Business as Usual: Bank Net Zero Commitments, Lending, and Engagement*

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Abstract

We use administrative credit registry data from Europe to study the impact of voluntary lender net zero commitments. We have two sets of findings. First, we find no evidence of lender divestment. Net zero banks neither reduce credit supply to the sectors they target for decarbonization nor do they increase financing for renewables projects. Second, we find no evidence of reduced financed emissions through engagement. Borrowers of net zero banks are not more likely to set decarbonization targets or reduce their verified emissions. Our estimates rule out even moderate-sized effects. These results highlight the limits of voluntary commitments for decarbonization.

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1 Introduction

As the effects of climate change are beginning to be felt, there are increasing calls from policymakers, activists, and other stakeholders to transition the economy away from carbon-intensive production. The United States and Europe have set net zero targets for 2050; China has one for 2060; and India has one for 2070. The net-zero transition will require a massive mobilization of capital: McKinsey & Co. (2022) estimate that the net zero transition will require $9.2 trillion per year in investment for energy and land use systems between 2021 and 2050. This raises the important question: where will the financing required to transition the global economy come from?

Banks play a central role in capital allocation, so they are key to financing the green transition. Banks have made ambitious public commitments to reduce financed emissions and increase financing for sustainable activities. Most prominently, more than 138 banks, representing over 40% of global banking assets, have made explicit *net zero commitments* through the Net Zero Banking Alliance (NZBA). These "net zero banks" have made a commitment to "align lending and investment portfolios with net-zero emissions by 2050" with "intermediate targets for 2030 or sooner." These targets must be set within 18 months of joining the alliance, and they specify the sectors that each lender has targeted as high priority for decarbonization.[1] In addition to announcing sectoral targets for reducing financed emissions, net zero banks also make outright pledges to scale up sustainable finance.[2]

The announcement of bank net zero commitments has triggered contrasting reactions. Many laud the NZBA initiative as evidence that banks are beginning to seriously incorporate climate change concerns in their lending and investment decisions, suggest-

[1]For example, Deutsche Bank has set targets for reducing financed emissions in oil and gas, power generation, transportation, and steel by 2030.

[2]For example, Deutsche Bank has pledged to scale up sustainable financing and investment volumes by 500 billion euros between January 2020 and the end of 2025.

ing that banks can help to bridge the large financing gap for the net-zero transition.[3] In the United States, some even went further, taking lender divestment from fossil fuels as a given and holding net zero banks responsible for divesting.[4] Others, however, have pointed out that these net zero commitments are voluntary and could simply reflect greenwashing behavior.[5]

In this paper, we conduct the first large-scale causal evaluation of the impact of banks' net zero commitments on their lending behavior and on the climate impact of borrowing firms. We use two administrative data sources covering European banks that provide a comprehensive view of these banks' lending portfolios. The first is a bank-firm credit registry with granular information on the near-universe of lending within the euro area. We match this credit registry data to bank-level data on net zero pledges and borrower-level information on decarbonization targets and carbon emissions. The second is banks' global lending by sector and country; this global coverage is important because most lending by European banks to emissions-intensive sectors, such as mining, occurs to firms outside of the euro area.[6]

We organize our empirical analysis around three hypotheses for how banks can impact financed emissions. Net zero banks can decarbonize their portfolios in two ways: divestment and engagement. Banks can *divest* from polluting firms and reallocate capital to less emission-intensive firms. Alternatively, net-zero banks can continue to

[3]Upon the announcement of the initiative, the *New York Times* wrote: "The agreements are largely voluntary. But they show a commitment by a broad range of financial institutions–banks, insurers, pension funds, asset managers, stock exchanges, credit rating agencies, and audit firms–to have emissions slashed in the companies in which they invest, and to have their lending aligned toward the target of restricting a global temperature rise to 1.5 degrees Celsius above preindustrial levels." (*New York Times*, "Global finance industry says it has $130 trillion to invest in efforts to tackle climate change," November 3, 2021).

[4]S&P Global Market Intelligence, "Net-zero alliances jittery as GOP attorneys general play antitrust card," June 2023.

[5]See, for example, "Banks Use 'Net Zero by 2050' as a Smoke Screen to Conceal Support for Dirty Coal," Sierra Club, 2023.

[6]Throughout the paper, mining refers to NACE section B, which includes mining of coal, extraction of oil and natural and gas, and mining of metal ores. In 2018 lending by euro area banks to euro area borrowers in the mining sector accounted for less than 25% of their total mining lending worldwide.

lend to polluting firms, but *engage* by pushing them to reduce their emissions. For example, banks can encourage polluting firms to set climate targets and invest in cleaner technologies. If net zero banks neither divest nor engage with polluting firms, then net-zero commitments have limited impact on financed emissions and instead represent *greenwashing* by banks.

We obtain the following findings. First, we reject the divestment hypothesis. Net zero banks do not divest from polluting sectors, nor do they scale up project financing for renewable power projects. Second, we reject the engagement hypothesis. Borrowing firms dependent on net zero banks are not likelier to set their own climate targets, nor do they reduce their verified emissions. We conclude that net zero commitments do not lead to meaningful changes in bank behavior.

Our analysis proceeds in three steps. First, we provide new facts about bank net zero targets. We document that banks joining NZBA are larger and lend more to "brown" sectors such as mining, particularly in emerging markets. Second, banks joining the initiative set targets concentrated in power generation, oil & gas, and transport—three sectors that together produce the majority of global emissions. Moreover, these banks set targets in sectors to which they have more lending exposure before making a net zero commitment. Third, banks see a substantial improvement in their MSCI ESG rating after joining NZBA. This suggests large banks with ESG ratings derive reputational and financial gains from making climate commitments.

Second, we examine the divestment hypothesis. Identifying lender divestment requires an empirical strategy that holds fixed other variables that impact equilibrium credit provision, such as firm-specific loan demand and selection into net zero commitments. We address these challenges by using a triple difference-in-differences specification. Intuitively, this strategy asks whether net zero banks reallocate lending away from firms in polluting sectors, relative to other banks that do not claim to target net zero. We find that net zero banks do not differentially divest from sectors they have targeted as a priority for decarbonization, relative to banks without a net zero commitment. Our 95% confidence intervals can rule out any effect larger than 2.6%. We also find no evidence of divestment from other proxies of high-emissions firms, such as firms in the mining sector (which includes coal, gas, and oil), with confidence intervals that rule out effects larger than 4.0%. Further, we find no evidence of a change in interest rates charged by net zero banks to targeted sectors or high-emission firms. Our estimates are robust to controlling for detailed industry-time and even firm-time fixed effects to proxy for changes in credit demand. Across a range of specifications, we find robust evidence against the divestment hypothesis.

A concern with the sector-level analysis is that net zero banks may be reallocating financing to low-carbon firms within the same sector. Polluting firms may also be using bank financing to invest in long-term decarbonization. To address these concerns, we analyze project finance lending to the power generation sector. We use a new methodology to classify project finance loans as renewable, allowing us to evaluate whether net zero banks scale up project finance specifically for renewable power generation. We find no significant difference in the scale-up of renewables financing by net zero banks relative to those without a commitment.

Third, we examine the engagement hypothesis by testing whether firms that borrow from net zero banks are themselves more likely to take steps toward reducing emissions. We use two measures of engagement. The first is whether the borrowing firm sets a formal, validated emissions-reduction target. We measure target-setting using data from the Science Based Targets initiative (SBTi).[7] Despite an overall rise in target-setting in recent years, we find that firms borrowing from net zero banks are not more likely to set a decarbonization target after their lender joins NZBA. We can reject with 95% confidence that firms borrowing from NZBA banks see an increased probability of setting a target. Our second measure focuses on verified emissions reported through

[7] SBTi is the most commonly used target-setting platform by nonfinancial firms.

the EU Emissions Trading System (ETS), the official carbon pricing regime in the EU. We can also reject that firms borrowing from net zero banks significantly decrease their total emissions. This evidence cuts against the engagement hypothesis.

Overall, our results cast doubt on the efficacy of voluntary net zero commitments for reducing financed emissions, whether through divestment or engagement. This evidence supports recent efforts by governments to improve the credibility of net zero commitments. More broadly, it suggests that voluntary private-sector initiatives may have little impact on decarbonization.

Related Literature: This paper contributes to three strands of the literature. First, it contributes to the strand on how financial institutions may impact decarbonization in the real economy by divesting from emissions-intensive sectors (Giglio et al., 2021). For the banking sector, a small recent literature seeks to quantify whether lenders have divested from polluting sectors. The evidence is mixed. Some papers find evidence of lender divestment from firms with high voluntarily reported carbon emissions (Kacperczyk and Peydró, 2022, Ye, 2023), or firms in the coal mining sector (Green and Vallee, 2022, Jung et al., 2022). There is also some evidence that lenders charge relatively higher interest rates to polluting firms (Delis et al., 2019, Degryse et al., 2023, Altavilla et al., 2023). However, other studies find no evidence of divestment from firms with high carbon emissions (Bruno and Lombini, 2023; Giannetti et al., 2023) or from firms engaged in mountaintop removal coal mining (Haushalter et al., 2023).

A key challenge in examining lender divestment is that results are very sensitive to the measurement choices of the econometrician. There is large variation across this literature in how one defines polluting firms, an issue which stems in part from the limited reliability of voluntarily reported and imputed data on carbon emissions (Aswani et al., 2024 and Bolton and Kacperczyk, 2021). Another challenge is defining what constitutes a climate-aligned bank, and whether broad statements about climate change should be interpreted as commitments to divest. We contribute by being the first to study the causal effect of lender *net zero commitments*, which constitute sharp and precise statements that allow us to use the banks' own characterization of which sectors they are targeting to reduce financed emissions. This sidesteps the issue of having to impose external definitions of climate-alignment or brown sectors. We also use administrative European datasets on bank-firm lending and carbon emissions. This provides broader coverage both in terms of the number of lenders and of their loan portfolios relative to other datasets used in this literature, such as data on syndicated lending. Further, our analyses of global sectoral loan portfolios and renewables project finance loans are also new to the literature.

Second, this paper also contributes to the literature on engagement strategies in ESG investing which argues that engagement strategies may be more effective at generating climate impact than divestment.[8] We expand this literature by considering new empirical tests for a range of bank decarbonization strategies that extend beyond divestment, including scaling up renewables project finance, engagement through borrower target-setting, and engagement through reductions in borrowers' verified EU ETS emissions. These specifications demonstrate that lenders with net zero commitments are not divesting or engaging with polluting firms to meet their targets, with precisely estimated effects that rule out even moderate effects.

Third, this paper also informs recent work that studies divestment in other contexts besides banking. Pastor et al. (2024) show that the common approach to measuring socially responsible capital by summing the assets under management (AUM) of institutions that include ESG in their stated investment policies is flawed, as these institutions may vary in the degree to which they actually modify their portfolios. We similarly show that the amount of socially responsible banking capital may be

[8]See Broccardo et al. (2022), Berk and van Binsbergen (2021), Green and Roth (2023), Hartzmark and Shue (2023), Oehmke and Opp (2023).

lower than previously assumed, given the limited evidence we find of divestment and engagement. Duchin et al. (2022) study the market for industrial assets, and find that sales of polluting plants merely reallocate ownership with limited effects on aggregate emissions, but with the concrete financial benefit of increased ESG ratings for the seller. Like their paper, we find evidence that large banks derive reputational benefits from making net zero commitments through improved ESG ratings, with limited evidence of changes in their portfolio.

2 Hypothesis Development

Banks can pursue several strategies to reduce their financed emissions (Kölbel et al., 2020). These strategies are not mutually exclusive.

First, banks can *divest*, that is reduce lending to high-polluting firms and reallocate capital to less emissions-intensive firms and industries (Hirschmann, 1970).[9] A potential consequence of this reallocation is an increase in these firms' cost of capital that could incentivize them to become greener or shrink in size (Pástor et al., 2021). This channel requires that these firms cannot easily substitute between different sources of financing, such as from climate-aligned to unaligned banks. Thus, the scope for divestment to increase brown firms' cost of capital is likely to be larger in concentrated lending markets than in equity or corporate bond markets, since relationships matter more for bank credit supply and pricing.

Some banks, however, may not want to divest from polluting industries. There is anecdotal evidence that banks in green initiatives resist divesting from emissions intensive companies.[10] These banks often argue that emissions intensive sectors, such

[9]For example, the sustainable lender and NZBA signatory Triodos Bank is an advocate of divestment. See "Divestment is banks' best tool for net zero," *The Banker*, June 22, 2023.

[10]For example:"Big banks resist most direct road map to net zero emissions: Lenders reluctant to end financing of new oil, gas and coal exploration projects," *Financial Times*, October 10, 2021. As the *Financial Times* article notes, leading NZBA member banks resisted following the International Energy

as transportation and steel, have limited substitutes and provide necessary inputs for the economy overall. They therefore prefer to *engage* with polluting firms to reduce their greenhouse gas emissions. For example, banks can help firms finance costly investments that reduce their emissions' intensity (Broccardo et al., 2022), acknowledging that decarbonizing the economy over the longer-term will require large amounts of financing (Hartzmark and Shue, 2023). There is also evidence that that fossil fuel companies play a disproportionately large role in green innovation (Cohen et al., 2021), implying that divestment could counter-productively hinder the development of important climate solutions. Banks can use the threat of divestment to support their engagement strategy, incentivizing firms to make credible plans to reduce emissions.

An important concern with voluntary emissions-reduction targets is that they may not lead to meaningful changes in lending or the emissions of borrowers but instead represent *greenwashing*. First, banks joining green initiatives may not be able to self-regulate. For example, it is not clear if there is any sanction for banks that do not comply with their commitments. The NZBA secretariat suggests that banks must be transparent about their progress towards their net zero targets by self-reporting this information and that banks who do not self-report can be removed from the alliance. This could create reputational risk, to the extent that some information is actively monitored by outside parties.

However, the discipline brought by reputational risk for noncompliance is mitigated by a second concern: there are limited and incomplete mechanisms for measuring and verifying banks' compliance with their green commitments (Crawford and Sobel, 1982). This measurement challenge applies especially for ascertaining progress on engagement, as lending is easier to measure than changes in borrower emissions. In

Agency (IEA) pathway to net-zero by 2050, since this would require ceasing to finance new fossil fuel explorations. Instead, banks favored the IPCC pathway, which does not include such a ban. Some banks threatened to leave NZBA over concerns about the strict targets phasing out coal, oil, and gas set by the UN's Race to Zero campaign, which accredits the pledges made by NZBA. See "US banks threaten to leave Mark Carney's green alliance over legal risks" *Financial Times*, September 21, 2022.

particular, it is difficult to know whether borrowing firms reduce their emissions and to ascertain the role, if any, played by their banks in their decarbonization efforts. There is limited global firm disclosure of historical, current, or projected future emissions. In many contexts, to the extent that this disclosure exists, it is voluntary and is limited to large public firms. Our data offer important advantages for overcoming this measurement challenge. We observe actual emissions for firms covered by the EU ETS, and we can also observe firm decarbonization targets, a natural first step to reducing emissions. Moreover, we can also observe if banks engage with corporate sponsors through project finance loans for green activities such as renewable power generation projects.

In line with this discussion, we formally test the following three hypotheses:

> *Hypothesis 1 (Divestment):* Climate-aligned banks will reduce their portfolio exposure to brown borrowers by more than non-aligned banks, especially in sectors targeted for decarbonization, and will increase their portfolio exposure to green borrowers by more than non-aligned banks.
>
> *Hypothesis 2 (Engagement)*: Firms borrowing from climate-aligned banks are more likely to take steps to decarbonize than firms borrowing from non-aligned banks.
>
> *Hypothesis 3 (Greenwashing)*: Lending to both brown and green borrowers will evolve similarly across both climate-aligned and unaligned banks, and there is no evidence that borrowers are taking steps to decarbonize. That is, neither Hypothesis 1 nor Hypothesis 2 hold.

3 Data

This paper merges administrative lending data from the European Central Bank with hand-collected information on lender net zero initiatives and firm-level data on net zero targets and emissions.

3.1 ECB Administrative Data

We use two administrative datasets from the European Central Bank that offer unique and complementary perspectives on bank lending. Both datasets cover banks headquartered in the eurozone and subject to the Single Supervisory Mechanism. We use the ECB's group structure database to consolidate all lending to the ultimate parent.

AnaCredit. AnaCredit is the ECB's administrative monthly firm credit registry. The reporting requirement applies when the total credit extended by a euro-area credit institution to a euro-area firm exceeds a threshold of 25,000 euros.[11] The dataset identifies the lender, borrower, loan amount, interest rate, maturity, and collateralization status for each outstanding loan. Banks also report the borrowing firm's industry, which we standardize to the two-digit NACE level. The data begins in September 2018, and is monthly. We annualize the data by considering the quarter-end borrower-bank credit exposures in the third quarter of each year. The advantage of this data is that we can do detailed analysis at the bank-firm level. A drawback is that it is limited to borrowing by euro-area firms. The final AnaCredit dataset is at the parent-bank, firm, and quarter level.

We split the AnaCredit dataset into three components. The first is the "intensive margin" dataset, where we limit to bank-firm relationships that persist for the whole sample. This allows us to examine portfolio reallocation and pricing for firms that continue to borrow from the same bank throughout the sample period. The second dataset is the "extensive margin" dataset and includes the full set of bank-firm relationships. It allows us to examine new relationships that are formed, as well as when

[11] Loans to natural persons are excluded.

banks exit from existing relationships. Third, we use a separate extract from AnaCredit that explicitly focuses on project finance.

FinRep. FinRep is quarterly administrative bank-level supervisory data on lender balance sheets and income statements for virtually all euro area deposit-taking institutions from 2015 onwards. In FinRep, banks report their total *global* lending by industry at the NACE section level. This dataset is at the parent-bank, NACE sector, and quarter level. We use this dataset from 2018 onwards.[12]

A subset of banks with significant non-EU exposures also report their lending at a more disaggregated level, reporting total lending at the NACE section level and by country of origin for non-financial corporate borrowers. This reporting requirement applies to banks with a non-domestic exposure that exceeds 10% of their total exposures, or a non-domestic subsidiary whose lending is also included in the broader FinRep data. This dataset is at the parent-bank, NACE sector, country, and quarter level.

The advantage of these two FinRep datasets is that we can measure European banks' global lending by sector, including high-polluting sectors such as mining. However, the drawback is that the data are aggregated, meaning we cannot exploit variation across different borrowers and sub-industries. We therefore use AnaCredit to consider detailed firm-level outcomes and FinRep to obtain a comprehensive picture of bank lending across the globe.

AnaCredit and FinRep are broadly comparable in terms of reporting lenders and loan amounts recorded. The banks which appear in both FinRep and AnaCredit represent between 78-85% of total credit in AnaCredit (see Figure A.1a). Their AnaCredit loans account for 70-80% of all euro area lending to non-financial corporates reported in FinRep (see Figure A.1b). The AnaCredit banks that appear in FinRep have between 60-70% of total assets reported in FinRep (See Figure A.1c). Finally, in the cross-section

[12]The data goes back to 2015 but has inconsistent bank reporting in the early period.

of banks, lending reported in AnaCredit is correlated almost one-for-one with lending reported in FinRep (see Figure A.1d).

3.2 Advantages of Administrative Data

The administrative data have important advantages over the data on syndicated loan market usually used in the literature, such as Dealscan. First, the data covers both large and small banks, as well as large and small borrowers. For example, we show that a sizable amount of lending to the mining sector (NACE section B) is done by smaller banks. A second advantage is that the administrative data includes information on both quantities and interest rates, the two key features of the debt contract. Third, the administrative data includes information on the full bank-borrower network, which captures entry and exit into lending relationships.[13]

Fourth, the administrative data allow us to look both within the euro area and globally, rather than just North America or Europe. We will show that most mining lending occurs outside of the United States and Europe, so this is a particularly important limitation for understanding divestment from mining. Lastly, these data cover all loan contracts, not just syndicated loans.[14] These features allow for a finer and more comprehensive analysis than what can be done using publicly available data.

[13]Information on the syndicated loan market covers new origination at issuance (i.e., at one point in time) to the same borrower by a group of banks. It has the advantage of being public information and thus being readily available. At the same time, it is used sparsely by some large borrowers typically to raise large amounts of funding for the purposes of financing major investments, or mergers and acquisitions. This is relevant as banks in (or outside) the syndicate could be already lending to the same borrower.

[14]Figure A.5 shows that syndicated loans represent less than 15% of lenders total portfolios. Moreover, there is evidence that banks monitor borrowers less in syndicated lending than in standard non-syndicated lending (Heitz et al., 2023), so the relative importance of engagement and divestment could differ across different types of relationships.

3.3 Other Data Sources

We complement our administrative data with information from MSCI Inc on ESG (i.e., environmental, social, and corporate governance) ratings, spanning 2018-2023. We merge these data to our ECB administrative dataset using LEI identifiers (i.e., legal identity identifiers) and a fuzzy match on lender name. We also compile information from the Science-Based Targets Initiative (SBTi) on decarbonization targets set by nonfinancial firms spanning 2018-2023. Finally, we obtain firm-level emissions from the EU Emissions Trading System. We match these data at the firm-level to AnaCredit using firm RIAD codes.[15] We found that the ETS data provide a larger and more up-to-date sample of actual (rather than modelled) firm-level emissions, compared to commercially-produced firm-level emissions datasets such as Urgentem.

4 Institutional Details

4.1 Net Zero Banking Alliance

We examine lenders' voluntary net zero commitments through the net zero banking alliance. Joining the alliance constitutes a voluntary commitment to reduce financed emissions. The NZBA was formed in April 2021 and announced formally in October of that year at a meeting convened by the United Nations as part of COP 26. Joining the alliance constitutes an agreement to help the global economy reach "net zero" by 2050, that is to limit global temperature increases to at most 1.5 degrees Celsius, in line with the goals of the Paris Agreement.[16] The NZBA is just one initiative under the umbrella organization Global Financial Alliance for Net Zero (GFANZ).[17]

[15]Specifically, we obtain a crosswalk from EU ETS identifies to Orbis Bvd-IDs and use an internal ECB crosswalk for Orbis BVD-Ids to Anacredit RIAD codes

[16]By comparison, the SBTi targets only require limiting global temperature increases to 2 degrees.

[17]GFANZ is comprised of seven sector-specific alliances: (1) net zero initiatives for banks (Net Zero Banking Alliance or NZBA), (2) insurers (NZIA), (3) data and credit rating providers (NZFSP), (4)

A key feature of the NZBA is that it requires member banks to set sectoral targets for reducing the financed emissions in their credit and investment portfolios. These targets must apply to financed emissions in 2030 as well as in 2050, with intermediary targets set every five years from 2030 onward. Banks' first targets for 2030 must focus on priority sectors where the bank can have the most significant impact, such as the most greenhouse gas-intensive sectors in their portfolios. Within three years of joining, banks are required to set targets in all, or a substantial majority of, the nine sectors outlined in the NZBA guidelines: agriculture, aluminum, cement, coal, real estate, iron & steel, oil & gas, power generation, and transport. Appendix Figure A.2 shows an example target released by Deutsche Bank after it joined the Net Zero Banking Alliance.[18]

NZBA members are also required to have their targets validated, or assured, by a third party within four years of joining the alliance.[19] Currently the dominant validator of targets is the Science-Based Targets Initiative (SBTi). SBTi has long validated the targets of non-financial corporate firms, but in October 2021 began validating the targets of financial institutions as well.[20] Joining banks also agree to disclose their progress against their stated targets, to support transparency of the initiative. The combination of detailed target-setting requirements, UN monitoring, and third-party assurance makes the NZBA one of the strictest, if not the strictest, climate initiatives for banks.

We obtain information on lenders' net zero commitments, signing dates, and

investment consultants (NZICI), (5) Venture capital (VCA), (6) asset owners (Net-Zero Asset Owner Alliance, or NZAOA, and Paris Aligned Asset Owners, PAAO), and (7) asset managers (NZAM).The UNEP-FI acts as the secretariat for the net-zero banks, insurance and asset owners initiatives (i.e., NZBA, NZIA and NZAOA), which includes monitoring and assessing compliance with the requirements of membership.

[18]In October 2023, Deutsche Bank expanded their sectoral targets to cover more sectors. A subset of NZBA banks also have sustainable finance targets, which constitutes a commitment to scale up financing for clean technologies. For example, Deutsche Bank has pledged to scale up sustainable financing and investment volumes by 500 billion euros between January 2020 and the end of 2025.

[19]UNEP-FI.

[20]SBTi.

sectoral targets from the Net Zero Banking Alliance website, the Science-Based Targets Initiatives website, and bank sustainability disclosures. An institution is designated as a member of the Net Zero Banking Alliance if either the parent or any of the banking subsidiaries are members.

4.2 Classifying Brown and Green Firms

We use the following measures to classify firms as either brown or green.

Targeted Sectors (Brown). As a first measure, we use banks' NZBA sectoral targets to classify borrowing firms. The idea behind this classification is that we would expect divestment to be concentrated in the sectors that the banks themselves have decided to target for reducing financed emissions.

Mining (Brown). As a second measure of "brown" firms, we use the NACE sector for mining (NACE section B).[21] This sector includes coal, oil, and natural gas–the industries which have low-carbon substitutes, and are at the center of the debate over green banking initiatives and much of the literature (e.g., Green and Vallee, 2022).

EU Taxonomy (Green). In June 2020, the European Union passed the Taxonomy Regulation. This regulation instituted a classification system for identifying environmentally sustainable activities for both mitigation and adaptation activities based on their NACE codes. The goal was to direct investments toward sustainable projects and activities to further the objectives of the Paris Agreement. We identify any NACE codes under the EU Taxonomy's mitigation classification as "green." The EU taxonomy

[21] Specifically, the divisions of NACE level B are: mining of coal and lignite, extraction of crude petroleum and natural gas, mining of metal ores, other mining and quarrying, and mining support service activities.

requires information at least at the two-digit NACE level, so we only use the EU Taxonomy-based classification for analysis using AnaCredit data.

5 Who, What, When, and Why: Facts about Bank Net Zero Commitments

In Table 1, we list each of the 34 banks in our sample that joined the NZBA, when they signed, and their sectoral targets. Table 2 presents summary statistics on the characteristics of banks that make climate commitments through the NZBA. Among the 331 banking groups in the AnaCredit credit registry, 34 have joined the NZBA.[22] Figure 1 shows the signing dates and target-setting behavior of the NZBA banks (Panel A). The majority of banks signed on at the beginning of the alliance in 2021. 24 banks have set sectoral targets (the banks which joined later have yet to do so). Conditional on having set a target, banks usually set at least two (Panel B). Most banks set targets in power generation, oil and gas, and transportation (Panel C).

5.1 Selection into Net Zero Commitments

Table 2 and Figure 2 present summary statistics on the characteristics of banks that make net zero commitments through the NZBA. These summary statistics are as of September 2018, before the adoption of NZBA, to assess the *ex-ante* characteristics of these lenders. These data reveal that the 34 banks who have joined the NZBA consist mainly of the mega-banks. These banks have, on average, over 446 billion euros in assets, while the average non-NZBA bank has around 30 billion. NZBA banks also have slightly lower net interest margins and rely less on deposit financing, in part because they are larger.

[22]Five banking groups have had their targets validated by SBTi, of which 3 are in the NZBA.

NZBA banks tend to lend *more* to "brown" firms. Panel A of the table reports that, globally, these banks have a higher share of lending to the mining sector (1.39% for NZBA banks versus 0.47% for other banks). Within the euro area, panel C reports that this pattern persists (0.25% for NZBA banks versus 0.19%). NZBA banks also have a lower share of lending to "green" sectors, as defined by the EU Taxonomy (16.3% for NZBA banks versus 22.9% for other banks).

Taken together, this suggests that there is strong selection into NZBA, favoring the biggest banks. As a result, NZBA members cover the majority of European banks' lending. We estimate that they represent over 60% of all bank lending in Europe. By contrast, Berk and van Binsbergen (2021) estimate that socially conscious capital makes up less than 2% of stock market wealth in the United States. This suggests that the changes in lending by NZBA banks could be large enough for divestment to have meaningful effects.

Do NZBA banks charge higher interest rates to brown firms? The evidence is mixed based on summary statistics of interest rates in panel B of Table 2. For example, NZBA banks charge slightly higher interest rates to firms in the mining sector (5 basis points, see panel B in Table 2), and NZBA banks also charge slightly lower interest rates to firms in EU taxonomy sectors for sustainable activities. At the same time, NZBA banks charge slightly higher rates to firms that have set a target through SBTi.[23] Overall, the differences in interest rates charged by NZBA and non-NZBA banks to green and brown firms are quantitatively small.

[23] In recent work using loan-level data from AnaCredit, Altavilla et al. (2023), find that banks making climate commitments through the SBTi charge 1.55 basis points higher loan spreads to firms with one standard deviation higher emissions intensity.

5.2 Lender Sectoral Targets

Panel B of Figure 1 shows that 24 NZBA banks have set sectoral targets, and Panel C shows that there is variation in which sectors banks have chosen to target. We next explore whether banks set targets in sectors that they have more *ex ante* exposures to, as per the requirements of the alliance. In particular, lenders are instructed to set "meaningful" sectoral targets in the most greenhouse gas intensive sectors in their portfolio, representing the majority of their total financed emissions. To explore their target-setting behavior, we limit our AnaCredit dataset to NZBA members. We run the following specification at the bank-sector level using data from 2018:

$$Y_{b,s,2018} = \alpha + \beta SectorTargets_{b,s} + \delta_b + \epsilon_{b,s,2018}$$

where $Y_{b,s,2018}$ refers to lending by bank b to sector s in 2018, and $SectorTargets_{b,s}$ is dummy variable that equals one for the sectors which banks have targets in, and 0 otherwise. We use both lending shares and total lending as dependent variables.

Table 3 presents the results on the relation between sectoral targets and *ex-ante* sectoral lending exposure. Banks are more likely to set targets in sectors to which they lend more. On average, NZBA banks lending shares are 4 percentage points higher in the targeted sectors relative to non-targeted sectors (column 1). The result also goes through when looking at total lending in column (2), estimated using pseudo-Poisson maximum likelihood (PPML) to allow for zeros in bank lending to a specific sector. This specification implies that banks have 52% higher outstanding lending to targeted sectors, relative to other sectors.

5.3 ESG Ratings

Why do banks, and especially the largest banks, join NZBA? We next explore whether banks benefit from joining the alliance in terms of their ESG ratings. In Table 4, we restrict the sample to NZBA banks and evaluate what happens to bank's overall ESG ratings after joining NZBA. On average, NZBA banks' ESG ratings increase by more than half a notch, where a notch refers, for instance, to moving from AA to AAA. Looking specifically at the environmental ("E") subcomponent of the ratings, the score increases by 0.77 on average. This is a large change given that E ratings range from 1 (lowest) to 10 (highest). The boost in the "E" rating following lenders' joining NZBA can be seen visually in Figure 5. This upgrade in ESG ratings can boost the demand for NZBA banks' stock from institutional investors (Berg et al., 2022). This shows that banks derive concrete, reputational, and financial benefits from making net zero commitments. The question remains: do they follow through on their pledges?

6 Evidence on Divestment

6.1 Triple-Differences Research Design

One strategy net zero banks could follow to meet their commitments is to divest from high-emitting industries. Evaluating lender divestment requires an identification strategy. The econometric issue with simply looking at overall changes in credit is that lending is an equilibrium object. Changes in loan amounts could reflect shocks in loan demand from firms in these sectors, rather than a reduction in lender credit supply to those sectors.

We address this econometric challenge by employing an empirical strategy that uses non-NZBA banks as a counterfactual for NZBA banks. The idea is simple. If NZBA adoption leads banks to actively make their portfolios consistent with net zero by divesting from polluting firms, we would expect to see a differential change in the composition of banks' portfolios after joining the NZBA, relative to banks that have not joined NZBA.

Our main empirical specification is a triple-differences specification of the following form:

$$Y_{b,f,t} = \alpha_{b,f} + \delta_{f,t} + \gamma_{b,t} + \beta_1 \times PostNZBA_{b,t} \times SectoralTargets_{b,f} + \epsilon_{b,f,t}. \quad (1)$$

The dependent variable $Y_{b,f,t}$ is a an outcome at the firm-bank-time level, such as the log of lending from bank b to firm f in year t. The indicators $\alpha_{b,f}$, $\delta_{f,t}$, and $\gamma_{b,t}$ are bank-firm, firm-time, and bank-time fixed effects, respectively. $PostNZBA_{b,t}$ is an indicator that equals one after a bank joins NZBA, and zero before that. It always equals zero for banks that never join NZBA (never-treated banks). $SectoralTargets_{b,f}$ is an indicator variable that equals one if firm f is in a sector included in bank b's targets for decarbonization. When we do not include the bank-time fixed effect, we include a set of bank controls interacted with year-fixed effects. The bank controls we include are log of total assets, log of total lending, deposits-to-assets, and net interest margin, all measured in 2018. The use of bank-time fixed effects and the bank controls help address the issue of selection into commitments.

The coefficient of interest in equation (1) is β_1. This coefficient compares the change in lending to firms in targeted and non-targeted sectors after a bank adopts NZBA, relative to non-NZBA banks. The triple difference estimator can be viewed as the difference between two difference-in-differences estimators. In this context, it has a natural interpretation. It is the difference-in-differences estimate of the effect of joining NZBA on lending to firms in targeted sectors, relative to the difference-in-differences estimate of the effect of joining NZBA on non-targeted sector lending. An advantage of the triple differences estimator is that it is unbiased in the presence of parallel trends if the bias is the same across the two difference-in-differences estimators. That is, the triple-differences estimator only requires parallel trends in ratios (Olden and Møen, 2022). The identifying assumption is thus that there are no differential trends for lending to targeted versus non-targeted sector firms within banks adopting NZBA and other banks. Stated another way, credit supply will not be identified if there are bank-sector-time specific credit demand shocks.

We reinforce the identification of credit supply by including firm-time fixed effects in equation (1), as in Khwaja and Mian (2008). These fixed effects can be interpreted as absorbing firm credit demand. Identification of β_1 thus comes from comparing an NZBA and a non-NZBA bank lending to the same firms in targeted sectors, relative to their lending to the same firms in non-targeted sectors.[24] The inclusion of firm-time fixed effects requires that a firm borrows from at least two banks, so this reduces the sample size and increases estimation uncertainty. We therefore report results both without and with firm-time fixed effects.

In addition to testing whether net zero banks change lending to targeted sectors, we also examine if they change lending to the mining sector and to EU taxonomy designated sectors. Specifically, we consider the following two triple-differences specifications:

$$Y_{b,f,t} = \alpha_{b,f} + \delta_{f,t} + \gamma_{b,t} + \beta_1 \times PostNZBA_{b,t} \times Mining_f + \epsilon_{b,f,t} \tag{2}$$

$$Y_{b,f,t} = \alpha_{b,f} + \delta_{f,t} + \gamma_{b,t} + \beta_1 \times PostNZBA_{b,t} \times EUTaxonomy_f + \epsilon_{b,f,t}. \tag{3}$$

$Mining_f$ is an indicator variable that equals one if firm f is in the mining sector (NACE B).[25] $EUTaxonomy_f$ is an indicator variable that equals 1 if firm f is in one

[24]Strictly speaking, firm-credit demand can be bank-specific, so firm-time fixed effects do not necessarily control for all forms of confounding credit demand shocks. Nevertheless, it provides a useful test of whether NZBA banks differentially reduce lending to the same firms.

[25]The results are similar if we focus on lending to fossil firms firms: "Mining of coal and lignite" (NACE 05), "Extraction of crude petroleum and natural gas" (NACE 06), and "Mining support service

of the sectors designated in the EU Taxonomy. Note that for equation (1), there is heterogeneity in which sectors banks have chosen to target, while for the specifications in equations (2) and (3) the climate-alignment of a firm is the same across all banks.

6.2 Lending Volumes

6.2.1 Bank-Firm Level Evidence

We start by using the AnaCredit credit registry data to estimate our triple-differences specification (1). We first analyze whether net zero banks change their lending to firms by focusing on the intensive margin on lending. In particular, we consider continuous (i.e., uninterrupted) bank-firm relationships spanning six years around the adoption of NZBA (2018-2023). We aggregate the loan-level data to the bank-firm relationship level, and we keep outstanding balances from September each year to obtain a bank-firm-year panel. We consider the extensive margin—entry and exit from relationships—below.

Table 5 presents estimation of equation (1) with the log of lending to firm f by bank b at time t as the dependent variable. Panel A shows the results for the targeted sectors; Panel B for mining; and Panel C for the EU Taxonomy. In all specifications, we include coefficients, standard errors, and 95% confidence intervals.

Panel A of Table 5 shows that NZBA, relative to non-NZBA, banks do not reallocate lending away from firms operating in targeted sectors. On average, net-zero-alignment leads to a negligible decline in lending to targeted sectors (column 1). This estimate includes bank-firm fixed effects, bank balance sheet controls interacted with time fixed effects, and industry-time fixed effects. Industry-time fixed effects can be interpreted as proxying for industry-specific shifts in credit demand. Once we include the bank-time fixed effects the coefficient switches sign and is positive (column 2). Our preferred

activities" (NACE 09).

specification, in column 3, replaces industry-time fixed effects with firm-time fixed effects. The sample size declines, since firm-time fixed effects require that firms have more than one lending relationships. The null result persists with this specification. We can reject at the 5% level any divestment that exceeds 2.7%, a precisely estimated zero.

Column 1 of Panel B in Table 5 shows that banks increase their lending to mining after making a net zero commitment, compared to other banks, by over 4%, though the result is not statistically significant. In column 2, we add bank-time fixed effects, so the bank-level controls drop out, but we retain the industry-time fixed effects. Again, on average, lending to mining firms increases, but not significantly so. We can reject at the 5% level that lenders divest from mining by more than 2.7%. The specification with firm-time fixed effects in column 3 implies that lending to mining firms declines by 0.9% after lenders joining NZBA, relative to lending to other firms, relative non-NZBA banks.

Panel C of Table 5 indicates that banks do significantly increase their lending to "green" firms in the EU Taxonomy. This result persists regardless of the inclusion of bank-time fixed effects. However, switching from industry-time fixed effects to firm-time fixed effects (column 3), which controls for firm-specific credit demand shocks, we see that this result too becomes null. That is, we can reject at the 5% level that portfolio reallocation towards EU Taxonomy firms exceeds 1.5%.

Overall, we find that net zero banks do *not* reallocate lending away from firms in targeted sectors or from the high-polluting mining sector after signing on to NZBA. They also do not differentially increase lending to firms in the "green" EU taxonomy sectors.

6.2.2 Bank-Sector Level Evidence on Worldwide Lending to Mining

To further explore the divestment hypothesis, we zoom in on the evolution of lending by net zero banks and other banks to mining, a particularly salient "brown" sector. For this analysis, we use the comprehensive regulatory dataset FinRep, which contains bank lending by industry (NACE Level 1) and by country. The advantage of this dataset is that it captures lenders' worldwide lending. Mining firms are defined as any firm in NACE section B, which includes oil, gas, and coal.

Figure 3(a) plots lending to mining as a share of total worldwide lending to all sectors by NZBA and non-NZBA banks. Figure 3(b) presents a similar plot for total lending to the mining sector in billions of euros, again for NZBA and non-NZBA banks. These figures reveal several notable patterns. First, NZBA banks have both a higher absolute level and a higher share of lending to the mining sector. Worldwide, NBZA banks allocate about 1.5-2% of their portfolios to mining, compared to 0.75-1.25% for non-NZBA banks. Second, the two sets of banks have similar trends in the pre-NZBA period, looking at both shares and levels. Third, the worldwide level of worldwide mining lending has been stable. There is no evidence that NZBA banks have reduced the level or the share of their lending to mining, relative to non-NZBA banks, either before or after the adoption of NZBA (denoted by the vertical line).

To verify the visual patterns in Figures 3 more formally, we estimate versions of the triple differences specification in (2), adapted to the bank-sector-time level data in FinRep:

$$Y_{b,s,t} = \alpha_{b,s} + \gamma_{b,t} + \delta_{s,t} + \beta \times PostNZBA_{b,t} \times Mining_s + \epsilon_{b,s,t} \ , \qquad (4)$$

where $Y_{b,s,t}$ is the level or share of lending by bank b, in quarter t to sector s. $\alpha_{b,s}$ is a bank-sector fixed effect, which can be thought to capture in sector-specific specialization effects for a particular bank. $\gamma_{b,t}$ is a bank-time fixed effect, and can capture any unobserved characteristics that vary by banks over time. $\delta_{s,t}$ is a sector-time fixed effect, that can be thought to capture sector-level demand shocks. $PostNZBA_{b,t}$ equals one after a bank joins the NZBA. The indicator $Mining_s$ equals one for the mining sector. This specification tests whether banks adopting NZBA see a change in the level or share of lending to mining after signing on to NZBA, relative to other banks, controlling for aggregate shocks and trends correlated with bank characteristics such as size.

The first two columns in Table 6 report the results from estimating equation (4) with the share of lending by bank b to a given sector s as the dependent variable. The regression is estimated at the bank-sector-year level. The table shows that banks that join NZBA do not reduce the share of lending to mining after joining NZBA.

Columns 3 and 4 in Table 6 present the same regression for the *level* of lending to the mining sector. We estimate the regression by pseudo Poisson maximum likelihood (PPML).[26] The estimates in Table 6 imply that banks signing on to NZBA do not reduce the level of lending to the mining sector after joining NZBA, relative to their lending to other sectors and relative to other banks, confirming what is already visible in the time series charts. Our specification in column (4) allows us to rule out divestment from mining that exceeds 4%.

To further explore these trends, we use the more granular bank-sector-geography-level version of the FinRep dataset. We report lending patterns for NZBA and non-NZBA banks by region: European Union (EU), United States (US), other OECD

[26] Relative to taking natural logarithms of the dependent variable and estimating the specification by OLS, this estimator has the advantage of allowing for zeros (Silva and Tenreyro, 2006; Cohn et al., 2022). Silva and Tenreyro (2006) show that OLS leads to biased estimates of log-linear models in the presence of heteroskedasticity. Further, Cohn et al. (2022) show that the common approach of adding one before taking natural logs has no natural interpretation and leads to biased estimates that can even have the wrong sign in expectation. Both studies recommend estimation by Poisson regression to accommodate zeros and heteroskedasticity. Note that the number of observations in columns 3-4 declines relative to the first two columns because PPML omits groups where the observations are all zero.

countries, and the rest of the world. Figure 4 plots the level of lending, and Figure A.3 plots lending shares. These regionally disaggregated data reveal that most of the lending to mining by European banks occurs *outside* of the eurozone, especially in emerging markets. This highlights a limitation of using only data with lending to a specific region. Global banks have extensive loan exposures to high-emission sectors outside the US and the euro area, so an analysis of these banks' green commitments should incorporate information on their worldwide activities. Furthermore, there are significant changes within regions. The US has seen a large decline in total lending to mining since 2020 across all banks, whereas other OECD countries have seen an increase. When we reestimate equation (4) allowing for differential effects by region, we find no evidence of differential divestment from mining by NZBA lenders in any region of the world (see Table A.1).

Taken together, this evidence on lending volumes casts doubt on the hypothesis that net zero lenders are actively divesting from targeted sectors or other brown sectors.

6.3 Loan Pricing

We now turn back to the Anacredit data to examine loan pricing using the intensive margin dataset. While net zero banks do not make any pledges to change their pricing, they may believe that lending to brown sectors is riskier. To test this, Table 7 presents the results from estimating our triple-differences specification (1) with interest rates as the dependent variable. We aggregate interest rates to the bank-firm-time level by taking the loan-weighted average of interest rates on outstanding loan contracts.

Panel A in Table 7 presents the results for the targeted sectors. In column (1), we see that climate-aligned banks increase interest rates by 0.02 percentage points (2 basis points) for firms in the targeted sectors. The inclusion of bank-time and firm-time fixed effects leads to even lower estimates (columns 2 and 3). For example, the specification with firm-time fixed effects in column 3 implies that NZBA adoption leads to a 0.02 percentage point *reduction* in interest rates in targeted sectors. We can reject with 95% confidence an interest rate increase larger than 5 basis points. To benchmark these magnitudes, the average interest rate for all firms is 3.1%, and the average interest rate for firms in the targeted sectors is 2.9% in 2018 (see Table 2).

Panel B in Table 7 presents the results for mining from estimation of equation (2). On average, NZBA adoption leads to an increase in interest rates of 24 basis points for mining firms (column 3). We can reject at the 95% level an interest rate increase larger than 55 basis points. Table 2 shows that the average interest rate in 2018 for mining firms by NZBA banks is 2.4%, and a one standard-deviation move for mining firms by NZBA banks is 1.5%. Thus the maximum effect (0.55 percentage points) represents less than a one-third of a standard-deviation move in interest rates.

Panel C in Table 7 presents the results for loan pricing to EU taxonomy firms based on the estimation of (3). We can reject that NZBA banks charge lower interest rates to green firms in the EU Taxonomy. Across all specifications, the effect on interest rates to firms in EU taxonomy sectors is not significantly different from zero. The specification in column 3 implies that NZBA adoption leads to a 2 basis point increase in interest rates for EU taxonomy firms borrowing from NZBA banks. We can reject at the 95% confidence level that firms borrowing from climate-aligned banks receive an interest rate benefit that exceeds 5 basis points.

In sum, the evidence on interest rates is not consistent with the view that NZBA banks charge higher interest rates to brown firms or lower interest rates to "green" EU taxonomy firms. Climate commitments do not appear to have a meaningful impact on the cost of bank debt financing for brown or green firms.

6.4 Extensive Margin: Entry and Exit from Lending Relationships

We next analyze whether net zero banks change their lending relationships on the extensive margin by testing whether NZBA adoption leads lenders to create new lending relationships (entry) or end existing relationships (exit). Entry is defined as an indicator variable that equals one if bank b has a lending relationship with firm f in period t, but does not have one prior to t. Exit is defined as an indicator variable that equals one if bank b does not have a lending relationship with firm f in period t, but did have a relationship prior to t.

Table 8 shows the results from estimating the specification in equation (1) using loan relationship entry and exit as the outcome variables. Panel A shows the results for the targeted sectors; Panel B for mining; and Panel C for the EU Taxonomy. Columns (1) and (3) report the specification with bank-firm, bank controls, and industry-time fixed effects. Columns (2) and (4) includes the fully saturated specification with bank-firm, bank-time, and firm-time fixed effects.[27]

Looking at Panel A in Table 8, we obtain significant results that go in the *opposite* direction of divestment. In particular, NZBA banks are *more* likely to enter into new relationships in the targeted sectors. In terms of magnitudes, the specification with firm-year fixed effects in column (2) implies that NZBA lenders are 3 percentage points more likely to enter into a new relationship with a firm in the targeted sector after signing on to NZBA. On the other hand, columns (3) and (4) show that there is mixed evidence on whether lenders are more likely to exit from firms in the targeted sectors. Our preferred specification in column (4) implies that NZBA lenders are 0.87 percentage points more likely to exit from a lending relationship in the targeted sector after adopting NZBA. However, any exit is dwarfed by the results on entry, suggesting that, on net, NZBA lenders are creating more new relationships with firms in the

[27] These columns are therefore limited to firms which borrow from multiple banks, explaining the decline in the sample size.

targeted sectors.

Panel B in Table 8 presents the estimates for mining. We observe no significant change in either entry or exit from the mining sector. We can reject that entry declines by more than 0.58 percentage points when controlling for industry-year fixed effects (column 1), and by more than 1.96 percentage points when controlling for firm-time fixed effects (column 2). Looking at exit, we also see that NZBA banks are no more likely to exit from lending relationships with mining firms. We can reject exit that increases by more than 1.6 percentage points with industry-year fixed effects, and by 2.6 percentage points for the specification with firm-time fixed effects.

In Panel C of Table 8, we explore whether NZBA banks are more likely to create new relationships with green firms in the EU taxonomy. Again, we see no significant change in either entry or exit from relationships with firms in the EU taxonomy. In particular, we can reject any new entry that exceeds 0.49 percentage points (column 2), and reject any reduction in exit that exceeds 0.50 percentage points (column 4).

Overall, these results cast doubt on the hypothesis that NZBA lenders are divesting from polluting firms, or forming new relationships with green firms.

6.5 Evidence on Green Project Finance

A natural question is whether banks reallocate their portfolio towards lower emissions firms within the same sector, or whether they finance low carbon projects within a particularly hard-to-abate sector. This is an alternative way that lenders could meet their sectoral targets to reduce financed emissions. In general, examining this type of within-sector portfolio allocation is very challenging for a number of reasons. First, there are data limitations on carbon emissions—only a subset of firms have voluntary or required disclosures of emissions, making it difficult to identify low-emissions firms. Second, there are questions about what financing may be used for. For example, a firm with higher emissions could, in principle, use bank financing to invest in an emissions-reducing technology.

To address these challenges, we look within a sub-sample of the Anacredit data on project finance. Project finance is a particular type of lending structure, whereby companies create a new, off-balance-sheet project company in order to develop a project. This new company then borrows funds from a bank using a limited recourse loan. This type of structure means that funds are allocated to a particular project, rather than flowing into a large company's general treasury. We focus on project finance for power generation (NACE section D), because power generation is the most common sectoral target for net zero banks, is the largest source of emissions globally, and because there are obvious ways to identify low carbon projects in power generation—the development of renewables. Moreover, Steffen (2018) estimates that a majority of renewable energy power generation is often financed using project finance structures.[28] Appendix Figure A.6 shows that power generation is among the most important sectors for project finance.

We use the following algorithm to classify power generation projects as "renewable." AnaCredit reports the name of the project. We then run a topics model on the project names to obtain the most frequent words. Using this list, we identify keywords related to green energy (such as "solar," "wind," "biofuels," "hydro," and "geothermal"), taking into account that keywords can occur in various European languages.

Using this classification system, we observe 56 billion euros of project finance to NACE section D in 2023, of which 36 billion are for renewables projects. We then look at the amount of financing for renewable power generation projects by whether the bank has made a net zero commitment. Figure 6 shows that non-NZBA banks do far more project finance than net zero banks in general, as well as for renewables.

[28] He also notes that developing power plants is often a case in textbooks for the benefits of off-balance sheet project finance relative to on-balance-sheet corporate finance (Steffen, 2018).

While NZBA banks have a lower initial level of renewables financing, they have slightly closed the gap relative to non-NZBA banks. However, much of this occurs in the pre-NZBA period—there is no clear shift in renewables financing after they join the NZBA.

Table 9 shows that these broad patterns are confirmed by estimating a difference-in-differences specification of the form:

$$RenewablesProjectFinance_{b,t} = \alpha_b + \gamma_t + \beta PostNZBA_{b,t} + \epsilon_{b,t}, \tag{5}$$

where the dependent variable is the share of renewable project finding (columns 1-2), the log of renewable project financing (columns 3-4), or the total project financing for power generation (columns 5-6). Table 9 shows estimates on $PostNZBA_{b,t}$ that are generally positive, but not statistically significant. Overall, there is suggestive evidence that NZBA banks are scaling up financing for green power generation more quickly than non-NZBA banks. However, this occurs from a low level and has not accelerated after net zero targets adoption.

7 Firm-Level Evidence on Engagement

7.1 Firm-Level Climate Targets

Rather than divesting, climate-aligned banks may pursue an engagement strategy by pressuring borrowing firms to reduce their emissions. One way banks can engage is by encouraging firms to set climate targets. If a firm is trying to reduce its carbon emissions profile, the first step is to set a decarbonization target for how much it wants to reduce emissions and by when it seeks to achieve this reduction. Figure 7 shows that firms have increased their target-setting behavior in recent years, with the number of firms in Anacredit setting targets going from closer to zero in 2018, to almost 200 in 2023.

While overall target-setting has increased, we would like to test whether firms mostly borrowing from net zero banks are more likely to themselves set decarbonization targets compared to borrowers that primarily borrow from non-NZBA banks. To test this hypothesis, we run the following specification:

$$SBTiTarget_{f,t} = \alpha + \beta PostNZBA_{f,t} + \epsilon_{f,b,t} \tag{6}$$

The dependent variable $SBTiTarget_{f,t}$ is an indicator variable that equals one if that borrowing firm f has a validated SBTi target in period t. For each borrower f we identify its primary lender and set $PostNZBA_{f,t}$ equal to the NZBA status of that lender.[29] The indicator variable $PostNZBA_{f,t}$ equals one after that lender joins the NZBA; it is zero beforehand and is zero for any lender that never joins the NZBA. The coefficient β will therefore reveal if borrowers are more likely to set a decarbonization target after their primary lender joins the NZBA. In addition to the main specification, we also consider additional interactions with whether firms are in bank's targeted sectors, the mining sector, or the EU taxonomy.

Table 10 reports the results. Across all specifications, we see that borrowing firms connected to NZBA banks are no more likely to set their own targets. Column 1 presents a cross-sectional regression using data from 2023 showing that firms borrowing from NZBA banks are *less* likely to have a target. Column 2 presents estimates of the difference-in-differences specification (6) and reveals that firms connected to net zero banks are less likely to set a target after their lender joins NZBA. The remaining columns show estimates for specific sectors. The coefficient we estimate across all

[29] Results are similar if we use the firm-level *ex ante* loan-weighted average NZBA exposure, rather than the NZBA status of the primary lender. See Table A.4.

specifications is extremely small. Our confidence intervals allow us to reject at the 95% level that firms increase target-setting behavior after their lender joins NZBA. Consistent with this, panel (c) in Figure 7 reveals that the evolution of the share of lending to firms with an SBTi target is almost identical for NZBA banks and non-NZBA banks.

7.2 Firm-Level Emissions

The most direct evidence that net zero lenders decarbonize their portfolios through engagement would be for firms borrowing from these banks to reduce carbon emissions. Measuring actual firm-level emissions for a large number of firms is challenging, since most emissions data is self-reported on a voluntary basis. To overcome this challenge, we use data from the European Emission Trading System (ETS). The ETS is a compliance carbon market which requires that firms in certain sectors purchase allowances for their carbon emissions. This requires that firms monitor their actual emissions as well as the number of allowances they acquire. This procedure yields a match for 844 firms over a five-year period.

We use a difference-in-difference specification similar to equation (6) to consider whether firms that borrow from net zero banks are more likely to reduce their emissions compared to firms that borrow from banks without a net zero pledge. As earlier, we define $PostNZBA$ based on whether the bank with the highest lending share in 2018 for that borrower is part of the NZBA.[30] The dependent variable is the log of total emissions of of carbon dioxide equivalents. Table 11 reveals that there is no evidence of any differential emissions reductions for firms borrowing from net zero banks.

[30]Results are similar when calculating firm-level NZBA exposure based on the loan weighted average bank-level NZBA status. See Table A.5.

8 Conclusion

Many point to the rise of bank net zero commitments as evidence that the private sector will play an important role in scaling up financing for the global transition to a low-carbon economy. This paper is the first attempt to quantify whether banks with a net zero pledge have made meaningful changes to their lending behavior.

Using administrative data that allows for a comprehensive examination of net zero lending commitments, we find that net zero lenders have not divested from emissions-intensive firms, in mining or in the sectors for which they have set targets. This holds both for borrowing firms in the eurozone, as well as across the globe. We also find limited evidence that banks reallocate financing towards low-carbon renewables projects within the power generation sector, casting doubt on within-sector portfolio reallocation. Further, we do not find evidence for engagement. Firms connected to a net zero bank are no more likely to set decarbonization targets, nor do they reduce their carbon emissions.

Our findings have significant implications for current debates on greenwashing and whether changes in credit supply by financial institutions can help the global economy meet its net zero ambitions. Facing public scrutiny, banks themselves have begun to walk back the extent to which a voluntary climate commitment reflects a binding obligation.[31] Our evidence suggests that NZBA banks are neither divesting nor engaging differently from banks without a commitment.[32]

[31]In his annual shareholder letter for 2024, J.P Morgan Chase CEO Jamie Dimon writes about voluntary climate commitments: "We are going to use the word 'commitment' much more reservedly in the future, clearly differentiating between ***aspirations*** we are actively striving toward and ***binding commitments.***"

[32]Our evidence is consistent with frustration expressed by Triodos Bank, an NZBA signatory, in February 2023 regarding the laxity of the current guidelines for NZBA members: "It is disappointing and discouraging that the requirements of the UN's climate action campaign Race to Zero have been dropped and that some financial institutions that have signed the commitment still finance fossil fuel expansion and exploration."

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Tables and Figures

Table 1: NZBA Joining Dates and Sectoral Targets

Bank	Signing Date	Target Set	Sector Targets
Abanca	May-2021	Y	transport; iron & steel; cement
ABN Amro Bank NV	Dec-2022	N	
AIB Group	Apr-2021	Y	commercial and residential real estate; power generation
Alpha Bank	May-2023	N	
Banca Ifis	Oct-2021	Y	transport
Banco BPM	Mar-2023	N	
Banco Sabadell	Oct-2021	Y	power generation; oil & gas; cement; coal
Bank of Aland	Apr-2021	N	
Bankinter	Oct-2021	N	
BBVA	Apr-2021	Y	cement; iron & steel; oil & gas; power generation; transport
BCEE	Oct-2021	N	
BMPS	Jan-2022	Y	power generation; oil & gas; iron & steel
BNP Paribas	Apr-2021	Y	oil & gas; power generation; transport
BPCE	Jun-2021	Y	power generation; oil & gas
BPER	Mar-2022	Y	power generation; oil & gas
Caixabank	Apr-2021	Y	oil & gas; power generation
CGD	Jun-2021	Y	power generation; cement; commercial real estate
Commerzbank	Apr-2021	Y	cement; commercial and residential real estate; iron & steel; power generation; transport
Credit Agricole	Jun-2021	Y	oil & gas; transport; power generation; commercial real estate; cement
Credit Mutuel	May-2021	Y	oil & gas; power generation
Deutsche Bank	Apr-2021	Y	iron & steel; oil & gas; power generation; transport
Erste Group Bank	Oct-2021	N	
Grupo Cooperative Cajamar	Jun-2022	N	
Ibercaja Banco	Apr-2021	Y	power generation; iron & steel; residential real estate
ING	Aug-2021	Y	cement; commercial & residential real estate; iron & steel; power generation; transport
Intesa Sanpaolo	Oct-2021	Y	oil & gas; power generation; transport; coal;
La Banque Postale	Apr-2021	Y	cement; commercial & residential real estate; power generation; transport
Mediobanca	Nov-2021	Y	power generation; transport
NLB Group	May-2022	N	
Rabobank	Oct-2021	Y	agricultural; commercial and residential real estate; transport; power generation
Santander	Apr-2021	Y	iron & steel; oil & gas; power generation; transport
Societe Generale	Apr-2021	Y	oil & gas; power generation; coal
Triodos Bank	Apr-2021	Y	agricultural; commercial and residential real estate
UniCredit	Oct-2021	Y	oil & gas; coal; power generation; transport

Note: This table lists each NZBA bank, their signing date, and sectoral targets as of September 1, 2023.

Table 2: Characteristics of NZBA and non-NZBA Banks

Panel A: FINREP

	(1) All		(2) NZBA		(3) Non-NZBA	
	Mean	SD	Mean	SD	Mean	SD
Total Assets (Bn)	81.3	244.6	445.9	504.0	30.5	108.1
Deposits to Assets	77.6	16.6	71.4	11.9	78.4	16.9
Net Interest Margin	1.12	0.72	1.06	0.48	1.12	0.75
Mining Share (in %)	0.59	1.68	1.39	1.87	0.47	1.62

Panel B: AnaCredit

Interest Rates (%):

	(1) All		(2) NZBA		(3) Non-NZBA	
	Mean	SD	Mean	SD	Mean	SD
Mean Interest Rate	3.14	1.41	3.10	0.91	3.14	1.46
Mining Interest Rate	3.01	1.58	3.05	1.60	3.00	1.58
Taxonomy Interest Rate	3.19	1.52	3.15	1.01	3.19	1.57
SBTi Interest Rate	0.91	0.31	0.95	0.34	0.86	0.39
Target Interest Rate			2.91	0.83		

Loan-Level Summary Statistics (%):

	(1) All		(2) NZBA		(3) Non-NZBA	
	Mean	SD	Mean	SD	Mean	SD
Outstanding amounts (Mn)	2.97	14.9	1.13	1.59	3.18	15.7
PF Lending to NACE D (Mn)	12.1	12.7	16.8	8.24	10.6	13.6
Renewable Share PF	67.7	23.3	60.7	16.7	70.3	24.9
Mining Share	0.20	0.45	0.25	0.20	0.19	0.47
Taxonomy Share	22.2	15.8	16.3	9.12	22.9	16.3
SBTi Share	0.0020	0.025	0.00039	0.0020	0.0022	0.026
Target Share			10.6	13.9		
N	331		34		297	

Note: This table shows summary statistics for all banks in the AnaCredit sample. We also report summary statistics separately for the 34 banks that join the Net Zero Banking Alliance (NZBA) and for the remaining banks (non-NZBA). Data is from FinRep and AnaCredit. The data are as of September 2018 (i.e. before the introduction of NZBA).

Table 3: Net Zero Banks Ex-Ante Exposures to Targeted Sectors

	Lending Share (OLS) (1) b/ci95/se	Total Lending (PPML) (2) b/ci95/se
Sector_Target$_{b,s}$	0.0411***	0.5178***
	[0.0240,0.0582]	[0.2231,0.8126]
	(0.0087)	(0.1504)
N	612	612
N_Banks	34	34
adj. R^2	0.034	
Bank_FE	N	Y

Note: This table shows that targeted sectors account for a larger share of NZBA members *ex ante* bank lending. The table presents regressions at the bank-industry level of bank lending to a given industry on whether the bank has a target for that industry. The sample is restricted to the banks that joined NZBA. Lending is measured in 2018. Column (1) uses banks' lending share in each sector as the dependent variable. Column (2) uses the banks' total lending in euros as the dependent variable. Column (2) is estimated by PPML (i.e. Poisson-Pseudo Maximum Likelihood). Column (2) includes a bank fixed effect to absorb differences in bank size. Standard errors (in parentheses) are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 4: Net Zero Banks ESG Ratings After Joining the Alliance

	(1) ESG Rating	(2) Environmental Pillar Score
PostNZBA	0.620***	0.765**
	(0.116)	(0.314)
N	1567	1567
adj. R^2	0.074	0.037

Note: This table presents regressions of MSCI ESG ratings on an indicator variable that equals one after the introduction of NZBA in April 2021. The sample is limited to NZBA banks. Column 1 uses the overall ESG rating as the dependent variable. Column 2 uses the environmental pillar score (E). Standard errors are clustered at the bank level and reported in parentheses.

Table 5: Effect of Bank Net Zero Commitment on Lending to Firms: Intensive Margin

Panel A: Target Sector Firms			
	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$\text{PostNZBA}_{b,t}$	0.0380*		
	[-0.0054,0.0814]		
	(0.0221)		
$\text{PostNZBA}_{b,t} \times \text{SectorTarget}_{b,f}$	-0.0087	0.0052	0.0117
	[-0.0437,0.0263]	[-0.0427,0.0531]	[-0.0273,0.0508]
	(0.0178)	(0.0243)	(0.0198)
N	10191570	10191540	2506224
N_Banks	326	321	302
Mean Dep. Variable	0.1870 mn	0.1870 mn	0.3215 mn
adj. R^2	0.853	0.854	0.849

Panel B: Mining Sector Firms			
	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$\text{PostNZBA}_{b,t}$	0.0375*		
	[-0.0055,0.0805]		
	(0.0219)		
$\text{PostNZBA}_{b,t} \times \text{Mining}_f$	0.0479	0.0324	-0.0091
	[-0.0162,0.1120]	[-0.0270,0.0918]	[-0.1336,0.1154]
	(0.0326)	(0.0302)	(0.0633)
N	10191570	10191540	2506224
N_Banks	326	321	302
Mean Dep. Variable	0.1870 mn	0.1870 mn	0.3215 mn
adj. R^2	0.853	0.854	0.849

Panel C: EU Taxonomy Firms			
	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$\text{PostNZBA}_{b,t}$	0.0323		
	[-0.0097,0.0743]		
	(0.0214)		
$\text{PostNZBA}_{b,t} \times \text{Taxonomy}_f$	0.0401***	0.0507***	-0.0017
	[0.0185,0.0616]	[0.0302,0.0713]	[-0.0191,0.0157]
	(0.0110)	(0.0104)	(0.0089)
N	10191570	10191540	2506224
N_Banks	326	321	302
Mean Dep. Variable	0.1870 mn	0.1870 mn	0.3215 mn
adj. R^2	0.853	0.854	0.849
Bank_Firm_FE	Y	Y	Y
Bank_Time_FE	N	Y	Y
Firm_Time_FE	N	N	Y
Industry_Time_FE	Y	Y	N
Controls	Y	N	N

Note: This table presents estimates of equations (1), (2), and (3) with log lending as the dependent variable using the Anacredit data. Balance-sheet controls are bank-level characteristics (total assets, deposits-to-assets, and net interest margin, all measured in 2018) interacted with time fixed effects. Industry-time fixed effects are two-digit NACE by time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 6: Effect of Bank Net Zero Commitment on Lending: Bank-Sector-Level Analysis of Worldwide Lending

	Lending Share (OLS)		Total Lending (PPML)	
	(1)	(2)	(3)	(4)
	b/ci95/se	b/ci95/se	b/ci95/se	b/ci95/se
$\text{PostNZBA}_{b,t}$	-0.0004		-0.0144	
	[-0.0010,0.0002]		[-0.0975,0.0687]	
	(0.0003)		(0.0424)	
$\text{PostNZBA}_{b,t} \times \text{Mining}_s$	-0.0012	-0.0012	0.1727	0.1584
	[-0.0037,0.0014]	[-0.0037,0.0014]	[-0.0794,0.4248]	[-0.0407,0.3576]
	(0.0013)	(0.0013)	(0.1286)	(0.1016)
N	109692	110088	101530	101882
N_Banks	277	278	277	276
Mean Dep. Variable	.0546	.0546	1.1729 bn	1.1692 bn
adj. R^2	0.936	0.933		
Bank_Sector_FE	Y	Y	Y	Y
Sector_Time_FE	Y	Y	Y	Y
Bank_Time_FE	N	Y	N	Y
Controls	Y	N	Y	N

Note: This table shows the regression results from estimating Equation (4). The data are from Finrep and are at the bank-quarter level. The dependent variable is a bank's lending share to mining firms (Column 1-2) and total lending to the mining sector (Column 3-4). $PostNZBA$ is an indicator variable that equals 1 after banks join the NZBA alliance, and 0 before that. $PostNZBA$ for banks that never join NZBA is always 0. Controls are bank-level characteristics (total assets, deposits-to-assets, and net interest margin, all measured in 2018) interacted with time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 7: Effect of Bank Net Zero Commitment on Firm-Level Interest Rates

Panel A: Target Sector Firms

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$PostNZBA_{b,t}$	-0.0001		
	[-0.0027,0.0025]		
	(0.0013)		
$PostNZBA_{b,t} \times SectorTarget_{b,f}$	0.0002	-0.0007	-0.0002
	[-0.0019,0.0023]	[-0.0016,0.0003]	[-0.0008,0.0005]
	(0.0011)	(0.0005)	(0.0003)
N	9506858	9506820	2277252
N_Banks	324	317	298
Mean Dep. Variable	.0245	.0245	.0249
adj. R^2	0.679	0.712	0.645

Panel B: Mining Sector Firms

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$PostNZBA_{b,t}$	-0.0001		
	[-0.0027,0.0025]		
	(0.0013)		
$PostNZBA_{b,t} \times Mining_f$	-0.0006	0.0004	0.0024
	[-0.0019,0.0006]	[-0.0011,0.0019]	[-0.0007,0.0055]
	(0.0006)	(0.0008)	(0.0016)
N	9506858	9506820	2277252
N_Banks	324	317	298
Mean Dep. Variable	.0245	.0245	.0249
adj. R^2	0.679	0.712	0.645

Panel C: EU Taxonomy Firms

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$PostNZBA_{b,t}$	-0.0002		
	[-0.0028,0.0025]		
	(0.0013)		
$PostNZBA_{b,t} \times Taxonomy_f$	0.0005	-0.0001	0.0002
	[-0.0001,0.0012]	[-0.0006,0.0003]	[-0.0005,0.0008]
	(0.0003)	(0.0002)	(0.0003)
N	9506858	9506820	2277252
N_Banks	324	317	298
Mean Dep. Variable	.0245	.0245	.0249
adj. R^2	0.679	0.712	0.645
Bank_Firm_FE	Y	Y	Y
Bank_Time_FE	N	Y	Y
Firm_Time_FE	N	N	Y
Industry_Time_FE	Y	Y	N
Controls	Y	N	N
Maturity_Controls	Y	Y	Y

Note: This table presents estimates of equations (2), (1), and (3) with the bank-firm level interest rate as the dependent variable using the Anacredit data. Balance-sheet controls are bank-level characteristics (total assets, deposits-to-assets, and net interest margin, all measured in 2018) interacted with time fixed effects. Industry-time fixed effects are two-digit NACE by time fixed effects. Maturity control is the loan-weighted average maturity. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 8: Effect of Bank Net Zero Commitment on Bank Lending to Firms: Extensive Margin

Panel A: Target Sector Firms

	Entry		Exit	
	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se	(4) b/ci95/se
$PostNZBA_{b,t}$	-0.0085		-0.0144	
	[-0.0307,0.0137]		[-0.0391,0.0103]	
	(0.0113)		(0.0126)	
$PostNZBA_{b,t} \times SectorTarget_{b,f}$	0.1018***	0.0305**	-0.0294**	0.0087*
	[0.0598,0.1437]	[0.0007,0.0604]	[-0.0541,-0.0048]	[-0.0005,0.0179]
	(0.0213)	(0.0152)	(0.0125)	(0.0047)
N	42464256	17154954	42464256	17154954
N_Banks	331	327	331	327
Mean Dep. Variable	.7858	.8085	.2092	.2205
adj. R^2	0.528	0.535	0.568	0.578

Panel B: Mining Sector Firms

	Entry		Exit	
	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se	(4) b/ci95/se
$PostNZBA_{b,t}$	-0.0058		-0.0152	
	[-0.0280,0.0164]		[-0.0395,0.0091]	
	(0.0113)		(0.0123)	
$PostNZBA_{b,t} \times Mining_f$	0.0126	0.0027	-0.0023	0.0055
	[-0.0058,0.0311]	[-0.0196,0.0249]	[-0.0204,0.0158]	[-0.0151,0.0261]
	(0.0094)	(0.0113)	(0.0092)	(0.0105)
N	42464256	17154954	42464256	17154954
N_Banks	331	327	331	327
Mean Dep. Variable	.7858	.8085	.2092	.2205
adj. R^2	0.527	0.535	0.568	0.578

Panel C: EU Taxonomy Firms

	Entry		Exit	
	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se	(4) b/ci95/se
$PostNZBA_{b,t}$	-0.0059		-0.0172	
	[-0.0276,0.0157]		[-0.0407,0.0062]	
	(0.0110)		(0.0119)	
$PostNZBA_{b,t} \times Taxonomy_f$	0.0009	0.0002	0.0140**	0.0004
	[-0.0119,0.0138]	[-0.0045,0.0049]	[0.0030,0.0249]	[-0.0050,0.0058]
	(0.0065)	(0.0024)	(0.0056)	(0.0028)
N	42464256	17154954	42464256	17154954
N_Banks	331	327	331	327
Mean Dep. Variable	.7858	.8085	.2092	.2205
adj. R^2	0.527	0.535	0.568	0.578
Bank_Firm_FE	Y	Y	Y	Y
Bank_Time_FE	N	Y	N	Y
Firm_Time_FE	N	Y	N	Y
Industry_Time_FE	Y	N	Y	N
Controls	Y	N	Y	N

Note: This table presents estimates of equations (2), (1), and (3) with indicator variables for lending relationship entry or exit as the dependent variables using the Anacredit data. Controls are bank-level characteristics (total assets, deposits-to-assets, and net interest margin, all measured in 2018) interacted with time fixed effects. Industry-time fixed effects are two-digit NACE by time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 9: Effect of Bank Net Zero Commitment on Renewables Project Finance

	Bank Share Renewable		Log Level Renewable		Log Level Total	
	(1)	(2)	(3)	(4)	(5)	(6)
	b/ci95/se	b/ci95/se	b/ci95/se	b/ci95/se	b/ci95/se	b/ci95/se
$\text{PostNZBA}_{b,t}$	0.0422	0.0352	0.2367	0.0828	0.3118**	0.1525
	[-0.0334,0.1179]	[-0.0789,0.1494]	[-0.0996,0.5731]	[-0.3181,0.4837]	[0.0073,0.6163]	[-0.1851,0.4900]
	(0.0382)	(0.0576)	(0.1695)	(0.2020)	(0.1537)	(0.1704)
N	636	636	547	547	636	636
N_Banks	114	114	98	98	114	114
Mean Dep. Variable	.6326	.6326	17.9759	17.9759	17.9692	17.9692
adj. R^2	0.862	0.866	0.935	0.937	0.932	0.933
Bank_FE	Y	Y	Y	Y	Y	Y
Time_FE	Y	Y	Y	Y	Y	Y
Controls	N	Y	N	Y	N	Y

Note: This table presents estimates of equation (5) using the Anacredit data on project finance at the bank-time level. The dependent variables are the share of renewables project finance (columns 1-2), the log of total renewables project finance (columns 3-4), and the log of total project finance to power generation (NACE sector D, columns 5-6). Controls are bank-level characteristics (total assets, deposits-to-assets, and net interest margin, all measured in 2018) interacted with time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 10: Lender Engagement: Effect of NZBA on Borrower SBTi Target Adoption

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se	(4) b/ci95/se	(5) b/ci95/se	(6) b/ci95/se
$NZBA_{f,2023}$	-0.0003*** [-0.0005,-0.0001] (0.0001)					
$PostNZBA_{f,t}$		-0.0001** [-0.0002,-0.0000] (0.0000)				
$PostNZBA_{f,t} \times SectorTarget_{b,f}$			0.0000 [-0.0001,0.0002] (0.0001)			
$PostNZBA_{f,t} \times Mining_{f}$				0.0001 [-0.0000,0.0003] (0.0001)		
$PostNZBA_{f,t} \times Taxonomy_{f}$					0.0000 [-0.0000,0.0001] (0.0000)	
$PostNZBA_{f,t} \times Fossil_{f}$						0.0011 [-0.0007,0.0028] (0.0009)
N	1449669	8698014	8697972	8697972	8697972	8697972
N_Banks	322	322	315	315	315	315
Mean Dep. Variable	.0002	.0001	.0001	.0001	.0001	.0001
adj. R^2	0.000	0.338	0.339	0.339	0.339	0.339
Bank_FE	N	Y	N	N	N	N
Firm_FE	N	Y	N	N	N	N
Time_FE	N	Y	N	N	N	N
Bank_Firm_FE	N	N	Y	Y	Y	Y
Bank_Time_FE	N	N	Y	Y	Y	Y
Industry_Time_FE	N	N	Y	Y	Y	Y

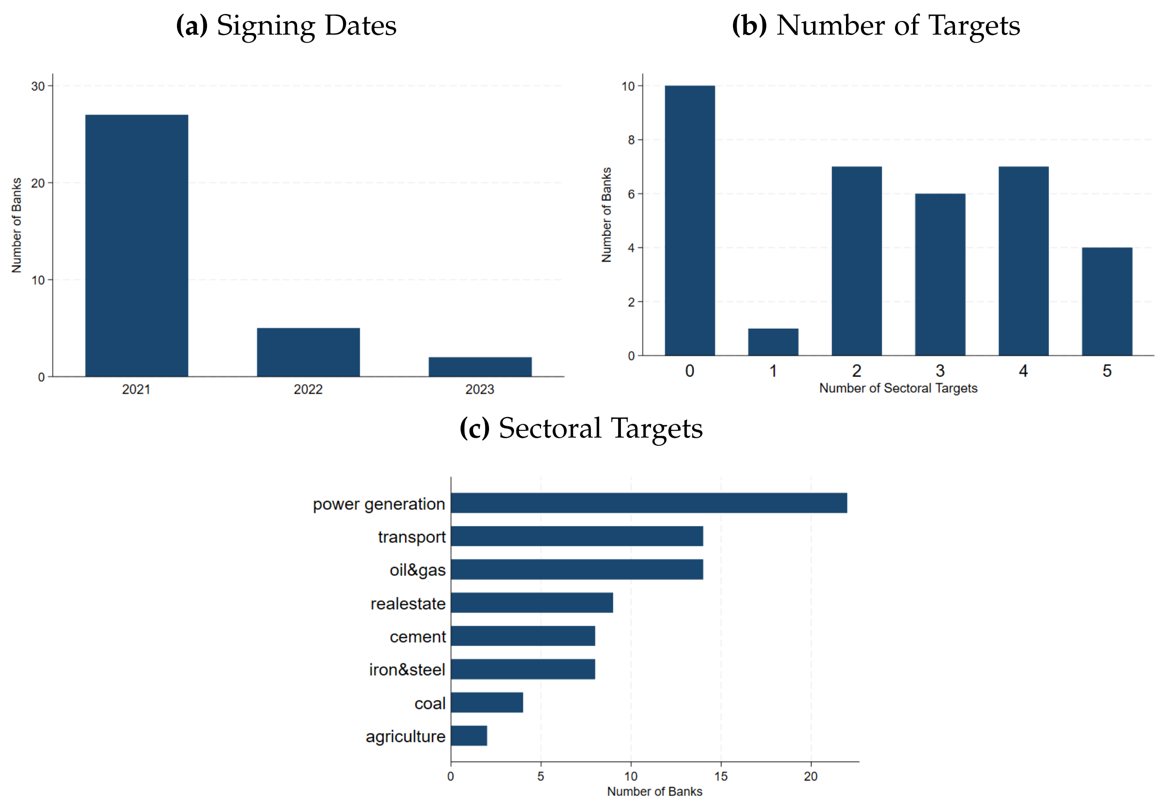
Note: This table presents estimates of equation (6). The dependent variable is an indicator variable for whether a firm has an SBTi target in period t. Industry-time fixed effects are two-digit NACE by time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 11: Net Zero Bank Exposure and Firm-Level Emissions

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$\text{PostNZBA}_{f,t}$	-0.0101	-0.0115	-0.0146
	[-0.0749,0.0548]	[-0.0875,0.0644]	[-0.0748,0.0455]
	(0.0328)	(0.0383)	(0.0304)
N	4220	4220	4175
N_Banks	118	118	118
Mean Dep. Variable	10.2549	10.2549	10.2654
adj. R^2	0.960	0.960	0.963
Bank_FE	Y	Y	N
Firm_FE	Y	Y	N
Time_FE	Y	Y	N
Bank_Firm_FE	N	N	Y
Industry_Time_FE	N	N	Y
Controls	N	Y	Y

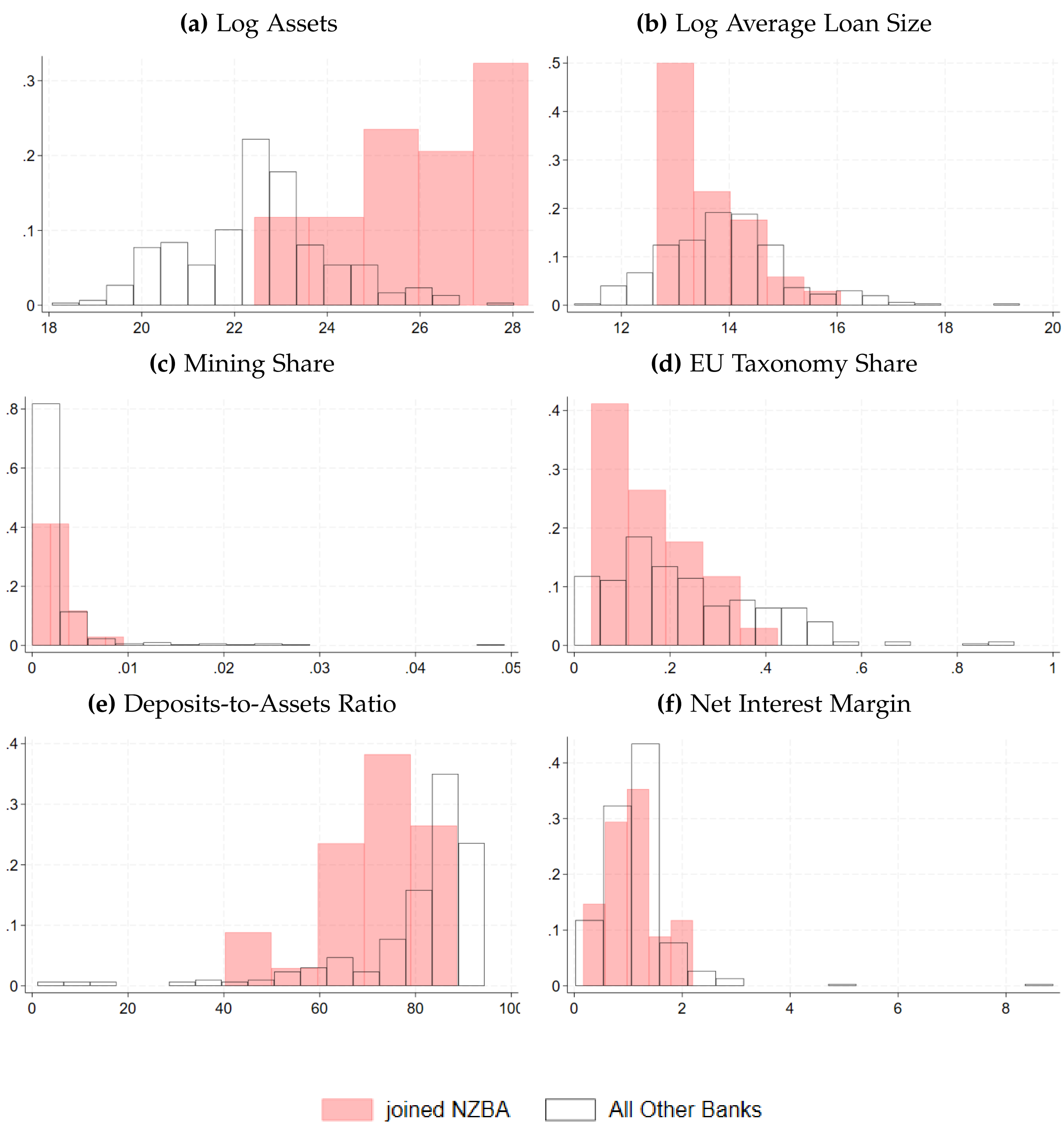
Note: This table presents estimates of equation (6) but with log firm carbon (equivalent) emissions as the dependent variable. $PostNZBA_{f,t}$ is the firm-level NZBA exposure based on NZBA status of the firm's primary lender. Controls are bank-level characteristics (total assets, deposits-to-assets, and net interest margin, all measured in 2018) interacted with time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Figure 1: Descriptive Facts about the Net Zero Banking Alliance



Note: This figure provides descriptive information about the Net Zero Banking Alliance. Panel (a) shows the number of banks that sign on to NZBA by year. Panel (b) shows the number of sectoral targets set by banks. Panel (c) shows which sectors banks have prioritized for decarbonization.

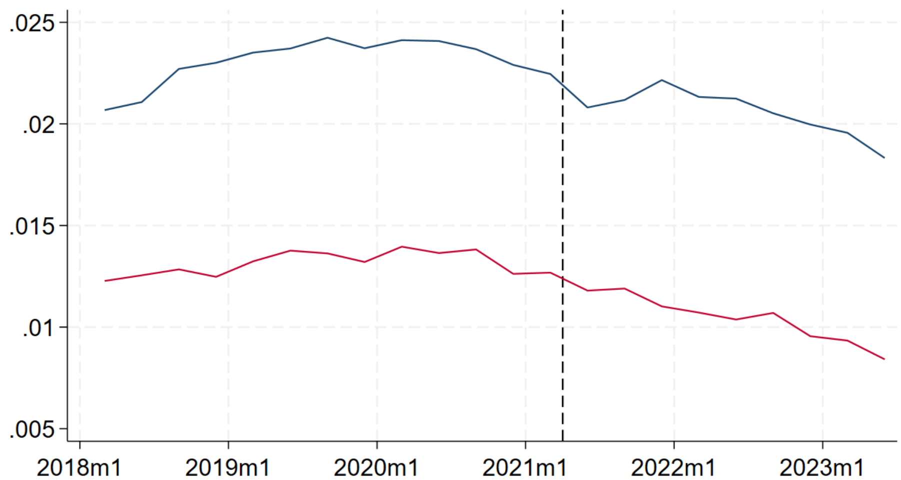
Figure 2: Distribution of Characteristics of NZBA and Non-NZBA Banks



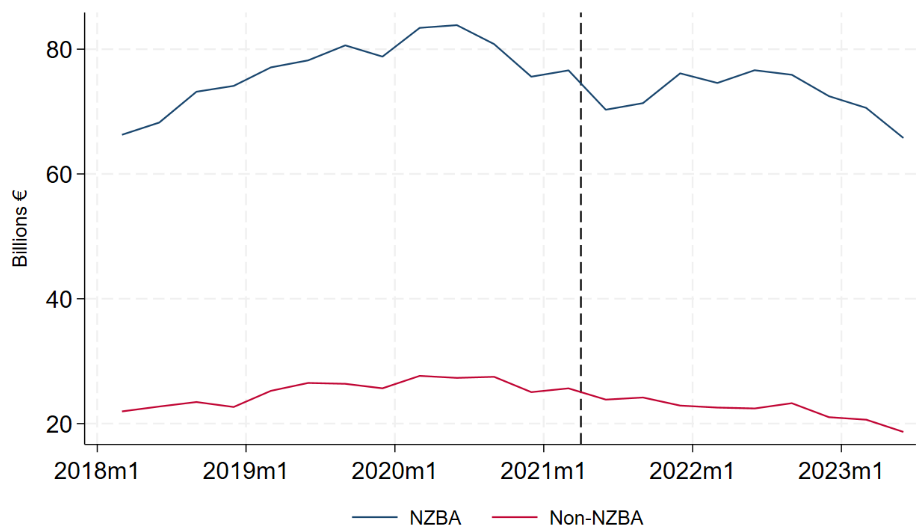
Note: This figure plots histograms of bank-level balance sheet and lending variables by whether the lender is ever a member of the NZBA. Data are from AnaCredit and FinRep as of September 2018.

Figure 3: Lending to Mining by NZBA and Non-NZBA Banks

(a) Lending Share to Mining



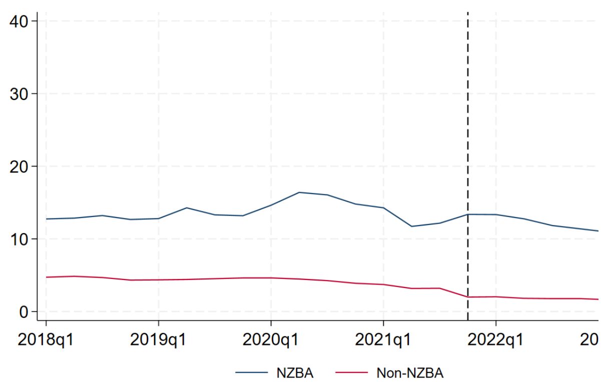
(b) Total Lending to Mining



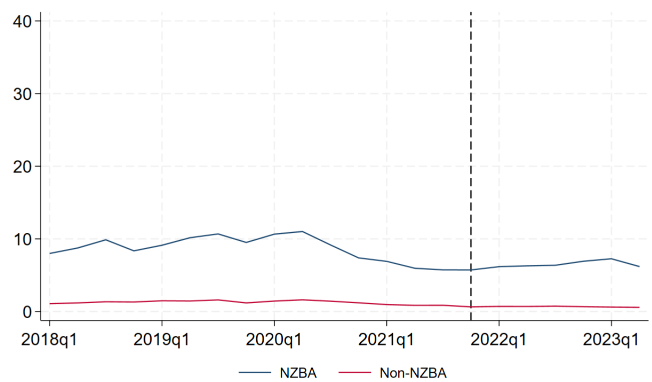
Note: This figure plots lending shares (Panel A) and total lending (Panel B) to mining firms (NACE section B) by whether the lender is ever a member of the NZBA. NACE section B includes mining of coal, fossil fuels, natural gas, and metals. Data from FinRep is limited to Euro-Area lenders and covers these lenders' worldwide lending. The vertical line refers to April 2021, the start of NZBA.

Figure 4: Total Lending to Mining Firms By Region

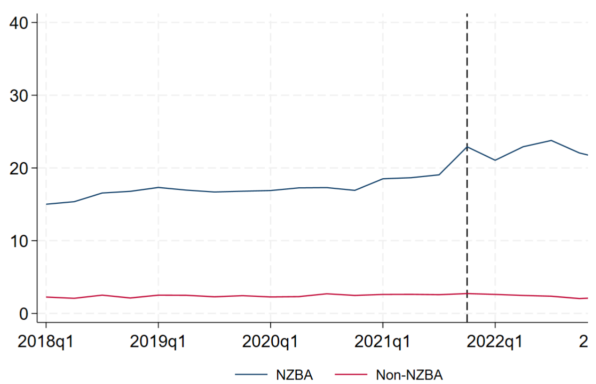
(a) Euro Area



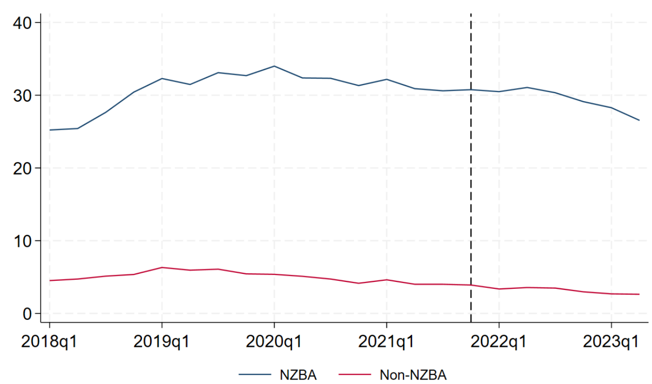
(b) United States



(c) Other OECD

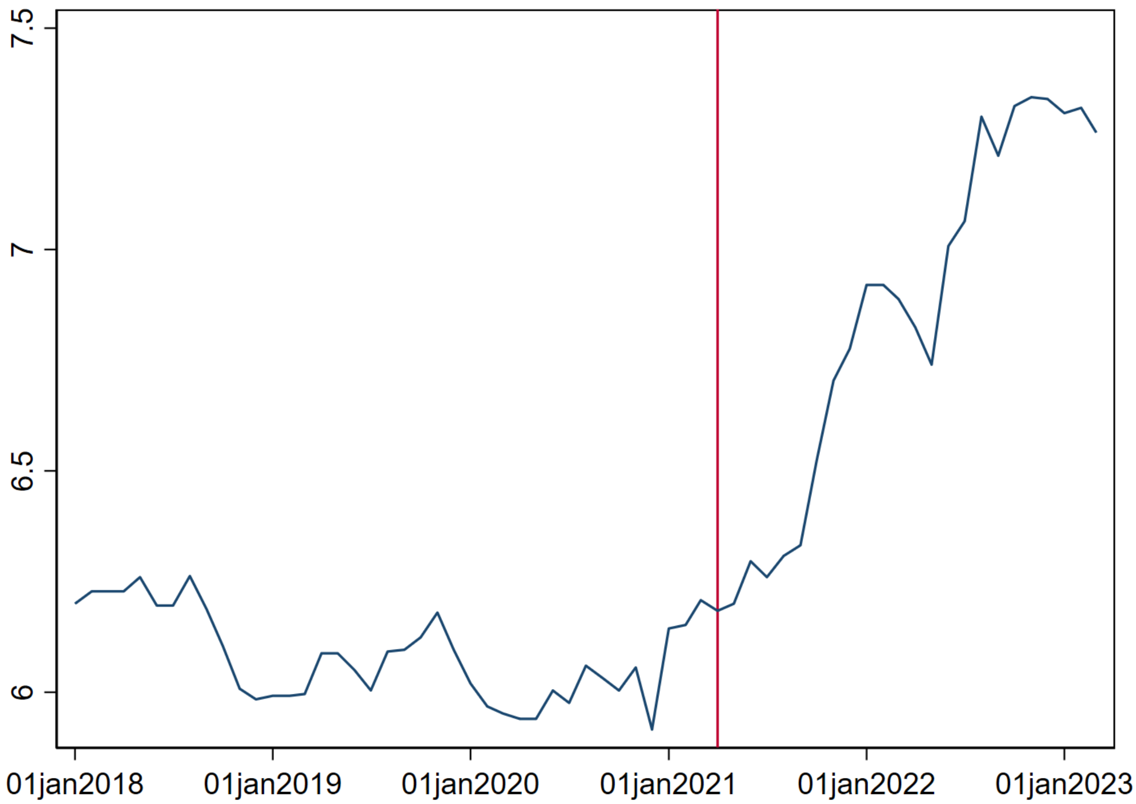


(d) Rest of the World (Non-OECD)



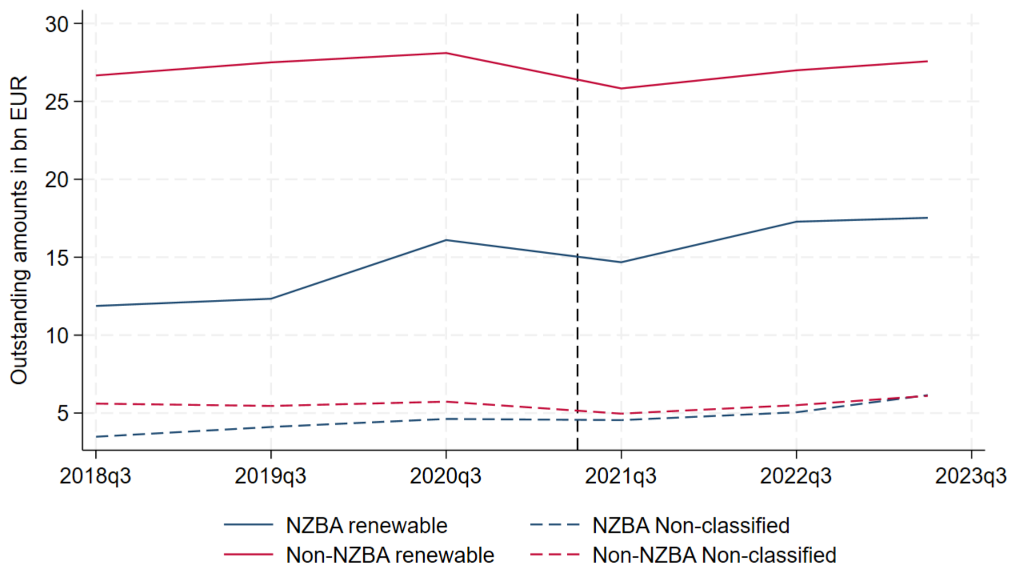
Note: This figure plots total lending to mining firms (NACE section B) by region and by whether the lender is ever a member of the NZBA (blue) or never a member (red). The vertical line indicates the beginning of the NZBA. Data are from FinRep.

Figure 5: Average MSCI Environmental Pillar Score ("E") Rating for NZBA Banks



Note: This figure plots the average Environmental Pillar Score ("E") score by month for the NZBA banks that have an ESG rating from MSCI. "E" scores range from 1 (lowest) to 10 (highest). The vertical line indicates the beginning of the NZBA in April 2021.

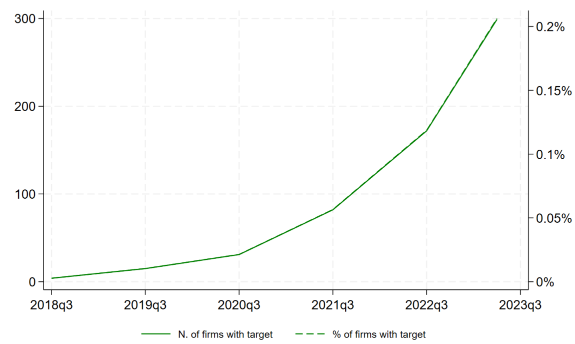
Figure 6: Project Finance Loans to Power Generation



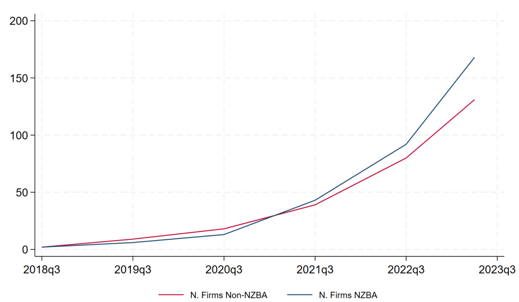
Note: This figure shows the amount of project finance loans going to each renewable and non-classified projects by NZBA and non-NZBA banks. Power generation is defined as NACE sector D. See text for a description of how projects are classified as renewable.

Figure 7: Lender Engagement: Borrowers with SBTi Validated Targets Borrowing from NZBA and non-NZBA Banks

(a) Number of Borrowers with an SBTi Target



(b) Number of Borrowers with an SBTi Target by NZBA



(c) Share of lending to firms with an SBTi Target by NZBA

Note: This figure focuses on SBTi target-setting by firm borrowers in AnaCredit. Panel (a) shows the overall number of firms with a validated target and the percent of firms with a target (right axis). Panel (b) shows the Number of firms with an SBTi target that borrow from NZBA banks (blue) and non-NZBA banks (red). The same firm may be included in both groups if it has borrowing relationships with both types of banks. Panel (c) shows the share of overall credit extended to firms with a target by NZBA banks (blue) and non-NZBA banks (red). Data are from SBTi and AnaCredit.

Business as Usual: Bank Climate Commitments, Lending, and Engagement

Online Appendix

Pari Sastry[†] Emil Verner[§] David Marques-Ibanez[‡]

April 2024

This is the Online Appendix for "Business as Usual: Bank Climate Commitments, Lending, and Engagement." The appendix provides additional tables and figures.

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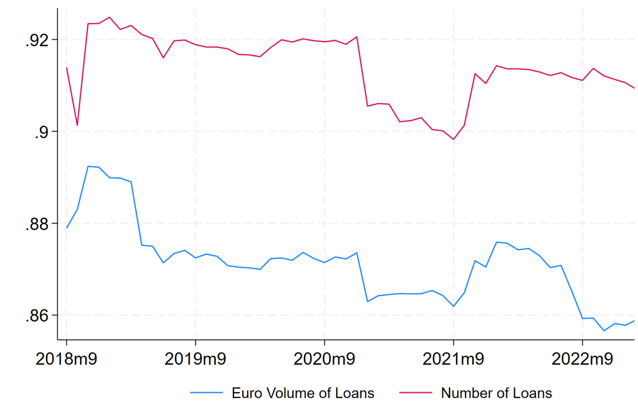
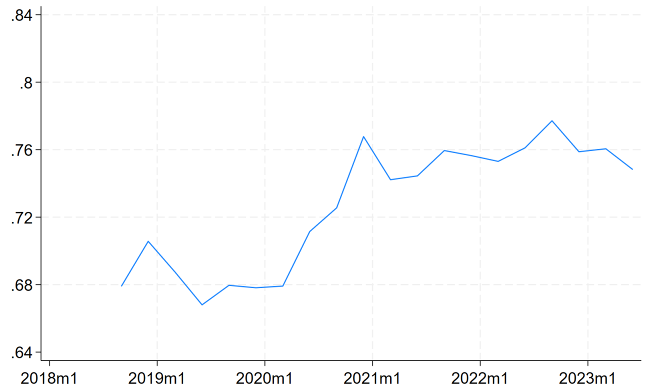
A Appendix Table and Figures

Figure A.1: Lending Coverage in FinRep and Anacredit

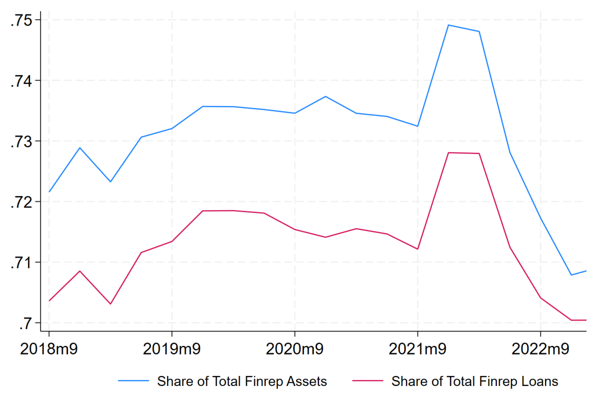
(a) Lending Share in AnaCredit of Banks in FinRep



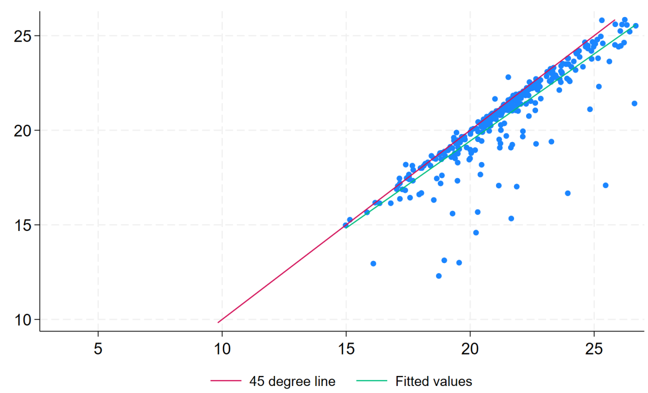
(b) Total AnaCredit Lending Divided By All NFC Loans in FinRep



(c) Lending and Assets Share in FinRep of Banks in AnaCredit



(d) Comparison of Log Total Loans by Bank in AnaCredit and FinRep in September 2019



Note: These figures show the relative coverage and correlations between banks with information in both the FinRep and AnaCredit datasets.

Figure A.2: Deutsche Bank Net Zero Target

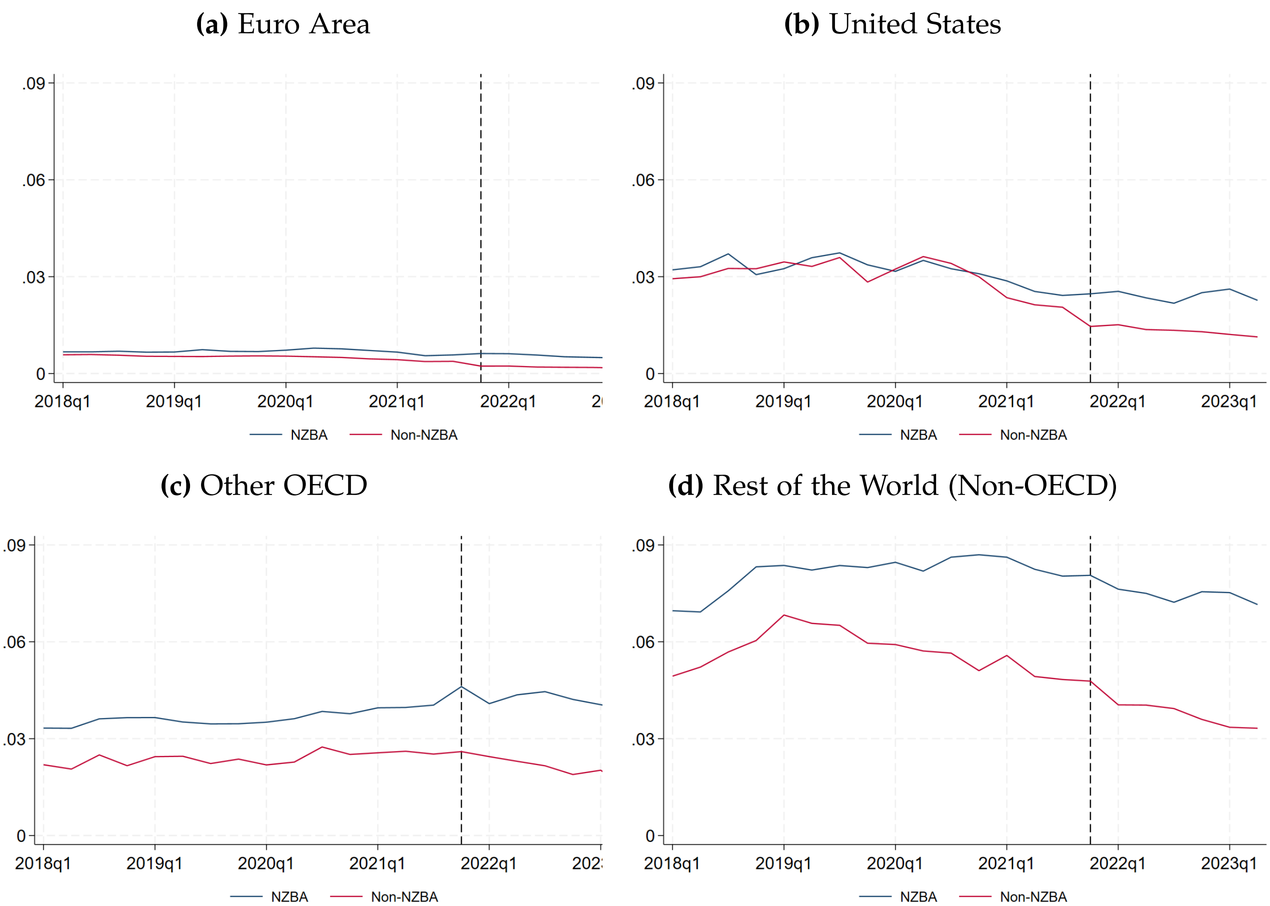
Net zero targets in four key sectors

Deutsche Bank's targets cover sectors accounting for a significant proportion of financed emissions of its € 250 billion corporate loan book1 as well as key sources of global Scope 3 emissions of clients. Targets for each sector are as follows:

- Oil & Gas (Upstream): 23% reduction in Scope 3 upstream financed emissions by 2030, and 90% reduction by 2050, in millions of tonnes of CO2
- Power generation: 69% reduction in Scope 1 physical emission intensity by 2030 and 100% reduction by 2050, in kilogrammes of CO2 equivalent per megawatt hour
- Automotive (light duty vehicles): 59% reduction in tailpipe emission intensity by 2030 and 100% reduction by 2050, in grammes of CO2 per vehicle kilometre
- Steel: 33% reduction in Scope 1 and 2 physical emission intensity by 2030 and 90% reduction by 2050, in kilogrammes of CO2 equivalent per tonne

Note: This figure shows an example of the target released by Deutsche Bank after it jointed the Net Zero Banking Alliance.

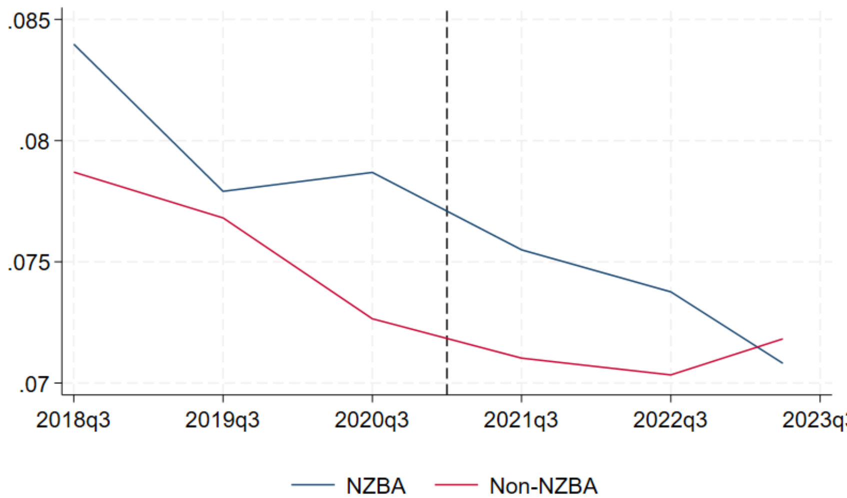
Figure A.3: Portfolio Shares of Lending to Mining Firms By Region



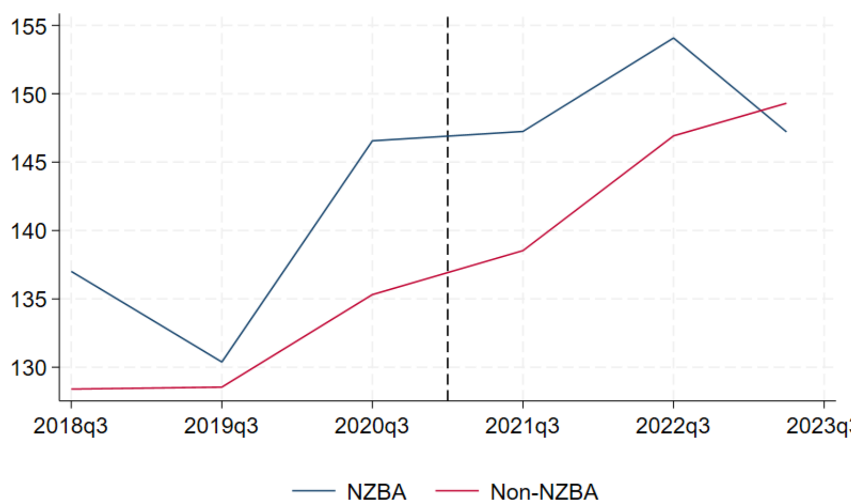
Note: This figure plots the share of lending to mining firms (NACE sector B) by whether the lender is ever a member of the NZBA (blue) or never a member (red). The vertical line indicates the beginning of the NZBA Alliance. Data are from FinRep. Data are from FinRep.

Figure A.4: Lending to "Green" Firms based on the EU Taxonomy by NZBA and Non-NZBA Banks

(a) Lending Share to EU Taxonomy Sectors



(b) Total Lending to EU Taxonomy Sectors

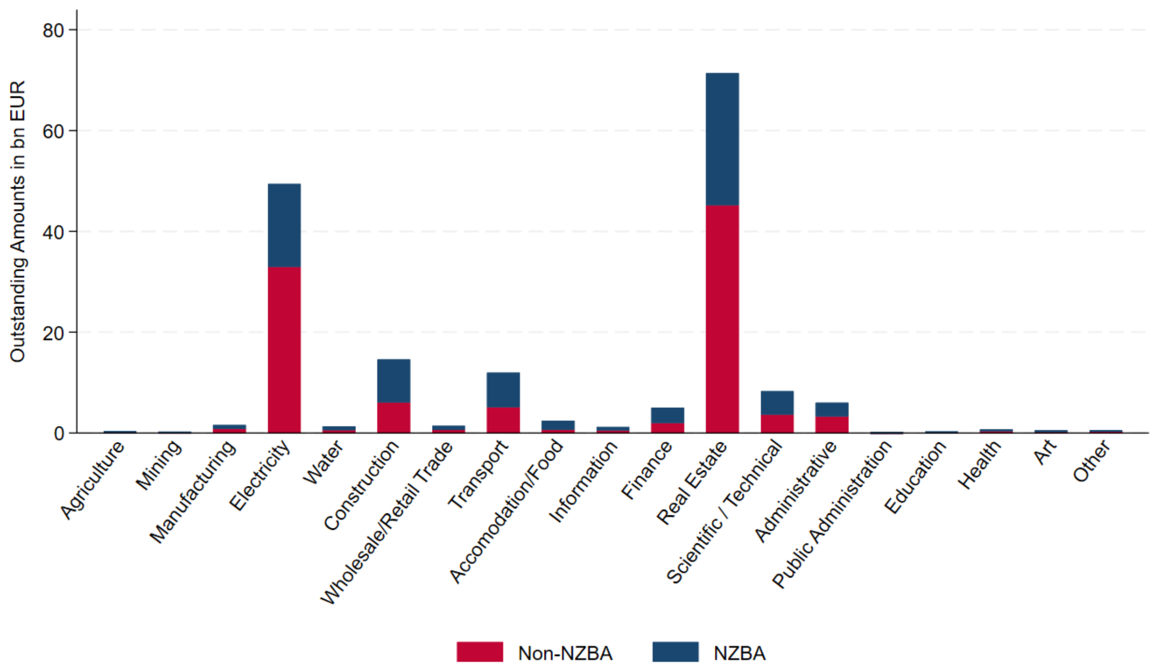


Note: This figure plots lending shares (panel A) and total lending in billions of euros (Panel B) to firms in sectors included in the EU's Taxonomy for Sustainable Activities. We present lending shares separately for whether the lender is ever a member of the NZBA. Data comes AnaCredit and is limited to Euro-Area lenders.

Figure A.5: Share of Syndicated Loans in Total Loans

Note: This figure shows syndicated loans (A20S) as a share of total loans to NFCs (A20) reported to National Central Banks and the ECB (BSI).

Figure A.6: Project Finance Loans by Sector



Note: This figure shows the amount of project finance loans going to each NACE sector in 2019Q3.

Table A.1: Bank-Level Analysis: Lender Divestment from Mining Firms by Region

Panel A: OLS Lending Share

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$\text{PostNZBA}_{b,t}$	-0.0001	0.0003	0.0010
	[-0.0014,0.0012]	[-0.0009,0.0015]	[-0.0006,0.0025]
	(0.0006)	(0.0006)	(0.0008)
$\text{PostNZBA}_{b,t} \times US$			-0.0013
			[-0.0028,0.0003]
			(0.0008)
$\text{PostNZBA}_{b,t} \times OtherOECD$			0.0001
			[-0.0018,0.0020]
			(0.0010)
$\text{PostNZBA}_{b,t} \times ROW$			-0.0017
			[-0.0046,0.0013]
			(0.0015)
N	7726	7720	7720
N_Banks	104	104	104
adj. R^2	0.299	0.649	0.649
Bank_FE	Y	Y	Y
Time_FE	Y	Y	Y
Balance_Sheet_Controls	N	Y	Y
Region_FE	N	Y	Y
Region_Time_FE	N	Y	Y
Region_Bank_FE	N	Y	Y

Panel B: PPML Total Lending

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$\text{PostNZBA}_{b,t}$	0.3635***	0.1422	0.3721**
	[0.1619,0.5652]	[-0.0337,0.3181]	[0.0653,0.6789]
	(0.1029)	(0.0898)	(0.1565)
$\text{PostNZBA}_{b,t} \times US$			-0.4451*
			[-0.9308,0.0407]
			(0.2478)
$\text{PostNZBA}_{b,t} \times OtherOECD$			-0.3838*
			[-0.8194,0.0517]
			(0.2222)
$\text{PostNZBA}_{b,t} \times ROW$			-0.2282
			[-0.5472,0.0909]
			(0.1628)
N	7339	4938	4938
N_Banks	97	97	97
Bank_FE	Y	Y	Y
Time_FE	Y	Y	Y
Balance_Sheet_Controls	N	Y	Y
Region_FE	N	Y	Y
Region_Time_FE	N	Y	Y
Region_Bank_FE	N	Y	Y

Note: This table presents estimates of the impact of NZBA adoption on lending to mining by region. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A.2: Bank-Level Analysis: Effect of NZBA Participation on Deposits

	(1) Log(Deposits) b/ci95/se	(2) Net Interest Margin b/ci95/se
$\text{PostNZBA}_{b,t}$	0.0198	0.0223
	[-0.0327,0.0722]	[-0.0592,0.1039]
	(0.0267)	(0.0415)
N	1986	1986
N_Banks	331	331
Mean (Dep. Var)	22.743	1.032
adj. R^2	0.992	0.747
Bank_FE	Y	Y
Time_FE	Y	Y

Note: This table presents bank-level regressions of the impact of NZBA adoption on total deposits. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A.3: Bank-Firm-Level Analysis of the Intensive Margin – Largest Firms

Panel A: Target Sector Firms (Quartile 4)

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$PostNZBA_{b,t}$	0.0203		
	[-0.0258,0.0663]		
	(0.0234)		
$PostNZBA_{b,t} \times SectorTarget_{b,f}$	0.0019	0.0142	-0.0024
	[-0.0317,0.0355]	[-0.0337,0.0621]	[-0.0427,0.0379]
	(0.0171)	(0.0244)	(0.0205)
N	3214830.0000	3214782.0000	1655004.0000
N_Banks	325	317	297
adj. R^2	0.8385	0.8410	0.8369
Bank_Firm_FE	Y	Y	Y
Bank_Time_FE	N	Y	Y
Firm_Time_FE	N	N	Y
Industry_Time_FE	Y	Y	N
Controls	Y	N	N

Panel B: Mining Sector Firms (Quartile 4)

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$PostNZBA_{b,t}$	0.0203		
	[-0.0246,0.0651]		
	(0.0228)		
$PostNZBA_{b,t} \times Mining_{f}$	0.0405	0.0325	-0.0558
	[-0.0559,0.1370]	[-0.0621,0.1271]	[-0.1990,0.0874]
	(0.0490)	(0.0481)	(0.0728)
N	3214830.0000	3214782.0000	1655004.0000
N_Banks	325	317	297
adj. R^2	0.8385	0.8410	0.8369
Bank_Firm_FE	Y	Y	Y
Bank_Time_FE	N	Y	Y
Firm_Time_FE	N	N	Y
Industry_Time_FE	Y	Y	N
Controls	Y	N	N

Panel C: EU Taxonomy Firms (Quartile 4)

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$PostNZBA_{b,t}$	0.0189		
	[-0.0251,0.0629]		
	(0.0224)		
$PostNZBA_{b,t} \times Taxonomy_{f}$	0.0116	0.0283**	-0.0030
	[-0.0140,0.0371]	[0.0064,0.0502]	[-0.0206,0.0146]
	(0.0130)	(0.0111)	(0.0089)
N	3214830.0000	3214782.0000	1655004.0000
N_Banks	325	317	297
adj. R^2	0.8385	0.8410	0.8369
Bank_Firm_FE	Y	Y	Y
Bank_Time_FE	N	Y	Y
Firm_Time_FE	N	N	Y
Industry_Time_FE	Y	Y	N
Controls	Y	N	N

Note: This table is similar to Table 5 but restricts the sample to firms in the top quartile based on initial borrowed amount in Anacredit. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A.4: Engagement: Effect of NZBA on Borrower SBTi Targets - Robustness Using Loan-share Weighted Firm NZBA Exposure

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se	(4) b/ci95/se	(5) b/ci95/se	(6) b/ci95/se
$NZBA_{b,2023}$	-0.0003*** [-0.0005,-0.0001] (0.0001)					
$PostNZBAShare_{f,t}$		-0.0001** [-0.0002,-0.0000] (0.0000)				
$PostNZBAShare_{f,t} \times SectorTarget_{b,f}$			0.0000 [-0.0001,0.0002] (0.0001)			
$PostNZBAShare_{f,t} \times Mining_{f}$				0.0002 [-0.0000,0.0003] (0.0001)		
$PostNZBAShare_{f,t} \times Taxonomy_{f}$					0.0000 [-0.0001,0.0001] (0.0000)	
$PostNZBAShare_{f,t} \times Fossil_{f}$						0.0011 [-0.0007,0.0030] (0.0009)
N	1449669	8698014	8697972	8697972	8697972	8697972
N_Banks	322	322	315	315	315	315
Mean Dep. Variable	.0002	.0001	.0001	.0001	.0001	.0001
adj. R^2	0.000	0.338	0.339	0.339	0.339	0.339
Bank_FE	N	Y	N	N	N	N
Firm_FE	N	Y	N	N	N	N
Time_FE	N	Y	N	N	N	N
Bank_Firm_FE	N	N	Y	Y	Y	Y
Bank_Time_FE	N	N	Y	Y	Y	Y
Industry_Time_FE	N	N	Y	Y	Y	Y

Note: This table is similar to Table 10 but uses the firm-level loan-share weighted PostNZBA measure ($PostNZBAShare_{f,t}$) as the treatment variable for estimating equation (6). Loan share weights are as of 2018. The dependent variable is an indicator variable for whether a firm has an SBTi target in period t. Industry-time fixed effects are two-digit NACE by time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table A.5: Net Zero Bank Exposure and Firm-Level Emissions - Robustness Using Loan-share Weighted Firm NZBA Exposure

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se
$\text{PostNZBAShare}_{f,t}$	0.0096	0.0231	0.0233
	[-0.0750,0.0942]	[-0.0693,0.1154]	[-0.0522,0.0989]
	(0.0427)	(0.0466)	(0.0381)
N	4220	4220	4175
N_Banks	118	118	118
Mean Dep. Variable	10.2549	10.2549	10.2654
adj. R^2	0.960	0.960	0.963
Bank_FE	Y	Y	N
Firm_FE	Y	Y	N
Time_FE	Y	Y	N
Bank_Firm_FE	N	N	Y
Industry_Time_FE	N	N	Y
Controls	N	Y	Y

Note: This table is similar to Table 11 but uses the firm-level loan-share weighted PostNZBA measure ($\text{PostNZBAShare}_{f,t}$) as the treatment variable for estimating equation (6). Controls are bank-level characteristics (total assets, deposits-to-assets, and net interest margin, all measured in 2018) interacted with time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.