel C), and leverage risk (Panel D). We augment the policy variable *RINGF* in Equation (1) with relative time dummies. Dots are point estimate, the grey horizontal lines are uniform 90% confidence intervals.

Table 1 | Baseline results

	(1) <i>Z-score</i>	(2) <i>Z-score</i>	(3) <i>Z-score</i>	(4) <i>Z-score</i> <i>(PAB)</i>	(5) <i>Z-score</i> <i>(Within-</i> <i>country)</i>	(6) <i>Z-score</i> <i>(PS-match)</i>
<i>RINGF</i> (<i>Treated</i> × <i>Post</i>)	-0.423*** (0.0996)	-0.554*** (0.197)	-0.831*** (0.275)	-0.643*** (0.214)	-0.559*** (0.152)	-0.754*** (0.188)
Size	0.182 (0.204)	0.623* (0.368)	0.677* (0.381)	0.783 (0.619)	1.565* (0.807)	2.564*** (0.858)
Liquidity	-0.281 (0.333)	0.147 (0.513)	0.976 (0.618)	0.757 (0.982)	-0.333 (0.676)	2.779* (1.566)
Earnings	0.190 (0.222)	-0.145 (0.729)	-0.310 (1.333)	-0.786 (2.586)	3.698 (4.071)	-0.753 (4.781)
Loan-deposit		-0.188 (0.239)	0.0550 (0.372)	-0.310 (0.608)	-1.245** (0.583)	-0.689 (0.991)
Non-deposit		-1.626* (0.812)	-1.903 (1.508)	-1.197 (2.025)	-2.028 (1.394)	-11.73** (3.954)
Merger		-0.0809 (0.179)	-0.064 (0.193)	-0.316 (0.185)	-0.119 (0.192)	-1.269** (0.451)
Liquidity (parent)		-0.465 (0.677)	0.078 (0.459)	-1.120 (0.681)	-0.920 (1.024)	-4.013 (2.598)
Capital (parent)		-6.690 (6.923)	-6.269 (6.801)	-16.73 (10.83)	-9.978 (15.66)	-25.18 (33.23)
Observations	475	460	460	282	187	86
R-squared	0.070	0.343	0.358	0.440	0.427	0.724
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	No	No	No	No
Year*Country FE	No	Yes	Yes	Yes	Yes	Yes
Covariates × <i>Post</i>	No	No	Yes	Yes	Yes	Yes
Parent Cov. × <i>Post</i>	No	No	Yes	No	No	No
Cluster	Parent	Parent	Parent	Parent	Parent	Parent

This table reports the results from estimating Equation (1). The explanatory variable of interest is *RINGF*, an indicator variable that is equal to one in year 2012 and 2013 for foreign subsidiaries of Nigerian parent banks and zero otherwise. The dependent variable in column 1 to 6 is Z-score (log). In Column 1, we use OLS and include subsidiary-level control variables comprising the lagged values of size, liquidity, and earnings, we also use subsidiary fixed effects and time effects. In Column 2, we also include parent-level control variables comprising capital ratio and liquidity and introduce host country*time fixed effects. In Column 3, we add interaction terms of *post* with foreign subsidiary covariates as well as parent covariates. In Column 4, 5, and 6, we use the PAB sample, within-country sample, as well as the PS-matched sample, respectively (see Section A4 for a detailed description of these samples). See Section A3 (online appendix) for variable definitions. Robust standard errors clustered at the parent level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level, respectively.

Table 2 | Credit, liquidity, and leverage risk

	Full sample			PAB sample			Within-country sample			PS-matched sample		
	(1) <i>Credit risk</i>	(2) <i>Liquidity risk</i>	(3) <i>Leverage risk</i>	(4) <i>Credit risk</i>	(5) <i>Liquidity risk</i>	(6) <i>Leverage risk</i>	(7) <i>Credit risk</i>	(8) <i>Liquidity risk</i>	(9) <i>Leverage risk</i>	(10) <i>Credit risk</i>	(11) <i>Liquidity risk</i>	(12) <i>Leverage risk</i>
<i>RINGF</i> (<i>Treated</i> × <i>Post</i>)	0.566** (0.228)	0.268*** (0.0511)	0.0586*** (0.0219)	0.599** (0.244)	0.254*** (0.0444)	0.0576** (0.0228)	0.487** (0.190)	0.295*** (0.0589)	0.0605*** (0.0203)	0.727** (0.283)	0.390*** (0.0778)	0.0569** (0.0253)
Observations	374	456	464	236	280	286	165	185	189	76	87	87
R-squared	0.182	0.519	0.530	0.352	0.621	0.651	0.245	0.450	0.458	0.346	0.609	0.607
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent

This table reports the results from estimating Equation (1). The explanatory variable of interest is *RINGF*, an indicator variable that is equal to one in year 2012 and 2013 for foreign subsidiaries of Nigerian parent banks and zero otherwise. The dependent variables in Column 1, 2, and 3, are credit risk, liquidity risk, and leverage risk respectively. Column 4, 5, and 6, show results for the PAB sample. Column 7, 8, and 9, show results for the within-country sample. Column 10, 11, and 12, show the results for the PS-matched sample. See Section A3 (online appendix) for variable definitions. Robust standard errors clustered at the parent level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level, respectively.

Table 3 | Confounding factors

	(1) <i>Z-score</i>	(2) <i>Credit risk</i>	(3) <i>Liquidity risk</i>	(4) <i>Leverage risk</i>
<i>Panel A: Capital requirements</i>				
<i>RINGF (Treated × Post)</i>	-0.5480** (0.2526)	0.8098* (0.4282)	0.1506*** (0.0306)	0.0794* (0.0408)
Observations	373	288	369	377
R-squared	0.331	0.230	0.581	0.178
<i>Panel B: Placebo</i>				
<i>RINGF_Placebo</i>	0.135 (0.592)	0.818 (0.622)	0.0369 (0.101)	0.0283 (0.0261)
Observations	409	312	405	417
R-squared	0.319	0.661	0.325	0.532
<i>Panel C: Capital constraints</i>				
<i>RINGF (Treated × Post)</i>	-0.5864*** (0.1910)	0.5592** (0.2146)	0.2319*** (0.0483)	0.0559** (0.0225)
Observations	410	337	407	414
R-squared	0.3901	0.2050	0.5655	0.5613
<i>Panel D: Internal capital market flows</i>				
<i>RINGF (Treated × Post)</i>	-0.769** (0.298)	0.503* (0.272)	0.252*** (0.0269)	0.0591** (0.0221)
<i>RINGF × Distance</i>	-0.0169 (0.171)	-0.198 (0.284)	-0.189 (0.126)	-0.00916 (0.0147)
Observations	224	180	219	226
R-squared	0.385	0.273	0.546	0.446
Bank FE	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes
Parent Covariates	Yes	Yes	Yes	Yes
Cluster	Parent	Parent	Parent	Parent

This table reports the results from our robustness tests in Section 6. *RINGF* is an indicator variable that is equal to one in year 2012 and 2013 for foreign subsidiaries of Nigerian parent banks and zero otherwise. Panel A presents estimates for a sample of foreign subsidiaries located in countries that did not introduce new capital requirements at the same time as the CBN ringfencing. Panel B presents estimates based on a placebo that falsifies ringfencing treatment to occur in 2011. Panel C presents estimates based on a sample of well-capitalized foreign subsidiaries. Panel D presents estimates from estimating Equation (2) interacting *RINGF* with geographical distance. For a full list of variable definitions see Section A3 (online appendix). Robust standard errors clustered at the parent level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4 | The role of market and supervisory oversight

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score
<i>RINGF</i> (<i>Treated</i> × <i>Post</i>)	-0.1854** (0.0882)	-0.4262*** (0.1293)	-0.2884* (0.1623)	-0.3398*** (0.1238)	-0.5231*** (0.1890)	-0.1957* (0.1064)	-0.1951* (0.1083)	-0.1640** (0.0782)	-0.3361** (0.1380)	-0.4003** (0.1796)
<i>RINGF</i> × <i>PrmtCorrPwr</i>	-0.6922*** (0.2536)									
<i>RINGF</i> × <i>Restrucpwr</i>		-0.8486* (0.4525)								
<i>RINGF</i> × <i>SupIndPolitical</i>			-0.6932* (0.3586)							
<i>RINGF</i> × <i>LoanClassStrin</i>				-1.2780** (0.5135)						
<i>RINGF</i> × <i>ProvStrin</i>					-0.9538*** (0.1980)					
<i>RINGF</i> × <i>SupForbear</i>						-0.6036** (0.2433)				
<i>RINGF</i> × <i>MoralHazard</i>							-0.2754* (0.1379)			
<i>RINGF</i> × <i>PrivateMonitoring</i>								-0.3612*** (0.0923)		
<i>RINGF</i> × <i>AccountingPractices</i>									-0.7538* (0.3907)	
<i>RINGF</i> × <i>ExtRatiCredMonit</i>										-0.4876 (0.5490)
Observations	475	475	475	475	475	475	475	475	475	475
R-squared	0.3173	0.3173	0.3174	0.3231	0.3152	0.316	0.3159	0.3139	0.315	0.3139
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year*Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parent Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent	Parent

This table reports the results from estimating Equation (2) using the full sample. The explanatory variable of interest *RINGF* interacted with host-country characteristics capturing differences in supervisory oversight and market discipline. Interaction terms in Column 1 through 10 are dummy variables that are equal to one if country-specific value is below the mean measured across all countries and zero otherwise. For a full list of variable definitions see Section A3 (online appendix). *RINGF* is an indicator variable that is equal to one in year 2012 and 2013 for foreign subsidiaries of Nigerian parent banks and zero otherwise. Robust standard errors clustered at the parent level are reported in parentheses. ***, **, *, indicate significance at the 1%, 5%, and 10% level, respectively.

Supplementary Appendix

to

**“Implicit Guarantees and Cross-Border Bank Stability:
Evidence from Geographic Ringfencing”**

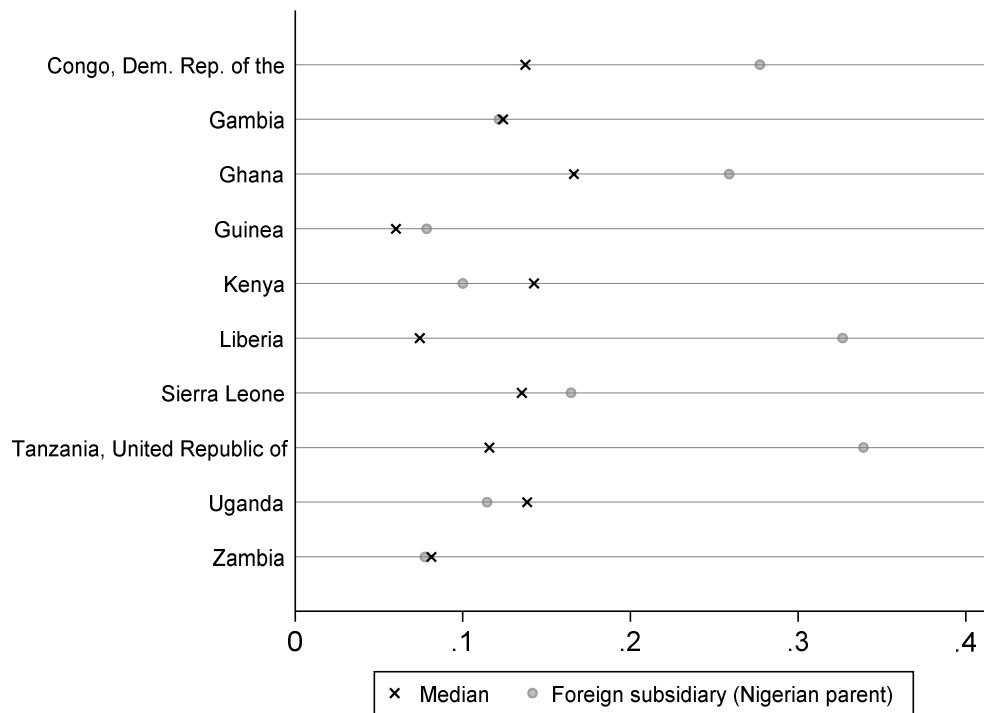
Section A1	Capital requirements in African host countries
Section A2	Capitalization of foreign subsidiaries from 2010 to 2011 (pre-treatment)
Section A3	Variable definitions
Section A4	Sample description
Section A5	Propensity score matching
References	

A1 | Capital requirements in African host countries

		2008	2009	2010	2011	2012	2013	2014	Notes
Cameroon	m USD	4	4	4	4	4	4	20	Capital increase announced in 2010. Effective in 2014.
Dem. Rep. of Congo	m USD	5	5	10	10	10	10	12	Capital increase in 2010 and 2014.
Ghana	m USD	5	5	13.1	13.1	32	32	64	Capital increase announced in 2008.
Guinea	bn GNF	50	50	50	50	50	100	100	Capital increase in 2013. Announced in 2008.
Gambia	m GMD	60	60	150	150	200	200	200	Capital increase in 2012. Announced in 2010.
Kenya	m USD	4	4	4	4	12	12	12	Capital increase announced in 2008. Effective in 2012.
Liberia	m USD	6	8	8	10	10	10	10	Capital increase announced in 2008. Effective in 2011.
Senegal	m FCFA	5	5	10	10	10	10	10	Capital increase announced in 2007. Effective in 2010, revised to 2017 in 2010.
Sierra Leone	bn SLL	12	15	30	30	30	30	30	Capital increase in 2010.
Tanzania	bn TZS	5	5	5	5	15	15	15	Capital increase announced in 2008. Effective in 2012.
Uganda	bn UGX	4	4	4	10	10	25	25	Capital increase announced in 2010. Effective in 2013.
Zambia	m ZMW	12	12	12	12	12	104	104	Capital increase in 2012. Foreign banks 520m, domestic banks 100m ZMW.

This table shows a timeline of new capital requirements under Basel II for African countries in the PAB-sample. See Section A4 for a description of the PAB sample.

A2 | Capitalization of foreign subsidiaries from 2010 to 2011 (pre-treatment)



This figure shows the average pre-treatment capital of foreign subsidiaries of Nigerian parent banks in comparison to the median capital of all foreign subsidiaries (PAB sample) per host countries.

A3 | Variable definitions

Variable name	stata file	Definition	Source
Dependent variables			
Z-score	<i>lnz_score5</i>	Sum of capital ratio and return on assets, divided by volatility of ROA. Volatility of ROA based on a rolling window of five years	Fitch Connect
Credit risk	<i>cr</i>	Net-loan-charge-offs divided by the loan loss allowances in previous period	Fitch Connect
Liquidity risk	<i>lr</i>	Sum of liquid liabilities minus the sum of liquid assets, normalized by total assets	Fitch Connect
Leverage	<i>leverage</i>	Total assets minus equity, to total assets	Fitch Connect
Control variables			
<i>Subsidiary</i>			
Size	<i>banksize</i>	Natural logarithm of total assets	Fitch Connect
Liquidity	<i>liquidity</i>	Cash to total assets	Fitch Connect
Earnings	<i>earnings</i>	The ratio of non-interest operating income to total operating income	Fitch Connect
Loan-deposit ratio	<i>loandepo</i>	The ratio of loans to deposits	Fitch Connect
Non-deposit ratio	<i>nondepo</i>	The ratio of non-deposit debt to total assets	Fitch Connect
<i>Parent</i>			
Capital	<i>pcapital</i>	Equity to total assets	Fitch Connect
Liquidity	<i>pliquidity</i>	Cash to total assets	Fitch Connect
Distance	<i>distance_km</i>	Geographical distance from a bank subsidiary to headquarters in km	Manually computed using data from Google Maps
<i>Host country characteristics</i>			
Prompt corrective action power	<i>PrmptCorrPwr</i>	Dummy variable equal to one if power low, zero otherwise	Barth, Caprio, and Levine (2013)
Restructuring power	<i>Restrucpwr</i>	Dummy variable equal to one if power low, zero otherwise	Barth, Caprio, and Levine (2013)
Political independence of supervisor	<i>SupIndPolitical</i>	Dummy variable equal to one if independence low, zero otherwise	Barth, Caprio, and Levine (2013)
Loan classification stringency	<i>LoanClassStrin</i>	Dummy variable equal to one if stringency low, zero otherwise	Barth, Caprio, and Levine (2013)
Provisioning stringency	<i>ProvStrin</i>	Dummy variable equal to one if stringency low, zero otherwise	Barth, Caprio, and Levine (2013)
Supervisory forbearance discretion	<i>SupForbear</i>	Dummy variable equal to one if discretion high, zero otherwise.	Barth, Caprio, and Levine (2013)
Moral Hazard	<i>MoralHazard</i>	Dummy variable equal to one if moral hazard high, zero otherwise.	Barth, Caprio, and Levine (2013)
Private monitoring index	<i>PrivateMonitoring</i>	Dummy variable equal to one if monitoring low, zero otherwise.	Barth, Caprio, and Levine (2013)
Accounting practices	<i>AccountingPractices</i>	Dummy variable equal to one if practices not good standard, zero o.	Barth, Caprio, and Levine (2013)
External ratings and creditor monitoring	<i>ExtRatiCredMonit</i>	Dummy variable equal to one if monitoring low, zero otherwise.	Barth, Caprio, and Levine (2013)

This table provides variable definitions and sources.

A4 | Sample description

Our baseline sample (*full sample*) comprises 171 bank subsidiaries across 42 African host countries. The treated group consists of 14 subsidiaries. Parents of treated subsidiaries are Access Bank, Guaranty Trust Bank, United Bank for Africa, and Zenith Bank.²⁰ The remaining 157 subsidiaries in the control group comprise foreign subsidiaries that are owned by African parent banks (e.g. South African parent banks) as well as a few non-African parent banks (e.g. French parent banks). As shown in Table A4.1, our baseline sample has the largest geographic coverage including foreign subsidiaries in more than 40 African countries. From the summary statistics provide in Table A4.2 Panel A, we further observe that control units in the baseline sample are considerably larger than treated foreign subsidiaries. While these banks are similar in regard to liquidity, they have: lower earnings from non-interest income; higher loan to deposit ratios; and higher non-deposit ratios. In contrast to treated foreign subsidiaries. They also engage in some merger activity.

Prior evidence suggests that there are substantial behavioral differences across indigenous African cross-border (Pan-African) banks and non-African counterparts (see Section 2.1 for a discussion). Therefore, our first sub-sample excludes foreign subsidiaries of non-African parents, and limits the control group to foreign subsidiaries that are majority-owned by Pan-African cross-border banks (PAB). This results in the exclusion of 66 foreign bank subsidiaries. The *PAB* sample comprises 105 subsidiaries across 38 African host countries. From the descriptive statistics reported in Table A4.2 Panel A, we observe that limiting the sample to foreign subsidiaries of Pan-African parent banks reduces the average size-differential between control and treated units. Table A4.3 provides a list of Pan-African parents and foreign bank subsidiaries relations for the *PAB* sample.

In order to address concerns that country-specific factors may make some foreign subsidiaries less suitable as controls, we limit our group of foreign subsidiaries to those that operate in the same African country as treated foreign subsidiaries. This *within-country* sample comprises 77 foreign subsidiaries across 12 African host countries. Table

²⁰ These four banks are the largest in Nigeria by market capitalization. United Bank of Africa was at the forefront of the expansion on the African continent and maintains the largest network of foreign subsidiaries among the four.

A4.2 Panel A shows that control foreign subsidiaries in this sample are more similar to treated foreign subsidiaries in terms of their use of deposits. We find that average differences in the loan-to-deposit ratio and non-deposit ratio across the two groups is reduced.

Finally, we alleviate concerns that our results may be driven by ex-ante differences in the characteristics of treated and control group foreign subsidiaries by using a propensity score matched sample. Specifically, we estimate a probit model that predicts the probability (propensity score) that a foreign subsidiary is subject to the CBN ringfencing intervention, using bank-specific variables (bank size, liquidity, loan-to-total asset ratio, earnings, capital-to-total asset ratio, earnings, merger). The predicted propensity score accounts for differences between treated and control group subsidiaries. Our (propensity score) *PS-matched* sample comprises 34 subsidiaries across 11 African host countries. From the descriptive statistics reported in Table A4.2 Panel A, we observe that using the propensity score matching approach makes treated and control foreign subsidiaries more homogenous in terms of pre-treatment characteristics, albeit at the cost of a smaller sample size. In Section A5 we extend our matching approach by matching on parent bank characteristics as well as additional sets of foreign subsidiary characteristics.

A4.1 | Geographic composition of samples

Country	Treated	Control (Full)	Control (PAB)	Control (within-country)	Control (PS-matched)
Algeria	0	5	0	0	0
Angola	0	2	1	0	0
Benin	0	3	3	0	0
Botswana	0	4	3	0	0
Burkina Faso	0	2	1	0	0
Cameroon	0	5	3	5	0
Cabo Verde	0	3	0	0	0
Chad	0	2	2	0	0
Congo, Dem. Rep. of the	1	2	2	2	2
Congo, Rep. of	0	1	1	0	0
Cote d'Ivoire	0	6	3	0	0
Egypt	0	11	1	0	0
Equatorial Guinea	0	1	1	0	0
Eswatini	0	2	2	0	0
Gabon	0	4	3	0	0
Gambia	1	1	1	1	1
Ghana	3	6	4	6	5
Guinea	1	2	2	2	1
Guinea-Bissau	0	1	1	0	0
Kenya	2	9	5	9	2
Lesotho	0	2	2	0	0
Liberia	1	1	1	1	1
Malawi	0	1	1	0	0
Mali	0	1	1	0	0
Mauritania	0	1	1	0	0
Mauritius	0	7	3	0	0
Morocco	0	3	0	0	0
Mozambique	0	9	6	0	0
Namibia	0	3	3	0	0
Niger	0	1	1	0	0
Nigeria	0	5	3	0	0
Rwanda	0	1	1	0	0
Senegal	0	5	4	5	1
Seychelles	0	1	1	0	0
Sierra Leone	2	2	2	2	1
South Africa	0	3	0	0	0
Sudan	0	1	1	0	0
Tanzania, United Republic of	1	12	7	11	1
Togo	0	1	1	0	0
Tunisia	0	4	1	0	0
Uganda	1	12	9	12	2
Zambia	1	8	4	8	6
Zimbabwe	0	4	3	0	0
TOTAL	14	157	91	73	22

Control (Full sample)

Control (PAB sample)

Control (within-country sample)

Control (PS-matched sample)

This figure shows the sample composition (number of treated and control subsidiaries) for the: *full sample*, *PAB sample*, *within-country sample*, and the *PS-matched sample*. See Section A4 for a description of the samples. The maps on the right-hand side show location (host-country level) of control subsidiaries for the four different samples. Dark green indicates location of foreign subsidiaries (control group).

A4.2 | Descriptive statistics

Panel A	<i>Treated subsidiaries</i>				<i>Control subsidiaries</i>							
	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Full</i>		<i>PAB</i>		<i>Within-country</i>		<i>PS-matched</i>	
					<i>Mean</i>	<i>p-value</i>	<i>Mean</i>	<i>p-value</i>	<i>Mean</i>	<i>p-value</i>	<i>Mean</i>	<i>p-value</i>
Z-score (log)	2.807	0.902	0.932	3.532	2.92	0.721	2.64	0.619	2.6	0.569	1.79	0.125
Credit risk	0.145	0.306	-0.251	1	0.3	0.322	0.47	0.077	0.33	0.38	0.43	0.353
Liquidity risk	0.122	0.331	-0.29	0.826	0.26	0.232	0.24	0.31	0.3	0.149	0.28	0.258
Leverage risk	0.192	0.093	0.091	0.352	0.11	0.025*	0.1	0.014*	0.12	0.033*	0.12	0.209
Total assets (log)	18.427	0.949	17.207	19.928	20.18	0.000***	19.78	0.001**	19.7	0.002**	19.35	0.054
Total assets (USD, mil)	151	142	30	451	1,266	0.000***	800	0.000***	591	0.000***	431	0.024*
Liquidity	0.332	0.168	0.109	0.673	0.31	0.705	0.3	0.63	0.3	0.597	0.35	0.948
Earnings	0.116	0.167	0.001	0.458	0.06	0.327	0.05	0.267	0.04	0.177	0.09	0.662
Loan-deposit ratio	0.497	0.117	0.308	0.727	0.73	0.000***	0.74	0.000***	0.67	0.001**	0.6	0.215
Non-deposit ratio	0.008	0.018	0.000	0.056	0.02	0.1	0.03	0.092	0.01	0.524	0.01	0.64
Merger	0	0	0	0	0.02	0.158	0.03	0.159	0.04	0.159	0	.
N	14				157		91		73		23	
<hr/>												
Panel B	<i>SD</i>	<i>Overall</i>	<i>Between</i>	<i>Within</i>								
Z-score(log)		1.190	1.313	0.633								
Credit risk		0.690	1.032	0.370								
Liquidity risk		0.364	0.333	0.184								
Leverage risk		0.096	0.109	0.049								

This table provides summary statistics for the samples used in this study based on values in the pre-treatment period (2010 and 2011). Panel A shows the statistics (mean, standard deviation, minimum, and maximum) for the treated subsidiaries, as well as the mean and p-values of difference in mean tests for each of the four control groups. Panel B provides the overall, between, and within variation of the outcome variables for the full sample (2005 to 2011). For a description of the different samples and control groups see Section A4.

A4.3 | List of parent banks and foreign subsidiaries

Country	Parent bank	Foreign Subsidiary	Host country
Gabon	BGFI Holding Corporation S.A.	BGFI Bank Benin	Benin
Kenya	Diamond Trust Bank Kenya	Diamond Trust Bank Uganda Limited	Uganda
	Equity Group Holdings PLC	Equity Bank Uganda Ltd	Uganda
	Imperial Bank Limited	Exim Bank (Uganda) Limited	Uganda
	KCB Group PLC	KCB Bank Uganda Limited	Uganda
	NCBA Bank Kenya Plc	Commercial Bank of Africa (Tanzania) Limited	Tanzania
	NIC Group PLC	NC Bank Uganda Limited	Uganda
Libya	Banque Sahelo-Saharienne pour l'Investissement et le Commerce	Banque Sahelo-Saharienne pour l'Investissement et le Commerce (BSIC) Senegal	Senegal
Mauritius	SBM Holdings Ltd.	SBM Bank (Kenya) Limited	Kenya
Morocco	Attijariwafa Bank	Attijariwafa Bank Egypt - (S.A.E.)	Egypt
		CBAO Groupe Attijariwafa Bank	Senegal
		Credit du Senegal	Senegal
		Banque Attijari de Tunisie	Tunisia
		Union Gabonaise de Banque	Gabon
		Societe Ivoirienne de Banque S.A. (SIB)	Cote d'Ivoire
		Banque Internationale pour l'Afrique au Togo	Togo
	Banque Centrale Populaire	BCP Bank (Mauritius) Ltd	Mauritius
	Groupe Banque Centrale Populaire	Banque Atlantique de Cote d'Ivoire,S.A.	Cote d'Ivoire
		Banque Internationale du Cameroun pour l'Epargne et le Credit	Cameroon
Namibia	Capricorn Investment Holdings Limited	Bank Gaborone Limited	Botswana
Nigeria (Treated)	Access Bank Plc	Access Bank (SL) Limited	Sierra Leone
		Access Bank RDC S.A.	Congo, DR
		Access Bank (Ghana) PLC	Ghana
		Access Bank (Zambia) Limited	Zambia
	Guaranty Trust Bank Limited	Guaranty Trust Bank (Kenya) Limited	Kenya
		Guaranty Trust Bank (Gambia) Limited	Gambia
		Guaranty Trust Bank (SL) Limited	Sierra Leone
		Guaranty Trust Bank (Ghana) Limited	Ghana
		Guaranty Trust Bank Liberia Limited	Liberia
	United Bank For Africa Plc	United Bank for Africa Uganda Limited	Uganda
		United Bank for Africa (Tanzania) Ltd	Tanzania
		United Bank for Africa Guinea	Guinea
		UBA Kenya Bank Limited	Kenya
	Zenith Bank Plc	Zenith Bank (Ghana) Limited	Ghana

Country	Parent bank	Foreign Subsidiary	Host country
South Africa	Absa Group Limited	Absa Bank Mocambique SA	Mozambique
		Absa Bank Botswana Limited	Botswana
		Absa Bank Ghana Limited	Ghana
		Absa Bank Zambia PLC	Zambia
		Absa Bank Kenya PLC	Kenya
		Absa Bank Uganda Limited	Uganda
		National Bank of Commerce Limited	Tanzania
		Absa Bank Tanzania Limited	Tanzania
		Absa Bank (Seychelles) Limited	Seychelles
	Absa Bank (Mauritius) Limited	Mauritius	
	FirstRand Limited	FNB Mozambique SA	Mozambique
		First National Bank of Namibia Limited	Namibia
	Nedbank Group Limited	Nedbank Zimbabwe Limited	Zimbabwe
		Nedbank Namibia Limited	Namibia
		Nedbank (Lesotho) Limited	Lesotho
		Nedbank (Swaziland) Limited	Eswatini
		Banco Unico S.A.	Mozambique
	Standard Bank Group Limited	Stanbic Holdings Plc	Kenya
		Standard Bank S.A.	Mozambique
		Stanbic IBTC Bank PLC	Nigeria
		Stanbic Bank Zimbabwe Limited	Zimbabwe
		Standard Bank PLC	Malawi
		Standard Bank Namibia Limited	Namibia
		Stanbic Bank Botswana Limited	Botswana
		Stanbic Bank Zambia Limited	Zambia
		Stanbic Bank Ghana Limited	Ghana
		Stanbic Bank Kenya Limited	Kenya
		Standard Lesotho Bank Limited	Lesotho
		Standard Bank (Mauritius) Limited	Mauritius
		Stanbic Bank Tanzania Limited	Tanzania
		Standard Bank Swaziland Ltd.	Eswatini
		Standard Bank RDC S.A.	Congo, Dem. Rep. of the
Standard Bank de Angola, S.A.		Angola	
Stanbic IBTC Holdings PLC	Nigeria		
Stanbic Uganda Holdings Limited	Uganda		
Togo	Ecobank Transnational Inc.	Ecobank Nigeria Limited	Nigeria
		Ecobank Cote d'Ivoire	Cote d'Ivoire
		Ecobank Ghana Limited	Ghana
		Ecobank Benin	Benin
		Ecobank Cameroun S.A.	Cameroon
		Ecobank-Burkina	Burkina Faso
		Ecobank Guinee S.A.	Guinea
		Ecobank Liberia Limited	Liberia
		Ecobank Mali	Mali

Country	Parent bank	Foreign Subsidiary	Host country
Togo (continued)	Ecobank Transnational Inc.	Ecobank Niger	Niger
		Ecobank Senegal	Senegal
		Ecobank Kenya Limited	Kenya
		Ecobank Rwanda Plc	Rwanda
		Ecobank Mozambique, S.A.	Mozambique
		Ecobank Sierra Leone Limited	Sierra Leone
		Ecobank Tchad SA	Chad
		Ecobank Congo	Congo, Rep. of
		Ecobank Uganda Limited	Uganda
		Ecobank RDC S.A.U.	Congo, Dem. Rep. of the
		Ecobank Guinea Bissau	Guinea-Bissau
		Ecobank Zambia Limited	Zambia
		Ecobank Tanzania Limited	Tanzania
		Ecobank Gambia Limited	Gambia
		Ecobank Gabon	Gabon
	Ecobank Zimbabwe Limited	Zimbabwe	
	Ecobank Guinee Equatoriale	Equatorial Guinea	
	Oragroup S.A.	Orabank Benin	Benin
		Orabank Tchad	Chad
		Orabank Mauritanie	Mauritania
Orabank Gabon		Gabon	
Orabank Guinee SA		Guinea	
Trinidad / Tobago	Republic Financial Holdings Ltd.	Republic Bank (Ghana) Limited	Ghana
		BGFIBank Cameroun S.A	Cameroon
		Diamond Trust Bank Tanzania Limited	Tanzania
		KCB Bank Tanzania Limited	Tanzania
		Equity Bank (Southern Sudan) Limited	Sudan

A5 | Propensity score matching

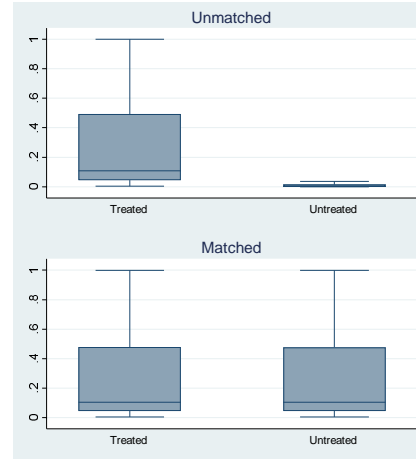
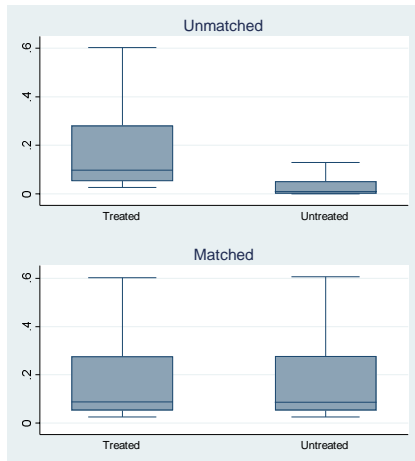
Banks differ in their activities and operational approaches when conducting operations abroad. For instance, a bank may extend loans to foreign firms or source deposits from foreign depositors. Additionally, banks can choose to intermediate funds locally within the host country or reallocate capital across borders. To control for differences in bank activities and operational approaches, we employ a final robustness test in which we re-estimate our baseline model using various matched samples. In addition to matching on foreign subsidiary characteristics, we also match on a broader set of parent bank characteristics to alleviate concerns that differences in parent bank business models, size, profitability, and risk profile drive our results. To obtain matches, we employ propensity score matching using two nearest neighbours. In order to match foreign subsidiaries, we use the sample of Pan-African banks and focus on variables such as parent bank size, capital, liquidity, earnings, loan loss provisions, risk-weighted assets, and net interest income. We also employ foreign subsidiary capital, earnings, liquidity, size as well as loan-deposit ratios, and non-deposit debt. Matching is performed on pre-treatment values. In total, we construct four alternative matched samples and re-estimate Equation (1) using each of these matched samples. Table A5.1 reports the results of the t-test and the alignment of propensity scores.

Table A5.2 reports the results of our robustness tests. Variables used for matching are listed on the left-hand side of the table. Columns 1 through 4 for Panel A to D show the results for the Z-score, credit risk, liquidity risk, and leverage risk, respectively. In terms of magnitude, sign, and statistical significance, the coefficients remain comparable to our baseline results reported in Tables 1 and 2. Overall, the results suggest that differences in the activities and operational approaches of parent banks and subsidiaries are not driving our results.

Table A5.1 | Propensity score matching: T-tests

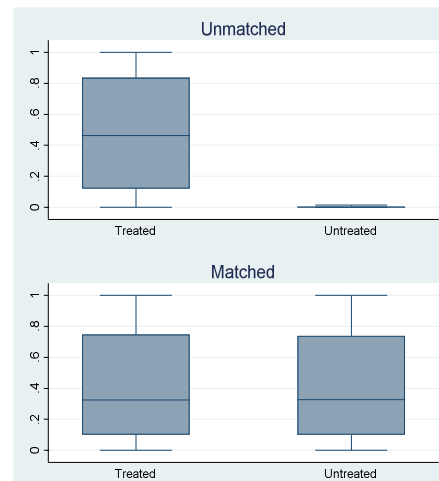
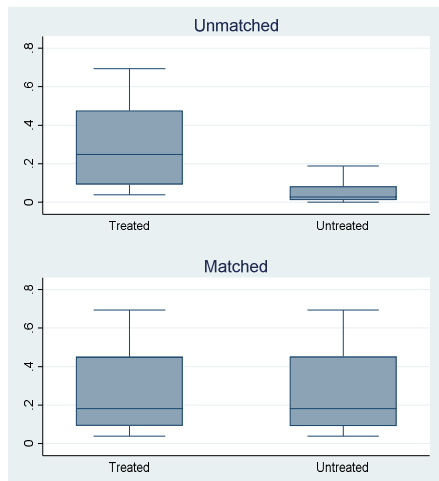
Panel A			
<i>Variable</i>	<i>Treated</i>	<i>Control</i>	<i>p-value</i>
Total assets (log)	18.29	19.70	0.000***
Liquidity	0.36	0.32	0.375
Earnings	0.09	0.05	0.086
Loan-deposit ratio	0.46	0.78	0.000***
Non-deposit ratio	0.00	0.02	0.262
Merger	0.00	0.01	0.592

Panel B			
<i>Variable</i>	<i>Treated</i>	<i>Control</i>	<i>p-value</i>
Total assets (log)	18.29	19.35	0.001***
Liquidity	0.36	0.33	0.535
Earnings	0.09	0.09	0.977
Loan-deposit ratio	0.46	0.74	0.000***
Non-deposit ratio	0.00	0.02	0.358
Merger	0.00	0.03	0.413



Panel C			
<i>Variable</i>	<i>Treated</i>	<i>Control</i>	<i>p-value</i>
Total assets (log)	18.29	19.56	0.592
Liquidity	0.36	0.33	0.537
Earnings	0.09	0.04	0.030*
Loan-deposit ratio	0.46	0.68	0.000***
Non-deposit ratio	0.00	0.00	0.76
Merger	0.00	0.04	0.356

Panel D			
<i>Variable</i>	<i>Treated</i>	<i>Control</i>	<i>p-value</i>
Total assets (log)	18.29	19.59	0.000***
Liquidity	0.36	0.39	0.44
Earnings	0.09	0.07	0.579
Loan-deposit ratio	0.46	0.56	0.052
Non-deposit ratio	0.00	0.01	0.294
Merger	0.00	0.02	0.513



This table reports t-test results from difference-in-means tests and the aligned propensity scores for the four samples of matched treated and control foreign subsidiaries.

Table A5.2 | Propensity score matching: Results

<i>Panel</i>	<i>Parent</i>	<i>Foreign subsidiary</i>	(1)	(2)	(3)	(4)	
			<i>Z-score</i>	<i>Credit risk</i>	<i>Liquidity risk</i>	<i>Leverage risk</i>	
A	Capital; Earnings; Liquidity; Size	-	<i>RINGF</i>	-0.484*** (0.0817)	0.482** (0.211)	0.180*** (0.0342)	0.057** (0.023)
	N: 30 NN: 2; Cal:0.01	N: 62	Observations	148	126	150	150
			R-squared	0.242	0.228	0.203	0.211
B	Capital; Earnings; Liquidity; Size	Capital; ROA; Liquidity; Size	<i>RINGF</i>	-0.520*** (0.0897)	0.517*** (0.184)	0.208*** (0.0327)	0.054** (0.024)
	N: 36 NN: 2; Cal:0.01	N: 87	Observations	202	175	199	204
			R-squared	0.250	0.190	0.118	0.320
C	Loan loss provisions; RWA; NII	-	<i>RINGF</i>	-0.668*** (0.162)	0.325** (0.139)	0.165*** (0.0392)	0.076*** (0.023)
	N: 19 NN: 2; Cal:0.01	N:49	Observations	113	97	111	115
			R-squared	0.329	0.176	0.230	0.327
D	Loan loss provisions; RWA; NII; Capital; Earnings; Liquidity; Size	Loan-deposit ratio; Non-deposit debt	<i>RINGF</i>	-0.488*** (0.138)	0.557*** (0.191)	0.227*** (0.035)	0.055** (0.024)
	N: 20 NN: 2; Cal:0.01	N: 71	Observations	193	166	193	194
			R-squared	0.254	0.204	0.170	0.216
			Bank FE	Yes	Yes	Yes	Yes
			Year	Yes	Yes	Yes	Yes
			Covariates	Yes	Yes	Yes	Yes
			Cluster	Parent	Parent	Parent	Parent

This table reports the results from propensity score matching with various matching parameters. Matching variables for parent banks comprise pre-treatment capital, earnings, liquidity, size, loan loss provisions as share of loans, risk-weighted assets (RWA), net interest income (NII). Matching variables for foreign subsidiaries comprise pre-treatment capital, earnings, liquidity, size. We report N (number of banks in matched sample), NN (number of nearest neighbour), and Cal (Caliper). Corresponding t-tests for matched samples of Panel A, B, C, and D are reported in Table A5.1. Column 1 to 4 report the estimated coefficients for the four main outcome variables: Z-score, credit risk, liquidity risk, and leverage risk. For a definition of variables see online appendix, Section A3.



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