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How CCyBs Travel – Internal Capital Markets & Domestic Borrowing

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Abstract

We examine how foreign macroprudential tightening transmits through multinational firms' internal capital markets. Using subsidiary exposure to countercyclical capital buffer (CCyB) increases, we find that while bank credit to subsidiaries falls 10 percent, parents fully substitute this via internal debt. Parents refinance this internal support by increasing borrowing from domestic banks and nonbanks, meeting the substitution needs of their subsidiaries. As a result, foreign CCyB tightening increases the exposure and risk borne by the parent's home jurisdiction. These findings reveal an unintended spillover: tightening in one country raises credit exposure and thereby borrower risk borne by lenders elsewhere through proactive internal financial redistributions within multinational corporations.

Keywords: multinational corporation, internal capital market, countercyclical capital buffer, banks, nonbanks.

JEL-Codes: F23, F34, F36, G21.

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1 Introduction

Macroprudential capital buffers, such as the countercyclical capital buffer (CCyB), are designed to strengthen the resilience of domestic banking systems. In integrated economies, however, these tools interact with multinational corporate structures in ways that are not well understood. Banks must apply higher capital requirements to exposures in jurisdictions that activate the CCyB, and mandatory reciprocity extends this requirement across borders. Yet multinational corporations (MNCs) operate internal capital markets that are outside the direct reach of prudential regulation. Whether these internal markets amplify or neutralize the intended effect of macroprudential tightening is an open question.

We address this question by studying how German multinational firms respond when one of their foreign subsidiaries borrows from banks that become subject to a CCyB increase. The setting offers a clean laboratory: German banks face no domestic CCyB over our sample period, whereas subsidiaries abroad experience the implications of jurisdiction-specific tightening. The shock is imposed on the bank credit supply to the subsidiary, not to the parent, and reciprocity ensures that the CCyB requirement is applied by all bank lenders to subsidiaries. This isolates a sharp and plausibly exogenous disturbance to external financing conditions at the subsidiary level.

We examine the activation and subsequent increases of CCyBs as a recurring, quasi-exogenous shock to bank lending. Norway was the first country to apply a positive CCyB in 2015, and several countries followed over the subsequent years. By the end of our observation period in 2019, roughly one-third of the 29 countries in our sample had a positive CCyB in place.[1] Crucial for our empirical design is the principle of mandatory reciprocity: once a country activates a CCyB, all banks, domestic and foreign alike, must apply the same buffer on their exposures to borrowers located in that jurisdiction. This rule is intended to prevent regulatory arbitrage and to limit international risk spillovers

[1] An immediate concern in our setting is the staggered adoption of CCyBs, which introduces heterogeneity in treatment timing and raises issues emphasized by e.g. Callaway and Sant'Anna (2021), Sun and Abraham (2021), Athey and Imbens (2022) and Goodman-Bacon (2021). We address these concerns in several robustness exercises. First, we include only the period until 2015:Q2, when just Norway had activated the CCyB. Second, we extend the window to 2016:Q4, when only Sweden additionally activated the CCyB (in 2015:Q3), and re-estimate the results both including and excluding all Swedish subsidiaries. Finally, we implement the estimator proposed by de Chaisemartin and D'Haultfœuille (2024). All results reported henceforth are confirmed.

that might arise if banks sought to bypass capital requirements by reallocating credit across borders or through local branches.

Our analysis relies on a unique combination of data sets. We use credit register data that provide quarterly information on the lending activities of German banks and nonbanks to individual corporate borrowers, both domestically and abroad. We merge these data with detailed firm-level information on borrowers' ownership structures, balance sheet items, and, most importantly, the composition of their liabilities, including intra-group debt. These granular data are available for all subsidiaries of multinational corporations. We focus on MNCs with a German parent and subsidiaries located outside Germany. This structure allows us to track how bank and nonbank lending respond to changes in foreign CCyBs, how internal capital markets within MNCs adjust in consequence, and how these dynamics affect lenders' risk-taking. The sample period begins after the global financial crisis in 2013 and ends in 2019, just before the onset of the COVID-19 pandemic.

We first investigate how CCyB activation and subsequent increases affect the volume of bank and nonbank credit extended to subsidiaries located in countries with an activated CCyB. The introduction or tightening of a CCyB raises banks' effective refinancing costs on exposures to these subsidiaries, which typically translates into tighter lending terms.[2] To identify this effect, we analyze data at the bank-firm-time level and compare subsidiaries in CCyB-activated jurisdictions with subsidiaries operating in countries where the CCyB remains at zero.

Our results show a clear credit supply response. Bank lending to affected subsidiaries declines following a CCyB increase, consistent with higher capital requirements worsening the conditions under which banks are willing to extend credit. This effect is economically meaningful and statistically robust. We next examine the

[2] None of the banks in our sample is capital constrained as the increase in the bank specific capital requirement resulting from the foreign CCyBs would have been significantly lower than their available excess capital. Therefore, the CCyBs do not restrict banks' capacity to extend credit but might have an impact on credit conditions. Higher capital requirements tend to increase banks' refinancing costs as for them capital is more expensive than debt due to, for instance, the favourable tax treatment of debt or underpriced deposit insurance (see for example Miles, Yang, and Marcheggiano (2013)). If banks' higher refinancing costs are passed on to borrowers in form of higher lending rates borrowers have an incentive to adjust their funding structure. Similarly, a change in banks' risk perception, triggered by the tightening of this particular macroprudential tool, may lead to an increase in risk premia.

extensive margin. Beyond reducing loan volumes, banks may alter their relationships with exposed subsidiaries. We therefore study whether a CCyB increase affects the likelihood that a bank-firm relationship is terminated. The evidence indicates that higher CCyBs significantly increase the probability that a subsidiary discontinues borrowing from a given bank, confirming that the shock propagates through both the intensive and extensive margins of bank credit. To confirm our mechanism, we assess whether these effects also appear in nonbank credit. Because nonbank lenders are not subject to CCyB requirements, we expect no differential impact on nonbank borrowing. The data confirm this prediction: nonbank credit to subsidiaries shows no systematic response to CCyB changes.[3]

MNCs can circumvent unfavorable financing conditions in one jurisdiction by borrowing through affiliates located in markets with lower frictions and by reallocating funds through their internal capital markets. To shed light on these dynamics, we begin by examining how subsidiaries adjust their internal borrowing from the parent company. Importantly, all parent companies in our sample are headquartered in Germany which did not have a positive CCyB at any point during our observation period.

Our results show a pronounced internal response. When the CCyB in the subsidiary's host country increases, internal borrowing from the parent rises significantly.[4] A one percentage-point (pp) increase in the CCyB is associated with a 1.2 pp increase in the ratio of internal debt from the parent to the subsidiary's total assets, and a 2.3 pp increase in the ratio relative to total liabilities. These magnitudes are large: they correspond to roughly one-third of the average internal debt level provided by parents.

We also investigate whether parents adjust their equity positions in affected subsidiaries. Consistent with credit-driven internal substitution rather than recapitalization, we find no significant change in parent equity investment. In sum,

[3] In our study, we only include firms which are part of an MNC and accordingly have access to internal capital markets. We acknowledge that results might be different for standalone firms. However, as these are in general smaller this usually also implies that they are less likely to borrow from nonbanks.

[4] We also investigate whether affected subsidiaries borrow internally from other, unaffected, subsidiaries but do not find this confirmed. The results are shown in Appendix Table A3.

parents respond to higher CCyBs in host countries by supplying additional funding exclusively through internal debt.[5]

Finally, we assess whether the increase in parent-provided internal funding fully offsets the decline in overall external bank credit -i.e. from banks in Germany as well as possibly from other lenders. To evaluate the degree of substitution between external and internal financing, we examine the effect of CCyB changes on the total liabilities of subsidiaries. The results indicate complete substitution. The increase in internal lending from the parent compensates fully for the reduction in bank borrowing triggered by CCyB increases. This pattern is reinforced by our findings on subsidiaries' probability of default (PD), which remains unchanged despite higher CCyBs. Accordingly, subsidiaries' overall risk does not deteriorate when their jurisdiction raises the CCyB, because parents absorb the credit supply shock through internal credit reallocation.

Taken together, the evidence shows that CCyB increases abroad trigger a clear internal capital market response within MNCs: (German) bank lending to affected subsidiaries contracts, but parents, which are located in a jurisdiction without an activated CCyB themselves, step in with sizable additional internal debt. This support is credit-based and large enough to fully offset the external shock, leaving subsidiaries' total liabilities and risk unchanged. In short, higher CCyBs reduce external credit provision, but internal capital markets neutralize the effect completely at the subsidiary level.

We next examine how parent companies finance the additional internal loans they extend to subsidiaries affected by foreign CCyB increases. As before, we distinguish between bank and nonbank borrowing. The results show a clear pattern: parents refinance their expanded internal lending by raising more external credit from their domestic financial system.[6] Specifically, a parent with at least one subsidiary in a CCyB-activated country borrows about 4.1% more from domestic banks and roughly 15% more from domestic nonbanks. This indicates that the reduction in bank borrowing at the subsidiary level is effectively replaced by an increase in external borrowing at the parent level.

We also analyze the implications for parent risk. Consistent with the observed rise in external credit, parents' probability of default increases by around 10 basis points for

[5] We also examine a proxy for non-bank debt, such as bond financing, and find no significant effects.

[6] Appendix Table A5 shows that they do not, however, obtain more credit from subsidiaries of the MNC.

both bank- and nonbank-based PD measures. This is an increase of roughly 25% relative to the average PD. Thus, the internal support that stabilizes subsidiaries is funded by additional leverage at the parent, which elevates the parent's risk profile.

Taken together, our analyses show that banks in Germany decrease their lending to firms domiciled in countries with an activated CCyB whereas nonbank lending remains unchanged. Furthermore, we find that parents, located in a jurisdiction without an activated CCyB, fully substitute for the relative decrease of bank credit to their affected subsidiaries by providing internal credit, which is refinanced by an increase of their domestic bank as well as nonbank borrowings.

Finally, we assess the broader consequences of these internal reallocations for MNCs, their lenders, and overall financial stability. We begin by examining aggregate bank and nonbank lending to MNCs within the EU. Since affected subsidiaries receive less bank credit while parents with affected subsidiaries obtain more bank and nonbank credit, we expect aggregate nonbank lending to rise at the lender-MNC level. The net effect on aggregate bank lending is ex ante ambiguous: the parent's refinancing response may or may not exceed the initial contraction at the subsidiary.

Our findings show that the CCyB-induced shock to subsidiaries translates into a meaningful reconfiguration of funding within MNCs. Parents fully compensate for the decline in credit supply that their subsidiaries experience from banks in Germany and in other countries. Parents also appear to behave in line with the precautionary liquidity motive documented in the overborrowing literature: they increase external borrowing not merely to fill the gap left by banks, but to build buffers against expected future constraints (e.g., Lins, Servaes, and Tufano (2010); Acharya, Almeida, and Campello (2013); Acharya and Steffen (2020)). Consistent with this mechanism, aggregate bank lending to MNCs rises, and the increase in parent borrowing more than offsets the decline at subsidiaries. Nonbank lending increases as well, reinforcing the upward shift in overall credit.

To quantify this, we aggregate all credit exposures from a given lender to all EU-based firms within an MNC. We then examine lenders' exposure-weighted probability of default (PD) across all firms in the group. If aggregate borrowing increases for MNCs with affected subsidiaries, we should also observe a corresponding rise in MNC-level risk. This is precisely what we find. Both aggregate bank and aggregate nonbank

borrowing by MNCs with affected subsidiaries increase relative to those of unaffected MNCs, and their weighted PD rises accordingly. These aggregate measures capture changes in the exposure of German banks and nonbanks to the MNC, not the MNC's global consolidated leverage. Thus, both bank and nonbank lenders, which in our setting are all located in Germany, where no CCyB was activated, face higher total exposure and higher borrower risk because of foreign macroprudential tightening.

These results indicate that internal capital markets of MNCs allow to sidestep CCyB-induced tightening by rerouting credit flows through the parent. While this stabilizes subsidiaries, it generates a cross-border spillover: leverage and risk-taking increase in the parent's jurisdiction, where regulatory conditions remain unchanged. This pattern is consistent with the precautionary overborrowing literature, which emphasizes that agents facing prospective constraints borrow more ex-ante, thereby amplifying aggregate vulnerabilities. Although our analysis focuses on MNCs and leaves aside single firms without multinational structures the evidence suggests that macroprudential tightening abroad can induce meaningful risk migration in integrated financial systems. Further tests confirm that countries with active CCyBs also tend to implement more macroprudential tools over time, reinforcing firms' incentives to accumulate precautionary liquidity through their parents.

In sum, foreign CCyB increases trigger clear cross-border spillover effects: parents borrow more from German banks than subsidiaries lose from them, causing aggregate bank and nonbank lending to MNCs to rise. This additional external borrowing pushes up the exposure-weighted default risk of the entire group. The tightening abroad is thus neutralized at the subsidiary level but reappears as higher leverage and risk in the parent's home country, where no CCyB is activated. Internal capital markets therefore turn targeted macroprudential tightening into a cross-border risk migration mechanism.

In the final part of our analysis, we examine the internal credit reallocations in more detail to understand whether they are primarily driven by lenders, by borrowing firms within the MNC, or by both. Our earlier finding, that nonbank credit to affected subsidiaries remains unchanged, already suggests that supply-side tightening alone cannot explain the observed patterns.

We begin by analyzing heterogeneity in subsidiary size. Distinguishing subsidiaries by their relative importance within the MNC reveals that smaller and more

credit-constrained subsidiaries receive disproportionately more internal funding when the CCyB in their host country increases. This indicates that the parent's internal response prioritizes subsidiaries that face tighter external constraints and have fewer alternative financing options. Next, we turn to the supply of external credit to parents. Earlier results showed that parents with affected subsidiaries experience an increase in their probability of default relative to other parents. We now investigate whether lenders shift additional risk toward these parents, which would support the presence of a credit supply channel. Our evidence suggests this is not the dominant force: riskier parents receive relatively less additional credit than safer parents, both from banks and from nonbanks. However, almost all parents, regardless of their risk level, increase their borrowing to some extent. Thus, the substitution of subsidiaries' lost bank credit with parent borrowing is heterogeneous and depends on parent risk. Riskier parents expand their borrowing by less, but they still borrow more on average. We then test whether the muted external borrowing response among riskier parents also translates into a smaller increase in aggregate lending to their MNCs. The evidence confirms this: groups with riskier parents experience a smaller rise in total bank and nonbank credit. These results suggest that while credit supply plays some role, credit demand is the primary driver of the overall reallocations, driven by the parent's precautionary motive to maintain internal liquidity.

To further distinguish between supply- and demand-driven channels, we saturate our bank-borrower-country-time regressions with extensive fixed effects and macroeconomic controls. Even in this demanding setup, the results remain consistent: CCyB activation abroad reduces bank lending to affected subsidiaries (a supply effect), but the resulting increase in parent borrowing, funded by both banks and nonbanks, is best explained by heightened credit demand at the parent. These funds are then channeled back to the affected subsidiaries through internal capital markets. The resulting higher leverage and thereby increased default risk of parents raise lenders' portfolio risk, indicating that macroprudential policy can leak through firms rather than through banks. Figure 1 summarizes these dynamics across all levels of analysis.

Our paper makes three contributions to the literature. First, we complement and extend existing work on countercyclical capital buffers by showing that their impact is not confined to the bank-firm interface. Prior studies examine domestic credit supply effects and cross-border spillovers through banks; we show that CCyB tightening abroad

triggers a coordinated financing response within multinational groups themselves. Second, we contribute to research on internal capital markets by demonstrating that internal and external debt are highly substitutable, even in response to small, policy-driven shifts in external borrowing conditions rather than crisis-level shocks. We document that parents systematically reallocate funds to affected subsidiaries and refinance this support through additional domestic bank and nonbank borrowing. Third, we extend the literature on intra-group shock transmission by identifying a new mechanism: foreign macroprudential tightening induces precautionary overborrowing at the parent level, increasing consolidated leverage and shifting risk across borders. Importantly, our analysis of MNC-level outcomes captures changes in the exposure of German banks and nonbanks to multinational firms. Given well-documented limits to substitution between domestic and foreign bank credit (e.g., Claessens and van Horen (2014); Beck, Ioannidou, and Schäfer (2018)), MNCs reallocate funding toward parent firms via internal capital markets when subsidiaries face tighter bank regulation abroad. Our results therefore speak to the cross-border redistribution of financial exposure induced by macroprudential policy. Together, these results reveal a firm-driven channel through which macroprudential policy can leak internationally, even under full reciprocity, with direct implications for the design and coordination of regulatory frameworks.

The remainder of the paper is organized as follows. Section 2 reviews the literature, while Section 3 describes the data and the institutional setting. Section 4 presents the methodology. Results on the direct effects of the CCyB on affected subsidiaries are reported in Section 5. Estimates on the internal response of multinational corporations via internal capital markets are discussed in Section 6. Refinancing at the parent level is discussed in Section 7, and system-level transmission and aggregate risk build-up are analyzed in Section 8. Robustness analyses are presented in Section 9 and Section 10 concludes.

2 Contributions to the Literature

Our paper relates to several strands of the literature. A first strand studies the design and effects of countercyclical capital buffers (CCyBs). Following the global financial crisis, many countries introduced CCyBs to enhance bank resilience and reduce the

procyclicality of bank lending (Cerutti, Claessens, and Laeven (2017); Cerutti, Correa, Fiorentino, and Segalla (2017)). The buffer's countercyclical design aims to enhance banks' loss absorption capacity during expansions and to support lending during downturns. Mandatory reciprocity, requiring that all banks, irrespective of their location or legal form, apply the same CCyB rate to exposures in the activating jurisdiction, was intended to prevent regulatory arbitrage via cross-border or branch lending. While the domestic effects of capital requirement changes on bank versus nonbank borrowing have been examined (Irani, Iyer, Meisenzahl, and Peydró (2021); Bednarek, Briukhova, Ongena, and von Westernhagen (2025)), and while cross-border spillovers of monetary and macroprudential policy are well documented (Baskaya, di Giovanni, Kalemli-Özcan, Peydro, and Ulu (2017); Buch and Goldberg (2017)),[7] there is no comprehensive evidence on how multinational corporations adjust their financing when regulatory shocks hit their banks abroad. Existing work focuses either on the domestic effects of macroprudential tools or on bank-level cross-border transmission mechanisms. Relevant studies include Jiménez, Ongena, Peydró, and Saurina (2017) on dynamic provisioning in Spain and Auer, Matyunina, and Ongena (2022) on Swiss CCyB activation targeted at mortgage exposures (see also Basten (2020) and Behncke (2023)). Closely related studies show that higher capital requirements reduce bank lending (Aiyar, Calomiris, Hooley, Korniyenko, and Wieladek (2014), Aiyar, Calomiris, and Wieladek (2014a), Aiyar, Calomiris, and Wieladek (2014b), Imbierowicz, Kragh, and Rangvid (2018), Gropp, Mosk, Ongena, and Wix (2019), and Favara, Ivanov, and Rezende (2021)) and shape banks' capital adjustment (Gropp, Mosk, Ongena, Simac, and Wix (2024)). Our contribution is to show that macroprudential tightening abroad does not stop at the bank-firm interface: it triggers a coordinated, multi-layered response inside multinational groups themselves.

A second strand examines internal capital markets within MNCs. Multinationals allocate funds internally to exploit cross-country differences in taxation (Mintz and Smart (2004); Buettner and Wamser (2013); and, for a meta study see Feld, Heckemeyer, and

[7] Relatedly is an emerging literature on international "regulatory arbitrage" that involves credit flows between countries (e.g., Houston, Lin, and Ma (2012); Laeven and Popov (2023); Burietz, Ongena, and Picault (2023); Benincasa, Kabas, and Ongena (2024);), cross-border lending and the affiliate presence of US banks abroad (Temesváry (2018)), and risk-taking by banks across locales in Central and Eastern Europe (Ongena, Popov, and Udell (2013)), or the UK and Ireland (McCann and O'Toole (2019)). And there is also a very large literature on the domestic and/or international transmission of financial and real shocks through the (global) banking sector.

Overesch (2013)), institutional quality, and financial development (Desai, Foley, and Hines Jr. (2004); Aggarwal and Kyaw (2008); Egger, Keuschnigg, Merlo, and Wamser (2014); Goldbach, Møen, Schindler, Schjelderup, and Wamser (2021)). Several studies show how internal funding adjusts when external borrowing constraints tighten.[8] For instance, Desai et al. (2004) find that U.S. affiliates increase internal borrowing under weak creditor rights or shallow banking sectors, while Goldbach et al. (2021) show the opposite for German affiliates facing survey-based credit constraints. Dewaelheyns and Van Hulle (2010) document how internal resources and collateral shape bank borrowing in Belgian business groups. Our findings complement this literature by demonstrating that internal and external debt are highly substitutable, and that even modest changes in external bank funding conditions, here induced by foreign CCyBs, lead to systematic reallocation of funds within MNCs. Unlike prior studies, we show that internal capital markets not only react to crisis-level constraints or structural underdevelopment but also to small, policy-driven shifts in the cost of external finance.

A third strand investigates the transmission of financial shocks within multinational groups. Biermann and Huber (2024) show that during the global financial crisis, subsidiaries provided internal support to their affected parents, which left them financially constrained and reduced their real growth, a behavior the authors describe as "Darwinist" toward international affiliates and "Socialist" at home.[9] Access to developed capital markets mitigated these effects. Our setting differs fundamentally: we study multiple exogenous shocks abroad (rather than one shock at home), incorporate both bank and nonbank credit, and document that internal capital flows can be "Socialist" toward subsidiaries as parents absorb foreign regulatory shocks. We also extend this literature by

[8] The saliency of the internal versus external financing for corporations (or lack thereof, see, e.g., Modigliani and Miller (1958)), and the external finance premium, for corporate and macroeconomic outcomes have long been the focus of both a key theoretical and empirical literature (e.g., Bernanke and Gertler (1989); Calomiris and Hubbard (1990); Paravisini (2008)). Further stages in the "financial graduation" by entrepreneurs such as from informal to formal financing (e.g., Degryse, Lu, and Ongena (2016)), and by firms within the formal financial sector from group to individual loans (e.g., Li, Mishra, Ongena, and Ioannidou (2023)), from single to multiple bank relationships (e.g., Detragiache, Garella, and Guiso (2000); Ongena and Smith (2000); Farinha and Santos (2002)), or from bank to bond market finance (e.g., Diamond (1991); Santos and Winton (2008)), has also been theoretically and empirically well analyzed.

[9] Similarly, Santioni, Schiantarelli, and Strahan (2019) find that the recourse of Italian MNCs to internal capital markets increased when Italian banks were distressed during the global financial crisis and the sovereign debt crisis in 2011.

showing how internal support is refinanced. Parents fund the additional internal lending by borrowing more from domestic banks and nonbanks, which raises their probability of default and the weighted PD of the entire MNC. This reveals a new form of macroprudential leakage: foreign CCyBs can increase leverage and risk in jurisdictions where no CCyB is active, an effect invisible in studies focused solely on bank-side adjustments.

Across all three strands, our contribution is to show that macroprudential policy can transmit internationally not only through banks, but also through the internal capital markets of multinational firms. Foreign CCyB activation reduces bank credit to subsidiaries, induces precautionary overborrowing by parents, increases consolidated leverage, and shifts risk across borders. This firm-driven transmission mechanism has been largely overlooked in prior work and carries direct relevance for the design and international coordination of macroprudential tools.

3 Data and Institutional Setting

3.1 The Multinational Corporation (MNC) and Its Borrowing

For our analysis, we combine two proprietary datasets from the Deutsche Bundesbank. Information on bank and nonbank lending comes from the MiMik (Mikrodatenbank Millionenkredite) database, which provides quarterly lender-borrower observations for both domestic and international loans. We focus on lending to non-financial private-sector firms located in all EU-27 countries as well as Iceland and Norway. To ensure meaningful lending dynamics, we restrict attention to credit relationships that are observed for at least eight consecutive quarters. Borrower PD measures are also derived from MiMik. For each firm-quarter, we compute the PD as the average of all PD estimates reported by its lenders.

We augment these data with the MiDi (Microdatabase Direct Investment), which covers the universe of German firms' outward foreign direct investments (FDI). MiDi allows us to identify firms whose main investor is located in Germany (the parent) and who hold equity stakes in firms abroad (the subsidiaries). Based on annual balance sheet reports, MiDi provides detailed information on affiliates' asset and liability structures, industry classifications, and other firm characteristics.

A key feature for our analysis is the granular liability structure reported in MiDi. For each subsidiary, we observe total liabilities and the composition of these liabilities, distinguishing external funding from banks, nonbanks, or bondholders from internal funding provided by the parent or other subsidiaries within the MNC. This information enables us to examine how internal capital markets operate across borders and how multinationals adjust internal and external funding in response to CCyB changes in the jurisdictions where their subsidiaries are located. MiDi also reports characteristics of the parent, including firm size and number of employees. All MiDi variables are measured at year-end.

Appendix Table A1 lists all countries in which sample firms are located and their respective CCyB levels over time. Appendix Table A2 provides summary statistics, including the number of lenders and borrowers, the number of lender-firm relationships, the distribution of CCyBs, lender-level credit exposures, PD measures for parents and subsidiaries, and the composition of internal debt. The appendix also contains variable definitions and descriptions.

3.2 The Countercyclical Capital Buffer (CCyB)

The CCyB was introduced by many countries after the global financial crisis as part of the internationally agreed Basel III framework (Basel Committee on Banking Supervision (2010)). During periods of normal or elevated credit growth, national authorities can raise the CCyB, requiring banks to hold additional capital above minimum requirements. These buffers can then be released in periods of stress, allowing banks to absorb losses without sharply reducing lending. The effectiveness of countercyclical capital requirements in stabilizing bank credit supply during downturns and crises is documented by the European Central Bank (2022) and the Basel Committee on Banking Supervision (2022), and the research cited therein. As a secondary objective, CCyBs may also help lean against excessive credit growth in upswings, though the expected impact on lending in such periods is comparatively small when banks are not capital-constrained European Central Bank (2022) and Lang and Menno (2023))

A defining feature of the CCyB is mandatory reciprocity. Any CCyB activated by a national authority applies not only to domestic banks but must also be reciprocated by foreign banks and branches for their exposures in that jurisdiction. This rule is intended

to prevent regulatory arbitrage, such as shifting lending across borders or booking loans in entities subject to lower capital requirements. Accordingly, a positive CCyB rate applies to *all* bank exposures in the activating jurisdiction, regardless of where the lending bank is located or under which legal form it operates. Capital requirements for cross-border claims therefore depend directly on the CCyB set by the borrower's host country.

Figure 2 illustrates the evolution of CCyBs in our sample countries from 2013:Q1 to 2019:Q4, based on data from the European Systemic Risk Board (ESRB), including the timing of activation. Figure 3 shows the average number of macroprudential tightening events, such as borrower-based measures (e.g., loan-to-value ratios) or additional capital requirements, for countries that introduced a CCyB during our sample period and for those that did not. These data come from the Integrated Macroprudential Policy (iMaPP) database (Alam, Alter, Eiseman, Gelos, Kang, Narita, Nier, and Wang (2019)), and we use them to assess whether a tighter CCyB policy might signal a broader, persistent tightening cycle.

4 Methodology

Our empirical strategy exploits the staggered activation of countercyclical capital buffers (CCyBs) across countries to trace a shock as it propagates through the financing structure of multinational corporations (MNCs). We proceed in three steps. First, we identify the direct effect of foreign CCyBs on subsidiaries' external borrowing and internal funding. Second, we examine how parent firms adjust their own external financing to support affected subsidiaries. Third, we analyze the consolidated implications at the MNC level by aggregating credit and risk across all affiliates. Across all steps, we distinguish bank and nonbank lenders and employ fixed effects structures that isolate variation stemming from the CCyB shock.

4.1 Subsidiary Level

We begin by estimating the direct effect of CCyBs on international lending to subsidiaries. For each lender-firm-quarter observation, we estimate:

$$Y_{l,f,t} = \beta * CCyB_{c_f,t} + I_f + I_{i,t} + I_{l,t} + \varepsilon_{l,f,t} \quad (1)$$

where the dependent variable $Y_{l,f,t}$ is the logarithm of credit issued by lender l to firm f in year:quarter t. The key independent variable $CCyB_{c_{f,t}}$ is the CCyB rate in the country c where firm f is domiciled. Lenders l are banks or nonbanks located in Germany.

To capture shifts in firms' credit demand, we include firm-industry x year:quarter fixed effects $I_{i,t}$. These absorb time-varying industry-level demand shocks and follow the approach in e.g. Jakovljević, Degryse, and Ongena (2015), Degryse, De Jonghe, Jakovljevic, Mulier, and Schepens (2019), Greenstone, Mas, and Nguyen (2020), and Berg, Reisinger, and Streitz (2021)). We cannot include firm x year:quarter fixed effects in the spirit of Khwaja and Mian (2008), as these these would fully absorb the CCyB variation at the firm level and prevent identification. Instead, firm fixed effects I_f control for time-invariant firm characteristics, while industry x year:quarter fixed effects I_{it} account for industry specifics varying over time. Lender x year:quarter fixed effects $I_{l,t}$ absorb observable and unobservable time-varying lender-specific factors, including funding conditions and portfolio shifts.

We also apply regression equation (1) at the firm-time level to examine how CCyBs affect subsidiaries' internal borrowing, equity, total parental funding, and total liabilities. In addition, we investigate the direct impact of CCyBs on borrower risk at the lender-firm-time level using the same econometric setup.

Throughout the analysis, we employ two subsidiary samples. The first includes all subsidiaries. The second is designed to address potential indirect spillovers within MNCs. If an MNC has multiple subsidiaries and at least one is located in a country with a positive CCyB, lenders may reallocate credit within the group, for instance, lending more to unaffected subsidiaries and less to the affected ones. Including all subsidiaries in such cases could contaminate the control group. Therefore, in the second sample, we exclude all subsidiaries with a zero CCyB that belong to MNCs in which at least one other subsidiary faces a positive CCyB. This ensures a cleaner comparison between treated and untreated subsidiaries.

4.2 Parent Level

We next examine how CCyB activation abroad affects parent companies, specifically, how parents refinance the internal support they extend to affected subsidiaries. We focus on whether parents obtain these funds from banks, nonbanks, or both. Our sample

includes all parent firms with foreign subsidiaries in the countries covered by our analysis. Given that nearly all German parents maintain at least one lending relationship with a German bank, we observe substantially more lender-firm observations at the parent level than at the subsidiary level.

To study parents' external financing responses, we estimate variants of the following specification:

$$Y_{l,f,t} = \beta * I_{affected_p} + I_f + I_{i,t} + I_{l,t} + \varepsilon_{l,f,t} \quad (2)$$

where $I_{affected_p}$ equals one for each parent p that has at least one subsidiary within the same MNC operating in a country with a positive CCyB. This setup parallels equation (1) but shifts the focus from subsidiary exposure to the parent's refinancing response.

In addition to parents' external borrowing from banks and nonbanks, we also analyze internal upstream flows, that is, funding from affected subsidiaries to the parent, using the same regression structure. Comparable to the subsidiary-level analysis, we also investigate the direct effect of CCyBs on parent risk by estimating equation (2) with the parent's PD at the lender-firm-time level as the dependent variable.

4.3 Multinational Corporation Level

Finally, we examine consolidated effects at the MNC level. This step captures whether internal reallocations within the MNC and the refinancing responses at the parent amplify or offset the initial CCyB shock. We aggregate the data to the lender-MNC-time level and split the analysis by lender type (banks versus nonbanks). For credit amounts, we sum the loans that a lender provides to all affiliates of the same MNC in a given quarter and take the logarithm. To measure the overall risk of the MNC, we compute an exposure-weighted probability of default by weighting each affiliate's PD with the credit amount obtained from the lender in the previous quarter.

We estimate the following specification:

$$Y_{l,MNC,t} = \beta * I_{affected_{MNC}} + I_{MNC} + I_{MNC,l} + I_{l,t} + \varepsilon_{l,f,t} \quad (3)$$

This specification is again related to equation (1) but incorporates several important modifications. First, the data are aggregated at the lender-MNC-time level. Second, the variable $I_{affected_{MNC}}$ equals one for any MNC with at least one subsidiary located in a country with a positive CCyB. Third, we include MNC-lender fixed effects $I_{MNC,l}$, which

allow us to trace how credit volumes and risk evolve for a given MNC-lender relationship over time. MNC fixed effects I_{MNC} capture all time-invariant characteristics at the group level, while lender-time fixed effects $I_{l,t}$ absorb time-varying funding conditions and portfolio adjustments at the lender level.

In sum, this approach allows us to quantify how the external borrowing and risk profile of an MNC changes when any of its subsidiaries is affected by foreign macroprudential tightening. These estimates capture the system-level consequences of internal capital market adjustments and parent refinancing responses.

5 The Direct Effects of the CCyB on Subsidiaries

We now turn to the direct impact of higher countercyclical capital buffers on international lending to subsidiaries of German multinational corporations. Since our sample covers only the build-up phase of the CCyB framework, the relevant margin is tightening rather than release. An increase in a host country's CCyB mechanically raises the capital requirement for all banks, domestic and foreign, lending into that jurisdiction due to mandatory reciprocity. If capital requirements impact lending, affected subsidiaries should experience a contraction in bank credit, while lending by nonbanks should remain unaffected. In this section, we examine these effects on bank lending, and the corresponding response of nonbank credit.

5.1 Bank Lending

We begin by quantifying how higher CCyBs affect bank lending to subsidiaries. The sample covers all lending relationships between German banks and corporate borrowers belonging to German-headquartered MNCs. Because Germany did not activate a CCyB during our sample period, all parent firms are by construction unaffected. Subsidiaries in host countries with a zero CCyB serve as the control group, while subsidiaries located in countries with a positive CCyB constitute the treated group.

We estimate the effect of the CCyB at the bank-firm-time level by regressing the logarithm of loan volumes on the *CCyB rate* in the subsidiary's host country. As discussed in the methodology section, the CCyB varies only at the country-time level. Firm x time fixed effects (as in Khwaja and Mian (2008) are therefore infeasible, as they would mechanically absorb all identifying variation. Instead, we follow Degryse et al. (2019)

and include firm fixed effects and industry x time fixed effects to proxy for time-varying credit demand at a broader level, and lender x time fixed effects to absorb changes in bank funding conditions and portfolio rebalancing.

We estimate the model using two subsidiary samples. The full sample (Panel A) includes all subsidiaries. The restricted sample (Panel B) excludes subsidiaries located in countries with a zero CCyB if their MNC has at least one subsidiary in a country with a positive-CCyB. This addresses potential within-MNC reallocation of bank credit, which could bias the control group if unaffected affiliates receive redirected lending when others face tighter conditions. Table 1 reports the results.

Across both samples and all specifications, the CCyB coefficient is negative and statistically significant. In Panel A, a 1 pp increase in the CCyB reduces bank credit to the affected subsidiary by 10.6%. With 12.1% the magnitude is slightly larger in Panel B, consistent with the idea that banks may evaluate subsidiaries at least partly in the context of their broader MNC structure. Once firm fixed effects are included, the economic magnitude is stable across specifications, suggesting that CCyBs respond to aggregate conditions rather than bank- or firm-specific characteristics.

Panel C examines the extensive margin. First, we test whether credit relationships are more likely to be terminated following a CCyB increase. A relationship termination indicator is set to one in the quarter in which a previously active bank-firm relationship over at least four consecutive months ends. Second, we analyze relationship initiations using an indicator for the quarter preceding the start of a new lending relationship lasting at least four consecutive quarters. The results show that higher CCyBs increase the likelihood of relationship termination, whereas columns (4) to (6) indicate no differential effect on relationship initiation.

Overall, Table 1 demonstrates a clear pattern: higher CCyBs abroad contract German banks' cross-border lending to affected subsidiaries, both on the intensive and the extensive margin. This establishes the first step in the transmission mechanism: a foreign macroprudential tightening reduces the direct cross-border bank credit available to subsidiaries of German MNCs.

5.2 Nonbank Lending

We now examine how CCyB activation abroad affects lending by nonbanks. Because nonbanks are not subject to CCyB regulation, the CCyB in a subsidiary's host country should, in principle, have no dampening effect on their lending behavior. All nonbanks in our data are domiciled in Germany. Nonbank lending is a meaningful component of external finance for subsidiaries: nonbanks lend, on average, 11.2% of their credit internationally, which is slightly more than banks (9.8%) and broadly in line with the overall lender average of 10.1%.

Two mechanisms could nonetheless generate changes in nonbank lending to affected subsidiaries. First, nonbanks could substitute for banks if they respond to supply reductions triggered by the CCyB. Second, changes in borrower demand could influence nonbank lending. If subsidiaries reduce overall credit demand because bank credit becomes more expensive or scarce, then total liabilities should fall. If, however, credit demand remains stable, subsidiaries may attempt to replace the bank credit lost due to the CCyB with alternative funding sources, of which nonbank credit is only one option. Another key alternative is internal credit from other entities within the MNC, which we analyze in the following subsections. Consequently, interpreting nonbank responses requires a broader view of the subsidiary's capital structure, which we develop later in the paper.

We estimate the same regression specification as in Panels A and B of Table 1, again using the full subsidiary sample and the restricted sample that excludes subsidiaries with zero CCyB when any affiliate in the same MNC faces a positive CCyB. The results are shown in Table 2.

Across all specifications, coefficients on the CCyB variable are statistically insignificant. Columns (1) and (2) compare affected subsidiaries with the full set of unaffected affiliates, while columns (3) and (4) restrict the comparison to unaffected subsidiaries whose MNC is entirely unexposed to a positive CCyB. The fixed-effects structure mirrors that used in the bank-lending analysis in columns (4) and (5) of Panels A and B in Table 1. Regardless of sample or saturation, nonbank lenders do not adjust their lending when a subsidiary's host country increases the CCyB.

Taken together, Table 2 confirms that nonbank lending to subsidiaries remains unchanged in response to CCyB tightening abroad. This result contrasts sharply with the

contraction in bank lending documented in Section 5.1 and highlights that the direct effect of the CCyB operates exclusively through regulated entities.

6 Internal Capital Markets of MNC

Foreign CCyB activation reduces direct bank lending to affected subsidiaries, but this need not translate into lower total funding if MNCs activate internal capital markets. In this section, we examine (i) whether subsidiaries increase internal borrowing from their parent, (ii) the type of funds parents provide to their affected subsidiaries, and (iii) whether internal funding fully compensates for the loss of external bank credit.

6.1 Parent Funding Flows to Subsidiaries

The previous section documents that subsidiaries receive roughly 10% less bank credit in response to a 1 pp increase in the CCyB of their host country. We now examine whether affected subsidiaries compensate for this contraction by borrowing more from their parent. As highlighted earlier, internal debt from other entities within the MNC could, in principle, also serve as a substitute for reduced bank credit.

Our data allow us to distinguish internal funding received from the parent from that received from other subsidiaries. We use firm-level observations and again employ two samples: one including all subsidiaries, and a second excluding subsidiaries in countries with a zero CCyB if the same MNC has at least one subsidiary located in a positive-CCyB country. The latter ensures that the control group is not contaminated by within-MNC spillovers. We analyze the impact of CCyBs on three measures of parental internal debt: i) the logarithm of internal debt from the parent, ii) internal debt from the parent over total assets, and iii) internal debt from the parent over total liabilities. These complementary measures ensure that our results are not driven mechanically by changes in firm size or leverage. As in previous specifications, we regress these variables on the *CCyB rate* in the subsidiary's host country and include firm fixed effects as well as industry x time fixed effects in the more saturated models to control for time-invariant firm characteristics and broader time-varying credit demand at the sector level. Table 3 reports the results.

Across all specifications, the CCyB coefficient is positive and statistically significant, indicating that affected subsidiaries systematically increase internal

borrowing from their parent. For example, column (6) shows that a 1 pp higher CCyB is associated with a 2.3 pp higher share of parental debt relative to total liabilities relative to untreated subsidiaries. The effect is somewhat larger in Panel B, where the control group excludes MNCs with any exposure to positive CCyB countries. Column (4) implies an increase of 15.7% relative to the mean. By contrast, re-estimating the same regressions using internal funding from other subsidiaries yields no significant effects.[10] This pattern clearly indicates that parents, and not peer subsidiaries, step in to replace the decline in external bank credit when host-country CCyBs tighten.

6.2 Composition of Total Parent Funding

In the next step, we examine whether parents adjust not only internal debt but also equity when subsidiaries face tighter bank credit due to higher CCyBs. In principle, parents could counterbalance the decline in affected subsidiaries' external bank credit by supplying them with additional equity capital. We therefore analyze both funding margins: equity injections and total parental funding, defined as internal debt plus parent equity. Table 4 reports the results.

Columns (1) and (3) show that parents do not differentially change their equity investment in affected subsidiaries. The coefficients are small and insignificant across specifications. Thus, subsidiaries located in countries with increasing CCyBs do not receive additional equity capital, the adjustment margin operates exclusively through internal debt.[11] Columns (2) and (4) document the overall change in parental funding. A 1 pp higher CCyB is associated with an increase of roughly 17% in total parent funding, an effect driven entirely by internal borrowing, given the absence of equity adjustments. In the next section, we investigate whether these internal debt flows only partially compensate the loss of bank credit or whether substitution is complete, and how this affects subsidiaries' total liabilities and risk.

[10] We report the results in Appendix Table A4.

[11] In unreported tests, we also do not observe any statistically significant impact of the CCyB on other sources of external funding, such as bonds.

6.3 Substitution of Bank Credit and Subsidiary Risk

In the final part of our subsidiary-level analysis, we examine the extent to which parental internal debt replaces the decline in external bank credit and whether this substitution affects the risk profile of affected subsidiaries. The central question is whether parents only partially offset the reduction in bank lending or whether the substitution is effectively complete.

We use two measures of subsidiaries' total funding position as dependent variables: (i) the logarithm of total liabilities and (ii) total liabilities as a fraction of total assets. We regress these variables on the *CCyB rate* in the subsidiary's host country, including the same fixed effects used in earlier specifications. Because we do not observe differential changes in other external credit sources, internal credit from other subsidiaries, or equity, any change in total liabilities directly reflects the degree of substitution between bank and parent credit. Table 5, Panel A, reports the results.

Across all specifications, the CCyB coefficient is insignificant. This holds whether we compare affected subsidiaries with all other subsidiaries (columns (1) and (2)) or restrict the comparison to MNCs with no additional subsidiaries located in positive-CCyB countries (columns (3) and (4)). It also holds whether we examine levels (columns (1) and (3)) or leverage (columns (2) and (4)). These findings indicate that internal capital markets fully compensate for the decline in international bank funding when host-country CCyBs increase. Subsidiaries' overall leverage remains unchanged despite the contraction in bank credit. In case of MNCs, the CCyB reduces banks' lending to affected subsidiaries, while these subsidiaries maintain unchanged leverage through intragroup borrowing. The neutrality with respect to affected subsidiaries' leverage suggests an absence of real effects.

We next analyze whether this full substitution is also reflected in borrower risk. Given that total liabilities remain unchanged and only the composition of funding shifts, we expect no differential change in subsidiaries' probability of default (PD). Using the same regression setup, Table 5 Panel B (full sample) and Panel C (restricted sample) show that the PD of affected subsidiaries does not respond significantly to higher CCyBs, except in the least-saturated specification of Panel C. This mirrors our leverage results and confirms that the shift from bank credit to internal parent credit leaves subsidiaries' risk unchanged.

Taken together, the results in the previous section show that increasing CCyBs reduce international bank lending while leaving nonbank lending unaffected. These effects are consistent with the CCyB's reciprocity mechanism, which ensures a level playing field among regulated lenders. However, the strong internal response from parents shown in this section implies additional indirect effects that are not captured at the subsidiary level. We therefore next turn to the parent companies located in Germany, where the CCyB remained at zero throughout the sample period, to analyze how they absorb and refinance these shocks transmitted through their subsidiaries.

7 Refinancing of Parents

In this part of our analysis, we examine the indirect effects of foreign CCyB activation on parent companies. While the CCyB is designed to reduce the procyclicality of domestic bank lending, its regulatory reach is strictly national: only firms located in the activating jurisdiction face tighter bank credit. However, our subsidiary-level results show that parents systematically step in and replace the decline in external bank credit with internal debt. This implies that a CCyB increase abroad may also affect firms in countries where the CCyB remains at zero. In this section, we therefore investigate how parents obtain the additional funds they provide to affected subsidiaries and what this refinancing response means for their own risk profile. We begin by analyzing changes in bank and nonbank lending to parents, and then turn to the implications for parental borrower risk.

7.1 Bank and Nonbank Lending to Parents

We now turn to the external funding sources that enable parents to expand internal lending to their affected subsidiaries. The goal of this section is to identify how parent companies refinance the additional internal debt they provide. All parent firms in our sample are located in Germany, where the CCyB remained at zero throughout the observation period. This setting allows us to rely on the intersection of (i) all German parents of MNCs and (ii) all borrowers in the German credit register. As virtually all German parents borrow from at least one German lender, unlike their subsidiaries abroad, this yields a much larger set of lender-firm observations than in the subsidiary-level analysis.

Following the earlier bank-firm and nonbank-firm regressions, we use the logarithm of bank credit and nonbank credit to the parent as dependent variables. We regress these variables on an indicator variable *Parent with affected subsidiary*, which equals one if a parent has at least one subsidiary in a country with a positive CCyB and zero otherwise. We include the same fixed-effect structure used in our most saturated specifications in Table 1 and Table 2. Table 6 reports the results.

It shows that parents with affected subsidiaries obtain significantly more external funding from both banks (columns (1) and (2)) and nonbanks (columns (3) and (4)). Bank lending increases by approximately 4.1%, while nonbank lending rises by about 15%. Additional tests examining upstream internal borrowing, from subsidiaries to the parent, do not reveal significant effects, indicating that parents do not rely on internal funds from their affiliates when refinancing the increased internal lending.[12]

7.2 Parent Risk

Table 7 examines how the increase in external bank and nonbank borrowing affects the riskiness of parent firms. Using lender-parent-time data and the same saturated fixed-effects structure as in the previous subsection, we regress parents' PD on the indicator *Parent with affected subsidiary*.

The results show that parents with at least one subsidiary in a positive-CCyB country exhibit significantly higher PDs. The estimated coefficients, 0.091 for banks and 0.102 for nonbanks, correspond to an increase in parent PD of roughly 25% relative to the mean, which is about 40 basis points. This confirms that the additional external borrowing undertaken to finance internal credit flows increases banks' risk assessment of parent firms.

These findings imply that higher CCyBs do not only affect firms located in the activating jurisdiction. Rather, macroprudential tightening abroad can increase the credit risk of MNC entities operating in countries with no positive CCyB, as is the case for German parents in our sample. This pattern provides evidence of international spillovers:

[12] The results are shown in Appendix Table A5. For each parent, the data are only available at the aggregate subsidiary level. That is, we do not know whether the insignificant effect is due to no change in borrowing from subsidiaries in general or due to opposite effects between affected and unaffected subsidiaries. It might e.g. be the case that parents borrow internally less from affected but more from unaffected subsidiaries, what we cannot rule out given our data.

when CCyB levels differ across countries, internal reallocation of funds within MNCs can transmit and potentially amplify risk across borders. In this sense, the results in Table 7 offer micro-level evidence of leakage of macroprudential policy through multinational internal capital markets.

8 System-level Transmission and Aggregate Risk

Our earlier results show a clear pattern: higher foreign CCyBs reduce direct bank lending to affected subsidiaries. Parents fully replace this decline with internal debt financed through additional borrowing from German banks and nonbanks, and their risk rises accordingly. In this section, we study how foreign CCyB tightening reshapes the exposure of German banks and nonbanks to multinational corporations. By aggregating lending relationships at the lender–MNC level, we analyze how internal capital market reallocations affect the domestic financial system when subsidiaries face tighter bank regulation abroad. This allows us to assess whether multinational internal capital markets generate leakages in national CCyB regulation, enabling firms to circumvent local tightening and potentially shifting risk across borders.

8.1 Bank and Nonbank Lending to MNCs

To assess how CCyB increases abroad affect the overall external financing of multinational firms, we aggregate lending at the lender-MNC-quarter level by summing all credit a given lender provides to every entity within the same MNC. This allows us to trace how the entire corporate group adjusts its external borrowing from the parent's jurisdiction when only part of the group faces tighter bank-capital regulation abroad.

The predictions differ for banks and nonbanks. For nonbanks the hypothesis is straightforward: since they are not subject to CCyBs and since we observe no response at the subsidiary level but a strong increase in lending to parents, total nonbank lending to affected MNCs should rise mechanically. For banks, however, the net effect is theoretically ambiguous. On the one hand, bank credit to CCyB-affected subsidiaries falls; on the other hand, bank credit to the parent rises. Whether total bank lending to the MNC decreases, remains unchanged, or increases depends on how aggressively parents refinance and whether they borrow precautionarily.

Precautionary motives matter here. In theoretical models on precautionary overborrowing, agents borrow excessively in anticipation of future constraints because they do not internalize the systemic externalities of their leverage decisions (Mendoza (2010); Bianchi (2011); Korinek (2011)). Along the same lines, when part of the group becomes exposed to tighter foreign capital requirements, the parent may borrow not only to replace the lost credit at the subsidiary level but also to accumulate internal liquidity buffers against the possibility of future tightening abroad. This mechanism maps into the logic of precautionary overborrowing: agents confronted with the prospect of future funding frictions may increase current borrowing to insure internal capital markets against future shocks. Furthermore, given the imperfect substitutability between domestic and foreign bank credit (e.g., Claessens and van Horen (2014); Beck et al. (2018)), parents may rely on domestic funding to stabilize subsidiaries when external financing conditions deteriorate abroad. Accordingly, total bank lending to the MNC could increase even though lending to the affected subsidiary declines.

We test these predictions by estimating within-lender-MNC changes in credit volumes following CCyB increases. Table 8 shows the results.

Aggregate lending by German banks and nonbanks to the MNC increases when the MNC has at least one subsidiary in a CCyB-activated country. Relative to unaffected MNCs, nonbank credit grows by 15.6%, while bank lending rises by 5.2%. These results confirm that (i) parents refinance the internal support they provide to affected subsidiaries externally, and (ii) the credit exposure of the MNC is reallocated toward the parent's financial system. It is also consistent with precautionary liquidity accumulation at the group level. Note that the increase in lender-MNC exposure documented here should be interpreted as a reallocation toward the German financial system because we do not observe non-German lenders, potentially reflecting incomplete substitution between domestic and foreign bank credit rather than an increase in globally consolidated borrowing.

8.2 MNC Risk

To assess whether the increase in external borrowing from German lenders at the MNC level also raises lenders' exposure to group-wide risk, we compute the weighted PD of each MNC for every lender-MNC-quarter observation. The weighting uses each entity's

credit volume from a given lender, ensuring that the measure reflects the risk inherent in the lender's actual portfolio allocation across the group.

Table 9 shows that the rise in both bank and nonbank lending to MNCs with affected subsidiaries translates into a meaningful increase in aggregate MNC risk faced by German lenders. The weighted PD increases by 7.8 basis points for banks and 9.3 basis points for nonbanks, corresponding to an increase of roughly 20% relative to the mean. This confirms that the internal reallocation of funds, and the associated external refinancing at the parent level, does not merely shift credit within the group but elevates German lenders' overall risk exposure. It measures the redistribution of risk across jurisdictions and reflects the higher risk borne by German banks and nonbanks following internal refinancing at the parent level.

Importantly, all lenders in our sample are domiciled in Germany, a jurisdiction with a zero CCyB throughout the sample period. The rise in weighted MNC PD thus reveals clear cross-border spillover effects: CCyB tightening abroad increases the credit risk borne by lenders at home through internal capital-market transmission within multinational firms.

8.3 Precautionary Refinancing under Imperfect Credit Substitution

The observed refinancing behavior is consistent with a precautionary response by parent firms operating in an environment where subsidiaries cannot fully substitute constrained bank credit with alternative foreign lenders. A large literature documents that domestic and foreign bank credit are imperfect substitutes due to differences in lending technologies, borrower segmentation, and procyclicality.[13] The precautionary overborrowing literature provides a natural framework. In these models, agents optimally increase leverage today when they anticipate future financing constraints, macro-prudential tightening, or liquidity shortages (Caballero and Krishnamurthy (2001);

[13] A large body of research shows that domestic and foreign bank credit are imperfect substitutes. Foreign banks typically rely on transaction-based lending technologies and hard information, target larger and more transparent borrowers, and exhibit stronger procyclicality, especially during crises, while domestic banks specialize in relationship-based lending using soft information and continue to serve smaller, more opaque firms. As a result, firms cannot fully offset contractions in foreign bank credit by switching to domestic lenders, and vice versa (see, among others, Vazquez, Reinhart, and Arena (2007); Gormley (2010); Giannetti and Ongena (2012); Albertazzi and Bottero (2014); Beck et al. (2018)).

Mendoza (2010); Bianchi (2011); Korinek (2011)). Corporate and banking applications similarly show defensive liquidity hoarding and preemptive credit-line drawdowns during periods of heightened uncertainty (Acharya and Skeie (2011); Acharya et al. (2013); Acharya and Mora (2015); Acharya and Steffen (2020)). A central insight of this literature is that precautionary borrowing does not require immediate stress, only the expectation of future constraints.

To test whether parents' additional borrowing aligns with such anticipatory behavior, we exploit the Integrated Macroprudential Policy (iMaPP) database (Alam et al. 2019) and compute the cumulative number of macroprudential tightening events in each country over time. This measure captures not only CCyB changes but also borrower-based tools, capital-based measures, and other credit-supply restrictions.[14] The idea is straightforward: in this setting, the activation of a CCyB may signal a broader tightening of macroprudential policy, inducing parents to borrow defensively in anticipation of persistent financing constraints abroad.

Figure 3 compares the trajectory of macroprudential tightening between two groups of countries: those that activated a CCyB during our sample period and those that did not. Countries with a CCyB exhibit a substantially higher and steadily rising number of macroprudential tightening events. While descriptive, this pattern strengthens the interpretation that parents' excess borrowing is not an overreaction but a rational precautionary response to a credible shift toward more restrictive macroprudential regimes abroad.

Taken together with our earlier results, this evidence aligns closely with theoretical predictions: when agents anticipate future constraints, they borrow more, not less, to build liquidity buffers. Parents in our setting behave exactly in this way, hedging against the risk of continued or repeated tightening in subsidiaries' jurisdictions. Their precautionary overborrowing raises German lenders' portfolio risk, thereby generating a cross-border transmission channel consistent with the systemic externalities emphasized in the overborrowing literature. Observed precautionary borrowing should be interpreted relative to the contraction in German bank lending and reflects defensive refinancing

[14] Measures include for instance capital requirements, leverage limits, loan loss provisions, limits on credit growth or other loan restrictions, and borrower based measures such as limits on the loan-to-value ratio.

under incomplete substitution between domestic and foreign credit sources, rather than excess leverage at the consolidated group level.

9 The Dynamics of Credit Reallocation and Further Robustness

We conclude the main analysis by probing the mechanisms behind the credit reallocations documented so far. The objective is twofold: to assess how robust the baseline patterns are, and to determine whether demand or supply ultimately drives the observed adjustments within MNCs. We proceed in three steps. First, we study whether the internal reallocation of credit differs systematically by subsidiary size, as smaller and more financially constrained subsidiaries may rely more heavily on parental support. Second, we test whether the riskiness of the parent shapes its ability to refinance internal flows and whether lenders restrict credit more strongly to riskier parents. Third, we examine how these heterogeneities aggregate to the MNC level, affecting total external borrowing from banks and nonbanks.[15] We then complement these firm-level results with a set of bank-country-time saturated regressions, designed to separate shifts in credit demand from changes in lender supply. Finally, we show that all baseline effects remain intact across a rich set of robustness checks, reinforcing the credibility of our findings.

9.1 Bank Lending by Subsidiary Size

We begin by examining whether the internal reallocation of credit within MNCs varies systematically with subsidiary characteristics. Panel A of Table 10 focuses on subsidiary size, a classic proxy for financial constraints. Prior work shows that smaller units are typically more credit constrained and more sensitive to external shocks (e.g., Fazzari, Hubbard, and Petersen (1988); Carpenter, Fazzari, and Petersen (1998); Gertler and

[15] Throughout this section, MNC-level outcomes are interpreted as changes in the exposure of German lenders, not as evidence on global consolidated firm leverage. Our MNC-level results capture changes in the exposure of German banks and nonbanks to multinational corporations rather than changes in global consolidated firm leverage. While we observe that parents fully offset the decline in bank credit to affected subsidiaries, this substitution may reflect not only reduced lending by German banks but also reduced lending by foreign banks that we do not observe. A large literature documents that domestic and foreign bank credit are imperfect substitutes due to differences in lending technologies, information frictions, and borrower segmentation. When bank regulation tightens abroad, multinational parents therefore rely disproportionately on domestic funding to stabilize their subsidiaries. As a result, foreign CCyB tightening reallocates credit exposure and risk toward the German financial system, even if total consolidated borrowing of the multinational group remains unchanged.

Gilchrist (1994); Kashyap, Lamont, and Stein (1994)). If internal capital markets compensate for reduced external bank lending, we should expect parents to channel more internal funds toward those subsidiaries that are relatively more constrained.

We construct three measures of relative subsidiary size within the MNC: (i) the ratio of a subsidiary's total assets to the total assets of all other subsidiaries of the same MNC, (ii) the ratio of subsidiary assets to the parent's assets, and (iii) the ratio of subsidiary turnover to parent turnover. These measures capture intra-group heterogeneity from different angles and allow us to test whether the allocation of parental support is systematically tilted toward the smaller, more constrained units.[16] We interact each size measure with the CCyB rate in the subsidiary's host country and estimate the same specification as in column (2) of Table 3, separately for the full sample of subsidiaries (columns (1) to (3)) and for the restricted sample that excludes subsidiaries with zero CCyB exposure but a treated sister subsidiary (columns (4) to (6)). Across all specifications and definitions of size, the interaction term is consistently negative and significant.

The results in Panel A show a clear pattern: the smaller the subsidiary relative to the rest of the group or to its parent, the stronger the increase in internal lending it receives when the CCyB in its host country rises. This confirms that internal capital markets do not only substitute for lost bank credit, but do so selectively, directing support to the subsidiaries most likely to be financially constrained.

9.2 Bank and Nonbank Lending by Parent Risk

A natural question is whether the observed redistribution of credit within MNCs reflects risk-shifting by lenders rather than the precautionary demand response documented above. If banks faced higher capital charges on subsidiaries located in countries with an activated CCyB, they might try to keep total exposure to the MNC unchanged by reallocating lending toward other group entities, most notably the parent, regardless of

[16] We deliberately do not use measures of total size for subsidiaries as we are interested in within MNC effects, which might be very different from the effects of total size. As an example, a subsidiary might be small in total size but relatively large within an MNC. This would indicate that the subsidiary is not strongly credit constrained from the total perspective, however, from the parent's within MNC view it is relatively strongly in need of further credit. The use of measures for relative size accordingly allows us to measure the credit provision by parents within their MNC.

the parent's underlying credit risk. Under this supply-driven interpretation, parents with affected subsidiaries should receive more credit independent of their PD.

We test this hypothesis by interacting our treatment indicator *Parent with affected subsidiary* with the parent's PD, and estimating the same saturated specifications used in Table 6 and Table 8. Panel B of Table 10 reports results at the parent-lender level, Panel C at the MNC-lender level. If lenders were systematically shifting risk within the MNC, the interaction term should be insignificant, indicating that bank credit to parents rises uniformly when subsidiaries are hit by higher CCyBs.

The data do not support this. Across all specifications, for both banks and nonbanks, the interaction term is negative and statistically significant. Riskier parents receive less incremental credit when their subsidiaries face a positive CCyB, directly contradicting the notion of risk-shifting by lenders. At the same time, the main effect of the treatment indicator remains economically large: in the most saturated specification, parents with a PD of zero obtain 7.6% more bank credit and 20.4% more nonbank credit. Given that the average parent PD in our sample is only 0.395% (median 0.228%), the negative interaction term rarely offsets the positive base effect. As shown at the bottom of Panel B, for more than 80% of parents, the net effect of a subsidiary's CCyB exposure is still an increase in external borrowing.

Panel C confirms these patterns at the aggregate MNC level, where we explicitly allow for trade-offs between lending to parents and subsidiaries. If German banks compensated for lower lending to risky parents by increasing lending to safer subsidiaries, the interaction effect should vanish once exposures are aggregated to the MNC. Instead, the coefficient remains negative and significant for both bank and nonbank lenders. This rules out the possibility that risk-shifting occurs at a consolidated MNC level.

Taken together, the evidence rejects a supply-driven interpretation. Lenders do not systematically reallocate risk within MNCs when CCyBs abroad tighten. Rather, the pattern is consistent with demand-driven precautionary borrowing: safer parents borrow more to buffer their subsidiaries, while riskier parents have less capacity to do so, reinforcing that internal capital market activation is governed by corporate balance-sheet strength, not by lender risk repositioning.

9.3 Demand vs. Supply

The previous sections already suggest that the reallocations of credit within MNCs are primarily driven by changes in credit demand, in particular, by parents' precautionary refinancing behavior, rather than by banks' deliberate attempts to shift risk across affiliates. To examine this more formally, we follow the approach in Berg, Reisinger and Streitz (2021) and increasingly saturate our main regression specification with different sets of fixed effects and macroeconomic controls. This allows us to isolate the relative contribution of demand and supply factors to the decline in bank lending to CCyB-affected subsidiaries.

To abstract from idiosyncratic firm-level variation and better capture the structural drivers of cross-border lending, we run the analysis at the bank-country-time level. For each lender, we regress the logarithm of the total credit exposure to all firms in a country on the *CCyB rate* in that country and year:quarter fixed effects. As the CCyB varies only at the country-time level, we cannot include country x time fixed effects. Instead, to proxy for credit demand, we add a consistent set of macroeconomic controls for each country-quarter: the unemployment rate, the credit-to-GDP gap, the three-month money market rate, real annual GDP growth, and annualized inflation. We ensure comparability across countries what reduces the sample size to some extent as not all of these variables are available in the same form for each sample country.[17]

Table 11 reports the results.

In column (1), without any fixed effects, the coefficient on the CCyB is -1.358. Adding Year:quarter fixed effects in column (2) barely changes the estimate (-1.286) or the adjusted R-squared, indicating that aggregate time variation plays only a minor role. Column (3) incorporates lender x time fixed effects, absorbing bank-level supply shifts. Again, the coefficient remains almost unchanged, implying that supply-side movements in bank balance sheets do not account for the contraction in cross-border lending.

The picture changes once we begin to condition on macroeconomic demand variables. Adding only macro controls in column (4) reduces the magnitude of the

[17] The results for the full, aggregate, sample, without macroeconomic control variables, are included in Appendix Table A3. It shows that a 1 pp higher CCyB reduces international bank lending by roughly one-third of a standard deviation, with the effect remaining large and highly significant even under the most saturated fixed-effects specification (t = 8.177).

coefficient to -0.623, a substantially larger change than any induced by supply-side saturation. Introducing country fixed effects in column (5), together with macro controls, renders the CCyB coefficient statistically insignificant and increases the adjusted R-squared from 28.5% (column (3)) to 35.9%. This shift indicates that a very large portion of the variation previously attributed to CCyBs is absorbed by proxies for local credit demand. Finally, column (6) includes both supply and demand controls jointly and the CCyB coefficient remains insignificant.

Taken together, these tests show that increases in CCyBs abroad primarily trigger demand-driven adjustments: affected subsidiaries reduce external bank borrowing, while parent firms in zero-CCyB jurisdictions raise their own borrowings, both to fully substitute for lost subsidiary credit and to build precautionary liquidity buffers. These funds are subsequently reallocated internally, stabilizing subsidiaries' leverage but raising the risk profile of lenders in the parent's jurisdiction. The combined evidence strongly supports a demand-side transmission mechanism, with internal capital markets serving as the conduit through which macroprudential tightening abroad leaks into other financial systems.

9.4 Further Robustness

Recent advances in the difference-in-differences (DID) literature highlight concerns arising in settings with staggered and heterogeneous treatment timing (Callaway and Sant'Anna (2021); Sun and Abraham (2021); Athey and Imbens (2022)) and with differential effects between early and late adopters (Goodman-Bacon (2021)). To ensure that our findings are not driven by these issues, we conduct a series of intuitive robustness tests and complement them with the estimator proposed by de Chaisemartin and D'Haultfœuille (2024).

As shown in Figure 2, Norway was the first country to activate a CCyB (June 30, 2015). Sweden followed later that same year (September 13, 2015). Using quarterly data, our first robustness check restricts the sample to the period 2013:Q1 to 2015:Q2, during which only Norway became treated, and only in the final quarter of that window.[18] We

[18] The effect we estimate relates to the contemporaneous effect and potentially also to some extent anticipation. Changes in CCyBs are often announced some time ahead what implies that lenders and borrowers might already react prior to the actual introduction or increase of a CCyB. We also

re-estimate the regressions from Panel B of Table 1, focusing on bank credit to subsidiaries and applying the restricted sample that excludes zero-CCyB subsidiaries whose sister subsidiaries are treated. The results, reported in Table 12, columns (1) to (5), again show a significant decline in bank lending to affected subsidiaries, fully consistent with our main estimates.

Finally, we employ the *did_multiplegt_dyn* estimator developed by de Chaisemartin and D'Haultfœuille (2024), which explicitly accommodates non-binary, non-absorbing treatments with dynamic effects, a setting directly relevant for CCyB adjustments. Panel B of Table 12 shows that this method again yields significant negative treatment effects, with magnitudes even larger than in our baseline regressions. The dynamic pattern indicates that the full contraction in cross-border bank lending emerges with a delay of roughly two quarters, suggesting that international exposures are adjusted gradually after CCyB increases.

Taken together, all robustness tests in this subsection, restricted treatment windows, alternative sample definitions, and modern DID estimators, consistently confirm the core finding that higher CCyBs abroad reduce bank lending to affected subsidiaries, reinforcing the credibility and stability of our empirical results.

10 Conclusion

We provide evidence of a clear, robust mechanism by which foreign macroprudential tightening transmits into the balance sheets of multinational corporations. A foreign CCyB tightening reduces bank credit to affected subsidiaries while nonbank credit remains unchanged. This triggers internal capital market reallocations within multinational firms. Parents stabilize subsidiaries by increasing internal lending, leaving subsidiary leverage and default risk unaffected. They refinance this support primarily through German banks and nonbanks. As a result, foreign macroprudential policy shifts credit exposure and risk toward the parent's financial system.

These findings highlight a jurisdictional spillover of macroprudential policy in the presence of segmented credit markets. Internal capital markets enable MNCs to neutralize

test this but do not find this confirmed. However, our data are only quarterly. Accordingly, we cannot rule out that lenders and borrowers already react a few days or even weeks prior to a change in CCyB.

foreign CCyB induced credit supply shocks at the subsidiary level while shifting credit exposure and borrower risk borne by lenders to parent jurisdictions where no buffer has been activated. Even with full regulatory reciprocity, parent and bank risk in the parent home country increases because internal capital markets allow firms to reallocate funding in ways that shift financial exposure across borders, underscoring the importance of international coordination.

For policymakers, the implications are immediate. CCyBs reinforce the regulated perimeter yet may inadvertently elevate vulnerabilities elsewhere when multinational groups can reallocate credit internally. Effective macroprudential design therefore should also consider consolidated corporate leverage, intra-group debt flows, and cross-border coordination, especially in financially integrated regions. Harmonizing CCyB calibrations, or pairing buffers with tools that explicitly target group-level exposures and liquidity needs, can narrow the scope for such leakages.

For researchers, the findings underscore the need to view corporate balance sheets and macroprudential instruments through a global, firm-network lens rather than a jurisdictional one. Standalone firms may react very differently than MNCs, and measuring these differences, including distributional effects across the corporate group, is crucial for assessing the aggregate effects of capital-based regulation. Further work should quantify how internal capital markets interact with other macroprudential tools and how those interactions shape international financial stability in practice.

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Figure 1: Summary of the Estimates.

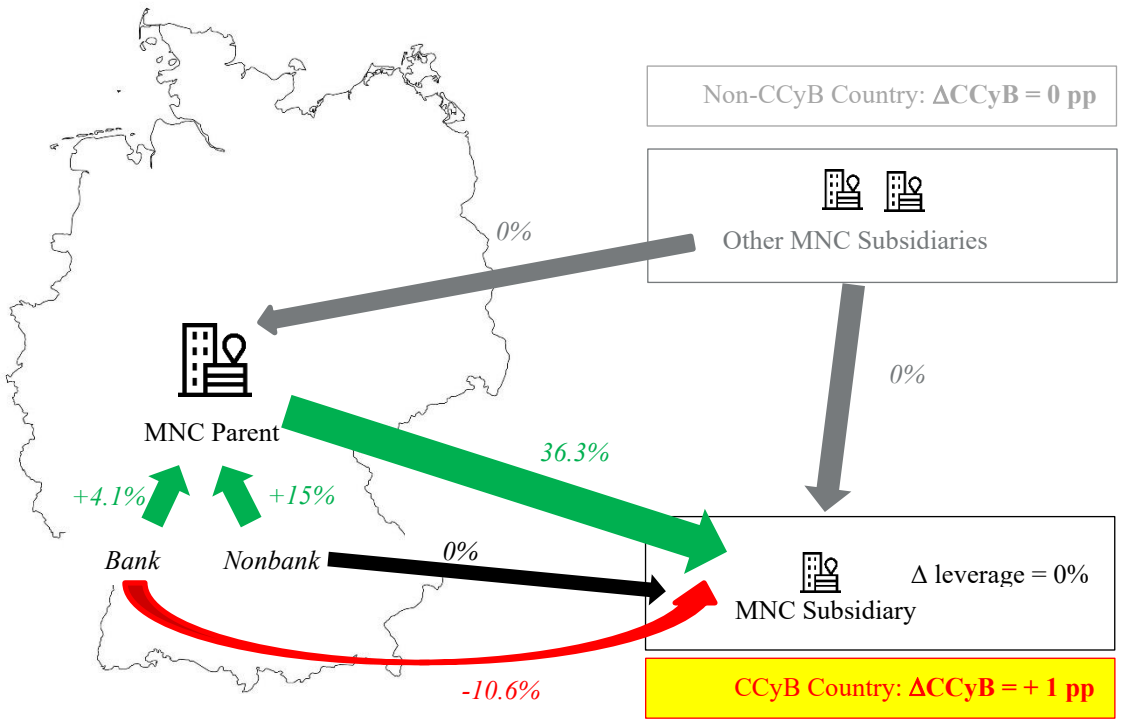
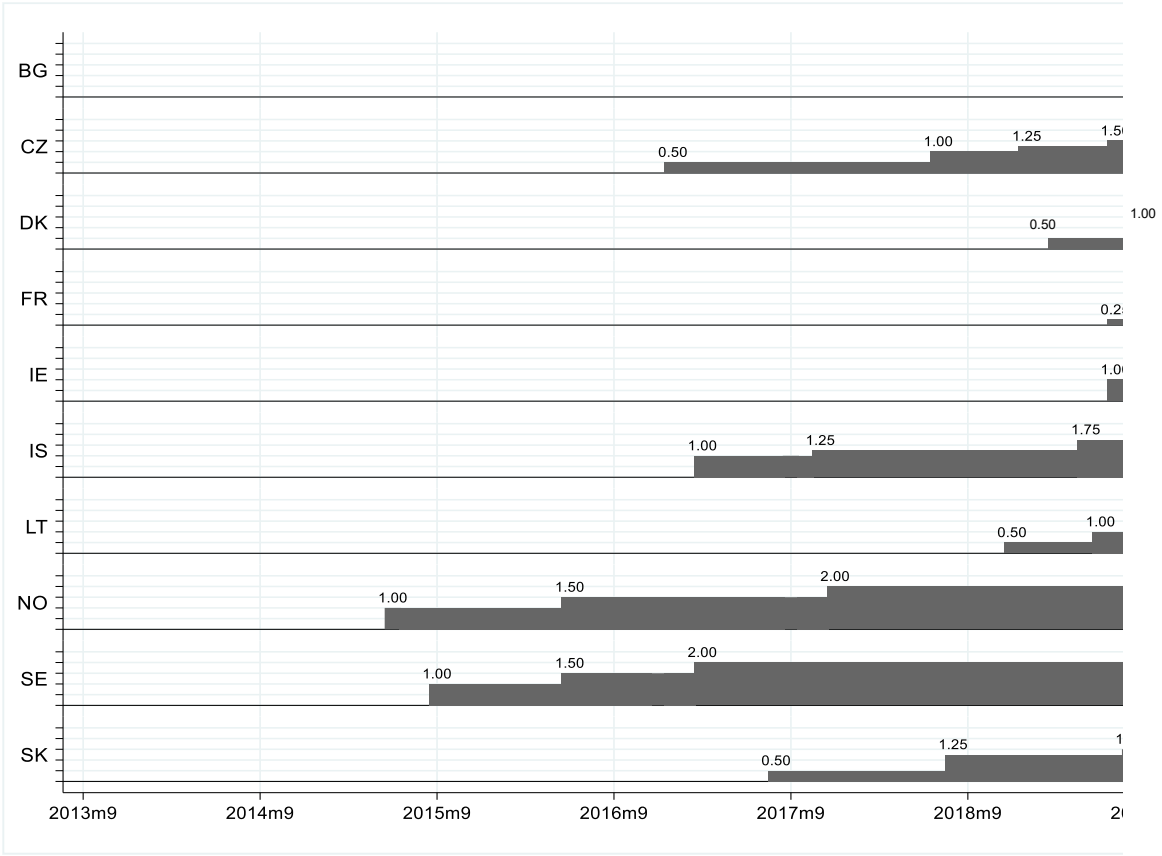


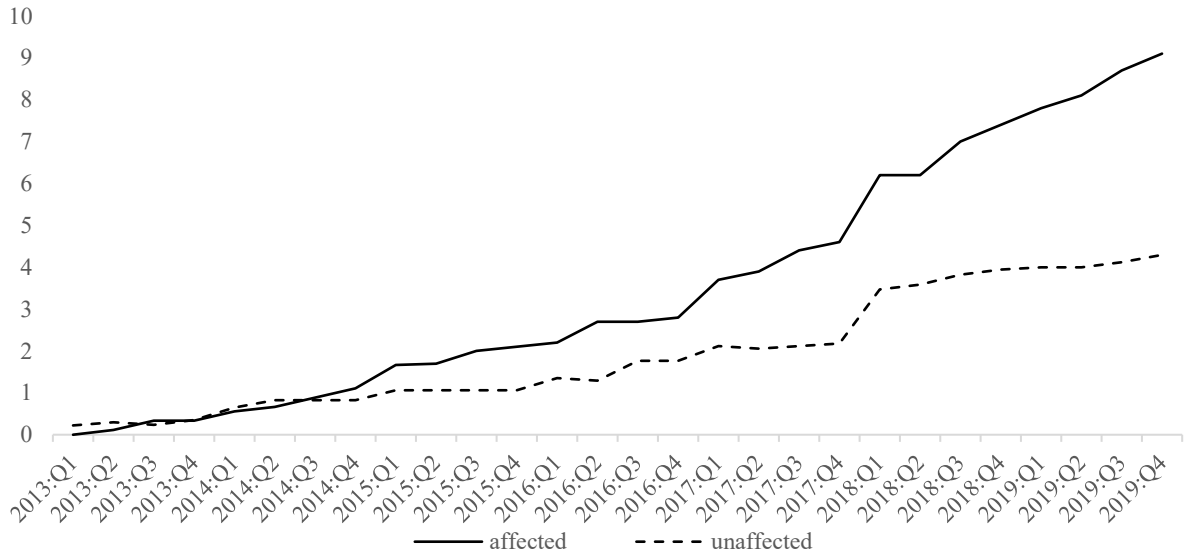
Figure 1 summarizes the main results of our analysis across all levels of the multinational group. A one percentage points (pp) increase in a country's CCyB reduces international bank lending to an affected subsidiary by 10.6%, with no corresponding change in nonbank credit. Parents fully compensate this decline through internal lending, which rises by 36.3%, equivalent to increases of 2.3 pp relative to total liabilities and 1.2 pp relative to total assets. Parents finance this support by borrowing 4.1% more from domestic banks and 15% more from domestic nonbanks. Affected subsidiaries do not receive more funding from other subsidiaries, nor do these subsidiaries lend more to the parent. Note that for each firm we only observe the total internal credit from other subsidiaries but not individual amounts from each individual subsidiary. Consistent with the increase in parent-level borrowing, parent PD and the weighted PD of the entire MNC rise when a subsidiary is exposed to a higher CCyB. Overall, these patterns indicate that CCyBs can generate international spillovers: when buffer levels are not aligned across countries, firms reallocate funds internally, causing macroprudential tightening to leak across borders.

Figure 2: Countries with a positive CCyB rate during 2013 to 2019.



The figure shows the levels of CCyB rates by country for the period 2013:Q3 to 2019:Q4, including all sample countries with a positive CCyB rate during the sample period. The CCyB is measured as a percentage of risk-weighted assets in the country where the CCyB is activated. Mandatory reciprocity applies, i.e., all banks must meet this capital requirement on their claims to borrowers in the respective country. The figure indicates each country using their ISO 3166-1 alpha-2 code. For an additional overview of CCyB rates implemented across countries see Appendix Table 1. Sources: ESRB, authors' compilation.

Figure 3: Number of Macroprudential Policy Tightening Measures in CCyB-affected vs -unaffected Countries over Time.



The figure shows the average number of tightening macroprudential policy measures in the countries which activated a CCyB (affected) or did not activate a CCyB (unaffected) during our sample period which ranges from 2013:Q1 until 2019:Q4. The following macroprudential measures are included: Countercyclical buffers (CCB), Capital requirements (Capital), Leverage limits (LVR), Loan loss provisions (LLP), Limits on credit growth (LCG), Loan restrictions (LoanR), Restrictions on foreign currency loans (LFC), Limits on the loan-to-value ratio (LTV), Limits on the debt-service-to-income or loan-to-income ratio (DSTI) and Limits on the loan-to-deposit ratio (LTD). Data source. iMaPP.

Table 1: The Effect of the CCyB on Bank Lending

The table shows in Panels A and B results for OLS regressions of the logarithm of bank-firm credit on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. Panel B excludes unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. Panel C shows regressions of an indicator variable for exit (columns (1) to (3)) and entry (columns (4) to (6)) at the bank-firm level on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. The indicator variable for the end of a bank-firm relationship is one in a quarter when a bank has no credit exposure to the firm but had an exposure in the prior four quarters and zero otherwise. The indicator variable for the start of a bank-firm relationship is one in a quarter when a bank has a new credit exposure to a firm and zero otherwise. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level.

Panel A. All subsidiaries

	(1)	(2)	(3)	(4)	(5)
CCyB rate (%)	-0.492**	-0.168***	-0.110**	-0.092**	-0.106**
	(-2.517)	(-3.722)	(-2.185)	(-2.185)	(-2.318)
FIXED EFFECTS					
Year:quarter	Yes	Yes	Yes	Yes	Yes
Firm	No	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	No	Yes	Yes	Yes
Lender	No	No	No	Yes	Yes
Lender x Year:quarter	No	No	No	No	Yes
Observations	32,073	32,073	32,073	32,073	32,073
Adj. R-squared	0.015	0.766	0.769	0.826	0.820

Panel B. Excluding unaffected subsidiaries with other affected subsidiaries in the MNC

	(1)	(2)	(3)	(4)	(5)
CCyB rate (%)	-0.572**	-0.183***	-0.128***	-0.094**	-0.121***
	(-2.489)	(-4.405)	(-3.142)	(-2.759)	(-3.295)
FIXED EFFECTS					
Year:quarter	Yes	Yes	Yes	Yes	Yes
Firm	No	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	No	Yes	Yes	Yes
Lender	No	No	No	Yes	Yes
Lender x Year:quarter	No	No	No	No	Yes
Observations	27,090	27,090	27,090	27,090	27,090
Adj. R-squared	0.008	0.778	0.780	0.829	0.824

Panel C. Extensive Margin

	Bank-Firm Relationship End			Bank-Firm Relationship Start		
	(1)	(2)	(3)	(4)	(5)	(6)
CCyB rate (%)	0.090***	0.026**	0.018***	-0.007	0.000	-0.003
	(10.069)	(2.665)	(2.814)	(-1.213)	(0.020)	(-0.853)
FIXED EFFECTS						
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
Firm	No	Yes	Yes	No	Yes	Yes
Industry x Year:quarter	No	No	Yes	No	No	Yes
Observations	177,367	177,367	177,367	177,367	177,367	177,367
Adj. R-squared	0.044	0.082	0.139	-0.008	0.010	0.045

Table 2: The Effect of the CCyB on Nonbank-lending

The table shows regression results of the logarithm of nonbank-firm credit on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. Columns (3) and (4) exclude unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB . The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level.

Nonbank Lending

	All subsidiaries		Excluding unaffected subsidiaries with other affected subsidiaries in the MNC	
	(1)	(2)	(3)	(4)
CCyB rate (%)	-0.011	-0.104	0.020	-0.079
	(-0.205)	(-1.567)	(0.256)	(-1.133)
FIXED EFFECTS				
Year:quarter	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry x Year:quarter	Yes	Yes	Yes	Yes
Lender	Yes	Yes	Yes	Yes
Lender x Year:quarter	No	Yes	No	Yes
Observations	14,550	14,550	12,681	12,681
Adj. R-squared	0.721	0.715	0.723	0.719

Table 3: The Effect of the CCyB on Debt Funding from the Parent

The table shows regression results of the logarithm of internal debt from the parent, the ratio of internal debt from the parent to total assets, and the ratio of internal debt from the parent to total liabilities on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. Panel B excludes unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level.

Panel A. All subsidiaries

	log(internal debt from parent)		internal debt from parent / total assets (%)		internal debt from parent / total liabilities (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
CCyB rate (%)	0.258***	0.363***	0.827*	1.237**	1.769**	2.284***
	(3.013)	(4.226)	(1.872)	(2.746)	(2.193)	(3.790)
FIXED EFFECTS						
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	Yes	No	Yes	No	Yes
Observations	25,887	25,887	25,887	25,887	25,887	25,887
Adj. R-squared	0.808	0.811	0.805	0.809	0.739	0.743

Panel B. Excluding unaffected subsidiaries with other affected subsidiaries in the MNC

	log(internal debt from parent)		internal debt from parent / total assets (%)		internal debt from parent / total liabilities (%)	
	(1)	(2)	(3)	(4)	(5)	(6)
CCyB rate (%)	0.299***	0.406***	0.939*	1.469**	2.456***	3.298***
	(3.497)	(3.354)	(2.063)	(2.557)	(3.524)	(5.216)
FIXED EFFECTS						
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	Yes	No	Yes	No	Yes
Observations	23,544	23,544	23,544	23,544	23,544	23,544
Adj. R-squared	0.806	0.809	0.802	0.806	0.738	0.743

Table 4: The Effect of the CCyB on Equity and Total Funding from the Parent

The table shows regression results of the logarithm of equity and total funding from the parent, defined as the sum of equity and debt funding from the parent, on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. Columns (3) and (4) exclude unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level.

Equity and Total Parent Funding

	All subsidiaries		Subsidiaries, excl. unaff. subs. with other affected subs. in the MNC	
	log(equity from parent)	log(total funding from parent)	log(equity from parent)	log(total funding from parent)
	(1)	(2)	(3)	(4)
CCyB rate (%)	0.129	0.174***	0.111	0.173***
	(1.599)	(3.293)	(1.365)	(3.087)
FIXED EFFECTS				
Year:quarter	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry x Year:quarter	Yes	Yes	Yes	Yes
Observations	25,887	25,887	23,544	23,544
Adj. R-squared	0.937	0.901	0.941	0.900

Table 5: The Effect of the CCyB on Total Liabilities and Probability of Default of Subsidiaries

The table shows in Panel A regression results of the logarithm of total liabilities, and the ratio of total liabilities to total assets on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. Columns (3) and (4) exclude unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. Panels B and C show regression results of the probability of default of bank borrowers on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. Panel C excludes unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level.

Panel A. Total Liabilities of Subsidiaries

	All subsidiaries		Subsidiaries, excl. unaff. subs. with other affected subs. in the MNC	
	log(liabilities)	liabilities/ total assets	log(liabilities)	liabilities/ total assets
	(1)	(2)	(3)	(4)
CCyB rate (%)	-0.018	0.452	-0.027	0.274
	(-0.422)	(0.352)	(-0.645)	(0.210)
FIXED EFFECTS				
Year:quarter	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry x Year:quarter	Yes	Yes	Yes	Yes
Observations	41,689	41,689	36,853	36,853
Adj. R-squared	0.927	0.913	0.927	0.913

Panel B. All subsidiaries

	Probability of Default				
	(1)	(2)	(3)	(4)	(5)
CCyB rate (%)	-0.051	0.020	0.042	0.040	0.020
	(-1.353)	(0.768)	(1.625)	(1.527)	(0.912)
FIXED EFFECTS					
Year:quarter	Yes	Yes	Yes	Yes	Yes
Firm	No	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	No	Yes	Yes	Yes
Lender	No	No	No	Yes	Yes
Lender x Year:quarter	No	No	No	No	Yes
Observations	32,073	32,073	32,073	32,073	32,073
Adj. R-squared	0.018	0.699	0.760	0.759	0.755

Panel C. Excluding unaffected subsidiaries with other affected subsidiaries in the MNC

	Probability of Default				
	(1)	(2)	(3)	(4)	(5)
CCyB rate (%)	-0.076**	0.018	0.051	0.049	0.023
	(-2.187)	(0.575)	(1.493)	(1.433)	(0.745)
FIXED EFFECTS					
Year:quarter	Yes	Yes	Yes	Yes	Yes
Firm	No	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	No	Yes	Yes	Yes
Lender	No	No	No	Yes	Yes
Lender x Year:quarter	No	No	No	No	Yes
Observations	27,090	27,090	27,090	27,090	27,090
Adj. R-squared	0.010	0.691	0.756	0.755	0.752

Table 6: Refinancing of Parents

The table shows regression results of the logarithm of bank-firm credit and nonbank-firm credit on an indicator variable which is one when a subsidiary of the MNC is located in a country with a CCyB and fixed effects, including only parents. Parent companies are based in Germany and accordingly have a zero CCyB over the sample period which ranges from 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the year:quarter level.

Refinancing of the Parent

	Bank lending		Nonbank lending	
	(1)	(2)	(3)	(4)
Parent with affected subsidiary	0.031**	0.041**	0.130***	0.150***
	(2.072)	(2.770)	(3.211)	(3.231)
FIXED EFFECTS				
Year:quarter	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry x Year:quarter	Yes	Yes	Yes	Yes
Lender	Yes	Yes	Yes	Yes
Lender x Year:quarter	No	Yes	No	Yes
Observations	123,893	123,893	28,556	28,556
Adj. R-squared	0.481	0.430	0.651	0.617

Table 7: Probability of Default of Parents

The table shows regression results of the probability of default on an indicator variable which is one when a subsidiary of the MNC is located in a country with a CCyB and fixed effects, including only parents. Parent companies are based in Germany and accordingly have a zero CCyB over the sample period which ranges from 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the year:quarter level.

PD of the Parent

	Probability of Default (bank lending)		Probability of Default (non-bank lending)	
	(1)	(2)	(3)	(4)
Parent with affected subsidiary	0.093**	0.091**	0.100***	0.102***
	(2.318)	(2.465)	(2.827)	(3.126)
FIXED EFFECTS				
Year:quarter	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry x Year:quarter	Yes	Yes	Yes	Yes
Lender	Yes	Yes	Yes	Yes
Lender x Year:quarter	No	Yes	No	Yes
Observations	123,893	123,893	28,556	28,556
Adj. R-squared	0.714	0.709	0.696	0.683

Table 8: The Aggregate Effect of the CCyB on Total Lending of MNCs

The table uses data aggregated to the lender-MNC-time level and shows regression results of the logarithm of bank-firm credit and nonbank-firm credit on an indicator variable which is one when a subsidiary of the MNC is located in a country with a CCyB and fixed effects. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the year:quarter level.

Credit to MNC

	Bank lending			Nonbank lending		
	(1)	(2)	(3)	(4)	(5)	(6)
MNC with affected subsidiary	0.052***	0.047***	0.052***	0.119***	0.150***	0.170***
	(3.153)	(3.138)	(3.325)	(3.420)	(5.897)	(6.091)
FIXED EFFECTS						
MNC	Yes	Yes	Yes	Yes	Yes	Yes
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
Lender	Yes	Yes	Yes	Yes	Yes	Yes
MNC x lender	No	Yes	Yes	No	Yes	Yes
Lender x Year:quarter	No	No	Yes	No	No	Yes
Observations	123,718	123,718	123,718	28,777	28,777	28,777
Adj. R-squared	0.206	0.815	0.805	0.420	0.893	0.893

Table 9: The Aggregate Effect of the CCyB on weighted Probability of Default of MNCs

The table uses data aggregated to the lender-MNC-time level and shows regression results of the weighted probability of default of all firms of an MNC on an indicator variable which is one when a subsidiary of the MNC is located in a country with a CCyB and fixed effects. The probability of default of firms of an MNC is weighted by firms' outstanding credit to a given lender. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the year:quarter level.

PD of MNC

	Probability of Default (bank lending)			Probability of Default (non-bank lending)		
	(1)	(2)		(3)		(4)
MNC with affected subsidiary	0.097***	0.086**	0.077**	0.099***	0.088**	0.093***
	(2.815)	(2.569)	(2.750)	(3.020)	(2.788)	(3.427)
FIXED EFFECTS						
MNC	Yes	Yes	Yes	Yes	Yes	Yes
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
Lender	Yes	Yes	Yes	Yes	Yes	Yes
MNC x lender	No	Yes	Yes	No	Yes	Yes
Lender x Year:quarter	No	No	Yes	No	No	Yes
Observations	123,718	123,718	123,718	28,777	28,777	28,777
Adj. R-squared	0.548	0.565	0.580	0.557	0.583	0.590

Table 10: Heterogeneities – Subsidiary Size and Parent Risk

The table shows in Panels C regression results of the logarithm of internal debt from the parent on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. The CCyB is interacted with one of three measures of relative subsidiary size with its MNC. These are (i) the ratio of total assets of the subsidiary relative to the total assets of all other subsidiaries of the same MNC, (ii.) the ratio of total assets of the subsidiary relative to the parent's total assets, and (iii.) the ratio of the turnover of the subsidiary relative to the parent's turnover. Columns (4) to (6) exclude unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. Panel B shows regression results of the logarithm of bank-firm credit and nonbank-firm credit on an indicator variable which is one when a subsidiary of the MNC is located in a country with a CCyB and fixed effects, including only parents. The indicator variable is additionally interacted with the probability of default of the parent in this quarter. In Panel C, the table uses data aggregated to the lender-MNC-time level and shows regression results of the logarithm of bank-MNC credit (columns (1) to (3)) and nonbank-MNC credit (columns (4) to (6)) on an indicator variable which is one when a subsidiary of the MNC is located in a country with a CCyB and fixed effects. The indicator variable is additionally interacted with the probability of default of the parent in this quarter. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level in Panel A, and at the year:quarter level in Panels B and C.

Panel A. Heterogeneity in Internal Funding by Relative Size of Subsidiary

	log(internal debt from parent)					
	All subsidiaries			Subsidiaries, excl. unaff, subs. with other affected subs. in the MNC		
	(1)	(2)	(3)	(4)	(5)	(6)
CCyB rate (%)	0.586***	0.379***	0.529***	0.649***	0.425***	0.596***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)
CCyB rate (%) * Total assets (subsidiary$_i$ / all subsidiaries)	-0.005**			-0.005***		
	(0.029)			(0.006)		
CCyB rate (%) * Total assets (subsidiary$_i$ / parent)		-0.001*			-0.001*	
		(0.068)			(0.070)	
CCyB rate (%) * Turnover (subsidiary$_i$ / parent)			-0.003**			-0.003**
			(0.031)			(0.040)
FIXED EFFECTS						
Time	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Industry x time	Yes	Yes	Yes	Yes	Yes	Yes
Observations	25,887	25,684	21,764	23,544	23,343	19,480
Adj. R-squared	0.811	0.810	0.805	0.809	0.808	0.803

Panel B. Refinancing of the Parent

	Bank lending		Nonbank lending	
	(1)	(2)	(3)	(4)
Parent with affected subsidiary	0.063***	0.076***	0.204***	0.204***
	(3.740)	(5.275)	(4.683)	(4.267)
Parent with affected subsidiary x PD parent	-0.094***	-0.103***	-0.154***	-0.111**
	(-4.119)	(-4.667)	(-2.939)	(-2.232)
FIXED EFFECTS & CONTROLS				
Base effect	Yes	Yes	Yes	Yes
Year:quarter	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes
Industry x Year:quarter	Yes	Yes	Yes	Yes
Lender	Yes	Yes	Yes	Yes
Lender x Year:quarter	No	Yes	No	Yes
Observations	123,893	123,893	28,556	28,556
Adj. R-squared	0.481	0.430	0.652	0.617
Economic Effect by PD parent				
10th percentile	5.322%	6.528%	18.871%	19.298%
50th percentile	3.997%	5.077%	16.102%	17.302%
Average	2.495%	3.431%	12.924%	15.012%
90th percentile	-2.200%	-1.714%	2.259%	7.324%
Percentile at which joint effect = zero	82.333%	84.551%	91.814%	96.715%

Panel C. Credit to MNC

	Bank lending			Nonbank lending		
	(1)	(2)	(3)	(4)	(5)	(6)
MNC with affected subsidiary	0.055***	0.065***	0.079***	0.164***	0.203***	0.208***
	(3.308)	(3.630)	(5.146)	(4.052)	(4.918)	(4.644)
MNC with affected subsidiary x PD parent	-0.095***	-0.101***	-0.110***	-0.171***	-0.151***	-0.109**
	(-3.590)	(-4.164)	(-4.856)	(-3.325)	(-2.990)	(-2.226)
FIXED EFFECTS						
Base effect	Yes	Yes	Yes	Yes	Yes	Yes
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
MNC	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
Lender	No	Yes	Yes	No	Yes	Yes
Lender x Year:quarter	No	No	Yes	No	No	Yes
Observations	123,882	123,882	123,882	28,553	28,553	28,553
Adj. R-squared	0.223	0.480	0.429	0.409	0.653	0.618

Table 11: Credit Demand vs. Supply

The table uses data aggregated to the bank-country-year:quarter level as in Table 8 and shows regression results of the logarithm of the credit volume of a given bank to firms in a given country on the level of the countercyclical capital buffer (CCyB) in percent, macroeconomic control variables, and fixed effects. The macroeconomic variables for each country are the unemployment rate, credit-to-GDP gap, 3 months money market rate, real annual GDP growth, and annual inflation. The sample period is 2013:Q1 to 2019:Q4. The data include all corporate non-financial borrowers of banks in Germany which are either a parent company in Germany or its subsidiaries abroad. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the bank and year:quarter level.

Credit volume of a bank in a given country - Fixed Effects Variations

	Bank lending					
	(1)	(2)	(3)	(4)	(5)	(6)
CCyB rate (%)	-1.358***	-1.286***	-1.029***	-0.623***	-0.105	0.114
	(-11.404)	(-11.958)	(-8.639)	(-5.812)	(-0.782)	(0.671)
FIXED EFFECTS & MACROECONOMIC CONTROL VARIABLES						
Year:quarter	No	Yes	Yes	Yes	Yes	Yes
Lender x Year:quarter	No	No	Yes	Yes	No	Yes
Macroeconomic Controls	No	No	No	Yes	Yes	Yes
Country	No	No	No	No	Yes	Yes
Observations	32,725	32,725	32,725	32,725	32,725	32,725
Adj. R-squared	0.044	0.074	0.285	0.466	0.359	0.656

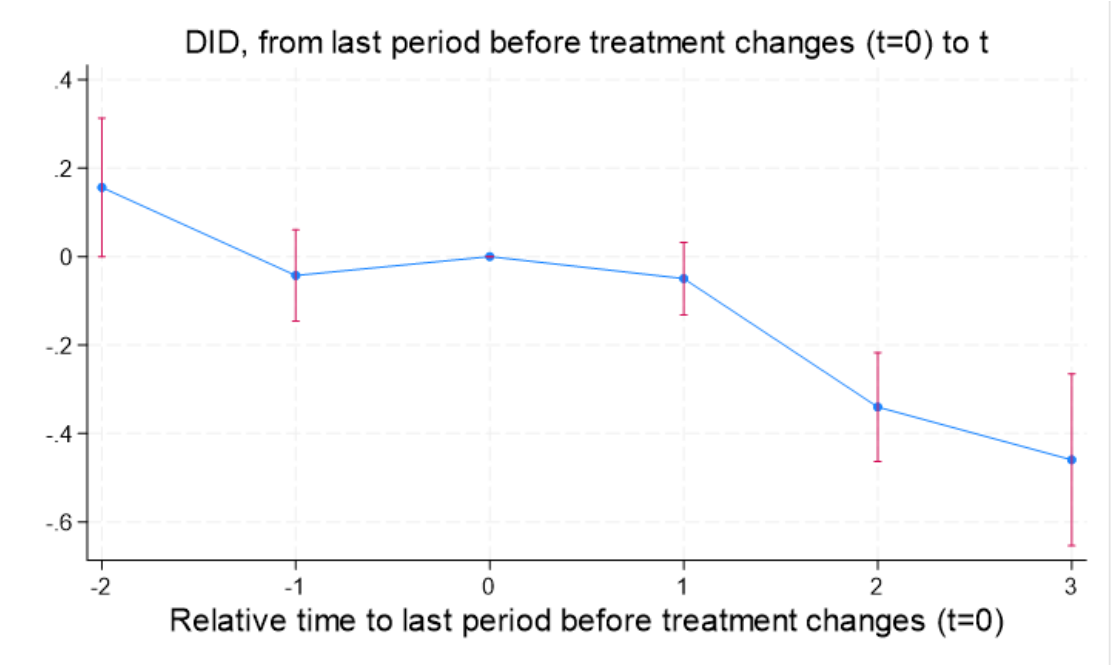
Table 12: Robustness - The Effect of the CCyB on Bank Lending

The table shows regression results of the logarithm of bank-firm credit on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, excluding unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. The sample period is indicated in the header of the columns. The first five columns include the period 2013:Q1 until 2015:Q2, where Norway was the only country which introduced the CCyB in 2015:Q2. Columns (6) and (7) include the period 2013:Q1 until 2016:Q4, where in addition to Norway only Sweden introduced the CCyB in 2015:Q3. Column (7) excludes all firms located in Sweden. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level. Panel B follows the approach suggested by de Chaisemartin and D'Haultfoeuille (2024) using their Stata code did_multiplegt_dyn.

Panel A. Including only Early Treated Countries

	Sample period						
	2013:Q1 to 2015:Q2					2013:Q1 to 2016:Q4	
							excl. Sweden
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CCyB rate (%)	-0.636***	-0.255***	-0.569***	-0.574***	-0.538***	-0.210**	-0.399***
	(-3.986)	(-7.325)	(-6.032)	(-6.237)	(-5.474)	(-2.223)	(-3.452)
FIXED EFFECTS							
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	No	Yes	Yes	Yes	Yes	Yes
Lender	No	No	No	Yes	Yes	Yes	Yes
Lender x Year:quarter	No	No	No	No	Yes	Yes	Yes
Observations	9,539	9,539	9,539	9,539	9,539	17,727	16,874
Adj. R-squared	-0.000	0.830	0.832	0.870	0.867	0.845	0.844

Panel B. Using the method of de Chaisemartin and D'Haultfoeuille (2024)



Appendix

Table A1: List of Sample Countries and their CCyB rates

The table shows the countries of firms in the sample, whether these countries activate the CCyB during 2013 to 2019, the maximum of the CCyB rate during the sample period, and the number of changes of the CCyB rate over this period. Source: ESRB website, authors' compilation.

Sample countries		activation of CCyB during 2013-2019	max. CCyB rate	# of CCyB rate changes
AT	Austria	no	--	--
BE	Belgium	no	--	--
BG	Bulgaria	yes	0.50%	1
CY	Cyprus	no	--	--
CZ	Czech Republic	yes	1.50%	4
DE	Germany	no	--	--
DK	Denmark	yes	1.00%	2
EE	Estonia	no	--	--
ES	Spain	no	--	--
FI	Finland	no	--	--
FR	France	yes	0.25%	1
GR	Greece	no	--	--
HR	Croatia	no	--	--
HU	Hungary	no	--	--
IE	Ireland	yes	1.00%	1
IS	Iceland	yes	1.75%	3
IT	Italy	no	--	--
LT	Lithuania	yes	1.00%	2
LU	Luxembourg	no	--	--
LV	Latvia	no	--	--
MT	Malta	no	--	--
NL	Netherlands	no	--	--
NO	Norway	yes	2.50%	4
PL	Poland	no	--	--
PT	Portugal	no	--	--
RO	Romania	no	--	--
SE	Sweden	yes	2.50%	4
SI	Slovenia	no	--	--
SK	Slovakia	yes	1.50%	3

Table A2: Summary Statistics

The table provides descriptive statistics of variables for the sample period 2013 to 2019. Data on bank and nonbank lending is in quarterly frequency, data on firms in annual frequency. All variables are winsorized at the 1st and 99th percentile.

Panel A. Number lenders	
Banks	1,075
Nonbanks	424
Total	1,499

Panel B. Number borrowers	
Subsidiaries	2,750
Parents	662
Total	3,412

Panel C. Number borrower-lender relationships

	Banks	Nonbanks	Total
Subsidiaries	4,079	2,262	6,341
Parents	9,322	2,372	11,694
Total	13,401	4,634	18,035

Panel D. All firms

	Obs	Mean	SD	p(5)	Median	p(95)
CCyB (%)	452,425	0.021	0.174	0	0	0.000
Credit (thd.)	393,124	6,543	11,502	34	2,220	32,013
PD (%)	393,124	0.463	0.497	0.067	0.282	1.549

Panel E. Subsidiaries

	Obs	Mean	SD	p(5)	Median	p(95)
CCyB (%)	80,750	0.118	0.397	0	0	1.250
Credit (thd.)	51,160	5,079	10,457	6	1,019	26,517
PD (%)	51,160	0.402	0.583	0.030	0.170	1.760
Internal Debt/Total Assets	51,160	20.106	22.341	0	12.758	68.572
Internal Debt from Parent/Total Assets	51,160	7.893	16.940	0	0	49.607

Panel F. Parents (min. one subsidiary in sample)

	Obs	Mean	SD	p(5)	Median	p(95)
CCyB (%)	143,495	0	0	0	0	0
Credit (thd.)	138,569	7,161	12,525	183	2,488	39,375
PD (%)	138,569	0.395	0.421	0.082	0.228	1.230
Number of Subsidiaries	143,495	3.396	8.014	1	1.571	3

Panel G. Variable descriptions

MNC	Multinational corporation, which consists of multiple firms.
Subsidiary	A company outside Germany which is part of an MNC and has a parent in Germany.
Parent	A company in Germany which is part of an MNC and has subsidiaries abroad.
Firm	An entity which is part of an MNC and can be either a parent or a subsidiary.
CCyB	The countercyclical capital buffer which applies to all bank-lending to firms located in the country where the CCyB is effective.
Credit	The amount of lending in € to a firm.
PD	The probability of default of a firm, calculated as the average over the individual PD estimates of all bank lenders to the firm in a given quarter.
Internal Debt	The internal lending between firms within an MNC.

Table A3: The Effect of the CCyB on Bank Lending at the Aggregate Level

The table uses data aggregated to the bank-country-year:quarter level and shows regression results of the logarithm of the credit volume of a given bank to firms in a given country on the level of the countercyclical capital buffer (CCyB) in percent in this country and fixed effects. The sample period is 2013:Q1 to 2019:Q4. The data include all corporate non-financial borrowers of banks in Germany which are either a parent company in Germany or its subsidiaries abroad. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the bank and year:quarter level.

Credit volume of a bank in a given country

	Bank lending			
	(1)	(2)	(3)	(4)
CCyB rate (%)	-1.244***	-1.207***	-0.960***	-0.927***
	(-9.978)	(-10.893)	(-8.747)	(-8.177)
FIXED EFFECTS				
Year:quarter	No	Yes	Yes	Yes
Lender	No	No	Yes	Yes
Lender x Year:quarter	No	No	No	Yes
Observations	36,282	36,282	36,282	36,282
Adj. R-squared	0.036	0.060	0.405	0.281

Table A4: The Effect of the CCyB on Internal Debt from other Subsidiaries

The table shows regression results of the logarithm of internal debt from other subsidiaries, the ratio of internal debt from other subsidiaries to total assets, and the ratio of internal debt from other subsidiaries to total liabilities on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, including only subsidiaries. Panel B excludes unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level.

Panel A. All subsidiaries

	log(internal debt from subsidiaries)		internal debt from subsidiaries / total assets		internal debt from subsidiaries / total liabilities	
	(1)	(2)	(3)	(4)	(5)	(6)
CCyB rate (%)	0.092	0.147	0.499	0.284	0.372	0.172
	(1.006)	(1.345)	(0.930)	(0.844)	(0.352)	(0.145)
FIXED EFFECTS						
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	Yes	No	Yes	No	Yes
Observations	25,878	25,878	25,878	25,878	25,878	25,878
Adj. R-squared	0.859	0.862	0.858	0.863	0.763	0.770

Panel B. Excluding unaffected subsidiaries with other affected subsidiaries in the MNC

	log(internal debt from subsidiaries)		internal debt from subsidiaries / total assets		internal debt from subsidiaries / total liabilities	
	(1)	(2)	(3)	(4)	(5)	(6)
CCyB rate (%)	0.093	0.161	0.414	0.305	0.569	0.855
	(0.925)	(1.327)	(0.765)	(0.835)	(0.598)	(0.777)
FIXED EFFECTS						
Year:quarter	Yes	Yes	Yes	Yes	Yes	Yes
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year:quarter	No	Yes	No	Yes	No	Yes
Observations	23,535	23,535	23,535	23,535	23,535	23,535
Adj. R-squared	0.853	0.856	0.857	0.862	0.767	0.775

Table A5: Refinancing of the Parent

The table shows regression results of the logarithm of the lending of a subsidiary to the parent on the level of the countercyclical capital buffer (CCyB) in percent and fixed effects, excluding unaffected subsidiaries with other subsidiaries in their MNC subject to a positive CCyB. The sample period is 2013:Q1 to 2019:Q4. The statistical significance of results is indicated by * = 10%-level, ** = 5%-level, and *** = 1%-level using heteroscedasticity-robust standard errors clustered at the firm-country and year:quarter level.

	Lending to parent from subsidiary	
	(1)	(2)
CCyB rate (%)	-0.061	0.014
	(-0.236)	(0.048)
FIXED EFFECTS		
Year:quarter	Yes	Yes
Firm	Yes	Yes
Industry x Year:quarter	No	Yes
Lender	No	No
Lender x Year:quarter	No	No
Observations	25,887	25,887
Adj. R-squared	0.774	0.783