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Business as usual: bank climate commitments, lending, and engagement

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Abstract

This paper studies the impact of voluntary climate commitments by banks on their lending activity. We use administrative data on the universe of bank lending from 19 European countries. There is strong selection into commitments, with increased participation by the largest banks and banks with the most pre-existing exposure to high-polluting industries. Setting a commitment leads to a boost in a lender's ESG rating. Lenders reduce credit in sectors they have targeted as high priority for decarbonization. However, climate-aligned banks do not change their lending or loan pricing differentially compared to banks without climate commitments, suggesting they are not actively divesting. We can reject that climate-aligned lenders divest from firms in targeted sectors by more than 2.6%. Firm borrowers are no more likely to set climate targets after their lender sets a climate target, which casts doubt on active engagement by lenders. These results call into question the efficacy of voluntary commitments.
Keywords: Banks, Green Lending, Voluntary targets
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Non-technical summary

Financial institutions face increasing pressure from external stakeholders to support the economy's transition away from carbon-intensive activities. In response banks around the world have joined a range of climate-related initiatives. In this paper, we evaluate the impact of banks' voluntary climate commitments on their lending behavior and on the climate impact of borrowing firms. We organize our empirical analysis around three hypotheses for how bank climate commitments can impact their financed emissions. First, climate-aligned banks can divest from polluting firms and reallocate capital to less emission-intensive firms. Second, banks can engage with high-polluting firms to push them to reduce their emissions. A third is that green commitments have limited impact on financed emissions. Our analysis relies on two administrative data sources covering European banks that provide a comprehensive view of these banks' lending portfolios. The first is a detailed European firm credit registry on bank lending to European firms going back to 2018. The second covers European banks' global lending by sector.

Our analysis proceeds in three steps. First, we document that there is strong selection into green initiatives. Banks joining green initiatives are larger and lend more to "brown" sectors such as mining. They have a similar share of lending to mining in the euro area as non-signers, but a substantially higher share of lending to mining in their global portfolios. Banks joining the initiative set targets concentrated in power generation, oil and gas, and transport. Moreover, they set targets in sectors to which they have more ex ante lending exposure. Second, We document that climate-aligned lenders reduce lending to targeted sectors by about 20 percent. This would appear to support the hypothesis that lenders divest from brown sectors. Yet we find no evidence of divestment by climate-aligned banks from targeted sectors. We also find no evidence of divestment from other proxies of high-emissions firms, such as firms in the mining sector and firms outside of the EU taxonomy for environmentally sustainable activities. We also show that climate-aligned lenders have a slightly higher rate of entry into new relationships with firms in high-emissions targeted sectors, while we find a limited effect on exit. Further, we find no evidence of a change in interest rates charged by climate-aligned banks to high-emission firms. Across a range of specifications, we find robust evidence against the divestment hypothesis. Third, we find that firms borrowing from NZBA banks are not more likely to themselves set a decarbonization target. Overall, our results cast doubt on the efficacy of voluntary climate 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 relatively little impact on decarbonization.

1 Introduction

Financial institutions face increasing pressure from external stakeholders to support the economy's transition away from carbon-intensive activities. While there have been active divestment campaigns in equity markets and bond markets for decades, lending markets have received a new focus in recent years following the 2015 Paris Climate Accords. In response to concerns about accelerating climate change, banks around the world have joined a range of climate-related initiatives. These initiatives are typically voluntary, and they differ in their precise goals, membership, and on how explicit they are about setting targets. Many laud these initiatives as evidence that banks are beginning to seriously incorporate climate change concerns in their lending and investment decisions, arguing that banks are moving faster than policymakers in this space. Others, however, have suggested that these voluntary initiatives with limited enforcement reflect "greenwashing' behavior and are unlikely to bring significant changes in firm carbon emissions.[1]

In this paper, we evaluate the impact of banks' voluntary climate commitments on their lending behavior and on the climate impact of borrowing firms. We focus on banks joining the Net Zero Banking Alliance (NZBA). While there are a number of voluntary climate-related initiatives, the NZBA is the largest and most stringent. The NZBA has 138 member banks from 44 countries, representing over 40% of global banking assets.[2] Furthermore, it has an explicit focus on portfolio lending and emissions target-setting. Specifically, banks who are signatories of the NZBA 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 and refer to which sectors the lender has targeted as high priority for decarbonization.

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

[2]UNEP. "Net Zero Banking Alliance." Accessed May 2023. https://www.unepfi.org/net-zero-banking.

Banks must also publish a high-level transition plan providing an overview of how they expect to meet their sectoral targets.

We organize our empirical analysis around three hypotheses for how bank climate commitments can impact their financed emissions. First, climate-aligned banks can *divest* from polluting firms and reallocate capital to less emission-intensive firms. Second, banks can *engage* with high-polluting firms to push them to reduce their emissions. For example, banks can encourage polluting firms to set climate targets and invest in cleaner technologies. A third hypothesis is that green commitments have limited impact on financed emissions and instead represents *greenwashing*.

Our analysis relies on two administrative data sources covering European banks that provide a comprehensive view of these banks' lending portfolios. The first dataset is a detailed European firm credit registry on bank lending to European firms going back to 2018. This allows for a detailed analysis at the firm-level, allowing us to explore to what extent green banking initiatives impact European firms, such as their overall bank borrowing, which banks they borrow from, the cost of their borrowing, and target-setting. The second dataset covers European banks' global lending by sector going back to 2015. This provides an important complement to the credit registry data, as most lending by European banks to emissions-intensive sectors, such as mining, occurs to firms outside of the euro area.[3] For example, in 2018 lending by euro area banks to euro area borrowers in the mining sector (including coal, oil, and gas) accounted for less than 25% of their total mining lending worldwide.

Our analysis proceeds in three steps. First, we provide new facts about which lenders set climate targets, what targets they set, and why they set targets. We document that there is strong selection into green initiatives. Banks joining green initiatives are larger and lend more to "brown" sectors such as mining. They have a

[3]Throughout the paper, we refer to NACE Section B as "mining." This sector includes mining of coal, fossil fuels, natural gas, and metals.

similar share of lending to mining in the euro area as non-signers, but a substantially higher share of lending to mining in their global portfolios. Banks joining the initiative set targets concentrated in power generation, oil & gas, and transport. Moreover, these banks set targets in sectors to which they have more *ex ante* lending exposure.

An important question is why banks choose to join these green initiatives to begin with. Banks may join initiatives as part of a risk management strategy to address transition risk, to improve their reputation (Krueger et al., 2020), or because being green might simply be more profitable, for example, by lowering the cost of capital (Fatica et al., 2021). We document that a concrete benefit for banks that join NZBA is they see an increase in their MSCI ESG rating of 0.6 points out of 10, a substantial upgrade. This suggests large banks with ESG ratings derive reputational and financial benefits from making climate commitments.

Second, we examine the divestment hypothesis. We start by documenting what lenders themselves would likely report, namely the evolution in absolute lending to targeted sectors. Climate-aligned lenders reduce lending to targeted sectors by about 20 percent. They also reduce lending to targeted sectors relative to non-targeted sectors. Taken at face value, this would appear to support the hypothesis that lenders divest from brown sectors.

Can this reduction in lending to targeted sectors be explained by climate commitments through the NZBA? Answering this question requires specifying a counterfactual for lending. We therefore examine the evolution of lending to targeted sectors relative to other sectors, for NZBA banks relative to other banks, in a triple-differences specification. Once we control for the evolution of lending by non-NZBA banks, we find no evidence of divestment by climate-aligned banks from targeted sectors. 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) and firms outside of the EU taxonomy for environmentally sustainable activities.[4] We also examine the extensive margin of lending—entry and exit from lending relationships. Climate-aligned lenders have a slightly *higher* rate of entry into new relationships with firms in high-emissions targeted sectors, while we find a limited effect on exit. Further, we find no evidence of a change in interest rates charged by climate-aligned banks to high-emission firms.

The large and granular administrative data we use allows us to reject even small magnitudes of the divestment hypothesis. Our standard errors are sufficiently small that we can reject with 95% confidence that climate-aligned lenders divest from firms in targeted sectors by more than 2.6% and from mining firms by more than 4.0%. Moreover, the 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.

Third, we examine the engagement hypothesis by testing whether firms that borrow from climate-aligned banks are themselves more likely to set decarbonization targets. We focus on validated SBTi targets,the most commonly used target-setting platform by nonfinancial firms. While there has been an overall rise in target-setting in recent years, we find that firms borrowing from NZBA banks are not more likely to themselves set a decarbonization target. We can reject with 95% confidence that firms borrowing from NZBA banks increase target-setting by more than 4 basis points. This evidence cuts against the engagement hypothesis, as a first step to reducing emissions for many firms would be to set a target.

Overall, our results cast doubt on the efficacy of voluntary climate 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

[4]The EU Taxonomy is a regulatory classification passed in 2020 by the European Parliament which designates specific sectors and activities as "sustainable."

have relatively little impact on decarbonization.

1.1 Related Literature

This paper contributes to three strands of literature. First, we relate most closely to the small but growing literature on how financial institutions support the economy's adaptation to climate change by divesting from emissions-intensive sectors (Giglio et al., 2021). Most recent papers on climate-related divestment study the syndicated lending market, and so far the evidence is mixed. Both Kacperczyk and Peydró (2022) and Green and Vallee (2022) find that banks with climate-related lending targets decrease their lending to large polluting firms. These studies find that lender divestment has real effects on firm outcomes, such as investment and size, because targeted firms cannot easily offset the lost financing. However the two papers differ in whether lender divestment meaningfully changes firm emissions. Ye (2023) also uses data from the syndicated loan market and finds that banks setting climate targets reduce lending to high-emissions firms, leading to reduced green patent filings by these firms but higher green patent filings by other firms. Degryse et al. (2023) finds that climate-aligned banks offer better pricing terms to green firms, while Delis et al. (2019) find that climate-aligned banks charge higher rates to fossil-fuel firms. On the other hand, Bruno and Lombini (2023) finds inconsistent results on lender divestment which depend heavily on which measure of firms' carbon emissions is being used. Haushalter et al. (2023) find limited evidence that banks that commit to curtailing lending for mountain-top removal mining actually do so.

Looking beyond syndicated lending, other papers that have studied lender divestment in other contexts find different results. For example, Sachdeva et al. (2022) use proprietary regulatory data on the thirty largest U.S. banks to study a U.S. Department of Justice-led initiative that compelled banks to cut lending to industries that posed a high risk for money laundering and fraud. They find that targeted banks reduced credit to these firms as required, but that the targeted firms fully substituted by borrowing from other banks. Using administrative AnaCredit data from the ECB, Altavilla et al. (2023) find that green banks (SBTi signatories) charge higher rates to high-emissions firms and lower rates to firms that make commitments to reduce emissions.[5] In a recent and complementary paper, Giannetti et al. (2023) also use administrative data on European banks lending to European firms. They find no evidence that lenders with more environmental disclosures divest from brown firms.

In contrast to most of these studies, we use administrative data that comprises the universe of European banks and their entire firm lending portfolios, of which syndicated lending makes up just a fraction (around 15%). Relative to Giannetti et al. (2023), we study lending net zero *commitments* rather than disclosures, and we also examine banks worldwide lending, in addition to lending to European firms. Additionally, we focus on measures that are consistent with lenders' stated portfolio targets, rather than general measures of "brown" firms, and look at targets that span a variety of sectors besides mining that include power generation and transportation. We also examine lending patterns internationally, while these papers mostly focus lending with the U.S. and Europe. With this data, we find no differential change in lending by banks with explicit net-zero climate commitments to brown firms, anywhere in the world. We also focus on the more recent time period. Our results on the impact of climate commitments on banks' ESG ratings and on the correlates of firm target-setting are also new to the literature.

Second, this paper is also related to the climate finance literature on shareholder divestment. Motivations for divestment can be classified into value-alignment, risk management, and impact (Bénabou and Tirole, 2006; Brest et al., 2018; Krueger et al.,

[5]Relatedly, Bolton and Kacperczyk (2023) study climate commitments made by non-financial firms, finding that climate-aligned firms do lower their emissions.

2020). Within the category of impact, there is a debate in the literature about whether divestment or engagement strategies are more effective at generating impact (see Broccardo et al., 2022, Berk and van Binsbergen, 2021, Hartzmark and Shue, 2023). While equity and debt markets differ in significant ways, we contribute to this literature by considering both lender divestment and engagement measures.

Third, this paper contributes to the extensive banking literature on the real effects of shocks to bank credit supply. Recent evidence from the 2008 financial crisis also confirms that it is hard to substitute bank credit with other sources of financing (Campello et al., 2010; Duchin et al., 2010; Campello et al., 2011; Chodorow-Reich, 2013; Becker and Ivashina, 2014; Duygan-Bump et al., 2015). It is however difficult to draw an analogy from research on banking crises to green lending because, as we show, banks have not yet meaningfully reduced credit supply to brown firms. That said, the theoretical and empirical evidence suggests that if even a handful of large banks were to divest from polluting firms, or even threaten to divest, that could impose a serious financing shock on polluting firms. This channel may therefore become more relevant over time.

2 Hypothesis Development

Banks can pursue several strategies to reach their emissions-reduction targets (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).[6] 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).

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

This channel requires that firms cannot easily substitute between different sources of financing, such as from climate-aligned banks 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. Lender divestment has been the focus of several recent studies, which find large reductions in syndicated lending to polluting firms by climate-aligned banks (Kacperczyk and Peydró, 2022; Green and Vallee, 2022). Moreover, Degryse et al. (2023) finds that climate-aligned banks lend at lower interest rates to green firms, defined as firms that voluntarily disclose emissions through the Carbon Disclosure Project.

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.[7] These banks often argue that emissions intensive sectors, such 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. 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

[7]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 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.

firms to make credible plans to reduce emissions.

While there may be an economic rationale behind an engagement strategy, there is a concern that in the short-run engagement may be indistinguishable from *greenwashing*. This is because there are limited and incomplete mechanisms for measuring and verifying banks' compliance with their green commitments (Crawford and Sobel, 1982). In particular, it is difficult to know whether borrowing firms reduce their emissions and to ascertain the role, if any, played by their banks in the decarbonization efforts. There is limited economy-wide firm disclosure of historical, current, or projected future emissions, and to the extent that this disclosure exists, it is on a voluntary basis and is limited to large public firms. Furthermore, decarbonization is likely to take time, and these gains may not be realized for years after the initial capital expenditure. Because lending is easier to measure than changes in emissions, divestment is far easier to monitor than engagement. It is also not clear if there is any sanction for banks that do not comply with their agreements. 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, but this is mitigated by the first concern about measurement. Banks joining green initiatives may not be able to self-regulate.

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, 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.

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 to consolidate all lending to the ultimate parent.

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. These banks also 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.[8]

A subset of banks with significant non-EU exposures also report their lending at a more disaggregate 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.

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

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.

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.[9] 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, allowing us to study lending allocation across more detailed industries relative to FinRep. 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, but the drawback is that the data 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 two 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–this dataset includes the full set of bank-firm relationships, and allows us to examine new relationships that are formed and when banks exit from existing relationships.

AnaCredit and FinRep are broadly comparable in terms of reporting lenders and loan amounts recorded. The banks which appear in both FinRep and AnaCredit repre-

[9] Loans to natural persons are excluded.

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

We therefore use FinRep to obtain a comprehensive picture of bank lending across the globe and AnaCredit to consider detailed firm-level outcomes.

MSCI ESG Ratings. We complement our administrative data with information from MSCI on ESG ratings, spanning 2018-2023. We merge to our ECB administrative dataset using LEI identifiers and a fuzzy match on lender name.

SBTi Targets. We also compile information from the Science-Based Targets Initiative (SBTi) on decarbonization targets set by nonfinancial firms spanning 2018-2023. We merge to our ECB administrative dataset using LEI identifiers and a fuzzy match on lender name.

3.2 Advantages of the administrative data

FinRep and AnaCredit have salient advantages compared to publicly available data from the syndicated loan market usually used in the literature, such as Dealscan. First, the administrative data allow us to look both within the euro area and globally, whereas Dealscan is usually skewed to lending to North American and European firms. 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. Second, the administrative data cover both large and small banks, as well as large and small borrowers. We will show that a sizable amount of lending to the mining sectors is done by smaller banks which do not make climate commitments. A third advantage is that the administrative data includes information on both quantities and prices (interest rates), allowing for a comprehensive analysis of both key features of the debt contract. Fourth, the administrative data includes information on the *overall stock of lending*, not just new origination. This means that starting from the disclosure in 2018, we are able to obtain the full network or bank-borrower lending relationships, allowing us to examine changes on the extensive margin. Lastly, these data cover all loan contracts, not just syndicated loans. 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.

These features allow for a finer and more comprehensive analysis of lender divestment than what can be done using publically available datasets.

4 Determining Climate Alignment

How do we identify whether a bank is climate-aligned? A common approach is to consider whether banks have joined one of the myriad of voluntary climate-related initiatives that have been adopted in recent years. These initiatives, however, vary tremendously in terms of their scale and scope, so it is important to look carefully at what each initiative implies for the joining bank. Some initiatives focus on asserting a general demonstration of concern for the climate (e.g., United Nations Environment Programme Finance Initiative, Principles of Responsible Banking, Equator Principles, Global Alliance for Banking on Values). Others focus on incorporating environmental considerations into accounting and disclosure approaches (e.g., Partnership for Carbon Accounting Financials, Task Force on Climate-Related Financial Disclosures, Carbon

Disclosure Project). Lastly, some apply broadly to a wide variety of financial and non-financial sectors (SBTi Business Ambition for 1.5).

4.1 Net Zero Banking Alliance

We have chosen to focus specifically on the Net Zero Banking Alliance (NZBA) – a voluntary commitment to change financed emissions that is tailored specifically to banks. 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 (i.e., the 2021 United Nations Climate Change Conference). Joining the alliance constitutes an agreement to help limit global temperature increases to at most 1.5 degrees Celsius so the global economy reaches "net zero" by 2050, in line with the goals of the Paris Agreement.[10] The NZBA is just one initiative under the umbrella organization Global Financial Alliance for Net Zero (GFANZ), which 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) 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).[11]

A key feature of the NZBA is that it requires member banks to set targets for credit and investment portfolios within eighteen months of joining the alliance. These targets must apply to financed emissions in 2030 as well as in 2050, with intermediary targets set every five years from 2030 onward. The 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 within their portfolios. Within three years of joining,

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

[11] 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.

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. These targets explain how the bank plans to reduce its financed emissions, and how its planned trajectory lines up with what is required globally to meet the goals of the Paris agreement.[12] Appendix Figure A.2 shows an example target released by Deutsche Bank after it first joined the Net Zero Banking Alliance.[13]

NZBA members are also required get their targets validated, or assured, by a third party within four years of joining the alliance.[14] Currently the dominant validator of targets in this space 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.[15] Joining banks also agree to disclose their progress against their stated targets, to support transparency of the initiative.

Although the initiative is at an early stage, 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 initiative for banks.

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

[12]See UNEP FI - NZBA Commitment Statement for more details.
[13]In October 2023, Deutsche Bank expanded their sectoral targets to cover more sectors.
[14]UNEP-FI.
[15]SBTi.

4.2 Classifying Brown and Green Firms

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

Targeted Sectors (Brown). As a first measure, we use banks' 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.

Mining (Brown). As a second measure, we use the NACE sector for mining (NACE Level B) as a simple measure of "brown" firms.[16] 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). In our analysis using AnaCredit data, we also examine divisions within mining to distinguish between coal, oil, and gas and mining of metals.

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

[16] 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.

5 Who, What, When, and Why: Descriptive Facts about Bank Climate 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 which make climate commitments through the NZBA. Among the 331 banking groups in the AnaCredit credit registry, 34 have joined the NZBA.[17] 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). Additionally, most banks set targets in power generation, oil and gas, and transportation (Panel C). Despite the focus of the literature on coal mining, in practice only four banks in the sample have set sectoral targets in coal.

5.1 Selection into Net Zero Commitments

Table 2 and Figure 2 present summary statistics on the characteristics of banks that make climate 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 in assets. NZBA banks also have slightly lower net interest margins and rely less on deposit financing, in part because they are larger.

NZBA banks tend to lend *more* to "brown" firms. Globally, panel A reports that

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

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(.25% for NZBA banks versus 0.19%). NZBA banks also have a lower share of lending to "green" sectors according to 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 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.[18] Overall, the differences in interest rates charged by NZBA and non-NZBA banks to green and brown firms are quantitatively small.

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

[18] 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.

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 (Column 1) and total lending (Column 2) as dependent variables.

Table 3 presents the results on the relation between sectoral targets and *ex-ante* sectoral lending exposure. We see that 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 targetted 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 the 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. We see that, on average, NZBA banks' ESG ratings increase by more than half a notch, where a notch refers to moving from AA to AAA. Looking specifically at the environmental ("E") subcomponent of the ratings, we see that this score increase 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).

6 Evidence on Divestment

In this section, we examine whether lenders with climate commitments have divested from brown sectors. We first consider a basic test of whether climate-aligned lenders have reduced lending to targeted sectors. This analysis, however, does not take into account what would have happened to lending in the absence of climate commitments through the NZBA. We therefore next employ an identification strategy that constructs a counterfactual for lending to targeted sectors in the absence of climate commitments using lending by non-NZBA banks.

6.1 Naive Approach: Change in NZBA Banks' Lending

We first examine whether NZBA banks reduce lending to targeted sectors. This is the outcome lenders would disclose in their net zero progress report. Lenders' sectoral targets constitute a voluntary commitment to reduce *financed emissions* by either 2030 or 2050 relative to a pre-specificied baseline. If lenders choose to meet their targets by divestment, this constitutes a reduction in financing to the targeted sectors. Therefore, a simple measure of compliance can be obtained by estimating the following specification:

$$Y_{b,f,t}^{NZBA} = \alpha + \beta PostNZBA_{b,t} + \epsilon_{b,f,t}^{NZBA} \quad (1)$$

where $Y_{b,f,t}^{NZBA}$ refers to the log of lending by NZBA bank b to firm f in time t, where the sample is restricted to NZBA banks *and* firms in that bank's targeted sectors. $PostNZBA_{b,t}$ equals 1 after bank b joins the NZBA and 0 before. Note that in this specification we do not compare NZBA bank's lending to targeted versus non-targeted sectors, nor do we compare NZBA banks to non-NZBA banks.

The first column in Table 5 reports the results for log of lending as the dependent variable. On average, NZBA banks reduce lending by 20% in the targeted sectors after signing on to the alliance. Lenders are also 17 percentage points more likely to exit relationships in the targeted sectors (column 3).

We next consider a difference-in-differences design that tests how lending to firms in targeted sectors compares to lending to firms in non-targeted sectors. We retain the sample restriction that limits to NZBA banks, but we now include firms in both targeted and other sectors. We run the following specification:

$$Y_{b,f,t}^{NZBA} = \alpha + \beta PostNZBA_{b,t} \times SectorTarget_{b,f} + \epsilon_{b,f,t}^{NZBA} \quad (2)$$

where $Y_{b,f,t}^{NZBA}$ refers to lending by NZBA bank b to firm f in time t. $PostNZBA_{b,t}$ is a dummy that equals 1 after bank b joins NZBA and 0 before. $SectorTarget_{b,f}$ is an indicator variable that equals 1 if firm f is in the banks' targeted sectors. The results are reported in columns (2) and (4) of Table 5. Looking at column (2), we see that the reduction in lending to targeted sectors persists–NZBA banks do reduce lending to targeted firms relative to non-targeted firms by 13%, but the result on exit disappears. In fact, banks are less likely to exit from relationships with firms in targeted sectors relative to firms in non-targeted sectors by 7 percentage points.

6.2 Triple-Differences Research Design

The analysis in the previous section is limited to banks that join NZBA. While we find some evidence of credit reduction, it is not clear from this analysis alone whether NZBA banks may have reduced lending to targeted sectors even in the absence of voluntary climate commitments. For example, there may be an aggregate decline in loan demand from firms in these sectors. Therefore, the evidence in Table 5 does not necessarily imply that lenders reduced lending to targeted sectors *because* of NZBA. To understand if NZBA adoption contributes to a reduction in lending to targeted sectors, we need to specify a counterfactual. We next formulate 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 high-emissions 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:

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

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. The dummy $PostNZBA_{b,t}$ is an indicator that equals one after a bank joins NZBA, and zero before that. It will always equals zero for banks that never join NZBA (never-treated banks). The dummy $SectoralTargets_{b,f}$ 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 coefficient of interest in equation (3) 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 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.

To make the identification strategy concrete in this setting, we are interested in estimating whether NZBA banks have reduced credit supply to target-sector firms. This is difficult to address directly in the context of a simple differences design, as in equation (1) we estimated above in Table 5, where the sample is restricted to net zero banks' lending to target sector firms. The regression in equation (1) examines the difference in NZBA bank lending before and after the banks joins the alliance. However, because lending is an equilibrium object, these changes can be driven by demand shocks rather than credit supply. This identification challenge continues to be a problem in the difference-in-differences regression specification in equation (2), where we look at lending by NZBA banks to target-sector and non-target sector firms

(Table 5 columns 2 and 4). The issue here is that there could be sector-specific demand shocks. This is an acute issue in this setting given that there are likely to be strong trends across sectors in credit demand due to technological shifts and government policy.

We therefore employ the triple differences, incorporating information on the behavior of non-NZBA banks. In effect, this allows us to use difference-in-difference estimator for differential changes in lending by non-NZBA banks to target-sector relative to non-target-sector firms to estimate the sector specific demand shocks. This identification strategy allows there to be bank-specific and sector-specific demand shocks. However, the triple-differences strategy does not allow there to be bank-sector specific shocks over time that are correlated with NZBA adoption.

We reinforce the identification by including firm-time fixed effects in equation (3), 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 bank and a non-NZBA bank lending to the same firms in a targeted sector, relative to their lending to the same firms in non-targeted sectors.[19] The inclusion of firm-time fixed effects requires that a firm borrow from at least two banks, so this reduces the sample size and increases estimation uncertainty substantially. 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

[19] 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 indicating that NZBA banks do not differentially reduce lending to the same firms.

specifications:

$$Y_{b,f,t} = \alpha_{b,f} + \delta_{f,t} + \gamma_{b,t} + \beta_1(PostNZBA_{b,t} \times Mining_f) + \epsilon_{b,f,t} \tag{4}$$

$$Y_{b,f,t} = \alpha_{b,f} + \delta_{f,t} + \gamma_{b,t} + \beta_1(PostNZBA_{b,t} \times EUTaxonomy_f) + \epsilon_{b,f,t}. \tag{5}$$

The dummy $Mining_f$ is an indicator variable that equals one if firm f is in the mining sector (NACE B).[20] $EUTaxonomy_f$ is an indicator variable that equals 1 if firm f is in one of the sectors designated in the EU Taxonomy. Note that for equation (3), there is heterogeneity in which sectors banks have chosen to target, while for the specifications in equations (4) and (5) the climate-alignment of a firm is the same across all banks.

6.3 Lending Volumes

6.3.1 Bank-Firm Level Evidence

We start by using the AnaCredit credit registry data to estimate our triple-differences specification (3). We first analyze whether NZBA banks change their lending to firms by focusing on the intensive margin on lending. In particular, we consider continuous bank-firm relationships spanning five years around the adoption of NZBA (2018-2022). 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 6 presents the results from estimation of equation (3) 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.

[20] The results are qualitatively 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 activities" (NACE 09).

Panel A of Table 6 shows that NZBA banks do not reallocate lending away from firms operating in targeted sectors, relative to non-NZBA banks. The estimate in column (1) suggests that, on average, climate-alignment leads to a negligle decline in lending to targeted sectors. 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 in Column 2, we the coefficient switches sign and is positive. Our preferred 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. This result implies that we can reject at the 5% level any divestment that exceeds 2.7%.

Column 1 of Panel B in Table 6 shows that, on average, banks increase their relative lending to mining after joining NZBA, compared to non-NZBA banks, by 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 on average, but not significantly so. We can reject at the 5% level that lenders divest from mining by more than 2.7%. The specification 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 6 suggests 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 in Column (3), we see that this result too becomes a null result. That is, we can reject at the 5% level that portfolio reallocation towards EU Taxonomy firms exceeds 1.5%.

Overall, once we control for trends in lending to different sectors by non-NZBA banks, we find that climate-aligned banks do not reallocate lending away from firms in targeted sectors or from the high-polluting mining sector after signing on to NZBA, relative to non-NZBA banks. They also do not differentially increase lending to firms in the "green" EU taxonomy sectors.

6.3.2 Bank-Sector Level Evidence on Worldwide Lending to Mining

To further explore the divestment hypothesis, we zoom in on the evolution of lending by NZBA banks and non-NZBA 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.[21] 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. Finally, 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 bar).

To verify the visual patterns in Figures 3 more formally, we estimate versions of the triple differences specification in (4), adapted to the bank-sector-time level data in

[21] The higher lending share to mining in Figure 3 compared to Table 2 occurs because the former uses the lending share from FinRep, while the latter uses AnaCredit. European banks have significantly higher lending shares to mining outside of Europe, which is only captured by FinRep.

FinRep:

$$Y_{b,s,t} = \alpha_{b,s} + \gamma_{b,t} + \delta_{s,t} + \beta(PostNZBA_{b,t} \times Mining_s) + \epsilon_{b,s,t} \ , \tag{6}$$

where $Y_{b,s,t}$ is the level or the 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 7 report the results from estimating Equation (6) 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. Our standard errors are precise enough that we can reject at the 5% level that the NZBA banks divest from mining firms by more than 0.37 percentage points. (Note that the mean lending share to mining firms is 5%.)

Columns 3 and 4 in Table 7 present the same regression for the *level* of lending to the mining sector. We estimate the regression by pseudo Poisson maximum likelihood (PPML).[22] The number of observations declines relative to the first two columns

[22] 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

because PPML omits groups where the observations are all zero. The estimates in Table 7 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 visible in the time series charts.

To further explore these trends, we use a more granular bank-sector-geography dataset again using the official supervisory confidential dataset FinRep; the sector is again reported at the NACE level. We report lending patterns for NZBA and non-NZBA banks by region: European Union (EU), United States (US), other OECD 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 (6) 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 indicates that, when limiting the data to NZBA banks, there has been a decline in lending to firms in targeted sectors and in "brown" sectors like mining. However, there is no differential decline relative to non-NZBA banks. This casts doubt on the hypothesis that lenders are actively divesting from targeted sectors or other "brown" sectors.

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wrong sign in expectation. Both studies recommend estimation by Poisson regression to accommodate zeros and heteroskedasticity.

6.4 Loan Pricing

We now turn back to the Anacredit data to examine loan pricing using the intensive margin dataset. Table 8 presents the results from estimating our triple-differences specifications (3) 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 8 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. We can reject at the 95% level any increases larger than 0.25 percentage points. The inclusion of bank-time and firm-time fixed effects leads to even smaller 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, and we can reject any interest rate increases larger than 0.05 percentage points. To benchmark these mangitudes, the average interest rate for all firms is 2.5%, and the the average interest rate for firms in the targeted sectors is 2.9% in 2018 (Table 2).

Panel B in Table 8 presents the results for mining from estimation of equation (4). On average, NZBA adoption leads to an increase in interest rates of less than 0.24 percentage points for mining firms (column 3). We can reject at the 95% level any interest rate increases larger than 0.55 percentage 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 8 presents the results for loan pricing to EU taxonomy firms based on the estimation of (5). We can reject that NZBA banks charge lower interest rates to green firms in the EU Taxonomy. The effect on interest rates to firms in EU taxonomy sectros are not significantly different from zero across all specifications. The specification in column 3 implies that NZBA adoption leads to a 0.02 percentage point increase in interest rates for 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 0.05 percentage 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.

6.5 Extensive Margin: Entry and Exit from Lending Relationships

We next analyze whether climate-aligned 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 in a period 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 in some period prior to t. We are able to observe entry and exit because the AnaCredit data consists of the full outstanding stock of loans as of 2018 onward.

Table 9 shows the results from estimating the specification in equation 4 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. These columns are therefore limited to firms which borrow from multiple banks, explaining the decline in the sample size.

Looking at Panel A in Table 9, 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 sector. 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 sector. 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 targeted sectors.

Panel B in Table 9 presents the estimate 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 in column (1), and by more than 1.96 percentage points in 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 1.5 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 9, 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 0.58 percentage points (column 4).

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

7 Firm-Level Evidence on Engagement

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 truly trying to reduce their carbon emissions profile, the first step is to set a decarbonization target for how much they want to reduce emissions and by when they seek to achieve this reduction. Figure 6 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 borrowing firms connected to climate-aligned 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:

$$SBTiTarget_{f,b,t} = \alpha + \beta PostNZBA_{b,t} + \epsilon_{f,b,t} \tag{7}$$

The dependent variable $SBTiTarget_{f,b,t}$ 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 b. The indicator variable $PostNZBA_{b,t}$ 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 vary whether we include borrower, firm, and time fixed effects, as well as other industry controls. We also consider additional interactions with whether firms are in bank's targeted sectors, the mining sector, or in 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. The coefficient we estimate across all specifications is extremely small, and our confidence intervals allow us to reject at the 95% level any increased target-setting behavior above 4 basis points. Consistent with this, panel (c) in Figure 6 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.

8 Conclusion

In recent years, financial institutions have indicated an increasing willingness to incorporate climate-related considerations in their lending and investment decisions. A prominent initiative is the Net Zero Banking Alliance, which constitutes an agreement to set voluntary net zero targets and decrease financed emissions in targeted sectors over the medium-term (2030) and long-term (2050). This paper is the first attempt to quantify whether banks have met their stated goals using administrative data that allows for a comprehensive examination of net zero lending commitments.

We find that climate-aligned lenders reduce lending to targeted sectors, both in absolute terms and relative to other sectors. However, once we compare climate-aligned lenders to other lenders, we find that climate-aligned lenders have not differentially divested from emissions-intensive firms, in mining or in the sectors for which they have set targets. This holds both for firms in the Eurozone, as well as across the globe, where the bulk of European banks' brown lending takes place. Further, we do not find evidence for engagement. Firms connected to climate-aligned banks are no more likely to themselves set decarbonization targets.

Our findings have significant implications for current debates on greenwashing and whether credit rationing by financial institutions can help the global economy meet its net zero ambitions. Our evidence suggests that NZBA banks are neither divesting nor engaging differently from banks without a climate commitment.[23] That said, the alliance is at an early stage. It remains to be seen whether these voluntary net zero commitments by banks can translate into meaningful emission reductions by borrowing firms. Perhaps these trends will shift in the coming years.

[23]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: Characterstics 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	3.01	1.58	3.05	1.60	3.00	1.58
Taxonomy Interest	3.19	1.52	3.15	1.01	3.19	1.57
SBTi Interest	0.91	0.31	0.95	0.34	0.86	0.39
Target Interest			2.91	0.83		

Portfolio Shares (%):

	(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
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 the remaining banks (non-NZBA). Data is from FinRep and AnaCredit. The data are as of September 2018, before the introduction of NZBA.

Table 3: NZBA Banks Ex-Ante Exposures to Targeted Sectors

	Lending Share (OLS) (1) b/ci95/se	Total Lending (PPML) (2) b/ci95/se
$\text{Sector\_Target}_{b,s}$	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. 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: NZBA 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: NZBA Banks Lending After Joining the Alliance: Naive Approach using only NZBA Banks

	Intensive Margin		Exit	
	(1)	(2)	(3)	(4)
$\text{PostNZBA}_{b,t}$	-0.2016***	-0.0545	0.1696***	-0.0302**
	(0.0361)	(0.0350)	(0.0211)	(0.0126)
$\text{SectorTarget}_{b,f}$		0.0368		0.0360***
		(0.0234)		(0.0118)
$\text{PostNZBA}_{b,t} \times \text{SectorTarget}_{b,f}$		-0.1315**		-0.0668***
		(0.0536)		(0.0227)
N	632802	7908702	2963328	32704716
N_Banks	24	34	25	34
adj. R^2	0.006	0.787	0.059	0.475
Bank_FE	N	Y	N	Y
Firm_FE	N	Y	N	Y
Time_FE	N	Y	N	Y
Targeted_Sector	Y	N	Y	N

Note: This table presents estimates of equations (1) (columns 1 and 3) and equation (2) (columns 2 and 4) using the Anacredit sample. The sample is restricted to banks that join NZBA at any time. Standard errors in parentheses are clustered at the bank level. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Table 6: Effect of NZBA Adoption 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 (4), (3), and (5) 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 7: Effect of NZBA Adoption on Lending: Bank-Sector-Level Analysis of World-wide 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 (6). 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 8: Effect of NZBA Adoption 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 [-0.0019,0.0023] (0.0011)	-0.0007 [-0.0016,0.0003] (0.0005)	-0.0002 [-0.0008,0.0005] (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 [-0.0019,0.0006] (0.0006)	0.0004 [-0.0011,0.0019] (0.0008)	0.0024 [-0.0007,0.0055] (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 [-0.0001,0.0012] (0.0003)	-0.0001 [-0.0006,0.0003] (0.0002)	0.0002 [-0.0005,0.0008] (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 (4), (3), and (5) 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 9: Effect of Bank NZBA Adoption on Bank Lending to Firms: Extensive Margin

Panel A: Target Sector Firms

	Entry		Exit	
	(1)	(2)	(3)	(4)
	b/ci95/se	b/ci95/se	b/ci95/se	b/ci95/se
$\text{PostNZBA}_{b,t}$	-0.0085		-0.0144	
	[-0.0307,0.0137]		[-0.0391,0.0103]	
	(0.0113)		(0.0126)	
$\text{PostNZBA}_{b,t} \times \text{SectorTarget}_{b,f}$	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)	(2)	(3)	(4)
	b/ci95/se	b/ci95/se	b/ci95/se	b/ci95/se
$\text{PostNZBA}_{b,t}$	-0.0058		-0.0152	
	[-0.0280,0.0164]		[-0.0395,0.0091]	
	(0.0113)		(0.0123)	
$\text{PostNZBA}_{b,t} \times \text{Mining}_f$	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)	(2)	(3)	(4)
	b/ci95/se	b/ci95/se	b/ci95/se	b/ci95/se
$\text{PostNZBA}_{b,t}$	-0.0059		-0.0172	
	[-0.0276,0.0157]		[-0.0407,0.0062]	
	(0.0110)		(0.0119)	
$\text{PostNZBA}_{b,t} \times \text{Taxonomy}_f$	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 (4), (3), and (5) 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.

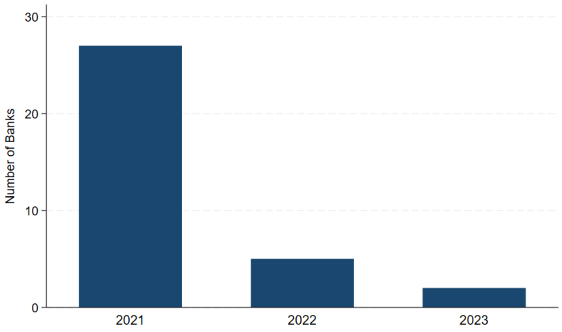
Table 10: Lender Engagement: Effect of NZBA on Borrower SBTi Target Adoption

	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se	(4) b/ci95/se	(5) b/ci95/se	(6) b/ci95/se
$NZBA_{b,2023}$	-0.0003*** [-0.0005,-0.0001] (0.0001)					
$PostNZBA_{b,t}$		-0.0001** [-0.0002,-0.0000] (0.0000)				
$PostNZBA_{b,t} \times SectorTarget_{b,f}$			0.0000 [-0.0001,0.0002] (0.0001)			
$PostNZBA_{b,t} \times Mining_f$				0.0001 [-0.0000,0.0003] (0.0001)		
$PostNZBA_{b,t} \times Taxonomy_f$					0.0000 [-0.0000,0.0001] (0.0000)	
$PostNZBA_{b,t} \times Fossil_f$						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

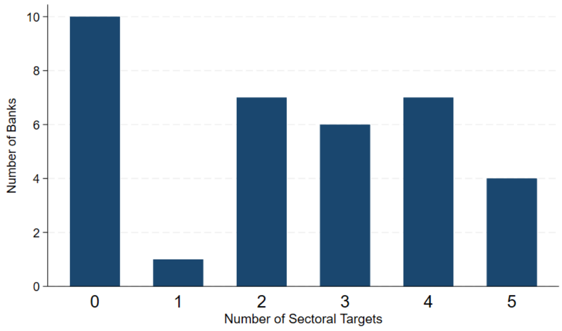
Note: This table presents estimates of equation (7). The dependent variable is an indicator variable for whether a firm has an SBTi target in period *t*. Industry-time fixed effects are two-digit NACE by time fixed effects. Standard errors in parentheses are clustered at the bank level. The table also reports 95% confidence intervals for each estimate in brackets. *, **, *** indicate significance at the 0.1, 0.05, and 0.01 levels, respectively.

Figure 1: Descriptive Facts about the Net Zero Banking Alliance

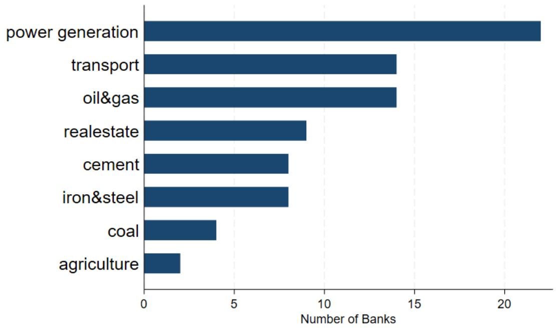
(a) Signing Dates



(b) Number of Targets

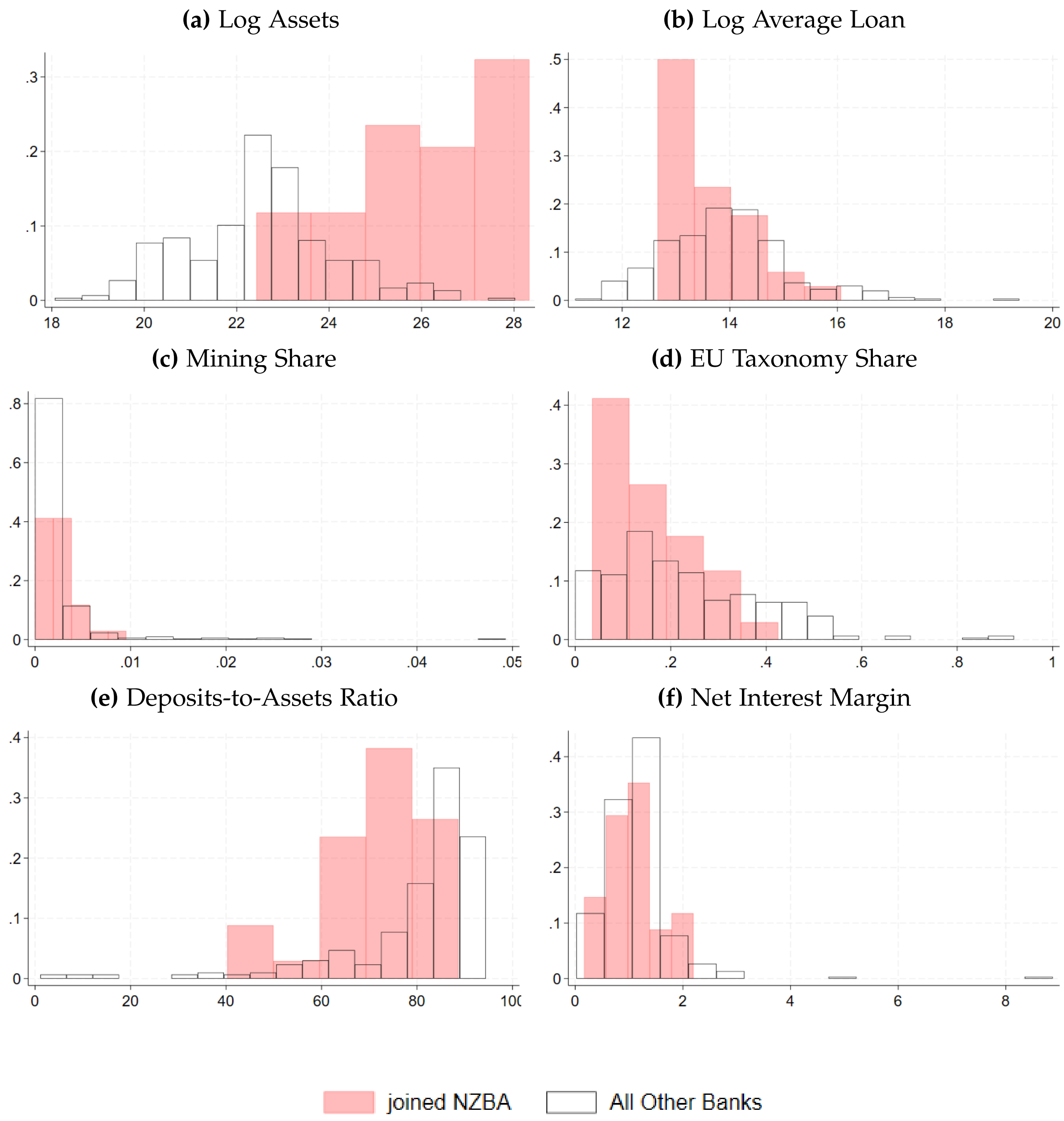


(c) Sectoral Targets



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.

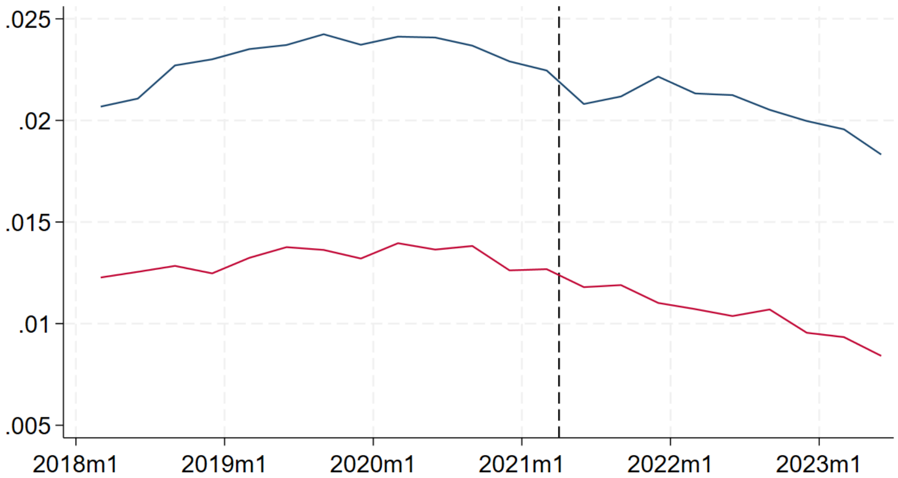
Figure 2: Distribution of Characteristics of NZBA and Non-NZBA Banks



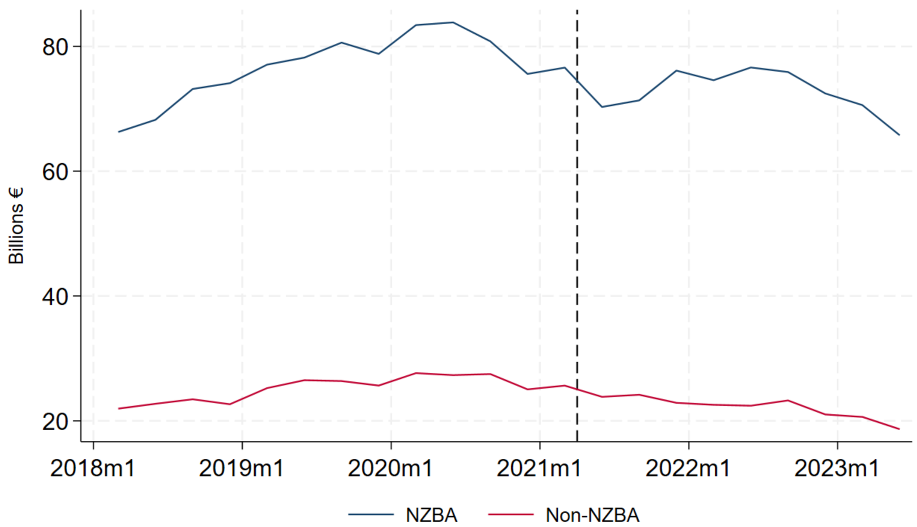
Note: This figure plots histograms of bank-level balance sheet and lending variables by whether the lender is ever a member of the NZBA. Data are from AnaCredit and FinRep as of September 2018.

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

(a) Lending Share to Mining



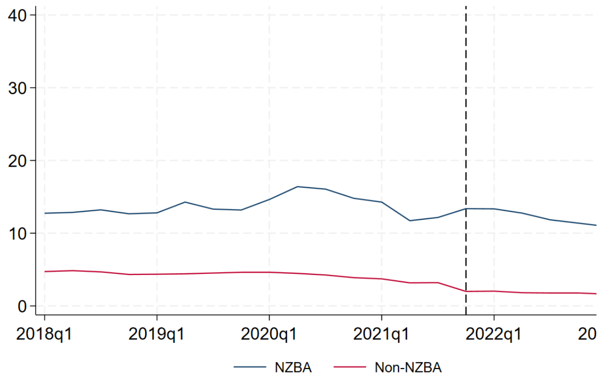
(b) Total Lending to Mining



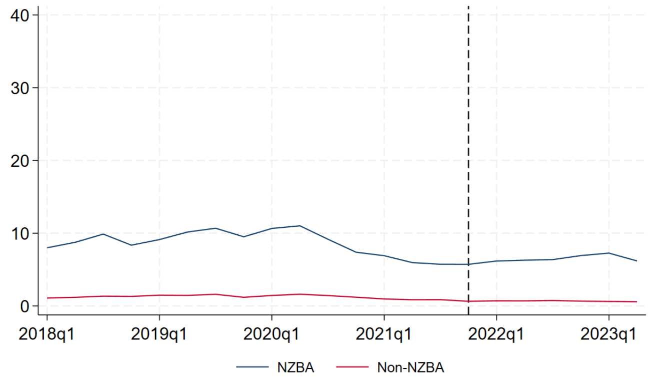
Note: This figure plots lending shares (Panel A) and total lending (Panel B) to mining firms (NACE section B) by whether the lender is ever a member of the NZBA. NACE section B includes mining of coal, fossil fuels, natural gas, and metals. Data from FinRep is limited to Euro-Area lenders and covers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

Figure 4: Total Lending to Mining Firms By Region

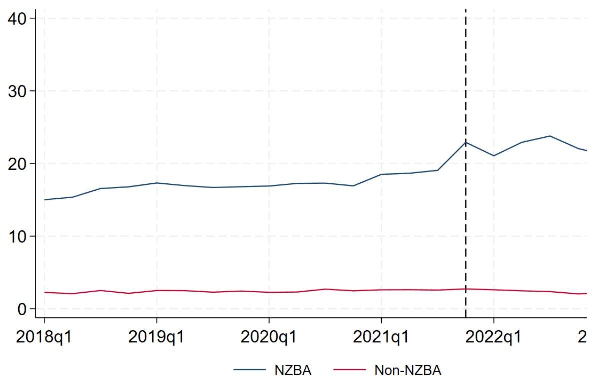
(a) Euro Area



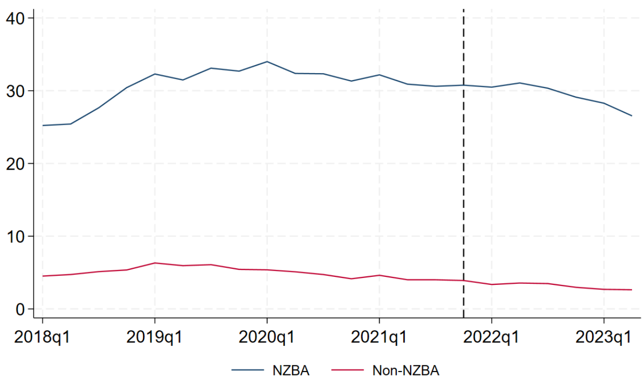
(b) United States



(c) Other OECD

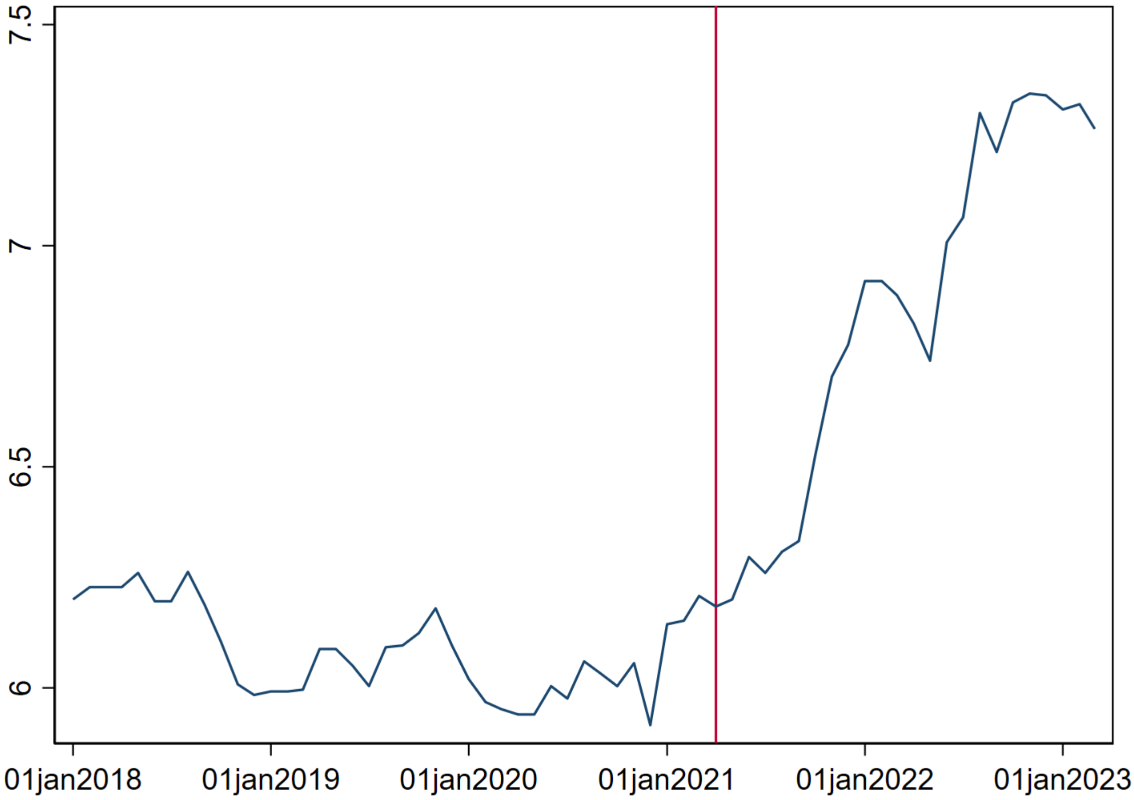


(d) Rest of the World (Non-OECD)



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.

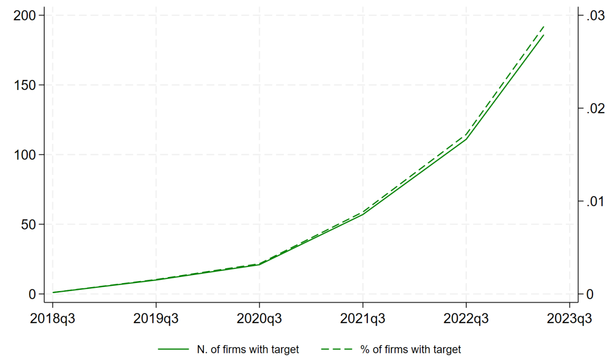
Figure 5: Average MSCI Environmental Pillar Score ("E") Rating for NZBA Banks



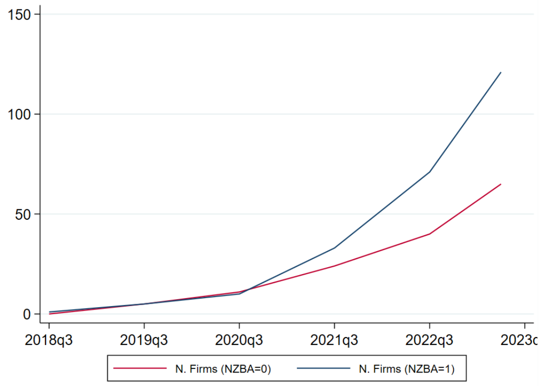
Note: This figure plots the average Environmental Pillar Score ("E") score by month for the NZBA banks that have an ESG rating from MSCI. "E" scores range from 1 (lowest) to 10 (highest). The vertical line indicates the beginning of the NZBA in April 2021.

Figure 6: Lender Engagement: Borrowers with SBTi Validated Targets Borrowing from NZBA and non-NZBA Banks

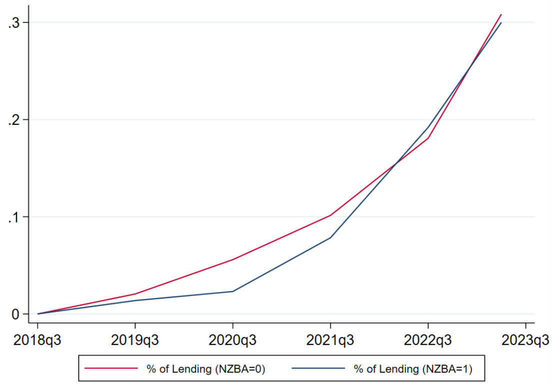
(a) Number of Borrowers with an SBTi Target



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



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



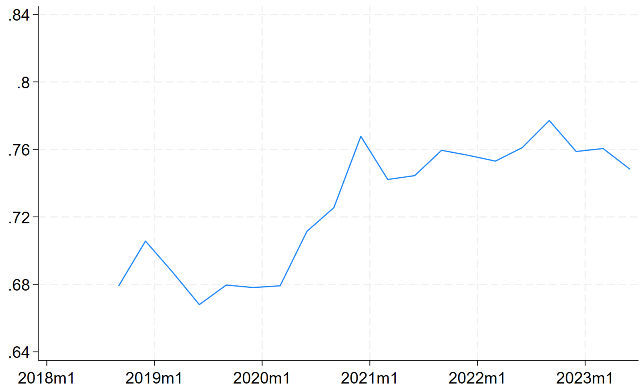
Note: This figure focuses on SBTi target-setting by firm borrowers in AnaCredit. Panel (a) shows the overall number of firms with a validated target and the percent of firms with a target (right axis). Panel (b) shows the Number of firms with an SBTi target that borrow from NZBA banks (blue) and non-NZBA 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.

A Appendix Table and Figures

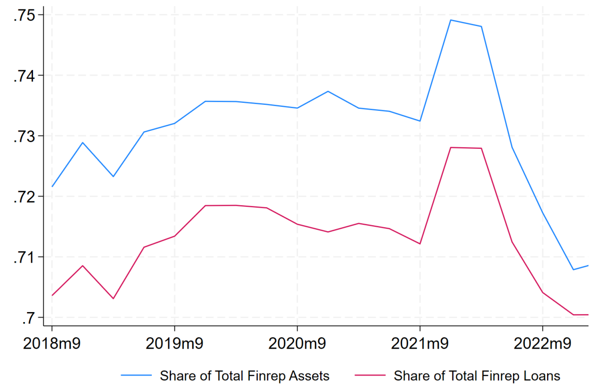
Figure A.1: Lending Coverage in FinRep and Anacredit

(a) Lending Share in AnaCredit of Banks in FinRep

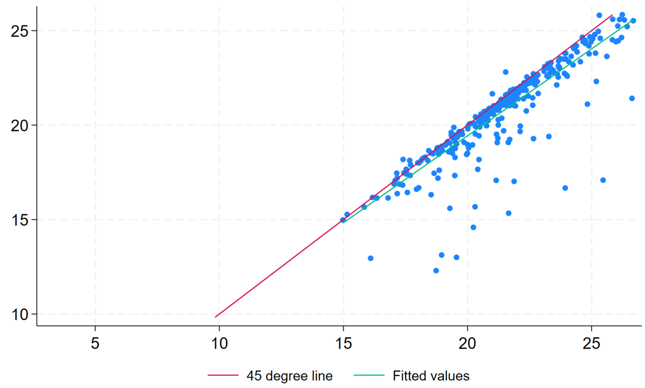
(b) Total AnaCredit Lending Divided By All NFC Loans in FinRep



(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

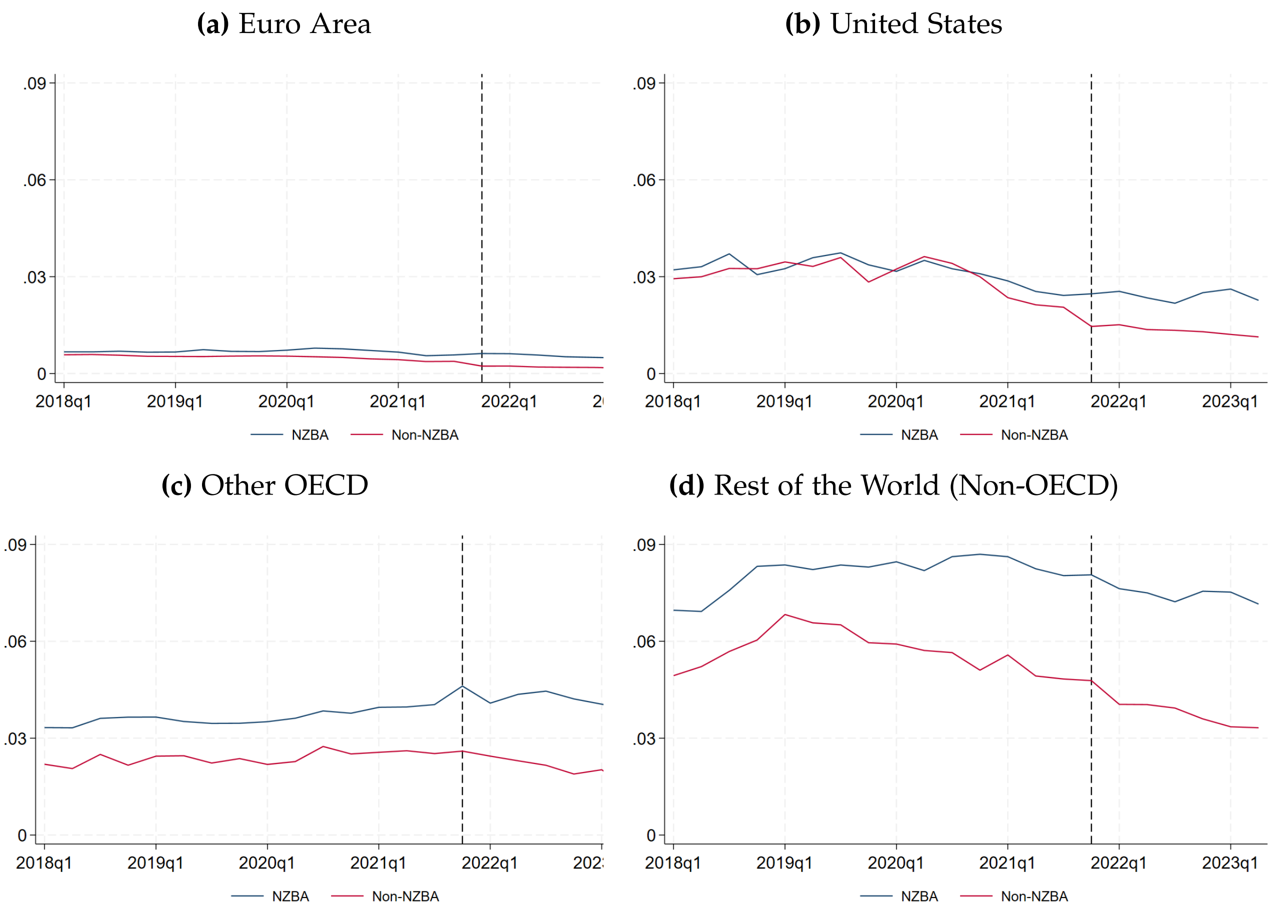
Net zero targets in four key sectors

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.

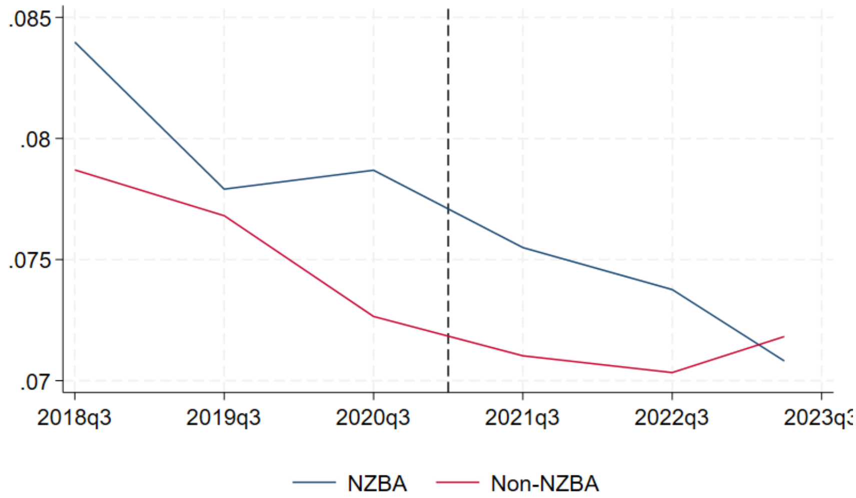
Figure A.3: Portfolio Shares of Lending to Mining Firms By Region



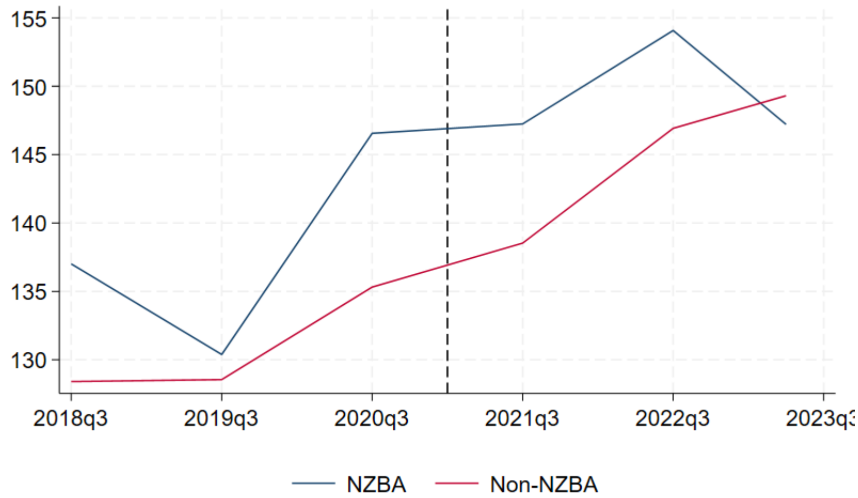
Note: This figure plots the share of lending to mining firms (NACE sector B) by whether the lender is ever a member of the NZBA (blue) or never a member (red). The vertical line indicates the beginning of the NZBA Alliance. Data are from FinRep. Data are from FinRep.

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).

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
$PostNZBA_{b,t}$	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 6 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

Panel A: Largest 25% of borrowers						
	(1) b/ci95/se	(2) b/ci95/se	(3) b/ci95/se	(4) b/ci95/se	(5) b/ci95/se	(6) b/ci95/se
$NZBA_{b,2023}$	-0.0006** [-0.0011,-0.0000] (0.0003)					
$PostNZBA_{b,t}$		-0.0002* [-0.0005,0.0000] (0.0001)				
$PostNZBA_{b,t} \times SectorTarget_{b,f}$			0.0001 [-0.0003,0.0005] (0.0002)			
$PostNZBA_{b,t} \times Mining_{f}$				0.0005 [-0.0001,0.0011] (0.0003)		
$PostNZBA_{b,t} \times Taxonomy_{f}$					0.0001 [-0.0002,0.0005] (0.0002)	
$PostNZBA_{b,t} \times Fossil_{f}$						0.0069 [-0.0018,0.0157] (0.0044)
N	279362	1676172	1676106	1676106	1676106	1676106
N_Banks	318	318	308	308	308	308
Mean Dep. Variable	.0007	.0002	.0002	.0002	.0002	.0002
adj. R^2	0.000	0.340	0.343	0.343	0.343	0.343
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

Panel B: Largest 30% of 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
$NZBA_{b,2023}$	-0.0002** [-0.0004,-0.0000] (0.0001)					
$PostNZBA_{b,t}$		-0.0001** [-0.0002,-0.0000] (0.0000)				
$PostNZBA_{b,t} \times SectorTarget_{b,f}$			0.0000 [-0.0001,0.0001] (0.0001)			
$PostNZBA_{b,t} \times Mining_{f}$				0.0001 [-0.0000,0.0003] (0.0001)		
$PostNZBA_{b,t} \times Taxonomy_{f}$					0.0000 [-0.0001,0.0001] (0.0000)	
$PostNZBA_{b,t} \times Fossil_{f}$						0.0011 [-0.0007,0.0028] (0.0009)
N	1446553	8679318	8679282	8679282	8679282	8679282
N_Banks	321	321	315	315	315	315
Mean Dep. Variable	.0002	.0001	.0001	.0001	.0001	.0001
adj. R^2	0.000	0.333	0.334	0.334	0.334	0.334
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 the analysis in Table 10 but reestimates the regressions subsamples of the largest firms. In addition to the controls reported at the bottom of the table, panel A also controls for 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.

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