Internal Capital Markets of Multinational Corporations Observed In Action

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Abstract

How do multinational corporations respond to macroprudential credit shocks abroad? We find that affected foreign subsidiaries, especially when credit constrained, substitute a decrease in bank credit with internal credit from their domestic parent company. The parent company funds this increase in internal financing with domestic bank credit as well as nonbank credit, at times even overborrowing and increasing its own risk. Hence credit shocks abroad may be redistributed internationally, negatively impacting lenders in other countries. The proactive financial redistributions that take place within multinational corporations through their internal capital markets are consequently a new and salient channel we identify.

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

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

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1 Introduction

How do multinational corporations (MNCs) respond to credit shocks abroad? More precisely, what is their overall financing response and correspondent internal financial redistribution? This is important as MNCs with entities located in different markets have the possibility to circumvent unfavorable financing conditions in one or more jurisdictions by borrowing in other jurisdictions and channel funds also across borders via their internal capital markets.

To empirically answer this salient question, we turn to a rich quasi-experimental setting. In particular, we analyze how MNCs respond to the many changes in the countercyclical capital buffer (CCyB) imposed abroad on one or many of its relationship banks.[1] While the impact of changes to bank capital requirements on bank versus nonbank corporate borrowing has been analyzed within the domestic context (e.g., Irani, Iyer, Meisenzahl and Peydró (2021); Bednarek, Briukhova, Ongena and von Westernhagen (2023)),[2] and the cross-border spillover effects of monetary and macroprudential policies have been documented for many countries (e.g., Baskaya, di Giovanni, Kalemli-Özcan, Peydro and Ulu (2017); Buch and Goldberg (2017)),[3] a comprehensive investigation of

[1] CCyBs were introduced in many countries after the global financial crisis (e.g., Cerutti, Claessens and Laeven (2017); Cerutti, Correa, Fiorentino and Segalla (2017)), with the goal of increasing bank resilience and thereby reducing procyclical bank lending. Its countercyclical design helps to moderate excessive credit expansion during credit cycle upswings and to support lending during downturns. Regulators incorporated the feature of mandatory reciprocity to prevent regulatory arbitrage through international bank lending. Reciprocation requires all banks to adhere to the capital requirement on exposures in the jurisdiction where the CCyB is activated. Accordingly, independent of lender location and entity type the same CCyB rate applies to all bank credit in this jurisdiction.

[2] Jiménez, Ongena, Peydró and Saurina (2017) study the impact of the introduction and subsequent modifications of a related macroprudential policy, i.e., dynamic provisioning in Spain, while Auer, Matyunina and Ongena (2022) study the compositional changes in the supply of credit by Swiss banks, following the activation in 2013 of the CCyB in Switzerland which targeted banks' exposure to residential mortgages (see also Basten (2020) and Behncke (2023)). 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) for example study how an increase in banks' capital requirements reduces banks' lending, and Gropp, Mosk, Ongena, Simac and Wix (2024) how it may affect bank capital ratio adjustments.

[3] 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

MNCs' financing response to shocks affecting (their) banks abroad seems entirely missing from the literature so far. This includes their borrowing from banks, nonbanks, and from internal capital markets, as well as the response in terms of the MNCs' refinancing itself and its impact on the risk of their relationship lenders.

We examine the activation and subsequent increases of CCyBs as a recurring shock that affects bank lending. Norway was the first country to activate a CCyB in 2015. Several countries followed and out of the 29 countries in our sample, one-third had a positive CCyB by the end of our observation period in 2019.[4] Important for our study is the principle of mandatory reciprocity of the CCyB. As mentioned previously, this rule is designed to prevent regulatory arbitrage and to mitigate potential international risk spillovers that could arise from banks trying to circumvent capital requirements by extending credit cross-border or through local branches.

For our analysis, we turn to a unique combination of data sets. We use credit register data containing quarterly information on German banks' and nonbanks' credit to individual corporate borrowers domestic as well as abroad. We augment the credit register data with information on borrowing firms, including detailed information on ownership structures, various balance sheet items, and, most importantly, the liability structure of firms, including internal debt. These detailed data are available for all subsidiaries of MNCs. We look at those MNCs with a main investor (parent) in Germany investing into firms outside Germany (subsidiaries). These data allow us to explore how bank and nonbank lending change in response to a (higher) CCyB, the resulting dynamics of internal capital markets within an MNC, as well as the related implications on lenders'

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.

[4] An immediate concern regarding such setting might be the staggered implementation with heterogeneity in treatment timing (e.g., Callaway and Sant'Anna (2021); Sun and Abraham (2021); Athey and Imbens (2022)) and the differential effects between early and later treated units (Goodman-Bacon (2021)). We address such concerns in robustness checks where we include only the period until 2015:Q2, when just Norway had activated the CCyB. We also investigate results for the period until 2016:Q4, when only Sweden additionally activated the CCyB (in 2015:Q3), in- and excluding all subsidiaries located in Sweden. Finally, we implement the method suggested in de Chaisemartin and D'Haultfœuille (2024). All results reported henceforth are confirmed.

risk taking. Our sample period starts after the global financial crisis in 2013 and ends in 2019 just prior to the pandemic.

We pursue our analyses at the *subsidiary, MNC,* and *system level*.

At the subsidiary level we investigate the impact of CCyBs on bank and nonbank credit volume to the subsidiaries which are based in countries with an active CCyB. The implementation and increase of a CCyB typically tends to increase banks' refinancing costs for the loans to these subsidiaries which can lead to higher lending rates.[5] We analyze data at the bank-firm-time level and compare only subsidiaries in countries with an activated CCyB to those in countries without an activated CCyB. Our results show that an increase in the CCyB causes subsidiaries to reduce their bank borrowings as, ceteris paribus, a higher capital requirement likely worsens the terms and conditions under which banks offer credit. In addition to the intensive margin we are also interested whether these results extend to the extensive margin. Specifically, we investigate the likelihood of a firm terminating its existing lending relationship with a bank in response to a change in CCyB. Our findings suggest that an increase in the CCyB increases the probability of a subsidiary discontinuing its borrowing from a particular bank.

In a third step, we also look at credit from nonbanks. Given that nonbanks are not subject to CCyBs, we hypothesize that changes in the CCyB should have no differential effect on firms' nonbank borrowings. Our results support this hypothesis for the firms in our study.[6]

[5] 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.

[6] 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.

At the multinational corporation level, and as mentioned previously, MNCs can circumvent unfavorable financing conditions in one jurisdiction by borrowing through firms in markets with lower frictions and levering their internal capital markets.

To shed light into these dynamics we start with taking a look at the borrowings of subsidiaries from their parent company. Importantly, the parent companies in our study are not subject to a positive CCyB as they are all are based in Germany which has no active CCyB during our sample period. Our results show that an increase in the CCyB in the country of a subsidiary implies an increase in internal borrowing from its parent company.[7] Specifically, a one percentage point (pp) higher CCyB is associated with an increase by 1.2 pp of the ratio of internal debt from the parent to the subsidiary's total assets, and a 2.3 pp increase in the ratio of internal debt from the parent to the subsidiary's total liabilities. This is a rather large effect as it equates to an increase of approximately one-third of debt from the parent company. Distinguishing subsidiaries further by their relative size in the MNC shows that especially more credit constrained subsidiaries obtain more credit from their parent company.

We also examine whether parents change their equity investment in affected subsidiaries in response to a higher CCyB but find no significant changes. In sum, parents provide more funding to affected subsidiaries in the form of increases in internal credit.

In the second part of the MNC level analysis, we ask whether the increase in internal funding from the parent fully offsets the decrease in bank credit to the subsidiary. In other words, we examine the degree of substitution between external bank credit and internal parent credit within a subsidiary. To do this, we assess the impact of CCyBs on the total liabilities of subsidiaries. Our results indicate that the increased provision of internal credit by the parent company fully compensates for the decrease in bank borrowing that emanates from the activation of CCyBs. This is also confirmed in further analyses on the probability of default (PD) of subsidiaries which show that subsidiaries' PD is not affected by higher CCyBs. Accordingly, the risk of firms which are part of an MNC does not change in response to changes in CCyBs in their jurisdiction.

In the last part of the MNC level analysis, we are interested in the more indirect effects of a change in CCyBs abroad. We investigate how parent companies refinance the

[7] We also investigate whether affected subsidiaries borrow internally from other, unaffected, subsidiaries but do not find this confirmed. The results are shown in Appendix A-3.

additional loans to their subsidiaries which are affected by changes in the CCyB in their country. As in our previous analyses, we examine both, bank and nonbank borrowings. Our results show that parent companies refinance the increase in internal lending to affected subsidiaries with more credit from both their domestic banks and nonbanks.[8] This suggests that the decrease in bank borrowing by affected subsidiaries is substituted with external borrowings of their parent companies. Our results indicate that a parent with a subsidiary located in a country with an active CCyB obtains 4.1% more bank and 15% more nonbank credit. We again also investigate the probability of default. Consistent with our results of increases in credit volume we find that the PD of parents increases for their banks and nonbanks by roughly 10 basis points which relates to an increase of about 25% compared to its average value.

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, not subject to a 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, ***at the system level*** we study the implications of these redistributions for both, MNCs and lenders, as well as the effects on overall financial stability. For this purpose, we first examine the total within-EU bank lending to MNCs. Given that affected subsidiaries receive less bank credit whereas parents with affected subsidiaries obtain more bank and nonbank credit, we would expect that aggregate nonbank lending increases for MNCs with affected subsidiaries. The aggregate effect on bank lending to MNCs is less clear.

Our findings show that a higher CCyB for relationship banks translates into a substantial shock to firms. Accordingly, parent companies might increase their precautionary cash holdings when their subsidiaries become affected by activated CCyBs to continue to ensure stable funding to their subsidiaries (e.g., Lins, Servaes and Tufano (2010)). Thus, the increase of parents' bank borrowings might even exceed the decrease of bank credit to affected subsidiaries. To test this, we aggregate the credit of all EU firms

[8] Appendix A-4 shows that they do not, however, obtain more credit from subsidiaries of the MNC.

of an MNC from a given lender. As a second measure for the broader implications of our results, we investigate the aggregate PD of MNCs. If there was an increase in aggregate borrowing for MNC with affected subsidiaries, we would also expect that the (weighted) risk of the MNC increases for lenders. We calculate the weighted PD of firms borrowing from a given lender using the individual credit volume from this lender to each firm of the MNC as weight.

Our results show that both, aggregate bank and nonbank borrowings, relatively increase for MNCs with subsidiaries domiciled in countries with activated CCyBs. Consistently, the weighted PD of these MNCs also increases for their lenders. This suggests that both total lending amount and risk increases for lenders due to the reallocation of credit within internal capital markets of MNCs in response to CCyBs in the countries abroad where subsidiaries are domiciled. Importantly, the lenders in our study are all based in Germany where no CCyB was activated during our observation period. The effect on MNCs' PD and bank borrowing indicates potential international spillover effects that might be relevant for financial stability. In case of MNCs, CCyBs can be sidestepped by rerouting loans through the parent company to affected subsidiaries, thus undermining the policy's intent to strengthen bank resilience. We acknowledge however that we are not able to draw conclusions regarding overall financial stability as our work focuses on MNCs and thus disregards effects stemming from single firms and their activities. A further descriptive comparison between countries with an active CCyB and with no active CCyB indicates that firms act rationally in obtaining precautionary funds to weather potential further future credit shocks to their subsidiaries, as countries with an active CCyB implement more macroprudential policies over time in general.

In the last part of the paper, we examine the dynamics of the internal reallocations of credit in more detail. We are specifically interested whether these are driven by lenders, borrowing firms, or both. Our previous result that nonbank credit to affected subsidiaries remains unaltered already suggests that supply-side factors may exert a lesser influence.

We start by investigating the supply of credit to parents. Our previous results have shown that the PD of parents with affected subsidiaries on average increases relative to other parent companies. We are now interested in whether banks in general shift risks to parent companies with affected subsidiaries. Such a finding would support a credit supply

channel as being relevant. Our results reveal that this is rather not the case as we find that riskier parent companies receive relatively less credit from both banks and nonbanks than safer parents. However, looking at the distribution of all parent PDs we observe that almost all parent companies increase their borrowing from banks as well as from nonbanks. These results suggest that the substitution of affected subsidiaries' bank borrowings with funding from their parents is heterogeneous and depends on the riskiness of their parent companies.

As a next step, we examine whether the smaller increase in credit to riskier parents also translates into less additional aggregate lending to the MNC. We find this confirmed. These results on both, individual parent as well as aggregate MNC credit from banks and nonbanks, suggest that lenders might play some role in the initial reallocation of credit by MNCs, but that credit demand seems to be the ultimate driver of our results. They also argue for riskier parents having less capacity to ensure stable funding for their subsidiaries compared to parent companies with lower PDs.

As another test of whether banks or firms are the driving force of the credit reallocations uncovered, we saturate the regressions at the bank-borrower country-time level with various sets of fixed effects together with macroeconomic control variables. Also in this setup, we observe that credit supply is not irrelevant but that changes in credit demand are mostly responsible for the effects we observe. These tests suggest that CCyBs abroad induce banks to lend less to the MNC`s affected subsidiaries (i.e., supply) but then this increases parent borrowings from banks and nonbanks (i.e., demand). The latter funds are then channeled back again by MNC to the affected subsidiaries using internal capital markets. Due to these reallocations of funds within MNCs and the resulting increased leverage and corresponding risk of parent companies, lenders' loan portfolio risk increases suggesting that macroprudential policy leaks through firms. Figure 1 summarizes the main results of our study regarding credit amounts for the different levels of analysis.

[*Figure 1 around here*]

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 indirect impact of the CCyB on

multinational corporations' adjustment of funding structures are discussed in Section 6. The *system* wide dynamics of credit reallocations are analyzed in Section 7. Robustness analyses are presented in Section 8 and Section 9 concludes.

2 Contributions to the Literature

2.1 Internal Capital Markets of MNCs

Our paper contributes to two strands of literature. First, we contribute to the literature on internal capital markets of MNCs. In general, firms tap internal capital markets to minimize their financing costs or tax burden by exploiting differences in international corporate tax rates (e.g., Mintz and Smart (2004); Buettner and Wamser (2013); and, for a meta study see Feld, Heckemeyer and Overesch (2013)), institutional quality, and financial development (e.g., Desai, Foley and Hines Jr. (2004); Aggarwal and Kyaw (2008); Egger, Keuschnigg, Merlo and Wamser (2014); Goldbach, Møen, Schindler, Schjelderup and Wamser (2021)). Our work relates to the latter studies, which examine how funding structures of MNCs change when they face external borrowing constraints.

External borrowing constraints are typically measured in terms of country or firm characteristics that are plausibly linked to the availability of external funding.[9] Desai, Foley and Hines Jr. (2004) for example find that foreign affiliates of U.S. MNCs increase their internal borrowing from the parent company to compensate for a reduction in external borrowing due to unfavorable capital market and legal conditions, as measured by the ratio of total bank loans to GDP and a creditor rights index. A study by Goldbach, Møen, Schindler, Schjelderup and Wamser (2021) shows that an increase in a survey-based credit constraint indicator is associated with less parental loans to affiliates of German MNCs. Dewaelheyns and Van Hulle (2010) find that for domestic business

[9] 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.

groups in Belgium, external borrowing at the subsidiary level declines with larger available resources in the internal capital market, proxied by group size and age. In contrast, as group leverage increases, to arguably minimize external borrowing costs, subsidiaries with more collateral increase their bank borrowing. Our results are consistent with these findings suggesting a high substitutability between external and internal debt.

Regarding the identification strategy, related to our analysis are studies that investigate the transmission of financial shocks within MNCs. Biermann and Huber (2024) for example study a credit supply shock to parents during the global financial crisis.[10] They find that subsidiaries provide internal funds to their affected parent, but became financially constrained themselves, and then experienced lower real growth. In a peculiar twist they find that managers were — their labeling — "Darwinist" with respect to international affiliates but "Socialist" in the home country, but that access to developed credit markets attenuated the real effects. In contrast to their setting, we study many exogenous credit shocks abroad (rather than one at home) and include nonbank credit in our analysis. Our findings suggest that internal capital flows are multidirectional and can even be "Socialist" with respect to subsidiaries. In general, internal capital markets seem not only an alternative when external borrowing is difficult, for example, due to underdeveloped capital markets or a credit supply shock resulting from a financial crisis, but also that even rather small changes in bank debt conditions result in changes of the funding strategy of affected MNCs.

We also provide new insights into how the increase in internal funds is refinanced and how this affects risk. Parent companies refinance the additional funds they provide to affected subsidiaries with both domestic bank and nonbank debt. Our results indicate that this on average increases the PD of parents and the weighted PD of the entire MNC and accordingly implies a leak of macroprudential policy through funding substitution within MNCs.

[10] 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.

2.2 Macroprudential Bank Capital Requirements

Indeed, as an addition to the literature on internal capital markets, we examine the role of national macroprudential bank capital requirements on the financing structures of multinational firms. The specific design of the CCyB as a broad-based capital requirement, that is unrelated to bank (and firm) characteristics, and its mandatory reciprocity by foreign banks provides us with a quasi-experimental setting as a CCyB affects the conditions for bank debt for some, but not all, subsidiaries of an MNC. This, together with our bank-firm level dataset, allows us to trace the adjustments in the funding mix of affected firms very granularly – distinguishing between bank and nonbank debt as well as internal funding through non-affected subsidiaries and/or parent companies.

In general, we thereby also add to the literature on the transmission mechanism of broad-based macroprudential capital requirements. The idea of the CCyB is to require banks to build up additional capital in normal times that can be used to absorb losses in a crisis. The extra loss absorption capacity due to the CCyB lowers the risk of procyclical lending cuts (e.g., Kashyap and Stein (2004); Repullo and Suarez (2013); Chen and Friedrich (2021)).

Our paper focuses on the pre-pandemic build-up phase of CCyBs and accordingly is linked to the literature on the impact of higher capital requirements on bank lending. Most papers tend to find negative volume effects, which are transitory (e.g., Peek and Rosengren (1995); Bridges, Gregory, Nielsen, Pezzini, Radia and Spaltro (2014); Behn, Haselmann and Wachtel (2016); Deli and Hasan (2017); Gropp, Mosk, Ongena and Wix (2019); Imbierowicz, Löffler and Vogel (2021); Gropp, Mosk, Ongena, Simac and Wix (2024)), but no unidirectional or only moderate risk-taking effects (e.g., Baena (2023); Couaillier and Henricot (2023)).

Some papers also analyze substitution effects of bank lending between banks that are affected by higher capital requirements and those which are not. For instance, De Jonghe, Dewachter and Ongena (2020) find that tighter bank specific capital requirements in Belgium lead to negative effects on their credit supply. Firms are not able to fully substitute the reduction in credit by borrowing more from banks with lower capital requirements. Also, for Spain Jiménez, Ongena, Peydró and Saurina (2017) document that in reaction to tighter provisioning requirements firms switch to less affected or unaffected banks. They also find important compositional effects in credit supply which

are related to risk. Partial credit substitution between affected und unaffected banks is also found by Aiyar, Calomiris, Hooley, Korniyenko and Wieladek (2014), Aiyar, Calomiris and Wieladek (2014a), Aiyar, Calomiris and Wieladek (2014b), and Fraisse, Lé and Thesmar (2019). Macroprudential leakage across country and/or financial sectoral boundaries is further discussed, modeled, and/or analyzed in Forbes (2019), Bengui and Bianchi (2022), Gebauer and Mazelis (2023), Krenz and Verma (2023), Hodula and Ngo (2024), Lin and Ouyang (2024) and Nikolov, Mendicino, Supera and Falasconi (2024).

However, in contrast to bank specific capital requirements the reciprocity rule of the CCyB ensures that all banks which lend to the country with the activated CCyB are equally affected, irrespective of whether banks are domestic or foreign. Therefore, within a country credit substitution, if any, should be lower. Chen and Friedrich (2021) for example investigate the impact of foreign CCyBs on cross-border lending of Canadian banks. They find that increases of foreign CCyB negatively affect Canadian banks' cross-border lending to the country activating the CCyB. This is in contrast to cases without reciprocity rules where international lending increases to countries with a tightening capital regulation which only applies to domestic banks as shown in Damar and Mordel (2017). In case of MNCs, our results, however, indicate sizable credit substitution effects even when capital requirements are broad-based. Affected affiliates offset the decline in (direct) borrowing from banks with non-CCyB affected bank and nonbank debt through their internal capital markets.

In addition to our results on lending adjustments, we document a channel for international risk spillovers by examining the impact of the CCyBs on banks' loan portfolio risk. In this regard, we add new insights to the international implications of macroprudential policies (see for instance Buch and Goldberg (2017) and European Central Bank (2020)).

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. For bank and nonbank lending to firms we rely on the MiMik (*Mikrodatenbank Millionenkredite*) database. The data include domestic as well as international loans on the lender-borrower level and in quarterly frequency. We focus on loans towards non-

financial private sector firms located in all EU27 countries as well as Iceland and Norway. We only consider lending relationships which exist at least for eight consecutive quarters (i.e., two years). Our data on borrower probability of default (PD) also derive from this database. To obtain the a firm's PD at a given point in time, we calculate the average of PD estimates across all lenders for this borrower in a given quarter.

For the borrowers in our sample, we augment these data with the MiDi (*Microdatabase Direct Investment*), which covers the universe of German firms' outward foreign direct investments (FDI). We identify those firms where the main investor is located in Germany (parent) and invests into firms outside Germany (subsidiaries). The MiDi dataset is based on annual balance sheet reports of subsidiaries and accordingly provides us with detailed information on asset and liability structures as well as several other characteristics such as the economic sector for each firm.

Crucial for our analysis is the detailed information on a firm's liability structure. For each subsidiary, we know the total amount of liabilities and how much of these liabilities are external, e.g., from banks, nonbanks, or bond holders, and how much are internal, e.g. from the parent company or other subsidiaries of the MNC. These data allow us to explore the dynamics of cross-border internal capital markets within an MNC and how they are put to use in reaction to changes in the CCyB in countries where subsidiaries are located. The dataset also includes information on the parent companies, such as their size or the number of employees. We use the MiDi data with end-of-year values.

Appendix Table A1 lists all countries where the firms in our sample are located together with information on CCyBs. Appendix Table A2 provides summary statistics on the number of lenders and borrowers, number of borrower-lender relationships, the distribution of CCyBs, lender-firm credit exposure and firm probability of default (PD) for all firms and split between subsidiaries and parents, and the composition of internal debt of subsidiary firms. It also includes a list of variable descriptions.

3.2 The Countercyclical Capital Buffer (CCyB)

The CCyB was introduced by many countries after the global financial crisis as an internationally agreed countercyclical capital requirement (Basel Committee on Banking Supervision (2010)). During normal and boom times, national authorities should increase the CCyB, requiring banks to build up an additional capital buffer above minimum

requirements, which can then be drawn down or released during periods of stress. The goal of the CCyB is to reduce procyclicality by enabling banks to absorb losses without cutting back lending in a downturn. The effectiveness of countercyclical capital requirements to stabilize banks' credit supply in a downturn and crises, for example, is documented by the European Central Bank (2022) and the Basel Committee on Banking Supervision (2022) and the literature cited in these reports. As a secondary objective, the CCyB might also help to contain excessive credit growth during the upswing of the credit cycle - although the impact on lending should be much smaller than in a crisis when banks are capital-constrained (see for example European Central Bank (2022) and Lang and Menno (2023)).

An important and defining feature of the CCyB is its mandatory reciprocity. This means that any CCyB set by a national regulator to banks' domestic exposures is to be reciprocated by banks operating from outside the perimeter of the regulating jurisdiction. This rule is to avoid regulatory arbitrage through the circumvention of capital requirements, for instance by international lending. Accordingly, a positive CCyB ratio applies to all bank exposures in the regulating jurisdiction, independent from where and by what kind of bank entity the exposures are issued. Thus, capital requirements on their international claims also depend on the level of the CCyB in the respective jurisdiction.

Figure 2 shows the development of the CCyB during our observation period from 2013:Q1 to 2019:Q4 for those countries in our sample with a positive CCyB. The data derive from the European Systemic Risk Board (ESRB) and CCyBs are included with their date of implementation. Figure 3 depicts the average number of macroprudential tightening events in addition to increases in CCyBs for countries which introduced a CCyB during our sample period and those that did not. The events include borrower based measures such as loan-to-value limits or other capital requirements. The data are taken from the Integrated Macroprudential Policy (iMaPP) database (Alam et al. (2019)).

[*Figures 2 and 3 around here*]

4 Methodology

4.1 Subsidiary Level

In order to explore the direct implications of CCyBs for firms, we start with investigating the differential effect of the CCyB rate on banks' international lending to subsidiaries at the lender-firm-time level. We estimate the following regression equation:

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

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

To control for changes in firm credit demand we include a set of firm-industry x year:quarter fixed effects $I_{i,t}$. These dummies proxy for firms' credit demand on a higher level than the individual firm (see, e.g., Jakovljević, Degryse and Ongena (2015); Degryse, De Jonghe, Jakovljevic, Mulier and Schepens (2019); Greenstone, Mas and Nguyen (2020); Berg, Reisinger and Streitz (2021)).

We are not able to include firm x year:quarter fixed effects (as in Khwaja and Mian (2008)) as these would not allow us to investigate the effects of the CCyB on a firm in a given country because the model would be fully saturated. 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 $I_{l,t}$ account for observable and unobservable time-varying factors at the lender level.

We also use regression equation (1) at the firm-time level to explore the implications of CCyBs on subsidiaries' internal debt, equity, total funding from the parent, and total liabilities. Finally, we also investigate the direct effect of the CCyB on borrower risk at the lender-firm-time level using the same regression setup.

We use two subsidiary samples in most parts of these analyses. The first includes all subsidiaries. The second relates to potential spillover effects within an MNC. It might be the case that lenders allocate credit to subsidiaries differently when one or more subsidiaries in the MNC are located in countries with an active CCyB. For example, a bank might lend more to unaffected and less to affected subsidiaries of the same MNC. Incorporating all of these subsidiaries might imply a bias as these indirect effects might

have an impact on the control group (of unaffected subsidiaries). We therefore also report all results for a second sample which excludes all subsidiaries with a zero CCyB where another subsidiary of the same MNC is subject to a positive CCyB.

4.2 Multinational Corporation Level

In the second part of our analysis, we explore the indirect implications of the CCyB on parents as well on the overall MNC. We start by exploring whether parents, that increase their lending to affected subsidiaries, obtain these funds from banks or nonbanks, or both. To do so we include all parents with foreign subsidiaries in our sample countries. Note that we have data on all investments of German parents into subsidiaries abroad but that these subsidiaries do not have to be borrowers of German lenders. Given that almost all (German) parents have at least one lending relationship with a (German) bank, it implies that we have a larger number of lending observations for parents available than for subsidiaries. We investigate versions of the following regression equation:

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

The specification is very comparable to equation (1), with the main difference that we estimate the external lending to parents and therefore use the indicator variable $I_{affected_p}$ to investigate the effect on a parent's borrowings. The variable is one for each parent *p* with at least one subsidiary in the same MNC located in a country with a positive CCyB. In addition to bank and nonbank lending to parents we also examine the lending from affected subsidiaries to the parent using the specification of equation (2). Comparable to subsidiaries, we also investigate the direct effect of the CCyB on parent risk at the lender-firm-time level using the same regression specification.

Next, we analyze the impact of the CCyB on the overall MNC. For this purpose, we aggregate our data at the lender-MNC-time level and split our analyses into bank and nonbank lenders. For loan amounts, we sum the credit a lender provides to each entity of the same MNC in a given quarter and use its logarithm. The risk of the overall MNC is calculated at the lender-MNC-time level by weighting the PD of each entity of an MNC by the loan amount obtained in the previous quarter from a given lender. We then estimate versions of the following regression equation:

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

The specification is again comparable to equation (1) but has the important differences that (i) the data is incorporated aggregated at the lender-MNC-time level, (ii) the indicator variable $I_{affected_{MNC}}$ is one for an MNC with at least one subsidiary domiciled in a country with a positive CCyB, and (iii) that MNC x lender fixed effects $I_{MNC,l}$ allow for an analysis of loan amounts and risk of an MNC for a given lender. In sum, we investigate changes in credit and risk of an MNC to a specific lender when one or more of the MNC's subsidiaries are located in a country with an activated CCyB. I_{MNC} are MNC fixed effects to control for time-invariant MNC-specific characteristics, and $I_{l,t}$ are again lender x year:quarter fixed effects.

4.3 System Level

Finally, we investigate the impact of parent risk heterogeneity to better understand whether the effects we uncover derive from changes in firms' credit demand or lenders' credit supply in response to changes in CCyBs. We use equation (3) and interact our indicator variable $I_{affected_{MNC}}$ with the probability of default of the parent in a given year:quarter.

In order to disentangle the demand versus supply implications of CCyBs, we investigate the differential effect of the CCyB rate on banks' international lending to subsidiaries at the bank-country-time level thereby varying the saturation with fixed effects as well as macroeconomic control variables:

$$Y_{l,c,t} = \beta * CCyB_{c,t} + I_{l,t} + I_{c} + \gamma * \Psi_{c,t} + \varepsilon_{l,c,t} \quad (4)$$

with $Y_{l,c,t}$ as the logarithm of the total credit exposure of lender l in country c in year:quarter t. $CCyB_{c,t}$ is the rate of the CCyB in country c in year:quarter t, and $I_{l,t}$ are lender x year:quarter fixed effects. As macroeconomic control variables $\Psi_{c,t}$ of country c in year:quarter t we employ the unemployment rate, credit-to-GDP gap, 3 months money market rate, real annual GDP growth, and annual inflation.

5 At the Subsidiary Level: The Direct Effects of the CCyB

The aim of the CCyB is to reduce procyclicality of bank lending. This implies that in an upturn of the financial cycle, an increase in the CCyB should increase the resilience of banks by requiring a higher capital cushion. In a crisis, the release of a previously built-

up CCyB increases banks' excess capital, which can be used to absorb losses without having to cut back lending too severely. Our sample period covers only the build-up phase of the CCyB in European countries until 2019. Therefore, our focus is on the effect of increases of CCyBs on international lending to nonfinancial firms, in our case subsidiaries of MNCs with parents and lenders domiciled in Germany.

5.1 Lending from Banks

We start by investigating the impact of increasing CCyBs on bank lending volume. Our sample includes German banks' lending relationships to all corporate borrowers of MNCs, where the latter consist of parent companies in Germany and subsidiaries abroad. Given that Germany did not introduce a CCyB during our sample period all parent companies are not subject to a positive CCyB. We therefore label parents and subsidiaries located in countries with no active CCyB as unaffected. Subsidiaries in countries with a positive CCyB are considered to be affected.

We account for firm heterogeneity and incorporate data at the bank-firm-time level. That is, we regress the logarithm of the credit volume a bank has issued to a specific firm in a given quarter on our variable *CCyB rate*. We increase the saturation with fixed effects across specifications. Ideally, we would like to include firm x year:quarter fixed effects to fully account for firm demand (as in Khwaja and Mian (2008)). However, this is not possible due to the lower granularity of our main independent variable which only varies at the country-time level. Instead we follow Degryse, De Jonghe, Jakovljevic, Mulier and Schepens (2019) and include industry x year:quarter and firm fixed effects in addition to the lender x year:quarter fixed effects.

As explained in the methodology section, we run our specifications for two samples of subsidiaries. The first includes all subsidiaries (Panel A) and the second excludes subsidiaries with a zero CCyB when another subsidiary of the same MNC has a positive CCyB (Panel B). We do the latter to account for a potential bias from within-MNC differences in bank lending due to CCyBs. Table 1 reports the results.

[*Table 1 around here*]

Both Panels A and B confirm the decreasing effect of larger CCyBs at the bank-firm level. Irrespective of the sample of included subsidiaries and the saturation with fixed effects, the coefficient of the CCyB rate is negative and significant in all regressions.

In general, Panel A shows that subsidiaries in a country where the CCyB is increased by 1 pp receive 10.6% less bank credit compared to subsidiaries domiciled in countries with no active CCyB. The effect is even stronger in Panel B with 12.1%, where we exclude subsidiaries with other subsidiaries with a positive CCyB in their MNC. This indicates that banks might consider firms and their idiosyncratic shocks to some extent also jointly at the overall MNC level, lowering the economic magnitude we observe in Panel A. Interestingly, in both Panels the economic magnitude of the coefficient does not change substantially over different saturation levels via fixed effects as soon as we control for time-invariant firm characteristics. This supports that CCyBs are set rather unrelated to specific characteristics of banks and/or firms in an economy but follow more aggregate measures such as the credit-to-GDP gap.

In Panel C of Table 1 we are interested in the extensive margin. In addition to the decrease in credit to affected subsidiaries, some bank-firm relationships might also be terminated in response to an increasing CCyB. To test this hypothesis, we define an indicator variable which is one in the quarter when a firm terminates a lending relationship with a given bank but had an active relationship in the previous four quarters, and zero otherwise. We also look at the start of relationships. We hypothesize that firms are less likely to start a new lending relationship with a given bank after the increase of the CCyB. We use an indicator variable which is one in the quarter prior to the start of a new firm-lender relationship of at least four consecutive quarters. Both indicator variables are regressed on the CCyB rate and fixed effects. Panel C confirms that our results also extend to the extensive margin. Firms are more likely to end an existing lending relationship with a given bank in response to a larger CCyB. However, columns (4) to (6) show that larger CCyBs do not have a differential impact on the start of lending relationships between firms and banks. Overall, these results confirm and extend our earlier finding that international lending to films in countries with an active CCyB decreases.

5.2 Lending from Nonbanks

In this section, we look at the impact of the CCyB on nonbank lending volume. Nonbanks are not subject to CCyB regulation changes. Accordingly, a change in CCyB in a given country should have no effect on the lending of nonbanks to firms in this country. All

nonbanks in our data are domiciled in Germany. One concern might be that nonbank lending to firms outside Germany might be negligible. However, our data show that nonbanks on average lend 11.2% internationally. This compares to 9.8% for banks and to an average of 10.1% for all lenders included in our data. There might be another aspect worth mentioning here. Changes in nonbank credit to affected subsidiaries could be related to either changes in nonbank credit supply or changes in firm credit demand. Nonbanks might substitute for the decrease in supply by banks, that is, they might respond to a change in credit supply by competitors which are affected by the CCyB. Alternatively, firm credit demand might change in response to a larger CCyB for their banks. If this was the case, we would expect that their total liabilities decrease. In contrast, if demand remains stable firms are potentially able to substitute the decrease in bank lending we observe in the previous subsection with other forms of credit where nonbank credit would only be one of these alternatives. Another one might be internal credit from other firms of their MNC, which we will investigate in the following subsection. Accordingly, to be able to interpret results in this section regarding demand and supply, we require deeper insights into firms' capital structure, which we provide in the following parts of the paper.

We use the same regression specification as in Panels A and B of Table 1 and again split the sample by including all subsidiaries, and excluding subsidiaries with zero CCyB where another subsidiary of the MNC is subject to a positive CCyB. The results are reported in Table 2.

[*Table 2 around here*]

Table 2 shows that nonbanks do not change their lending to firms in countries which increase the CCyB. In columns (1) and (2), we compare subsidiaries' borrowings from nonbanks in CCyB-countries with all other subsidiaries, in columns (3) and (4) only with subsidiaries where no other subsidiary of the MNC is domiciled in a country with an active CCyB. The saturation with fixed effects is the same as in columns (4) and (5) of Panels A and B in Table 1. Irrespective of the saturation and the sample, all coefficients are insignificant. It confirms that the lending of nonbanks to nonfinancial firms located in countries with an active CCyB is not differentially affected by increasing CCyBs compared with their general international lending.

5.3 Parent Capital Flows to Subsidiaries

The previous section shows that subsidiaries obtain roughly 10% less bank credit in response to a 1 pp increase of the CCyB in their country of location. In the first part of our analyses in this section, we therefore first examine whether affected subsidiaries borrow more from their parent company when the CCyB increases. As mentioned in the previous section, internal debt from other firms of the MNC is another alternative which might substitute for the decrease in bank credit.

Our data allow us to distinguish internal funding of subsidiaries through either the parent or via other subsidiaries of the MNC. We use data at the individual firm level and again split the sample by including all subsidiaries and excluding subsidiaries with zero CCyB where another subsidiary of the MNC is subject to a positive CCyB. We examine the impact of CCyBs on subsidiaries' internal debt received from their parent company and investigate three different dependent variables: 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. We thereby ensure that our results are not solely driven by changes in either firm size or firm leverage, or both. Comparable to our regressions before, we regress these dependent variables on our variable *CCyB rate*, which measures the level of the CCyB at this point in time in the country where a subsidiary is located, and different fixed effects. As regards our fixed effects, we control for firm invariant characteristics, as well as for time-varying factors at the firm-industry level in the more rigid specifications included in the even numbers of the table. Table 3 reports the results.

[*Table 3 around here*]

In all specifications, we find a positive and significant coefficient of the CCyB rate, suggesting that affected subsidiaries borrow more internal funds from their parent company. For instance, the results in column (6) indicate that subsidiaries in countries with a 1 pp higher CCyB fund themselves with a 2.3 pp relatively higher share of parental debt as a fraction of total liabilities. Here, again, the effect is somewhat stronger when the control group only includes subsidiaries of MNCs that have no further ties to other positive CCyB countries (Panel B). As another example, the results in column (4) of Table 3 relate to an increase of 15.7% relative to the average. We rerun these analyses also for

the internal funding from other subsidiaries but do not observe any significances.[11] This suggests that parents substitute the decrease in bank funding in response to a larger CCyB in the country where a subsidiary is located.

In Panel C, we are interested whether subsidiary characteristics matter for the provision of credit by parent companies in response to a decrease in bank credit. We investigate if relatively smaller and therefore potentially more credit constrained subsidiaries of an MNC obtain more credit from their parent company (e.g., Fazzari, Hubbard and Petersen (1988); Carpenter, Fazzari and Petersen (1998); Gertler and Gilchrist (1994); Kashyap, Lamont and Stein (1994)). We calculate the relative size of a subsidiary using three different measures: (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. In doing so, we are able to distinguish between subsidiaries' relative credit constraints within their MNC.[12] We interact these measures of subsidiaries' relative size with our main independent variable *CCyB* and use the same specification as in column (2) of Panels A and B, again splitting the sample by including all subsidiaries (columns (1) to (3)) and excluding subsidiaries with zero CCyB where another subsidiary of the MNC is subject to a positive CCyB (columns (4) to (6).

All coefficients of the interaction term show that relatively smaller subsidiaries obtain more internal credit from their parent companies in response to a larger CCyB in their country. This confirms that parents provide internal credit to their subsidiaries depending on the latter's credit constraints within their MNC.

In the last part of our analyses on parent funding to subsidiaries, we investigate whether parents also provide more equity to their subsidiaries when the CCyB increases for their banks. It might be the case that parents substitute the decrease in bank credit not

[11] We report the results in Appendix Table A3.

[12] 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 large in total size but relatively small 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.

only with debt but also with additional equity. Furthermore, we also investigate the total change in funding to affected subsidiaries. Total funding from parents is calculated as internal debt plus equity investment of the parent. Panel D shows the results. It confirms in both columns (1) and (3) that parents do not differentially change their equity investment in affected subsidiaries. Accordingly, firms domiciled in countries with an increasing CCyB substitute the decrease in bank credit only with an increase in internal debt from their parents.[13] Columns (2) and (4) illustrate that the increase in total parent funding in response to a 1 pp larger CCyB is around 17%. In the next section, we investigate whether parent credit only partially or even fully substitutes for bank credit and the related implications for the riskiness of subsidiaries.

5.4 Firm Risk

In this part of our analyses, we are interested in the degree of substitution of bank credit with parental debt and the corresponding risk of subsidiaries. That is, we ask whether parents on average only partly or even fully substitute the decrease of bank credit for affected subsidiaries. We use the logarithm of subsidiaries' total liabilities as well as their total liabilities as a fraction of total assets as dependent variables and regress these again on our variable *CCyB rate* and fixed effects. Given that we neither observe changes in other external or internal credit nor in equity, the change in total liabilities in response to an increasing CCyB gives an indication for the rate of substitution between bank and parent credit.

Table 4 shows in Panel A the regression results for the overall impact of the CCyB on affected subsidiaries' total debt relative to unaffected subsidiaries.

[*Table 4 around here*]

The coefficient of our main dependent variable *CCyB rate* does not reveal any significant effect of the CCyB on the overall leverage of affected subsidiaries. Irrespective of whether we compare affected subsidiaries with all other subsidiaries (columns (1) and (2)) or only with subsidiaries of MNCs that have no other subsidiaries located in countries with a positive CCyB (columns (3) and (4)), or whether we investigate the total volume

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

of liabilities (columns (1) and (3)) or their value as a fraction of total assets (columns (2) and (4)), a larger CCyB on average does not differentially change the total liabilities of firms. These findings indicate that funding through internal capital markets from parents fully compensates for the decline in international bank funding in response to an increase of the CCyB. Note that the impact of the CCyB on real effects are not clear. Firms' leverage remains constant compared with other subsidiaries in countries with no change in CCyB. However, the change in leverage and therefore also in real effects within a country might be different as firms which are not part of an MNC might not have the same opportunities to substitute a decrease in bank credit. Regarding banks, though, the CCyB seems to improve the loss absorption capacity of the banking system. So far, our results suggest that the CCyB leads banks to reduce their lending to affected subsidiaries.

Our findings on leverage should also translate to the probability of default (PD) of subsidiaries. We hypothesize that the PD of affected subsidiaries remains stable as we only observe a change in lender but not in the total amount of credit, as external bank credit is fully substituted with internal parent credit and no other parts of the capital structure of affected subsidiaries are differentially affected. In line with our previous regression specifications, we test this in Table 4 by regressing the PD of subsidiaries on our variable *CCyB rate* and fixed effects including again all subsidiaries (Panel B) and only subsidiaries of MNCs that have no other subsidiaries located in countries with a positive CCyB (Panel C). In all but the least saturated specification in Panel C we find that the PD of subsidiaries does not change differentially in response to a larger CCyB. This is in line with our results on leverage and confirms a full substitution of bank credit by internal parent credit. It also implies that banks decrease their exposure to firms in countries with an increasing CCyB but that the PD of these firms remains the same as their leverage does not change.

To summarize the findings in this section on the direct effects of the CCyB at the subsidiary level, we observe that increasing CCyBs imply a decrease in bank lending while nonbank lending remains unchanged. These results are in line with the intention of the CCyB reciprocation mechanism aiming to ensure an international level playing field. Importantly, however, our results on internal credit from parents to affected subsidiaries indicate that there are additional, indirect, effects which should also be considered. We therefore next turn to the parent companies located in Germany, with no positive CCyB

during our sample period, to analyze indirect effects of a change in CCyBs for their subsidiaries abroad.

6 At the Multinational Corporation Level: The Indirect Effects of the CCyB on Parents and the MNC

In the second part of our analysis, we investigate the more indirect effects of CCyBs. As mentioned before, the aim of the CCyB is to reduce procyclicality of bank lending. Yet, this applies only nationally, i.e., only to the country of a firm where the CCyB is changed. However, as our previous results on credit substitution by parents already indicate, a larger CCyB in one country might also have implications for other firms despite a zero CCyB in their country of location. In this part, we therefore first ask where the additional funds parent companies provide to their affected subsidiaries derive from and what this means for the riskiness of parents. And second, we look into the overall effect of these additional funds on MNC borrowings and risk. By analyzing the redistribution of funds within the MNC network and the adjustment of external funding of MNCs we want to shed light on whether there are leakages in national CCyB regulation through multinational firms when the latter have access to internal capital markets.

6.1 Bank and Nonbank Lending and Parent Risk

In this section, we are interested in the external funding sources of the additional funding the parents provide to their affected subsidiaries. The aim is to examine how parent companies refinance the increase in internal lending to their affected subsidiaries. The parent companies in our sample are all located in Germany which did not introduce a CCyB until the end of our sample period. In these analyses, we are able to rely on the intersection of the population of parents borrowing from German banks and the population of German parents of MNC. This implies a much larger data sample on external borrowing from banks and nonbanks than in the previous section, as most German parents borrow from at last one German lender, in contrast to their subsidiaries abroad. Comparable to our earlier analyses at the lender-firm-time level, we use the logarithm of bank credit and nonbank credit to a parent company as dependent variables. We regress these on an indicator variable *Parent with affected subsidiary* which is one when a parent has a subsidiary with a positive CCyB in its MNC and zero otherwise, and

the same set of fixed effects as in our two most rigid specifications in Tables 1 and 2. Table 5 shows the results.

[*Table 5 around here*]

Panel A confirms that parents of subsidiaries located in countries with a positive CCyB obtain relatively more external funding both from banks (columns (1) and (2)) and from nonbanks (columns (3) and (4)). Bank lending relatively increases by 4.1%, nonbank lending by 15%. In further tests, we also investigate whether parents obtain more internal debt from subsidiaries but do not find this confirmed.[14] Taken together, our results show that affected subsidiaries borrow more from their parents while these parents obtain more funding from both banks and nonbanks to provide these funds.

In Panel B, we again employ data at the lender-firm level and investigate the impact of the increase of bank and nonbank lending on the PD of parents. Using again our two most rigid specifications and parents' PD as dependent variable, we observe that a subsidiary with a positive CCyB implies a larger parent PD. With a coefficient of 0.091 for banks and 0.102 for nonbanks, the effect relates to a larger PD of roughly 25% compared to the mean (which is 40 basis points). It confirms that the increase in external credit results in higher risk for parents. This indicates that larger CCyBs do not only impact the firms in a country with a positive CCyB directly but might also have an effect on other firms of MNCs, which are not located in this country, such as is the case for the parent companies in our sample. Accordingly, the increase of the CCyB in one country might imply spillover effects to other countries when the two differ in their level of CCyBs. It provides empirical evidence for a leakage of macroprudential policy through a reallocation of funding within MNCs.

6.2 Bank and Nonbank Lending and MNC Risk

Our results in the previous sections show that banks in Germany decrease lending to firms in countries with a larger CCyB whereas nonbank lending does not differentially change. We also observe that parents fully substitute the decrease of bank credit to their affected

[14] The results are shown in Appendix Table A4. 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.

subsidiaries with internal credit, financed by increasing their borrowings from banks and nonbanks in Germany, which implies an increase of parents' risk. In this section, we are interested in the broader implications of these findings for the entire MNC and its lenders.

We first analyze the total amount of bank and nonbank credit for all firms of an MNC at the lender-MNC level. To do so, we sum the amount of credit of a given lender to all firms of the same MNC in each quarter. Given our earlier results, the lending of nonbanks to the entire MNC should be larger after increases of CCyBs as it does not differentially change for affected subsidiaries but increases for parents with an affected subsidiary. The effect of increasing CCyBs on bank lending to the overall MNC is less clear. We observe that bank credit to affected subsidiaries decreases but also that it increases to the parents of these subsidiaries. Accordingly, there are three possibilities. First, it might be the case that parents use excess funds together with new bank borrowing to be able to substitute the decrease in bank credit to their affected subsidiaries. This would imply that total bank lending to the MNC decreases. Alternatively, parents might act precautionary in response to the shock of unexpected increases in CCyBs to parts of the MNC. In general, firms hold cash to hedge against future cash flow shocks (Lins, Servaes and Tufano (2010)). Accordingly, parents might even borrow in excess of the decrease in bank credit to affected subsidiaries to build up precautionary funds in expectation of potential further future shocks to parts of their MNC. This assumes that they plan to keep compensating decreases in bank credit to subsidiaries also in the future. It would imply that total bank lending to the MNC increases. The third alternative is simply that bank lending to MNC with affected subsidiaries does not change differentially as parents only borrow the exact amount to fully substitute the decrease in bank credit to their affected subsidiaries.

To test this, we aggregate our data to the lender-MNC level and investigate the change in lending within a given lender-MNC relationship. We are specifically interested whether the same lender changes the lending to the same MNC in response to increasing CCyBs. Table 6 shows the results.

[*Table 6 around here*]

Panel A confirms that both aggregate bank and nonbank borrowings relatively increase for MNC with subsidiaries domiciled in countries with activated CCyBs. This is in line with our hypothesis that parents borrow for two reasons. First, they obtain

additional funds to be able to substitute the decrease in band lending to their affected subsidiaries. And second, they build precautionary buffers as a hedge against potential further future shocks to parts of their MNC. Overall, nonbank credit increases by 15.6% compared to MNC with no affected subsidiaries while bank borrowing relatively increases by 5.2%.

To provide further confidence in these results, we also investigate the risk of MNCs. We calculate the weighted PD of firms borrowing from a given lender using the individual credit volume from this lender of each firm of the MNC as weight. Panel B confirms that the increase in bank and nonbank credit to MNCs with affected subsidiaries also translates into higher total MNC risk. The weighted PD of MNC increases by 7.8 basis points (bps) for banks and even 9.3 bps for nonbanks what is substantial as it relates to an increase of about 20% compared to their mean value. This suggests that overall risk increases for lenders due to the reallocation of credit within internal capital markets of an MNC in response to CCyBs in other countries where its subsidiaries are located. Given that all lenders in our sample are domiciled in a country with no active CCyB in our sample period, it indicates potential spillover effects regarding financial stability due to credit reallocations within MNCs.

Finally, we are interested whether the precautionary additional borrowings of parents are rational. To do so, we calculate the number of overall macroprudential policy tightening events, linked to capital requirements or credit supply restrictions, in a given country over time based on data from iMaPP.[15] We thereby try to measure the expectations of parents related to their precautionary borrowings. The introduction of a CCyB in the country where a subsidiary is domiciled might be a signal that the country will implement a stricter macroprudential policy in general also in the future. We compare the average number of macroprudential policies between countries which introduced a CCyB during our sample period and those that did not in Figure 3.

[*Figure 3 around here*]

Figure 3 shows that countries with a CCyB introduce more macroprudential policies over time. While this is only descriptive evidence, it supports the notion that

[15] IMF Macroprudential Database. 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.

parents do not borrow irrationally in response to CCyB in the countries of their subsidiaries but that the precautionary borrowings relate to rather reasonable expectations on the likely future macroprudential stance.

7 At the System Level: The Dynamics of Credit Reallocation

In the third and last part of our analysis, we examine the dynamics of the reallocations of credit in more detail. We are specifically interested whether these are driven by lenders, borrowing firms, or both. Our previous results have shown that nonbanks do not seem to change their supply of credit to affected subsidiaries despite the decrease of credit by banks. While of course supply effects cannot be ruled out, the increase in internal debt from the parent instead of nonbank credit is already suggestive that demand factors might be more important. We therefore investigate in this section whether banks shift risks to parents as another test of whether supply is the more dominating factor. We repeat these analyses also on the MNC level. Finally, we aggregate our data to the bank-country-time level and employ various sets of fixed effects to be able to distinguish between demand and supply factors.

7.1 Bank and Nonbank Lending by Parent Risk

The increase in CCyBs for some firms might induce lenders to shift risks between different parts within an MNC. As an example, an increase in CCyB in a country increases a bank's cost of capital as it requires either increasing its capital ratio or decreasing its excess capital ratio, or both. A bank which has lending relationships with several firms of an MNC might therefore actively approach subsidiaries located in this country and suggest borrowing in other countries and internally transfer the funds. This would keep both credit exposure to the entire MNC as well as capital requirements stable. Abstracting from precautionary motives of the MNC, our results would be supporting these conjectures. However, an underlying assumption is that banks do so irrespective of the risk of firms. Accordingly, if credit supply would be the driving force behind our results, we would expect that banks increase their lending to parents in response to increasing CCyBs for some of their subsidiaries irrespective of the risk of parents. We test this in the following on the parent as well as on the MNC level.

We investigate the lending of banks and nonbanks to both parents (Panel A) and to the entire MNC (Panel B) comparable to Tables 5 and 6 and use the two most saturated regression specifications from Panel A of both. We additionally interact our main independent variable with the PD of the parent. If banks were to shift risks we would expect the interaction term in both Panels to be insignificant. Table 7 shows the results.

[*Table 7 around here*]

Our results do not confirm a general shifting of risks by banks. The interaction term is significant and negative in all specifications in both Panels. This shows that banks provide less credit to riskier parents. However, it is important to also account for the total effect of the main independent variable and its interaction term with parent PD. In Panel A, we observe in the respective most saturated specification that parents with a zero PD receive 7.6% more bank and 20.4% more nonbank credit when a subsidiary of the MNC is located in a country with an active CCyB. Importantly, as Appendix Table A2 shows, the average PD of parents with at least one subsidiary in our sample is 0.395% with a median of only 0.228%. Accordingly, parents in our sample are in general not very risky. This also implies that the negative effect of the interaction term in many cases does not outweigh the base effect of our indicator variable *Parent with affected subsidiary*. We provide the total economic effect at the bottom of Panel A for the 10^{th} and the 90^{th} percentile as well as the mean and median. Furthermore, we also show the percentile of parents' PD which results in a joint effect of zero. These statistics show that irrespective of the regression specification, more than 80% of parents obtain more bank credit. Accordingly, while banks do not seem to shift risks in general, it cannot entirely be ruled out.

In Panel B, we look at the aggregate MNC-lender perspective. These analyses account for the possibility that lenders might trade-off parent with subsidiary risk. As an example, lenders might lend to risky parents but only when their subsidiaries are of lower risk. This would bias our results in Panel A. In contrast, investigating the effect of increasing CCyBs at the MNC level conditional on parent risk helps addressing this concern as we should expect to find no significant effect on the MNC level in this case because less lending to riskier parents would be balanced with more lending to less risky subsidiaries. Nevertheless, Panel B shows very comparable results to Panel A. Both banks and nonbanks lend relatively less to MNC with riskier parents what rejects the hypothesis

that lenders generally shift risks in response to increasing CCyBs. This again supports that bank credit demand seems to be the more relevant factor behind our earlier findings on credit redistributions of MNCs.

7.2 Demand vs. Supply

Now, we try to understand the more aggregate effects of increasing CCyBs on bank's lending abroad and use our data at the bank-country-time level. That is, we calculate the total lending amount of a bank towards firms of MNCs in a specific country in a given quarter and regress its logarithm on the variable *CCyB rate*, which measures the level of the CCyB in this country at this point in time in percent, and fixed effects. Our definition of the variable *CCyB rate* and the regression specification is analogous to a staggered difference-in-differences estimation with heterogeneous treatment.[16] The results are shown in Table 8.

[*Table 8 around here*]

Table 8 shows that a larger CCyB rate in a given country implies a relative decrease in international bank credit to firms located in this country. Including more granular fixed effects in columns (2) to (4) slightly reduces the economic effect which nevertheless remains large and statistically strong also in the most rigid specification in column (4) with a t-value of the estimated coefficient of 8.177. An increase of the CCyB of 1 pp in a given country relates to a decrease of roughly one-third of a standard deviation of a banks' lending to this country.

However, the previous sections indicate that credit demand (by the parent) is a relevant force of the credit reallocations we observe. In this section, we therefore further saturate our main regression with various levels of fixed effects comparable to, e.g., Berg, Reisinger and Streitz (2021) to distinguish better between supply and demand. For this purpose, we use our regressions at the aggregate level as in Table 8 to rule out potential noise due to idiosyncratic firm factors. One caveat is that our main independent variable *CCyB rate* only varies at the country-time level. This implies that we are not able to include country x time fixed effects in the aggregate regressions. In this section, to be

[16] We provide further robustness tests regarding this regression specification below in the robustness section.

able to better proxy for credit demand, we therefore additionally incorporate macroeconomic control variables. These are the unemployment rate, credit-to-GDP gap, three months money market rate, real annual GDP growth, and annualized inflation. We require comparability of all variables between all countries in our sample what reduces the sample size to some extent as not all of these variables are available in the same form for all countries in our sample. We account for credit supply by including Lender x Year:quarter fixed effects and for demand using macroeconomic variables and country fixed effects. For comparison, we also show the model with no fixed effects. The results are reported in Table 9.

[*Table 9 around here*]

Column (1) of Table 9, which does not include any fixed effects, shows a coefficient of -1.358 what increases to -1.286 when adding Year:quarter fixed effects in column (2). The almost unchanged coefficient and only small increase in adjusted R-Squared indicates that time-varying factors seem to be less relevant for the effects we uncover. Compared with our results in Table 8, columns (1) and (2) of Table 9 show that effects are slightly stronger in size and slightly weaker in significance, but overall rather comparable for the slightly reduced sample with consistent macroeconomic variables. In column (3), we also include Lender x Year:quarter fixed effects to investigate the impact of credit supply on changes in lending in response to increasing CCyBs. Interestingly, the coefficient does not change much suggesting again that credit supply is a less relevant factor for our results. This changes substantially when including variables which partly account for credit demand. We start with only adding macroeconomic variables. Column (4) shows that they increase the coefficient to -0.623. This is an increase much stronger than when only including supply side factors. In column (5) we only account for credit demand and include country fixed effects (column (5)) together with macroeconomic variables. The insignificant coefficient reveals that firm demand is indeed the main driver behind our results. This is also reflected in the substantial increase in the adjusted R-squared. Compared with 28.5% in column (3) where we account for credit supply the adjusted R-squared is 35.9% when accounting for only credit demand. This strongly suggests that the effects we uncover in our study are mostly related to demand side effects. The coefficient remains insignificant when accounting for both demand and supply in column (6).

Overall, the tests combined strongly suggest that increasing CCyBs abroad induce substantial changes in the demand of credit for MNCs, which result in less bank borrowings of affected subsidiaries and increased parent borrowings from banks (and nonbanks). The latter funds are then channeled back again to the affected subsidiaries using internal capital markets which in the end may moderate their demand for external credit. Due to these reallocations of capital by MNC and precautionary hoarding of funds, lenders' loan portfolio risk increases suggesting that macroprudential policy "leaks through firms".

8 Robustness

The literature on difference-in-differences estimation has recently evolved substantially. One concern regarding our statistical test might be the setup of a staggered and heterogeneous treatment (e.g., Callaway and Sant'Anna (2021); Sun and Abraham (2021); Athey and Imbens (2022)) and differential effects between early and later treated units (Goodman-Bacon (2021)). We address this potential concern by rather simple but also very intuitive tests together with the approach introduced in de Chaisemartin and D'Haultfœuille (2024).

Figure 2 shows that Norway was the first country to implement the CCyB on June 30th, 2015. Until the end of 2016, only Sweden additionally introduced the CCyB on September 13th, 2015. Given that we incorporate quarterly data, in a first test we only include the period until 2015:Q2. This implies that only firms located in Norway become subject to the CCyB in the last quarter of this sample period.[17] We rerun our regressions from Panel B of Table 1 using credit from banks to subsidiaries and only include subsidiaries with no other subsidiary with a positive CCyB in their MNC. Table 10 reports the results.

[*Table 10 around here*]

[17] 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 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.

Columns (1) to (5) replicate Panel B of Table 1 for the period 2013:Q1 until 2015:Q2. It confirms our result that a larger CCyB implies less international lending to affected subsidiaries. As another test, we prolong this observation period until 2016:Q4 and both estimate the most rigid specification (from column (5)) including (column (6)) and excluding (column (7)) subsidiaries located in Sweden. Both Norway and Sweden increased their CCyB further in June 2016. Accordingly, column (6) includes only the two first treated countries where column (7) implies that only firms in one country are treated and effects are compared to all other countries with a zero CCyB. Irrespective of these choices, the main result is again confirmed.

Finally, we implement the method by de Chaisemartin and D'Haultfœuille (2024) using their Stata estimation command *did_multiplegt_dyn*. The method allows for a non-binary and non-absorbing treatment where lagged effects may affect the outcome, which is the case in our study. Panel B of Table 10 confirms the negative effect of increasing CCyBs on bank lending to affected subsidiaries. Interestingly, effects our stronger than in our main regressions in Table 1 but only from two quarters after treatment suggesting that the full impact of CCyBs on banks' international lending is only observable sometime after the change in CCyB.

9 Conclusion

The main objective of the CCyB is to increase banks' resilience to risks stemming from the financial cycle by enhancing their loss absorption capacity. As a secondary objective an increase of the CCyB might help to dampen excessive credit growth in the upswing of the financial cycle, thereby reducing the buildup of risks on banks' balance sheets. According to our results, banks' (international) risk exposure to firms in countries that have increased their CCyB declines –in terms of lending and banks' portfolio PD of affected borrowers.

At the same time, however, MNCs can circumvent the CCyB through their internal capital markets. We find that MNC affiliated firms which borrow from banks that are subject to the CCyB, offset the decline in bank credit by drawing more internal funds from their parents, which in turn increase external borrowing in their local market. Parents refinance their increased internal lending with both, local bank and local nonbank credit,

and at the same time additional precautionary credit to be able to weather potential future shocks to credit conditions due to changes in CCyBs or similar measures.

Importantly, there is some shifting of banks' risk exposures triggered by the increase of foreign CCyBs which spur the rerouting of credit flows away from international bank lending to affected firms towards local bank lending to the parents of those firms in countries with a zero CCyB. The scope for this arbitrage and risk shifting from affected borrowers abroad to their local parent companies depends to a large extent on the share of bank lending to multinationals. If the redistribution of bank lending towards borrowers in countries with a zero CCyB is large enough to fuel a credit boom, authorities might respond by increasing the CCyB. This would reduce or even eliminate the incentives that exist for multinationals. In sum, comparable levels of CCyBs across countries would substantially limit the potential arbitrage opportunities for MNCs.

We also acknowledge that we cannot deduce the effect of the CCyB on standalone firms from our findings. Even a very small change in the relative price of bank funding and internal debt might lead to a shift in the funding mix of MNCs. In contrast, the bank funding of standalone firms might virtually be unaffected by an increase in the CCyB. It suggests that further research on the effects of macroprudential policy measures on the economy in general and on firms in particular is necessary.

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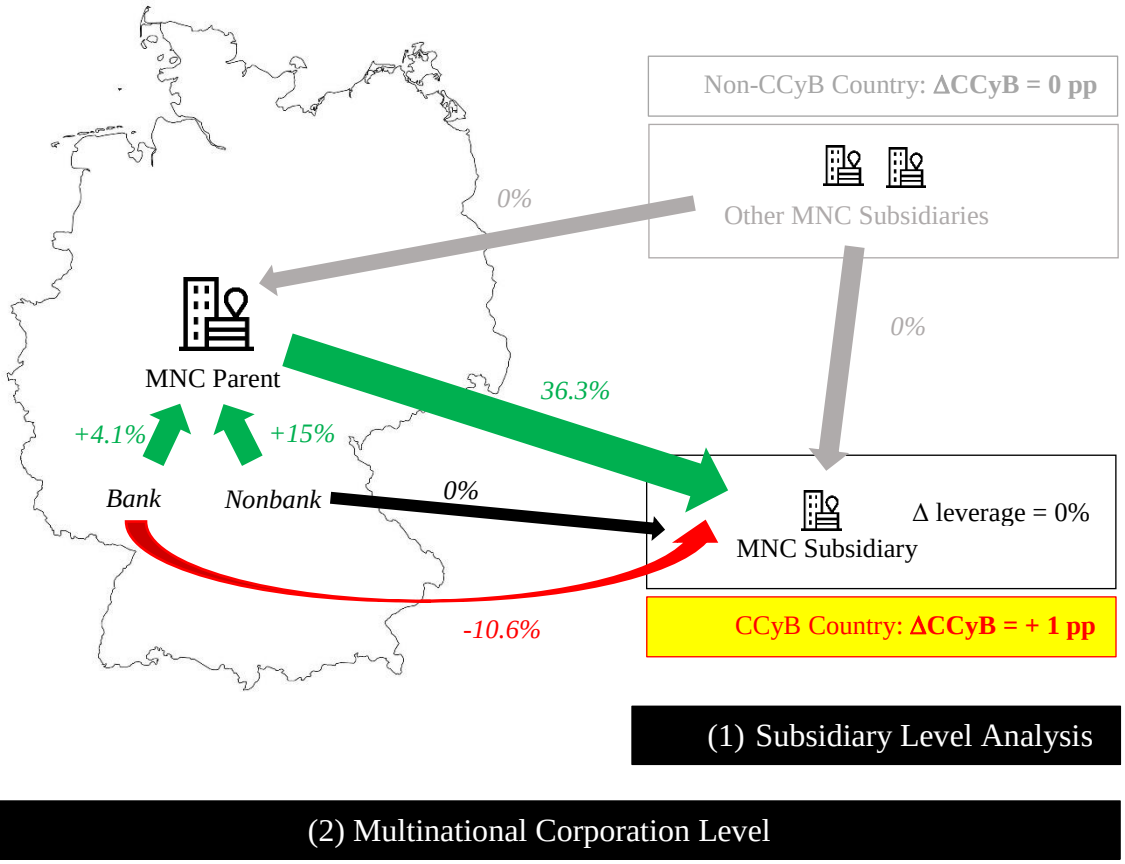
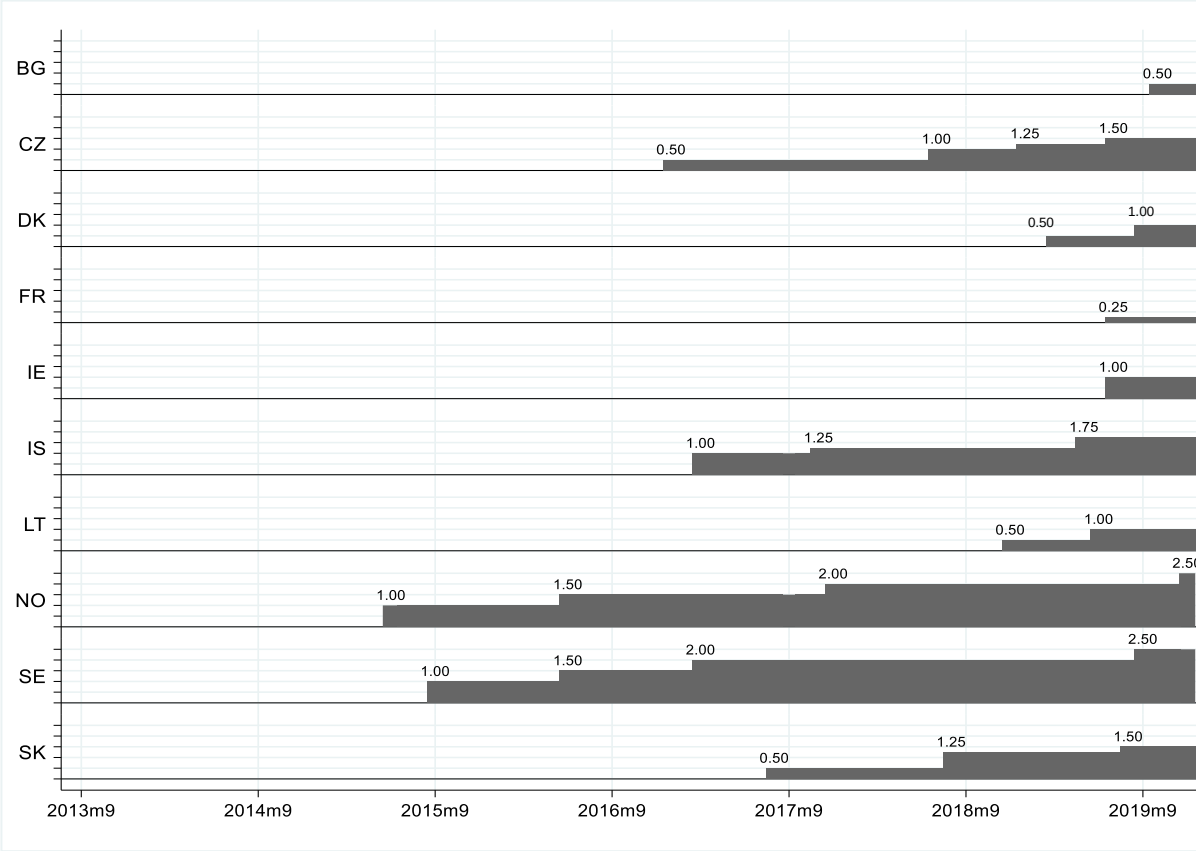
Figure 1: Summary of the Estimates.



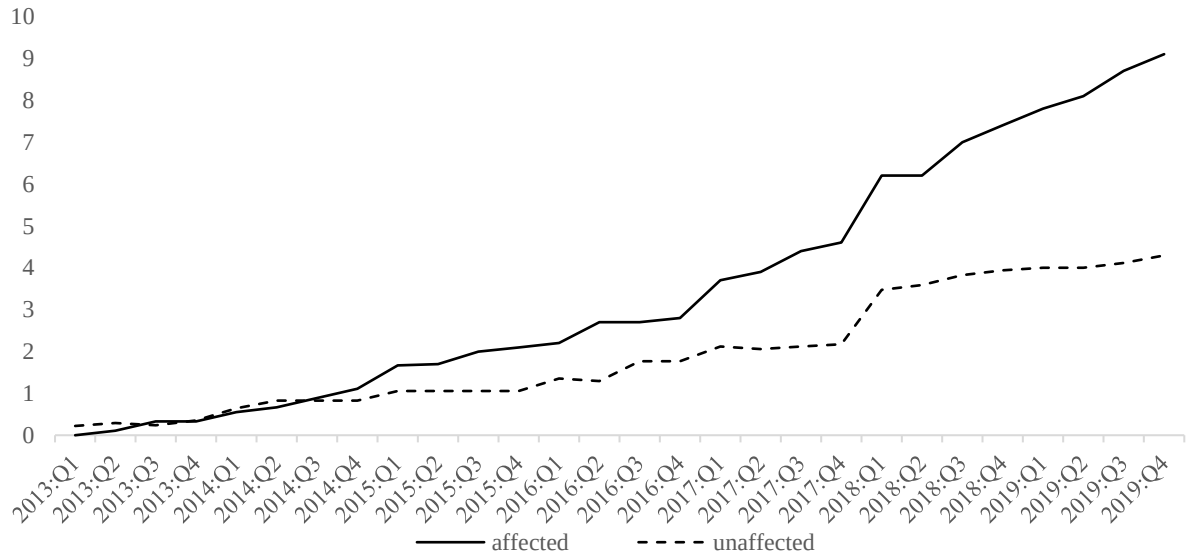
This figure summarizes the main results of our study regarding credit amounts for the different levels of analysis. An increase of the CCyB of 1 pp in a country implies a decrease of international bank credit to a subsidiary of an MNC of 10.6% while it does not change nonbank credit. This decrease in bank credit for affected subsidiaries is compensated with internal lending of parents to those which increases 36.3%, relating to an increase of 2.3 pp as a fraction of total liabilities and 1.2 pp as a fraction of total assets. Parents finance this increase in internal lending by borrowing 4.1% more from domestic banks and 15% more from domestic nonbanks. Affected subsidiaries on average do not borrow more from other subsidiaries and these other subsidiaries do not lend more to the parent. Note that for each firm we only know the total internal credit from other subsidiaries but do not observe individual amounts from each individual subsidiary. In addition to the increase of domestic debt for parents both from banks and nonbanks, our results furthermore show a relative increase in parent PD as well as in weighted MNC PD in response to an increasing CCyB for a subsidiary within an MNC. This argues for spillover effects of CCyBs to other countries when the level of the CCyB differs between both countries. In sum, our results show that macroprudential policy might leak through a reallocation of funds within internal capital markets of firms when CCyB levels are not harmonized across countries.

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 Funding from the Parent

The table shows in Panels A, B and C 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. In Panel C the dependent variable is again the logarithm of internal debt from the parent, and again broken out for both subsidiary groups, but in this specification the CCyB is also interacted with one of three measures of relative subsidiary size. 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. Panel D 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.

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

Panel C. 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 D. 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 4: 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 5: Refinancing and Probability of Default of Parents

The table shows regression results of the logarithm of bank-firm credit and nonbank-firm credit (Panel A) and the probability of default (Panel B) 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.

Panel A. 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

Panel B. 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 6: The Aggregate Effect of the CCyB on Lending and Probability of Default 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 (Panel A) and weighted probability of default (Panel B) 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 all 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.

Panel A. 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

Panel B. 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 7: The Effect of the CCyB on Lending by Parent Risk

The table shows in Panel A 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 B, 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 year:quarter level.

Panel A. 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 B. 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 8: 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 9: 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

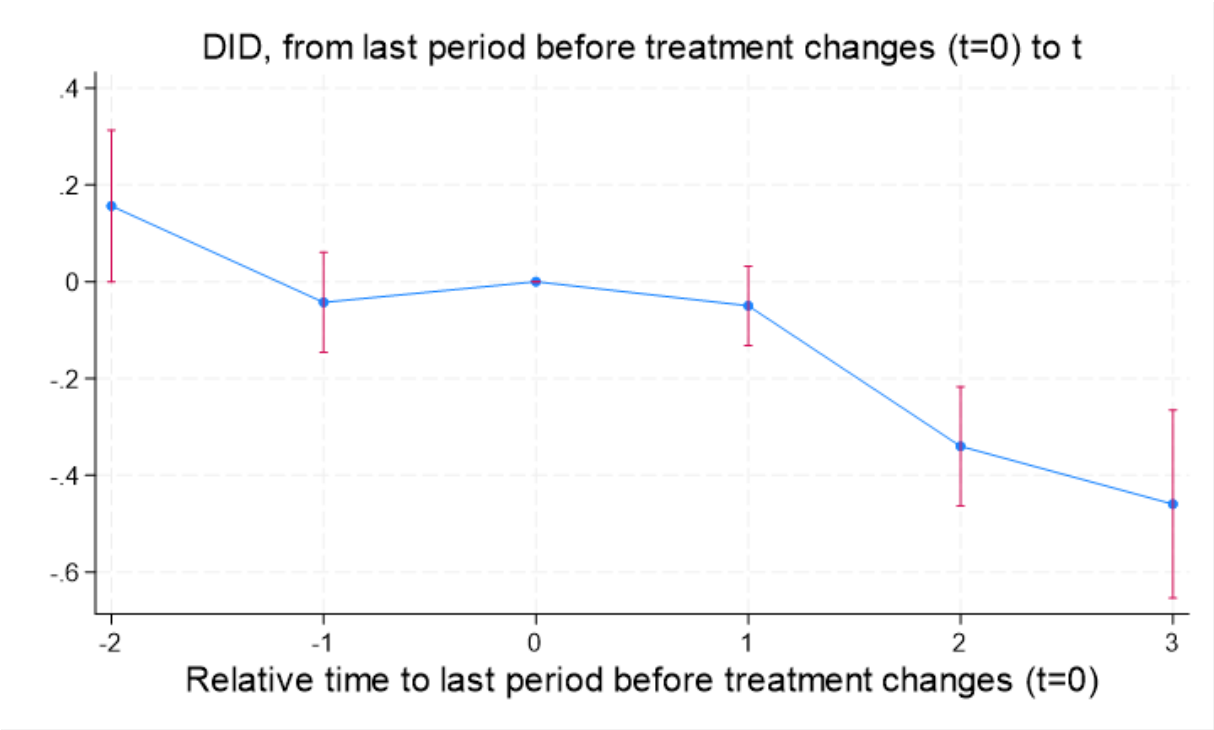
Table 10: Robustness - The Effect of the CCyB on Bank Lending

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 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 A4: 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