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BANKS' CARBON PLEDGES: AMAZING OR A MAZE?

by Cristina Angelico* and Enrico Bernardini*

Abstract

This study documents new findings on euro-area banks' carbon pledges by exploiting a rich dataset that combines information on banks' climate targets, collected from several providers, with financial and credit data. Decarbonization goals are characterized by a considerable heterogeneity in time horizons, scope, ambition and metrics; the information is fragmented and often differs across sources. Larger banks provide most of the credit to the high-emitting sectors, charging them a relatively low interest rate spread, and they are more likely to set carbon pledges and join international initiatives. The effects of climate commitments on lending policies to firms in carbon-intensive sectors are weak, varied and only materialize a few years after the pledge. Providers disagree in their estimates of the implied temperature rise associated with banks' portfolios and commitments. Overall, such estimates reveal that the euro-area banking system is not well aligned with the Paris Agreement's goals, reflecting the still insufficient corporate decarbonization efforts. Banks committed to reducing their financed emissions are also paying close attention to broader nature-related and biodiversity issues.

JEL Classification: G11, G21, Q50.

Keywords: carbon reduction targets, net-zero commitments, climate risk, green lending, sustainable finance.

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1 Introduction¹

There is broad scientific consensus on the need to decarbonize our economic systems to curb the global temperature rise and avoid the most severe damage to humankind and nature (IPCC (2023)). The financial sector must be prepared and able to support the transition towards a low-carbon economy through the reallocation of capital from carbon-intensive to clean assets. The flow of funds to be redirected to support greening the economy and the necessary drastic renovation of the energy system should be substantial. The International Energy Agency (IEA (2021)) estimates that investment needs in green energy by 2030 amount to USD 4.5 trillion per year globally, while the implementation of the European Green Deal will require around EUR 520 billion per year from 2021 to 2030 according to the European Environment Agency (Speck et al. (2023)).

In Europe, the financial intermediary function is primarily played by the banking system, which is gearing up to manage risks from climate change and environmental degradation by integrating such issues into the banks' strategies, governance, and risk management processes (i.e. ECB (2022)). The climate transition risk of banks can be measured with different metrics embedding either a backward-looking or a forward-looking perspective. The former is measured through the carbon emissions financed by the intermediaries or their exposure to high-emitting sectors (i.e. ECB (2023)); the latter instead considers banks' decarbonization pledges and emissions trajectories that can be translated into the so-called estimates of the implied temperature rise (ITR). While backward-looking metrics have been widely developed and analyzed both in the literature (see among the others Faiella & Lavecchia (2022) and Battiston et al. (2017)) and by supervisors (i.e. ECB (2023), ESRB (2022)), our understanding of the forward-looking data, such as banks' carbon pledges and projected emissions, is still scant.

This paper aims to fill this gap in the literature and inform the growing interest of regulatory and market-led initiatives in transition plans of the financial sector. The paper investigates banks' decarbonization pledges which represent transition plans' quantitative component (i.e. the metrics and targets pillar), though the whole transition plan comprises a more articulated framework of governance, strategy, management tools and concrete lines of action.

More precisely, the paper sheds light on European banks' decarbonization commitments by exploiting a uniquely rich dataset. The data on the banks' carbon pledges are sourced from four major repositories of banks' climate-related disclosures, including MSCI ESG research, the Carbon Disclosure Project (CDP), the Science-Based Targets Initiative (SBTi), and the Glasgow Financial Alliance for Net-Zero (GFANZ). MSCI ESG research provides detailed information, including the textual description, for more than 1,310 announcements made by the banks within our sample between 2005 and 2023. CDP is among the most

¹The views expressed herein are those of the authors and do not necessarily represent the views of the Bank of Italy. We thank Paolo Angelini, Ivan Faiella, and Patrizio Pagano for their very helpful comments. All remaining errors are our own. Authors' contacts: cristina.angelico@bancaditalia.it and enrico.bernardini@bancaditalia.it.

comprehensive dataset of self-reported data collected via an annual survey from corporate and financial institutions and other entities. GFANZ is a global coalition of financial institutions launched at COP26 in 2021, which pledged to align their lending and investment portfolios to net-zero emissions by 2050 through a change in business models and transition plans to support the climate transition. SBTi instead is an initiative that promotes and validates science-based corporate targets aligned with the Paris Agreement. Data on the carbon commitments is then combined with banks' loan data from AnaCredit and lenders' financial information provided by Bloomberg and LSEG-Datastream, which allows us to investigate the ex-ante bank features and the ex-post effects on lending policies related to banks' commitments.

The analysis is performed on a sample of 129 large listed banks representing almost 70% of the Euro area banking credit granted to non-financial corporations as of 2023 year-end, for which we have good data coverage. While carbon pledges can broadly refer to scope 1, 2, and 3 emissions (i.e. direct and indirect corporate GHG emissions), we focus on commitments on scope 3 emissions related to the banks' portfolios and financed emissions that can be reduced only via credit reallocation and pricing policies, or engagement with the clients. In the sample, 56 banks set at least one commitment on their financed emissions by 2023. The paper supports the following new findings by exploiting this novel and comprehensive dataset.

FINDING 1: Decarbonization goals are heterogeneous across banks; information is fragmented, difficult to interpret, compare, or combine, and often differs across data sources. Challenges derive from the fact that each bank makes multiple commitments over time that differ in scope (i.e. scope 1, 2, or 3), base and target years, and metrics used to set the target (i.e., absolute emissions or intensities). In addition, some of those targets refer to a specific line of business, such as lending to the real estate, automotive, cement, steel, or coal sectors. Different data sources provide various kinds of information; they are complementary and not substitutes. Among the data providers analyzed, MSCI ESG Research and CDP supply information disclosed by the banks, through reports, websites or surveys, while GFANZ and SBTi provide information only on the banks' objectives established within these two initiatives. The still limited number of banks with validated science-based targets or committed to setting them highlights the complexity of setting such objectives relative to the others analyzed in the paper as well as the potential reputational risk if the targets are not achieved.

The observed data heterogeneity and fragmentation have several crucial consequences. First, it makes it difficult for investors and authorities to evaluate the banks' goals. Second, it decreases their incentives to set credible and ambitious targets. Finally, it challenges authorities to assess the overall exposure of the financial system to climate-related risks and the potential financial stability risks. These limitations are particularly relevant given that climate-related risks can propagate from single banks to endanger the financial stability of the entire system (Bolton et al. (2020); NGFS (2020)). Given the challenges implied by such data heterogeneity and fragmentation, it becomes urgent to define a common framework and develop and disclose a comprehensive and reliable collection

of banks' carbon commitments.

FINDING 2: Pledges are related to banks' ex-ante financial and loan book characteristics. Larger banks with higher scope 3 emissions, granting most of the credit to the high-emitting sectors and charging them a lower interest rate spread (relative to other sectors), are more likely to set carbon pledges and join international initiatives. Nevertheless, there are differences in the banks' profiles depending on the type and scope of the commitment. Significant banks with larger loan books, more assets and investments and higher scope 3 emissions are more likely to set carbon targets. Notably, the institutions that set at least one carbon pledge by 2023 were those that in 2020, before announcing their climate commitments, granted most of the banking credit to the high-emitting sectors, which will be key during the green transition according to the IEA (2021), such as mining, energy, transport and manufacturing, and charged them a lower interest rate differential relative to the one applied to non-financial corporations in the low-carbon sectors.

These results may reflect a few reasons. First, larger banks lending to high-emitting sectors face significant public pressure and therefore might be more likely to advertise their pledges by joining international initiatives and communicating them to the public. Second, these banks also face a higher transition risk, which refers to the risk of financial loss due to a rapid shift in the economy towards a low-carbon future, especially in the case of a disorderly and abrupt transition, and therefore might be more willing to reduce their emissions and handle climate-related risks.

Besides, our research underscores that while some banks' characteristics are common to all the carbon commitment types considered, no unique bank profile fits all the pledges, meaning that institutions with different features tend to set distinct target types or join different initiatives.

FINDING 3: Different climate commitments can have different implications for banks' lending and pricing to firms in carbon-intensive sectors. Such effects on banks' behaviour - if present - do not materialize immediately after the commitment. We then analyse the ex-post effects of bank commitments to investigate whether lending policies - in terms of amounts granted and interest rate - to carbon-intensive sectors change after the banks announce their carbon pledges. Precisely we test if banks divest from high-polluting sectors and change credit prices to firms in such sectors, by employing the diff-in-diff methodology proposed by Callaway & Sant'Anna (2021). Although relevant and desirable, we do not delve into other strategies that banks can employ to meet their climate targets, such as banks' engagement with their clients to finance their decarbonization or changes in credit allocation within sectors. Among the climate commitments analyzed, despite the limited number of observations, we find signs that goals related to SBTi appear to be more influential in steering banks' lending policies towards a carbon-risk-aware behavior, at least via disinvestment or credit reallocation at the sector level. This influence may be attributed to the pressure for soundness and accountability exerted by external verification.

The analysis emphasizes that the effects on banks' behaviour do not ma-

terialize immediately after the commitment but - if present - rather emerge slowly, underscoring the long-term impact of the pledges as well as the need to avoid the potential risks of an abrupt transition that could restrain rather than boost green investments. As highlighted by Angelini (2024), Hartzmark & Shue (2023), Bartocci et al. (2024) and Columba et al. (2024), indeed, decarbonization strategies may have unintended economic and environmental consequences since tighter financing conditions on brown firms and sectors can cause a reduction in their abatement investments. Other carbon pledges including the participation to GFANZ, do not affect substantially the sectoral credit allocation and policies for the high-emitting sectors at least in the short term.

FINDING 4: *The ITR metrics supplied by two data providers for our sample differ and are not correlated. Despite the differences, according to both data sources, the European banking system (proxied by our sample) is not well aligned with the Paris Agreement’s goals of limiting the increase of the temperature to well below 2°C relative to the pre-industrial levels.* We analyze the Implied Temperature Rise sourced by Bloomberg and MSCI. The ITR is a common and intuitive indicator that translates the companies’ or portfolios’ carbon pledges into projected emissions trajectories and assesses the potential temperature rise at the end-of-century (as if the whole economy behaves in the same way). It has the benefit of bearing a direct relationship between climate goals and temperature rise and overcoming some of the above mentioned challenges related to the heterogeneity and fragmentation of the banks’ carbon targets. Indeed, it allows us to evaluate and compare the level of ambition of each single target and company, and it can be aggregated across institutions to make a system-wide risk assessment. Nevertheless, the data reveal divergence between the estimates by the two providers which might derive from the different data and methodologies employed and increase - rather than decrease - the uncertainty around the pledges’ evaluation. Further, ITR estimates are not strongly correlated with the banks’ carbon pledges considered in our analysis. Such scarce correlation might depend on the fact that the banks need to establish sufficiently ambitious or credible long-term goals. Therefore, in spite of its advantages, the opaqueness of the underlying assumptions, and the heterogeneity across data providers make it challenging to employ these measures for financing and investment decisions and micro- or macro-prudential analysis.

Despite the differences in the data, according to both data sources, the European banking system is not well aligned with the Paris Agreement’s goals. The degree of misalignment with Paris goals depends on the data considered, with the average implied temperature rising between 2.4°C and 2.71°C. The two estimates fall within the range of the 2.1-2.8°C forecast of the first UN Global Stocktake conducted in 2023.² However, this result underscores the urgent need for improved corporate decarbonization efforts, which are still lagging and could help reduce this misalignment.

²The Stocktake estimates the end-of-century global temperature increase if all current climate action plans are implemented and assesses the implementation and progress by the Parties toward meeting the Paris Agreement. The stocktake takes place every five years, with the first concluded at COP28.

FINDING 5: *Along with climate risk awareness, the growing attention to broader nature-related and biodiversity issues is confirmed by an increasing number of actions and commitments taken by banks in this area.* There is a close relationship between climate and biodiversity pledges of banks: within the subsample of institutions for which we have CDP biodiversity-related data, almost all those that aim to reduce their portfolio-related (or financed) emissions also set a biodiversity-related target. The nature-related announcements made vary substantially across banks; data need to be standardized, and detailed information can only be extrapolated from a careful reading of the textual description provided by each bank.

In a nutshell, the carbon commitments of European banks appear amazing; however concretely assessing them is a maze to get through.

The paper is structured as follows. The contributions to the literature are discussed in Section 2. Section 3 presents the main data sources, while Section 4 examines the features of banks' carbon commitments collected from the different data repositories. Section 5 investigates the ex-ante characteristics, lending policies and exposure to high-emitting sectors and countries' climate policies of the committed banks. Section 6 analyses the ex-post effects of banks' commitments on their sectoral credit allocation and lending policies to carbon-intensive sectors. Section 7 analyses the ITR data and provides an estimate of the degree of alignment of the European banking system to the Paris Agreement's goals. Section 8 evaluates the biodiversity pledges and Section 9 concludes.

2 Contribution to the related literature

Transition plans and climate targets are essential tools for an orderly economy-wide transition and are increasingly receiving attention from international standard-setters (ISSB (2023)), policymakers (IPSF (2023)) and voluntary market-led initiatives (NGFS (2023b)). While forward-looking information in corporate' targets and transition plans will be vital in enabling the financial sector to mobilize private finance to support the green transition, financial institutions should prepare their transition plans, also engaging with the entities they finance on their own plans, to manage their transition risk exposure. In light of these considerations, a few recent works analyze the goals and transition plans of non-financial and financial companies developed to reduce their carbon footprints.

The OECD (2022b) set out requirements for credible corporate climate transition plans, which aim to align with the temperature goal of the Paris Agreement. The OECD's work provides guidance to enhance the transparency, comparability, and granularity of corporate transition plans to address the growing risk of green-washing and to foster the growth of transition finance. Among the key elements to achieve these objectives, it mentions taxonomies, company-level metrics, key performance indicators, targets, sustainability reporting standards, and methodologies to assess climate alignment. Other works investigate the details of companies' transition plans (i.e. Comello et al. (2021)), whether firms

with carbon pledges reduce their emissions accordingly (i.e. Dahlmann et al. (2019), Ioannou et al. (2016)) and how firms' beliefs on climate regulation affect the emissions abatement (Ramadorai & Zeni (2024)). Aldy et al. (2023) show, for large-cap U.S. firms, a rise in the usage of climate communication from 2010-2020, although a majority of firms are not decarbonizing at a sufficient trajectory to meet the emission reduction targets (reported to CDP and SBTi). Bolton & Kacperczyk (2023a) document that companies with targets according to SBTi and CDP have lower scope 1 emissions and have significantly reduced their emissions; nevertheless, the aggregate emissions of the constituents of a broad global equity index have barely changed. Berg, Huidobro & Rigobon (2024), instead, document that, controlling for GHG emissions' data assurance, SBTi target-setters do not reduce their scope 1 emissions, while firms that audit their carbon data reduce their carbon intensities. Other works look at the link between companies' carbon pledges and financial choices (i.e. Lemma et al. (2021)).

NGFS (2023b) takes stock of emerging practices relating to climate transition plans in the financial system and assesses the role of central banks and supervisors. It concludes that transition plans could be a valuable source of information for micro-prudential authorities to develop a forward-looking view of financial institutions' exposure to climate-related risks. Nevertheless, while the potential of transition plans is widely recognized at the current stage, there are multiple definitions of such plans, reflecting the different objectives, audiences, and scopes (NGFS (2023b)). Di Maio et al. (2023), instead, examine the climate-related commitments publicly disclosed by the European globally systemically important banks (G-SIBs) as of late 2022 and the associated risks of misrepresentation due to the differences in the sectoral targets, the widespread use of caveats, and the missing clarity regarding exposures to carbon-intensive sectors and green financing goals. The analysis highlights the need to improve the overall comparability and reliability of the banks' net-zero commitments.

Relative to these works, our paper investigates the details of a wide range of climate objectives disclosed by a larger sample of European listed banks and collected in different repositories, including but not limiting the analysis to the net-zero commitments and the G-SIBs. In particular, it focuses on commitments on scope 3 emissions, especially relevant for the financial sector, and it investigates the relationship between the banks' targets, financial characteristics, lending policies and exposure to high-emitting sectors, estimates of the ITR, and biodiversity-related intentions. Furthermore, it assesses whether the banks' commitments affect the lending policies (either in quantity or interest rates) to carbon-intensive sectors.

Our work also connects to an emerging stream of the literature on the link between banks' green commitments and lending policies.³ These works differ in the commitments considered in the analysis, the sample of financial institutions and the credit data and reach mixed conclusions. An early work by Mésonnier

³Other works look at the effect of firms' voluntary and mandatory ESG and emissions disclosure on stock markets (Bolton & Kacperczyk (2023b), Krueger et al. (2024)) and analyze how institutional investors evaluate climate-risk disclosure (Ilhan et al. (2023)).

(2022) shows that over the period 2010–2017, in France, banking groups that self-report to CDP as being committed to climate change adaptation and mitigation tend to cut their lending relatively faster to domestic firms in the five most carbon-intensive industries. This pattern is entirely driven by credit to large corporations. Altavilla et al. (2023) find that banks committed to decarbonizing with SBTi charge higher interest rates to firms featuring higher carbon emissions and lower rates to firms committing to lower emissions, controlling for their probability of default. Using a dummy variable indicating whether a bank is committed to SBTi and a sample of global firms with syndicated loans, Kacperczyk & Peydro (2022) show that firms with higher carbon footprint borrowing from committed banks subsequently receive less bank credit. Using a large international sample of syndicated loans over the period 2011–2019, Degryse et al. (2023) document that green banks grant cheaper loans to green firms, after the ratification of the Paris Agreement in 2015. On the other hand, according to Sastry et al. (2024), European banks committed to reaching net zero (those joining GFANZ) do not change their lending allocation or loan pricing differently from those without commitments. Similarly, using textual analysis on banks’ sustainability and financial reports, Giannetti et al. (2023) find no evidence that European banks with environmental disclosure reduce lending to more polluting firms. Hale et al. (2024) find that banks that are signers of the Principles of Responsible Investments (PRI) do not have a different emission exposure of their portfolios of syndicated loans than banks without such commitment, with the exception of early signers, who already had lower exposure to emissions through their syndicated lending. Berg, Döttling, Hut & Wagner (2024), further, find that members of the Equator Principles (EP) initiative did not shift lending to greener projects relative to non-members after a tightening in the EP requirements. Other works show that institutions reduce lending to coal companies after the adoption of an exit coal policy (Green & Vallee (2024)) and that banks committed to SBTi reduce lending to high-emitting firms, leading to filing fewer green patents by these firms and more green patents by other firms (Ye (2023)).

Such studies usually rely on a small set of information on banks’ commitments and do not compare the effect of alternative pledges. Therefore, their conclusions might vary depending on the different pledges and samples analyzed. With the overarching goal of contributing to this expanding area of research, first this paper takes a step back and thoroughly investigates multiple lenders’ commitments sourced by different data providers to build a unique and rich dataset. We dig into the differences of the alternative carbon goals and investigate which banks commit according to several data sources. Subsequently, we compare the effects of the different pledges on credit policies for firms in high-emitting sectors, using the same sample of banks, time period and empirical methodology. The analysis contributes to the literature with a few novel insights that can help reconcile the mixed evidence provided so far. We document that commitments differ in content, scope, and ambition. They vary in frequency and the banks’ profiles change depending on the type and scope of the commitment. Further, we show that different pledges affect the banks’

sectoral credit allocation and credit pricing differently. Consistently with the works mentioned above, we find that pledges related to SBTi appear to be more influential in steering banks' lending disinvestment from carbon-intensive sectors while joining GFANZ or announcing other goals (recorded by CDP or MSCI) - even if related to the portfolio-related (financed) emissions - do not have a significant effect on lending to high-emitting sectors.

Moreover, our work contributes to the literature showing that environmental, social, and governance (ESG) ratings (Chatterji et al. (2016); Berg et al. (2022); Billio et al. (2021)), environmental scores (Bernardini et al. (2024); OECD (2022a); Bingler et al. (2022)) and Greenhouse Gases (GHG) data (Papadopoulos (2022)) from different providers differ substantially by analyzing the consistency of the information provided by various sources on banks' forward-looking metrics.

At the same time, the analysis contributes to the extensive collection of works assessing the exposure of the financial system to climate-related risks (among the others Faiella & Lavecchia (2022), Battiston et al. (2017), ECB (2023), ESRB (2022)), by improving our understanding of forward-looking data and providing a novel estimate of the exposure of the European banking system based on such forward-looking metrics.

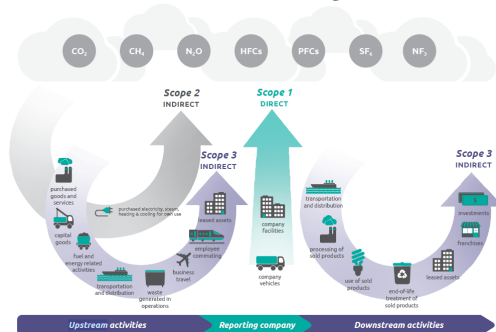
Finally, we connect to the recent early studies on nature-related financial risks for firms (Giglio et al. (2023), Garel et al. (2024), Flammer et al. (2025)) and banks (Cegla et al. (2023)) as well as on the complexities and challenges associated with assessing and addressing these risks from a supervisory perspective (NGFS (2023a)). We contribute to this emerging strand of the literature by providing novel evidence on the bank's biodiversity-related pledges and their link with climate-related commitments and the banks' features.

3 Data

The analysis is performed on a sample of 129 listed European banks, comprising 99 banks classified as "significant" within the European Single Supervisory Mechanism (SSM) and 30 non-significant institutions. We focus on this sample of large listed banks for which we have a comprehensive data coverage on climate-related commitments that is often unavailable for smaller, unlisted banks. The banks in the sample account for about 70% of the Euro-Area banking credit granted to non-financial corporations as of 2023 year-end (Table A2). Importantly, the sample also accounts for a similar fraction of banking credit granted to a few high-emitting sectors among those identified by the IEA (2021) as key for the transition to a net-zero economy, such as energy, mining, transport and manufacturing.

We collect GHG data from LSEG-Datastream, Bloomberg, MSCI and ISS from 2018 to 2023, although the data coverage changes over the time series. Given the scant data availability and the differences in data by the alternative providers, in the analysis, we consider the average scope 1, 2 and 3 emissions for each bank and year computed over all the available sources (see Tables A3

Figure 1: Carbon emissions according to the GHG protocol



Source: GHG-Protocol (2013).

for the summary statistics).⁴ The analysis focuses on pledges related to the value chain-related (scope 3) emissions (Figure 1), since these are particularly relevant for financial institutions as they involve the emissions related to their lending, equity and debt investments, representing the predominant share of their overall emissions (see Figures A1 and A2).

Pledges to reduce the carbon footprint or reach net-zero emissions are recorded from MSCI ESG research, CDP, SBTi, and GFANZ as of the last quarter of 2023. MSCI ESG Research provides a dataset of 1,317 commitments, related to scope 1, 2 or 3, between 2005 and 2023. MSCI developed the dataset by collecting information from different sources, such as sustainability reports, CDP, and websites. It includes a textual description of each announcement and a set of additional variables describing the targets (i.e., the percentage reduction, baseline, and target year) and the banks' climate-related achievements. This dataset is complemented with the data reported from 2018 to 2023 by banks to CDP through a questionnaire that covers their pledges to reduce portfolio emissions and curb biodiversity losses, sourced by Bloomberg. Then, it is combined with public information on the banks' participation to GFANZ (from 2021 to 2023), with detailed information (including a textual description) on the targets validated by SBTi and the commitments to set science-based targets with SBTi made between 2015 and 2023. More details on the data sources and the commitments are provided in Sections 4 and 8.

Climate-related data are combined with banks' financial data sourced by Bloomberg and LSEG-Datastream which include total assets, a composite credit

⁴According to the definitions of the GHG protocol: scope 1 refers to direct emissions from owned or controlled sources, scope 2 relates to indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company. Scope 3 includes all other indirect emissions in a company's value chain. Data on scope 1, 2 and 3 emissions vary across banks, over time and data sources. Emissions data by the different providers are usually linked by a positive correlation, ranging from 0.99 to 0.3, although in some cases the estimates can differ substantially across providers. Further emissions data are not always available for the time period spanned by the analysis.

rating (based on the banks' ratings of Standard&Poor, Fitch, and Moody's), the operating margin, the deposit to asset ratio and total investment (Table A4 in the appendix).

Bloomberg also sources metrics on country-specific climate performance and policies, which include two scores on the current and historical performance on CO2 emissions and the expected share of renewable power generation in 2030 (Table A5 in the appendix).

Finally, we collect data on banks' outstanding loans and lending rates from 2018 to 2023 from Anacredit, the Euro-Area credit registry which records at monthly frequency the amount and the interest rate of any loan granted to corporations by Euro-area credit institutions that exceed the threshold of 25,000 euros. Data includes the industry classification of the borrowing firms at least at the two-digit NACE level, allowing us to identify the loans granted to firms in high-emitting sectors as well as the associated price. The sectors of interest are manufacturing, energy, transport, mining. Within manufacturing, we also focus on the subsectors of iron, steel, and chemicals, while for the mining sector, we analyse the subsectors of oil and coal. For the sector definitions see Table A1. Tables A6-A8 in the appendix provide the summary statistics.

4 Banks' carbon reduction pledges

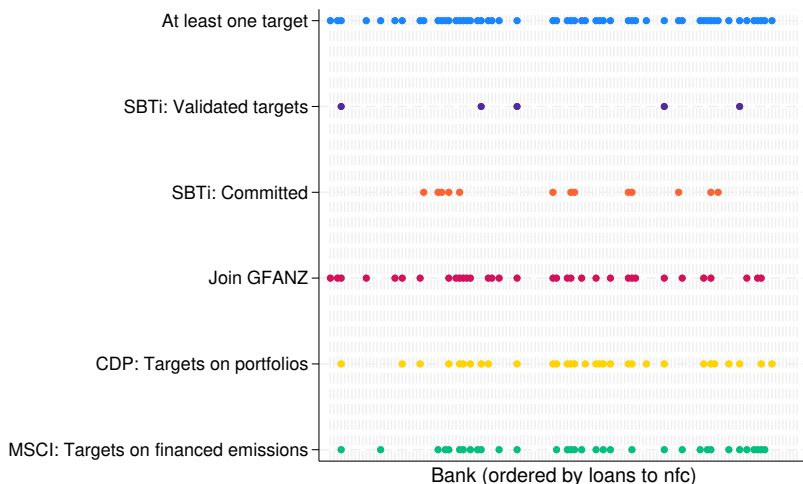
A growing number of financial institutions have pledged to reduce their GHG emissions, which may refer to energy consumption, business operations (travel, building, heating and cooling), and/or, more broadly, to the loan and investment book. Each bank makes multiple commitments over time that differ in several dimensions (i.e. scope, time span and rate of reduction); still, there is not yet a common framework they can adopt nor a comprehensive and reliable dataset on banks' objectives. At the same time, multiple private initiatives either collect data on companies' climate-related disclosures or provide guidelines to enable financial institutions to set their reduction targets.

Given this background, this Section provides novel evidence on the details of banks' commitments to reduce the emissions related to their lending or investment activities and highlights their limitations by combining data from four major data repositories on banks' climate disclosures: MSCI ESG Research, CDP, GFANZ, and SBTi. The alternative data sources provide various kinds of information, which is complementary and not substitute. Some data providers, such as MSCI ESG Research and CDP, supply information on the bank's overall climate plans according to the data reported to CDP or published by the banks in different forms, such as the sustainability reports. Instead, data from GFANZ and SBTi refer to sub-samples of the banks' pledges taken within these two initiatives.

Figure 2 summarizes the pledges made by each bank in the sample by 2023 as collected by the alternative data sources. The distribution of commitments seems not to show any size bias. Overall, 56 banks in the sample had set at least one target on the financed emissions, while 73 did have any portfolio-

related target by the end of 2023. As it is clear from the figure, banks differ in the type and number of commitments they make.

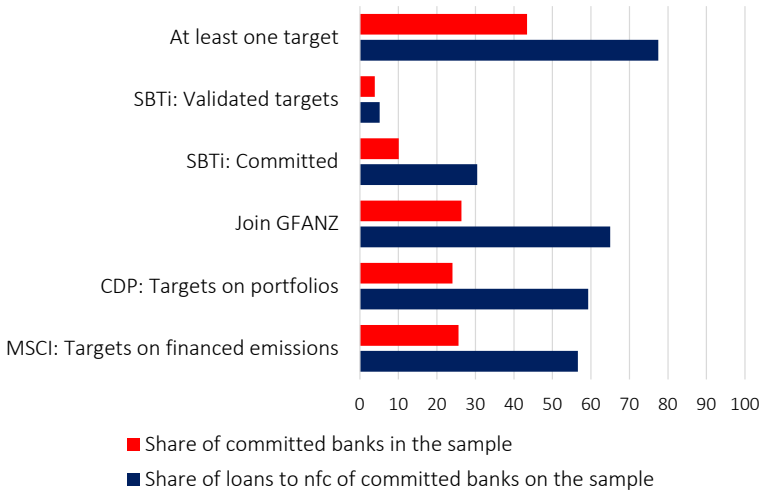
Figure 2: Banks' commitments on financed emissions by data source



Note: Data on banks' commitments to reduce the emissions related to their portfolios collected until the end of 2023. On the x-axis, banks are sorted according to their total loans to non-financial corporations (nfc): the first bank has the smallest amount, while the last has the largest amount. *MSCI: Targets on financed emissions* shows if a bank has committed to reduce the financed scope 3 emissions according to MSCI data. *CDP: Target on portfolios* indicates if a bank has reported to CDP that it is committed to reducing the scope 3 emissions related to its portfolios. *Join GFANZ* indicates the participation in the GFANZ initiative and pledge to achieve net-zero emissions by 2050. *SBTi: Committed* shows if a bank has committed to establishing science-based targets to be validated by SBTi; while *SBTi: Validated targets* if it has targets already validated by SBTi. *At least one target* shows if a bank as at least one target among those mentioned above.

Figure 3 overviews the number of committed banks and their relevance in terms of loans to non-financial companies. According to our data sources, more than 43% of the sample set at least one target by the end of 2023; notably, these committed institutions account for almost 80% of the loans granted by our sample to non-financial corporations. The number of banks that pledged to reduce their carbon footprint varies substantially over initiatives and data sources, reflecting the diverse range of commitments. This diversity underscores the different degrees of ambition and stringency of the alternative pledges, as explained below. Most of the committed banks are included in the repositories of GFANZ, MSCI ESG Research, and CDP, representing the largest share of loans considered in the sample. On the contrary, only a small number of banks has targets validated by SBTi or committed to establishing SBTi targets, and their loans are less representative of the total sample.

Figure 3: Banks' commitments by source: frequency and loan books



Note: The red bars display the share of banks committed to reduce their financed emissions within our sample by data source by the end of 2023. Commitments are not mutually exclusive rather each bank can have multiple commitments (i.e. join GFANZ, get SBTi validated targets and report to CDP it aims to reduce the portfolio-related emissions). The blue bars show the share of loans to non-financial corporations (nfc) granted by committed lenders within our sample by data source at the end of 2023. See Figure 2 and the text for more details on the commitments.

MSCI ESG Research. First, we discuss in detail the richest data set, provided by MSCI ESG research, containing 1,317 commitments made by 72 banks within our sample between 2005 and 2023. Such commitments concern around 55% of the loans to non-financial corporations granted by the banks of our sample. For each commitment, we analyse the textual description of the announcement as well as a number of variables on its characteristics (i.e. date, source, scope, and status) and banks' achievements. The analysis intensely exploits the textual description of the commitments to review the completeness of the MSCI data, verify the scope, and investigate the details of the pledges. Nevertheless, we are not able to assess the completeness of the data, implying that some banks may have made more announcements than those recorded in the dataset, including those for which no data is recorded. The data coverage also might vary across banks.⁵

Some examples of the textual commitments are shown in Table 1, while Figure 4 displays the most frequent words used in such announcements.

As emerges from a few examples reported in Table 1, there is no standard

⁵MSCI periodically updates carbon targets data of banks and companies, which can signal their novelties to be updated faster.

way to describe the pledges; instead, each bank sets its targets according to its business characteristics and strategies. The announcements usually mention the scope of emissions to be reduced (e.g., market-based or location-based for scope 2), the targeted reduction and the baseline and target years. Moreover, in some cases, some specific business lines (e.g., lending to energy or automotive sectors) or actions to be taken (e.g., increasing the use of renewable energy or reducing waste) are mentioned. The lack of a common framework and standardized metrics and horizons to express the commitments makes it very difficult to compare them across banks, evaluate the degree of ambition at goal and bank level and foresee the potential impact on financial stability and credit dynamics.

Table 1: Examples of commitments stated by the banks

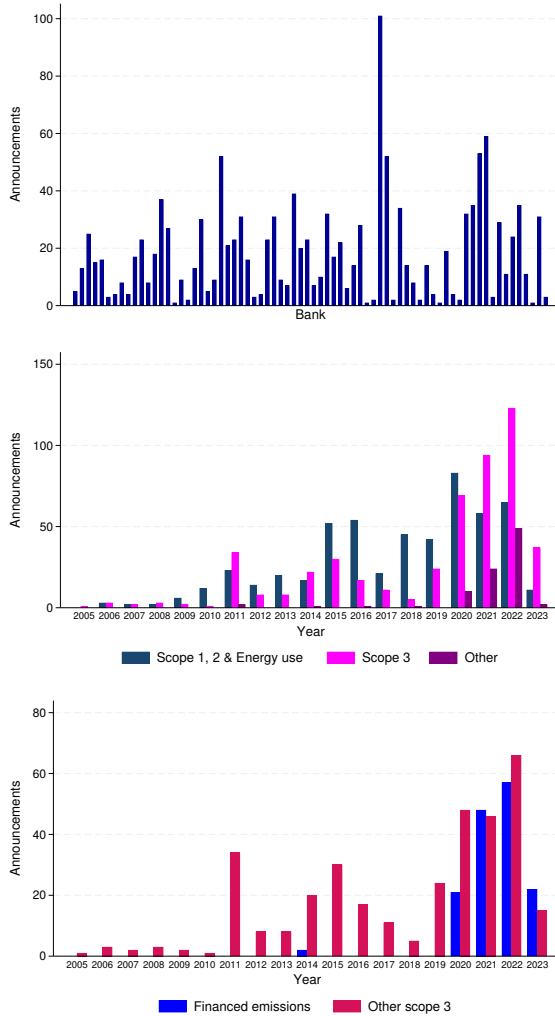
| | |
|-----|---|
| 1. | Reduce portfolio emissions from energy sector from 249 to 120 by 2030 based on 2020 |
| 2. | Reduce portfolio emissions from automobiles and components from 220 to 118 by 2030 based on 2020 |
| 3. | Reduce portfolio emissions from steel sector from 665 to 515 by 2030 based on 2020 baseline year |
| 4. | Reduce portfolio emissions from cement sector from 695 to 575 by 2030 based on 2020 baseline year |
| 5. | Increase renewable energy source by 100% by 2025 against 2018 |
| 6. | Reduce emissions associated with (Scope 3: Waste generated in operations) |
| 7. | Reduce Scope 1+2 emissions by 100% by 2030 based on 2020 baseline year |
| 8. | To reduce Scope 1+2 (market-based) by 50% by 2030 compared to 2011 levels |
| 9. | Reduce 50% intensity emission by 2030 from 2014 |
| 10. | Reduce scope 1, 2 and 3 GHG emissions by 20% by 2025 from a 2019 base year |
| 11. | Committed to transition its investment portfolio to net zero by 2050 at the latest |
| 12. | CO2e reduction covers scopes 1+2 and scope 3 for business travel |
| 13. | Reduce GHG emissions (Scope 1 emissions from transport) |
| 14. | Reduce Scope 3 Business travel emissions by 35% by 2022 on 2012 baseline year |
| 15. | Reduce paper consumption (Scope 3: Purchased goods & services) |
| 16. | Net zero CO2 emissions by 2050 |
| 17. | To reduce emissions from business travel by at least 1% per year from a 2019 base year |
| 18. | 40 percent reduction in kg CO2e emissions per employee |
| 19. | Reduce 58% in CO2e emitted per kWh produced by our customers by 2030 from 2020 levels |
| 20. | Reduce carbon emissions across lending and investment portfolios by 40-50% by 2030 compared to 2019 |
| 21. | Zero direct emissions by 2024 |

Note: Examples in the table are as reported in the database of MSCI ESG Research and in some cases they are missing the units of measurement. The relevant unit of measurement would be tCO₂e/€M loaned or invested, according to GHG Protocol and Partnership for Carbon Accounting Financials. Source: MSCI ESG Research.

Almost half of the pledges in the sample refer to scope 1 and 2 emissions or energy use, thus signaling banks' intentions to reduce the carbon intensity of their own operations.⁶ At the same time, more than 40% also include scope

⁶Objectives on scope 1 and 2 emissions and energy use usually mention reducing energy consumption and increasing energy share from renewable sources.

Figure 5: No. of commitments per bank, year and scope



Note: The top graph shows the number of announcements per each bank. The mid graph shows the number of announcements per emissions' scope over time. The bottom graph displays the number of commitments relative to financed emissions (i.e. category 15 emissions, referred to loans and investments portfolios) and other scope 3 categories (other than category 15). Announcements related to the *financed emissions* are a sub-sample of those related to scope 3 emissions. These are the announcements that explicitly mention scope 3 financed or portfolios' related emissions. Source: MSCI ESG Research.

On average about 34 announcements are recorded for each bank (among the 72 for which data are recorded), although the distribution varies substantially across banks, ranging from 1 to 101 announcements (upper panel of Figure 5).

The number of announcements has increased substantially over time, and almost half of them were made from 2020, when there was an uptake of those related to scope 3 emissions (central panel of Figure 5) and in particular to the financed emissions (lower panel of Figure 5). This increase is likely spurred by the preparation of COP26 and the launch of the GFANZ initiative in 2021 when the net zero commitments took off.

Among pledges on scope 3 emissions, 24% refer to revisions of internal operations, waste management or reduction of business travel or upstream scope 3 emissions, while 30% of scope 3-related targets explicitly mention financed emissions related to investments, lending or portfolios. Although they are increasing, these types of goals are still limited: 164 targets were established by 39 banks (Table 3).

Table 3: Topics and keywords for scope 3 commitments: no. of announcements and banks

| Topics & Keywords | Commitments | Banks |
|--|-------------|-------|
| Upstream | 60 | 18 |
| Business travel | 52 | 19 |
| Internal operations & waste | 10 | 7 |
| Purchased goods | 14 | 7 |
| Downstream | 11 | 8 |
| Financed emissions (i.e. lending, investment) | 164 | 39 |
| <i>Power generation</i> | 28 | 18 |
| <i>Real estate</i> | 16 | 10 |
| <i>Automotive</i> | 12 | 8 |
| <i>Mortgages</i> | 8 | 6 |
| <i>Iron, steel, aluminium and other metals</i> | 7 | 5 |
| <i>Oil & gas</i> | 6 | 6 |
| <i>Cement</i> | 5 | 5 |
| <i>Coal</i> | 3 | 3 |
| <i>Shipping</i> | 2 | 2 |
| <i>Fossil-fuel</i> | 2 | 2 |
| <i>Carbon intensive</i> | 1 | 1 |
| <i>Aviation</i> | 1 | 1 |
| Other | 252 | 48 |
| Total | 555 | 58 |

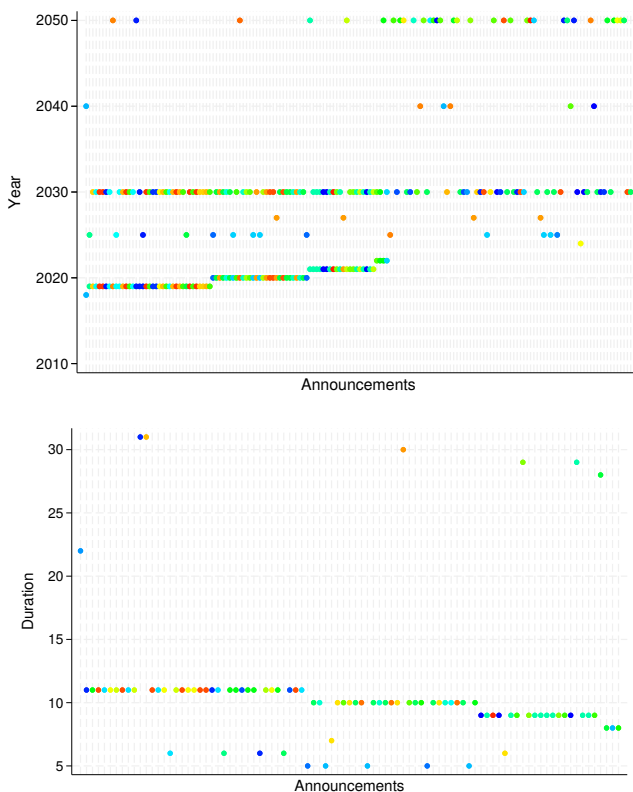
Note: The keywords in italics are mentioned in announcements related to financed emissions (i.e. those referred to investments, lending, portfolio etc.). Some announcements mention more than one keywords and each bank might make multiple announcements. Source: MSCI ESG Research.

Some of these lenders also specify the strategies to reduce the emissions related to their loan and investment portfolios starting from the most carbon-intensive sectors such as power generation, automotive, metal, cement, coal,

oil, gas and commercial or residential real estate and mortgages. The wording and content of the pledges vary, making their classification and comparison challenging. For instance, in some cases, they refer to the bank's investments, portfolio, clients, or financed emissions but also to lending, loans, bonds, credit, or equity. In a few cases they also mention geographies (i.e. Portugal or Europe) or carbon offsetting activities.

Only a fraction of the announcements specifies the details of the pledges such as the metrics, the percentage of emission reduction, or the baseline and target years. Among the announcements on the financed emissions only 30% clarify the target year and 16% both the baseline and target year (Figure 6).

Figure 6: Baseline and target years and duration for scope 3 commitments on financed emissions



Note: On the x-axis announcements related to financed scope 3 emissions ordered by the pledge's baseline year. On the y-axis, the baseline and target year mentioned in each announcement (upper panel) or the duration of the commitment (lower panel). Each color refers to one bank, each dot to one announcement. The upper panel displays the 164 announcements with available target year, the lower panel displays the 91 announcements with available duration (and hence both the baseline and target year). Source: MSCI ESG Research.

According to this sub-sample, the time horizon of the pledges varies across announcements and banks and it is mainly skewed towards the short-medium term: 76% of the pledges set a target year by the 2023, while the remaining set longer-term goals between 2030 and 2050. The duration averages about 11 years and ranges between 5 and 31 years.

The target metrics employed also differ substantially. Most pledges on portfolio’s emissions refer to intensities (almost 60%), defined in various ways. A few mention emissions by revenues, employees or customers, while others per tonne of steel, cement, vehicle, km or per square meter. About 30% of the sample instead sets targets on absolute emissions (i.e. as percentage reduction). Most announcements mention GHG emissions (or CO₂eq) or emissions in general, while a few refer to CO₂.

According to the evaluation provided by MSCI, more than 60% of the pledges analyzed so far refer to active targets, mainly covering scopes 1,2 and 3 emissions; almost 20% already have been achieved; only a few were not completed by the deadline (Table 4). About targets related to the financed emissions, MSCI evaluates that 60% are set by banks that are on track with all or some targets, while 30% by institutions not on track and the remaining 10% by lenders not classified.⁷ Even if the assessment does not consider the ambition of the target, it suggests that banks are proceeding with their strategies to reduce carbon emissions and have numerous goals ahead.

The data also include a few announcements mentioning *carbon neutrality* or *net-zero emissions*, still they often do not explicitly refer to scope 3 emissions and financed emissions making it challenging to classify and interpret them.⁸

Table 4: No. of banks’ commitments by scope and status

| | Achieved | Active | Not Achieved | Not Active | Unknown | Total |
|---------------------------|----------|------------|--------------|------------|----------|------------|
| Scope 1 | 12 | 41 | 3 | 6 | 1 | 63 |
| Scope 1 & 2 | 165 | 288 | 17 | 50 | 47 | 567 |
| Scope 1, 2 & 3 | 83 | 376 | 14 | 42 | 40 | 555 |
| Other | 5 | 90 | 1 | 2 | 34 | 132 |
| <i>Financed emissions</i> | <i>0</i> | <i>155</i> | <i>0</i> | <i>1</i> | <i>8</i> | <i>164</i> |
| Total | 265 | 795 | 35 | 100 | 122 | 1,317 |

Note: Data and evaluations are provided by MSCI ESG Research. ”Not active” refers to commitments that are defined as ”replaced” or ”withdrawn” by MSCI. Announcements related to the *financed emissions* are a sub-sample of those related to scope 3 emissions. These are the announcements that explicitly mention scope 3 financed or portfolios’ related emissions. Source: MSCI ESG Research.

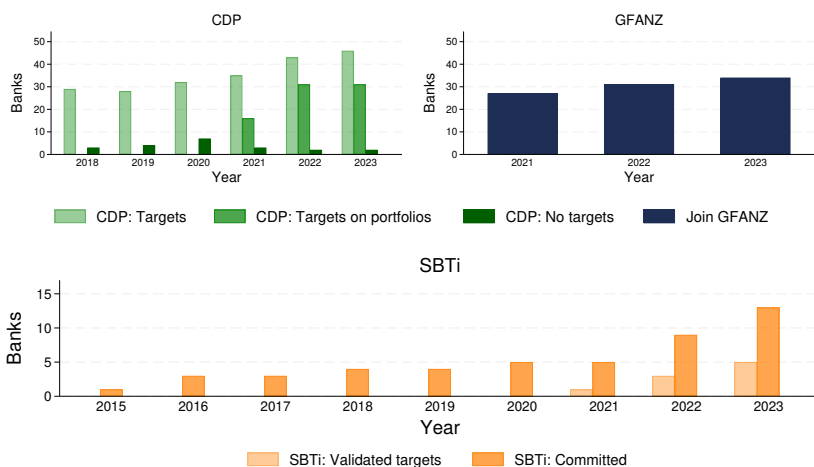
CDP. We then look at responses of the banks in our sample collected by

⁷In particular, MSCI classifies 20 banks in the sample as *On track with some targets*, 7 as *On track with all targets*, and 20 banks as *Not on track with any target*. Although it does not provide any evaluation for the other banks in the samples, those that are evaluated cover almost entirely the announcements on scope 3 and financed emissions.

⁸Overall 30 banks pledges to reach carbon neutrality and explicitly refer to scope 3 emissions, while 14 banks) to financed emissions.

the Carbon Disclosure Project (CDP) annual survey and sourced by Bloomberg. CDP is a valuable data source as it represents a "gold standard" of environmental reporting, being the most comprehensive dataset of self-reported data from corporate, regional, and local institutions, aligned with the TCFD recommendations.⁹ According to Figure 7, more than 30% of the banks in our sample report having active targets in 2023 and specifically about 20% have active targets to reduce the climate-related impact of their lending, investment and/or insurance underwriting portfolios (e.g. portfolio emissions). These banks cover about 60% of non-financial corporations' loans in our sample (Figure 3). Notably, almost none of the banks reporting to CDP declare that they have not set any target, suggesting that only climate-virtuous banks voluntarily disclose their commitments through CDP.

Figure 7: No. of banks with commitments by year and data source (CDP, GFANZ and SBTi)



Note: The upper left-hand side figure displays the number of banks reporting to CDP that they have active targets to reduce emissions (CDP: Target) and to reduce the climate-related impact of their lending, investment and/or insurance underwriting portfolios (CDP: Target on portfolios) or that they do not have any target (CDP: No targets) each year from 2018 to 2023. The upper right-hand side figure displays the number of banks members of GFANZ, over time. The bottom figure displays the number of banks with targets validated by SBTi or committed to set targets with SBTi, over time.

⁹CDP is a not-for-profit charity that collects globally information on environmental impacts (on climate change, forests and water) with two-level disclosure questionnaires, minimum or full version (with sector-specific questions), according to its eligibility criteria. The questionnaire on climate change comprises 15 modules covering, among the others, governance, strategy, risks, emission data, energy, carbon pricing, engagement. The latest dataset includes responses from over 23,000 companies, accounting over half of the global market value.

CDP has the advantage of providing harmonized, complete, and reliable self-reported information for a large set of entities. Nevertheless, it suffers from the limitation of recording fewer details on the targets relative to those made available by MSCI, which, despite its richness, however, does not ensure the same degree of coverage for all the banks it covers and might be incomplete.

GFANZ. We then look at the financial institutions that pledged to align their lending and investment portfolios to net-zero emissions by 2050 with the Glasgow Financial Alliance for Net-Zero (GFANZ), and in particular the Net-Zero Banking Alliance (NZBA) which is a global coalition of banks that pledged to align their lending and investment portfolios to net-zero emissions by 2050.¹⁰ NZBA requires members to set short- and long-term targets for credit and investment portfolios within 18 months after joining the alliance. Targets are then usually described in the bank’s climate and sustainability reports and websites; however they are not available on the GFANZ website. Overall, 34 banks within our sample joined GFANZ by 2023. They represent more than 66% of the loans to non-financial corporations within our sample (Figure 7) confirming that these are the larger banks. Most participants signed on when the alliance was launched in 2021, while only a few banks signed later (in 2022 or 2023). More details are provided by Sastry et al. (2024) who study the impact of such net-zero commitments on bank’s divestment strategies and engagement with clients.

Relative to the other data sources analyzed in this paper, GFANZ data allow us to identify ambitious institutions with the precise and challenging goal of achieving net-zero emissions by 2050. On the other hand, the data we exploit - publicly available on the GFANZ website - does not provide any details on how the institutions joining the coalition plan to achieve such objective, even if they are required to develop a detailed plan to do it.

SBTi. Finally, we analyze the public information provided by the Science-based target initiative (SBTi). SBTi aims at defining and promoting best practices in setting science-based targets in line with the goals of the Paris Agreement – limiting global warming to 1.5°C (or well-below 2°) above pre-industrial levels - and it is considered a gold standard for climate commitments. SBTi independently assesses and approves corporate targets that align with its own developed sector-specific frameworks. At this stage, with the SBTi Finance Framework, financial institutions can set near-term science-based targets that align their investment and lending activities with the Paris Agreement.¹¹ The status of SBTi pledges is categorized in two classes: i) institutions committed

¹⁰NZBA provides a framework and guidelines, supported by peer learning from pioneering banks, to help institutions set their targets and strategies, including medium-term targets.

¹¹SBTi is a non-profit initiative and is developing the first science-based global standard for financial sector to enable financial institutions to set long-term emission reduction targets that are consistent with achieving net-zero goals across their portfolios by 2050. As specified by the SBTi’s Corporate Net-Zero Standard, net-zero targets require that all emissions since 2050 are permanently removed.

to set targets, ii) institutions with targets already validated by SBTi.

Within our sample, the financial institutions with SBTi validated targets cover only 5% of the loans to non-financial corporations (Figure 3). The dataset includes 47 targets established by 5 banks and validated by SBTi. All 5 banks commit to reduce scope 1, 2 and 3 emissions and to reduce the carbon footprint of their corporate loans (and/or, in a few cases, equity and corporate bonds) belonging to the sectors of electricity generation, real estate (commercial and residential), iron and steel, automotive and cement.¹² The validated pledges are not generic intentions to reduce emissions; rather, each commitment is clearly-defined and precisely states the base and target year, the expected reduction for the relevant metric and the scope and sectors involved. The targets were published between 2021 and 2023 and are planned to be achieved in the near-term by 2030 (Figure 7).¹³ Most of the validated targets refer to scope 3 emissions. Targets related to scope 3 emissions are usually defined as intensities (i.e. GHG emissions per square meter, kWh, km, tonne of steel or cement), while those on scope 1 and 2 as absolute emissions. Notably, all banks pledged to engage with their counterparts to ensure that a percentage of their (equity, bond or loan) portfolios is invested in companies with SBTi validated targets or aligned to a specific temperature target (such as 2°C).

Besides the institutions with validated targets, 13 other banks in our sample committed to setting science-based targets to be validated by SBTi. These represent a share of 31% of the total loans to non-financial firms granted by our sample of institutions.¹⁴ Note that we do not have any information on the targets that the committed institutions will set; however, we can assume they will likely include the scope 3 financed (portfolio-related) emissions as for the institutions that already have validated goals.

The minimal number of banks with validated science-based targets or committed to setting them highlights the stringency, complexity, accountability, and potential reputational risk of developing objectives within this initiative relative to the other announcements and pledges analyzed in the paper.

5 Which banks commit? The ex-ante features of committed banks

We now investigate which banks commit to reducing their portfolio emissions and, in particular, how commitments vary with ex-ante bank characteristics, such as financials, lending and exposure to high-emitting sectors and the country's climate policy performance and ambition. The bank's characteristics and

¹²Based on their scope 1 and 2 science-based targets, all the 5 banks are aligned with the temperature rise goals of the Paris Agreement (well below 2°).

¹³Near-term targets are also a requirement for companies wishing to set net-zero targets.

¹⁴Note that these are information on the committed banks as of the end of 2023 and do not include institutions with validated targets. Among these, 5 banks got the deadline extended beyond the usual 24-month term to set the target and 1 committed to align with net-zero no later than 2050 across all emissions scopes. None of the commitments were removed for the banks within our sample.

portfolio details are as of the end of 2020 since most of the commitments on financed emissions have been undertaken from 2021 as discussed in Section 4.

To do so, first, we visually inspect how bank-specific variables vary across institutions with at least one commitment and those without any target in a collection of figures reported below.

Second, we estimate a set of regressions with the following specification:

$$Y_{b,2020} = \alpha + \beta Target_{b,2023} + e_{b,2020} \quad (1)$$

where $Y_{b,2020}$ is the bank-level variable we are interested in as of the end of 2020 (i.e. Total assets, Total loans, etc.), while $Target_{b,2023}$ is a dummy variable equal to 1 if the lender sets a specific decarbonization target (i.e. according to MSCI, CDP, GFANZ or SBTi) by 2023 and 0 otherwise. We estimate this set of regressions for each commitment type and also considering them altogether through a dummy variable equal to 1 if the lender has at least one decarbonization target among those analyzed and 0 otherwise. β is the coefficient of interest and indicates in the univariate analysis if there are significant differences in the ex-ante characteristics across banks that set a decarbonization target and those that do not. The estimated coefficients from this set of regressions are shown in the figures commented below and in the appendix. This univariate analysis provides us with a snapshot of the key characteristics of the banks that commit to decarbonising versus those that do not. The main results are robust if we consider 2019 data, although in this case we have a lower data coverage for a few variables.

Third, we estimate a set of multivariate logit regressions with the following specification:

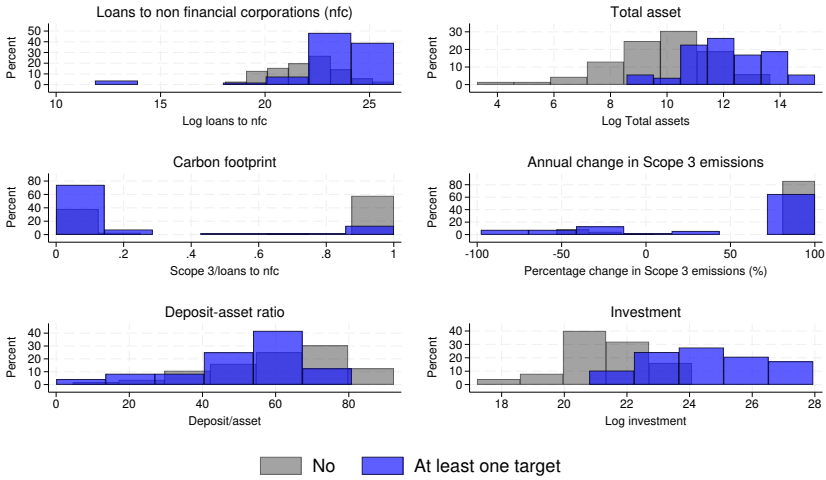
$$\pi(Target_{b,2023} = 1) = F(\beta X_{b,2020}) \quad (2)$$

where $Target_{b,2023}$ is a dummy variable equal to 1 if the lender sets a specific decarbonization target, or at least one target among those evaluated, and $X_{b,2020}$ is the array of bank-specific variables as of the end of 2020, including the total assets, loans, exposure and interest rate spread to carbon intensive sectors. The variables considered in the multivariate analysis are fewer than those used for the univariate analysis in order not to lose sample size due to joint-availability of data. The main results do not change if we include additional controls such as the scope 3 emissions, carbon footprint or deposit-asset ratio, or country's carbon policies scores, etc. This multivariate approach allows to gauge the relative contribution of the different banks' profiles to the decision to make any of the climate pledges considered in our analysis, as discussed below.

Climate and financial characteristics. Figure 8 shows that large significant banks granting more loans to non-financial corporations, with higher scope 3 absolute emissions, more assets and investments and a lower deposit-to-asset ratio, are more likely to set carbon targets. These banks' features are standard to all types of targets considered, although the following minor differences depend on the commitment's scope and type (Figure A3 in appendix). The size of

loan book and total assets are also among the significant determinants of banks' commitments according to the multivariate regressions, as shown in Table 5.

Figure 8: Different characteristics among banks with and without commitments



Note: These figures plot histograms of bank-level variables differentiating between banks with no targets (grey shaded) and those with at least one target on the financed emissions (blue shaded) among those recorded by MSCI, GFANZ, CDP and SBTi (validated targets or commitments to set science-based targets). For the variable definitions and summary statistics see Table A4.

A more heterogeneous picture is observed for the loan carbon footprint, the annual percentage change in scope 3 emissions and the composite credit rating across different types of commitments. Institutions joining GFANZ and those setting targets with or committing to SBTi had a lower carbon footprint (financed emissions) in 2020 vis-à-vis banks without such carbon pledges (Figure 9).¹⁵ This result suggests that banks with a lower ex-ante transition risk exposure are more likely to make such carbon pledges, while this is not the case for commitments recorded by MSCI and CDP. Such differences reflect the scope and the constraints posed by the different pledges. At the same time, our analysis reveals that there are no significant differences among banks with and without carbon pledges in the bank's annual percentage change in the scope 3 emissions, computed between 2019 and 2020.

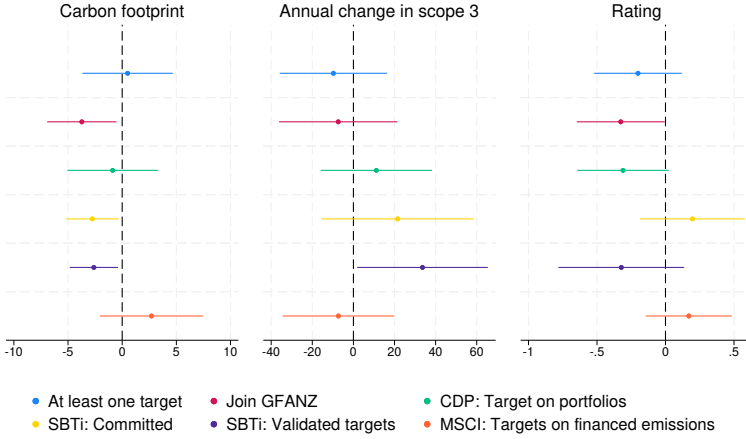
¹⁵The 2020 figures have been affected by the pandemic crisis across the board of committed and non-committed banks. We checked the results for the previous years (i.e. 2019 vs 2018) and we got similar results, therefore we used 2020-2019 as a reference, whereas a broader data coverage is available.

Table 5: Determinants of the banks' targets and commitments

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--|---------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| | At least one | GFANZ | CDP | SBTi: Val. | SBTi: Com. | MSCI |
| Loans to nfc | -0.0512 (0.867) | 0.782* (0.096) | 0.870* (0.054) | 6.545** (0.018) | 0.505 (0.479) | -0.267 (0.393) |
| Total assets | 1.256*** (0.000) | 1.335** (0.011) | 1.219*** (0.000) | 2.856 (0.246) | 0.682* (0.058) | 1.351*** (0.000) |
| Int. rate to nfc | -61.31 (0.106) | -132.5** (0.032) | -46.66 (0.515) | 472.5 (0.102) | -141.7 (0.274) | 88.48 (0.334) |
| Lending to carbon-intensive sectors | | | | | | |
| Coal & oil | -1.513 (0.107) | -0.959 (0.101) | -0.370 (0.492) | 2.809 (0.164) | 1.180*** (0.006) | -0.0346 (0.922) |
| Iron, steel & ch. | 1.564 (0.291) | 2.885* (0.071) | 2.260* (0.096) | 7.585* (0.056) | 0.721 (0.133) | 0.923 (0.128) |
| Energy | -0.711 (0.124) | -1.690 (0.168) | -0.0289 (0.926) | 6.803* (0.079) | 0.338 (0.349) | 0.290 (0.486) |
| Transport | 1.840 (0.326) | 0.0749 (0.952) | -2.387* (0.068) | -34.90** (0.028) | -3.007** (0.015) | -0.973 (0.189) |
| Exposure to carbon-intensive sectors | | | | | | |
| Coal & oil | 0.689 (0.113) | 0.633*** (0.008) | -1.814 (0.544) | 0.0587 (0.965) | -4.040 (0.107) | 0.578** (0.011) |
| Iron, steel & ch. | -0.282 (0.128) | -0.191 (0.497) | -0.463 (0.143) | -0.845 (0.494) | -0.239 (0.284) | -0.324 (0.227) |
| Energy | -0.0460 (0.550) | -0.107 (0.506) | -0.0782 (0.329) | -0.586 (0.498) | -0.0583 (0.537) | -0.0141 (0.844) |
| Transport | 0.196*** (0.002) | 0.281** (0.023) | 0.462*** (0.001) | 1.089** (0.014) | 0.301* (0.074) | 0.178** (0.013) |
| Weighted average sectoral interest rate | | | | | | |
| Coal & oil | 0.442 (0.961) | 27.28** (0.031) | -17.79* (0.073) | 14.83 (0.561) | -11.94 (0.345) | -9.080 (0.274) |
| Iron, steel & ch. | 12.84 (0.262) | -11.94 (0.345) | -8.175 (0.612) | -7.599 (0.754) | -18.90 (0.248) | 26.56** (0.030) |
| Energy | -55.73* (0.060) | -37.37 (0.276) | -61.11 (0.110) | 121.0 (0.120) | -117.6 (0.107) | -123.6** (0.013) |
| Transport | 50.95** (0.044) | 55.48* (0.057) | 61.31* (0.056) | 60.17 (0.345) | 71.12 (0.306) | 9.789 (0.804) |
| Cons. | -13.16* (0.093) | -35.26*** (0.002) | -34.19*** (0.003) | -200.8** (0.029) | -17.80 (0.341) | -10.76 (0.260) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |

Note: The table displays the estimates from a set of logit models with robust standard errors. The dependent variable varies across the columns and it is a dummy variable equal to 1 if the bank set at least one target/commitment by 2023 (column 1); if it joined GFANZ (column 2); if it set a target on its portfolios according to CDP (column 3); if it has targets validated by SBTi (column 4); if it committed to set targets with SBTi (column 5); if it has targets on the financed emissions according to MSCI (column 6). For the other variables definitions see Figures 8-14.

Figure 9: Banks' commitments and ex-ante characteristics



Note: These figures plots the estimates - with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_{b,2023} + e_{b,2020}$ with robust standard errors. $Y_{b,2020}$ is a bank-level variable (i.e. carbon footprint) at the end of 2020 and $Target_{b,2023}$ is a dummy variable equal to 1 if the lender set a target (i.e. join GFANZ) by 2023 and 0 otherwise. For the variables' definitions and summary statistics see Table A4. The significant coefficients are identified in the graphs as those with confidence intervals not crossing the zero.

Therefore, committed banks were not already reducing their emissions more than the others before announcing their pledges. Banks with targets validated by SBTi stand out as the only exception: in 2020, they had a higher percentage change in the scope 3 emissions than other banks.

Further, banks joining GFANZ had a significantly lower rating in 2020 than those not joining the alliance. Hence, the carbon commitment via participation in GFANZ could be arguably seen as a means to improve the bank's trust from stakeholders. Other variables, such as the operating margin, are not found to be significant for taking carbon pledges except for SBTi validated targets only (Figure A3 in the appendix).

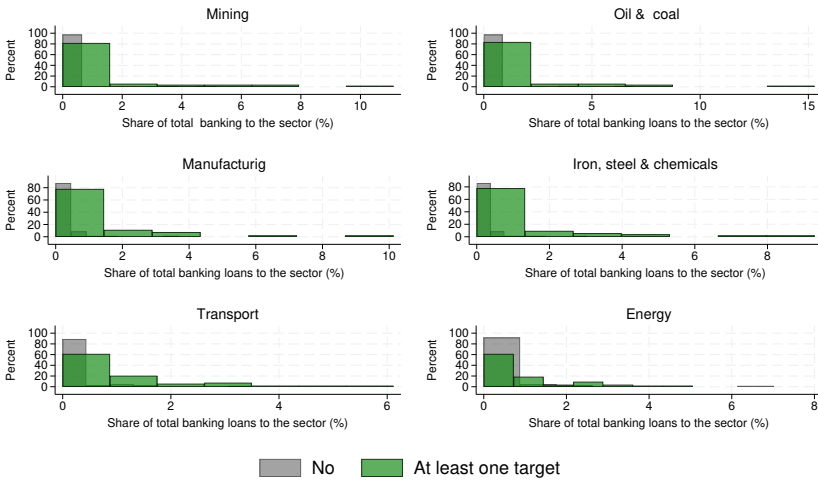
Lending to high-emitting sectors. We then study how relevant are committed and non-committed banks in terms of overall banking credit granted to a few high-emitting sectors, among those identified by IEA (2021) as crucial sectors that are required to reduce their emissions to bring global energy-related carbon dioxide emissions to net-zero by 2050. These sectors are manufacturing, energy, transport and mining. We also focus on a few sub-sectors within manufacturing and mining that are particularly key for the transition such as iron, steel and chemicals and coal and oil, respectively. Notably, committed banks are those that granted more credit to these crucial carbon-intensive sectors (Figure

10).

Banks with at least one decarbonization target in our sample accounted for a share in the range of 50-60% of the total bank lending to these high-emitting sectors in 2020 in the Euro Area, while non-committed institutions accounted for a much lower sectoral share ranging from 12% in the mining sector to 16% for transport and 23% for the energy sector. Values computed on the entire sample period (2018-2023) are very similar to those observed in 2020 (Table A2 in the appendix).

This pattern is valid for all types of commitments (i.e. GFANZ, targets according to CDP or MSCI), except for those with targets validated by SBTi that cover only a tiny portion of the lending granted to the high-emitting sectors, as shown in Figure 11 (and Figure A4 in the appendix). The data underscore the heterogeneity in the banks' features depending on the robustness and complexity of the alternative pledges and, in particular, of having science-based validated targets compared to announcing less stringent or opaque goals. The empirical evidence also highlights the differences between institutions that already have validated targets versus those that have committed to set them.

Figure 10: Shares of bank lending to carbon-intensive sectors of banks with and without commitments

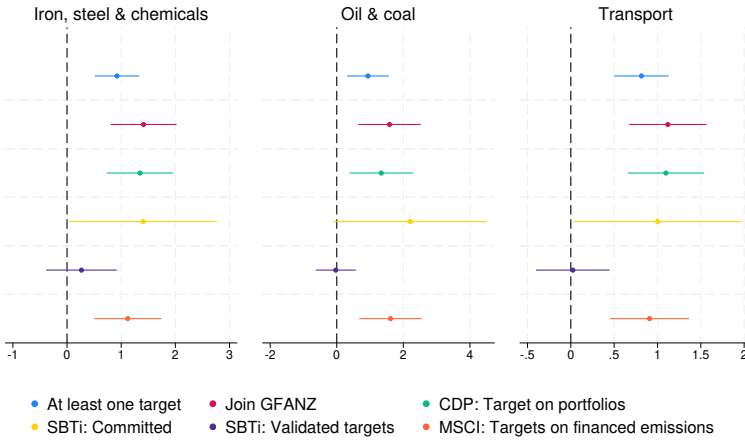


Note: These figures plot histograms of the share of banking system lending to each high-emitting sector. They differentiate between banks with no targets (grey shaded) and those with at least one target on the financed emissions (green shaded) among those recorded by MSCI, GFANZ, CDP and SBTi (validated targets or commitments to set science-based targets). In each plot, the x-axis displays the share of total loans granted by one bank over the credit given by the entire banking system to the sector.

The loans to the high-emitting sectors are also mainly concentrated in a few banks, which individually hold up to 10-15% of the total credit granted by the European banking system to the mining, manufacturing, iron, steel and chemicals as well as coal and oil sectors in 2020 (Figure 10).

The share of the system-wide bank lending to some carbon-intensive sectors is also a significant determinant of setting a climate pledge, according to the multivariate analysis, where the lending share to coal & oil, transport and iron, steel & chemicals is meaningful for several types of commitment (SBTI, CDP and GFANZ, although in different ways), as shown in Table 5.

Figure 11: Banks' commitments and ex-ante shares of bank lending to carbon-intensive sectors



Note: These figures plot the estimates - with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_{b,2023} + e_{b,2020}$ with robust standard errors. $Y_{b,2020}$ is the of bank-level share of loans granted by the bank to the mentioned sector relative to the total loans granted by the entire banking system to the same sector at the end of 2020. $Target_{b,2023}$ is a dummy variable equal to 1 if the lender set a target (i.e. joined GFANZ etc.) by 2023 and 0 otherwise. The significant coefficients are identified in the graphs as those with confidence intervals not crossing zero.

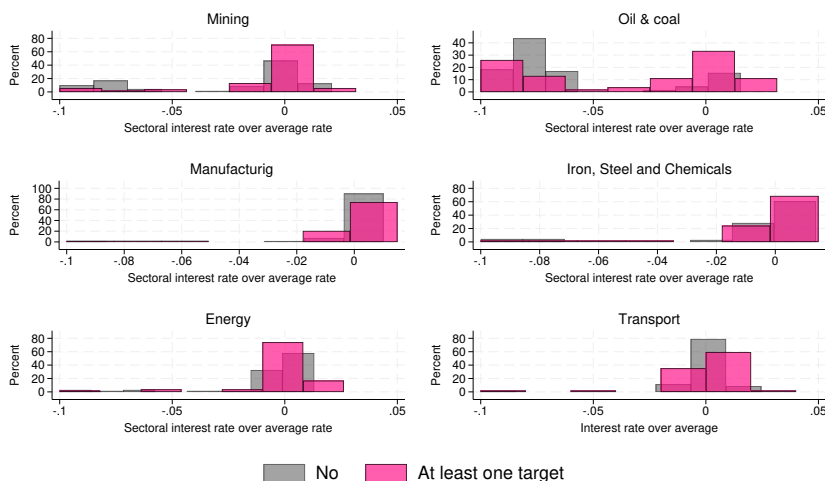
Credit pricing to high-emitting sectors. As regards the lending pricing, in 2020, the sectoral weighted average interest rate differential (vis-a-vis the bank's overall average rate to non financial corporations) charged by committed banks to some high-emitting sectors was lower than the one charged by non-committed institutions (Figure 12).¹⁶ Before the pledges, banks that joined GFANZ, those that declared portfolio-related targets to CDP and those that

¹⁶The univariate analysis directly compares the sectoral interest rate between committed and non-committed banks and allows to exclude sector-specific drivers of pricing.

committed with SBTi charged lower spreads to firms in the energy sector or in the oil and coal or iron, steel and chemicals sub-sectors, in 2020 (Figure 13).

The multivariate analysis confirms that banks that apply lower rates to the energy sector (and higher rates to the transport sector) were more likely to set at least one decarbonization target (Table 5), conditional on the bank’s average interest rate to non-financial corporations and other characteristics.

Figure 12: Loan interest rate spreads to carbon-intensive sectors for banks with and without commitments



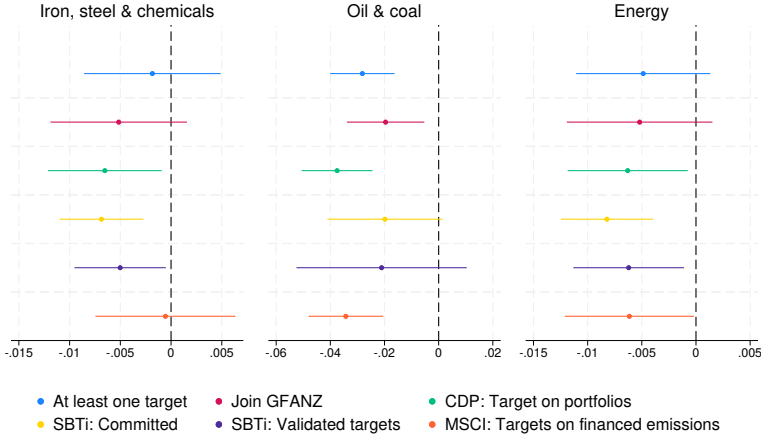
Note: These figures plot histograms of the differentials (spreads) between the bank’s weighted average interest rate to non-financial corporation and the weighted average interest rate charged to high-emitting sectors at the end of 2020. They differentiate between banks with no targets (grey shaded) and those with at least one target on the financed emissions (pink shaded) among those recorded by MSCI, GFANZ, CDP and SBTi (validated targets or commitments to set science-based targets). The spread is measured in basis points.

Exposure to high-emitting sectors. We then analyse the bank’s exposure to the high-emitting sectors measured by the share of loans granted by the bank to a given sector over the total loans granted by the bank to non-financial corporations at the end of 2020 (Figure 14). This metric is a gauge of credit portfolio concentration in carbon-intensive sectors relative to others that we use as a proxy of the bank’s exposure to transition risk.

The likelihood of setting carbon commitments is generally not related to the bank’s exposure, according to the univariate analysis, with one exception: banks more exposed to the coal and oil sector are more likely to set climate targets according to MSCI than the other lenders (Figure 15 and Figure A5 in

the appendix).¹⁷ This result might reflect the various levels of ambition and lower degree of constraint posed by general announcements recorded by MSCI relative to the other more binding commitments (i.e. those set with SBTi).

Figure 13: Banks’ commitments and ex-ante interest rate spreads to carbon-intensive sectors



Note: These figures plot the estimates - with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_{b,2023} + e_{b,2020}$ with robust standard errors. $Y_{b,2020}$ is the of bank-level the differentials (spreads) between the bank’s weighted average interest rate to non-financial corporation and the weighted average interest rate charged to high-emitting sectors at the end of 2020. $Target_{b,2023}$ is a dummy variable equal to 1 if the lender set a target (i.e. joined GFANZ etc.) by 2023 and 0 otherwise. The significant coefficients are identified in the graphs as those with confidence intervals not crossing the zero.

The multivariate logit estimates instead underline that, conditional on the bank’s size proxied by total assets and loans to non-financial corporations, the exposure to the transport sector is a meaningful determinant of the banks’ choice to set all types of targets, while the exposure to the coal and oil sector is significant for GFANZ and MSCI (5).

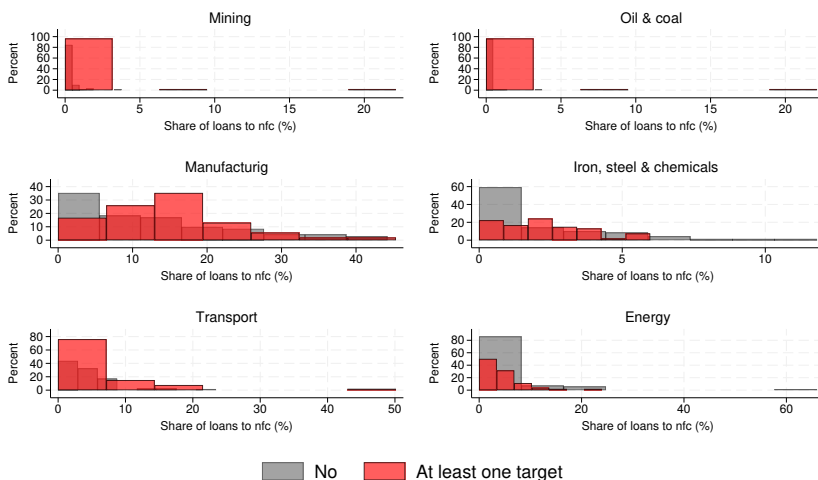
The ex-ante change in the exposure observed between 2019 and 2020 is not meaningful in explaining the carbon pledges of banks, suggesting that banks that commit to reducing their carbon footprint were not reducing their exposure ex-ante (Figures A5 and A7 in the appendix).¹⁸

¹⁷Institutions with higher exposure to the manufacturing sector are more likely to join GFANZ.

¹⁸Similar results are observed if we consider the change from 2018 or the average annual change between 2018 and 2020.

Country’s climate policies. Finally, banks’ carbon pledges are independent of their home country’s climate policy performance and ambition. A country’s ambition is evaluated through its current and historical performance on CO2 emissions and the expected share of renewable power generation in 2030 (Figures A6 and A8 in the appendix). This result is not surprising considering that our sample consists of banks domiciled in European countries and that climate goals are aligned for all countries at the EU level.¹⁹

Figure 14: Lending exposure to carbon-intensive sectors of banks with and without commitments



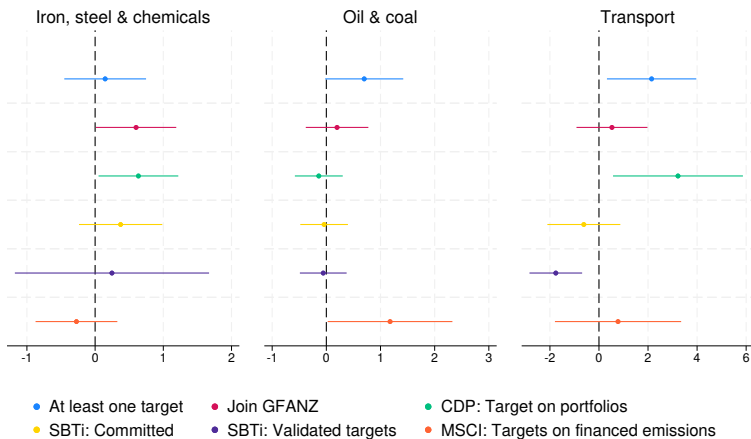
Note: These figures plot histograms of bank-level exposure to high-emitting sectors. They differentiate between banks with no targets (grey shaded), and those with at least one target on the financed emissions (red shaded) among those recorded by MSCI, GFANZ, CDP and SBTi (validated targets or commitments to set science-based targets). In each plot, the x-axis displays the share of loans granted by the bank to the mentioned sector relative to the total loans granted by the bank to non-financial corporations.

To sum up, these results reflect a few stylized facts. First, larger banks with higher emissions, granting most of the credit to the high-emitting sectors and charging them a lower spread, might face greater public pressure and aim to advertise their pledges by joining international initiatives or communicating their pledges to the public. The importance of public perception on these topics can make stakeholders feel more willing to commit. Second, these banks also face a higher transition risk, especially in the case of a disorderly and abrupt transition, and therefore might be more willing to reduce their emissions and related

¹⁹The only exception is represented by banks committed to setting targets with SBTi, which are more likely to be located in countries with a higher carbon score.

risks. Finally, while some bank characteristics are common to all the pledges analysed, some pledge-specific features indicate that there is not a unique bank profile that fits all the pledges. Notably, banks' features seem to mirror the robustness and complexity of the alternative pledges and, in particular, of the science-based targets.

Figure 15: Banks' commitments and ex-ante exposures to carbon-intensive sectors



Note: These figures plot the estimates - with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_{b,2023} + e_{b,2020}$ with robust standard errors. $Y_{b,2020}$ is the share of loans granted by a bank to the mentioned sector relative to the total loans granted by the same bank to non-financial corporations at the end of 2020. $Target_{b,2023}$ is a dummy variable equal to 1 if the lender set a target (i.e. joined GFANZ etc.) by 2023 and 0 otherwise. The significant coefficients are identified in the graphs as those with confidence intervals not crossing the zero.

6 Ex-post effects on lending policies of committed banks

In this section, we analyse the ex-post effects of bank commitments to investigate whether, where, and how the lending policies to carbon-intensive sectors change after the banks publish their climate and carbon pledges. Our research is specifically focused on exploring whether banks change their lending practices to some carbon-critical sectors after carbon pledges by changing the sectoral credit allocation and price. Although relevant, we do not have data granular enough to delve into other aspects such as banks' engagement with their clients to finance their decarbonization goals, or credit allocation within sectors or divestment.

To assess whether committed banks are changing exposure/lending rates to high-polluting sectors, we employ the diff-in-diff methodology proposed by Callaway & Sant’Anna (2021), which allows us to compute the average treatment effects in setups with multiple periods, variation in treatment timing (targets can be set at different points in time), and when the parallel trends assumption holds potentially only after conditioning on observed covariates. We define as ‘treated’ those banks with a commitment (i.e. joined GFANZ, committed to SBTi, with SBTi validated targets, or with targets according to MSCI or CDP) and estimate the average treatment effects on the treated (ATT) by comparing the outcome variables for the treated banks with those of the never treated banks (uncommitted).

Following Callaway & Sant’Anna (2021), we consider a conditional parallel trends assumption (similar to fixed effects analysis): we assume that banks with the same characteristics would follow the same trend in the outcome variables without treatment. We use as bank characteristics the amount of loans and the weighted average interest rate to non-financial corporations. We focus on this parsimonious set of variables - which emerged among the main determinants of the likelihood of setting a target (see Section 5) - to avoid losing several observations and time periods by including additional controls. Nevertheless, the main results survive if we condition on additional variables such as the total assets or on the normalized Pearson residuals obtained from a set of logit models with the following specification: $\pi(Target_{b,t}) = F(\beta X_{b,t})$ where $\pi(Target_{b,t})$ is the probability that the bank b is committed in a given year t and $X_{b,t}$ includes the bank’s amount of loans and weighted average interest rate to non-financial corporations and total assets. By adding the normalized residuals of such regressions, we control for any additional omitted variable that could drive the bank’s choice to commit and, at the same time, its credit policies. Results for these checks are available upon request.

The outcome variables are bank- and time-specific, such as the scope 3 emissions, carbon footprint, log of the loans granted to a given sector, the exposure to a given sector or the interest rate charged to it.

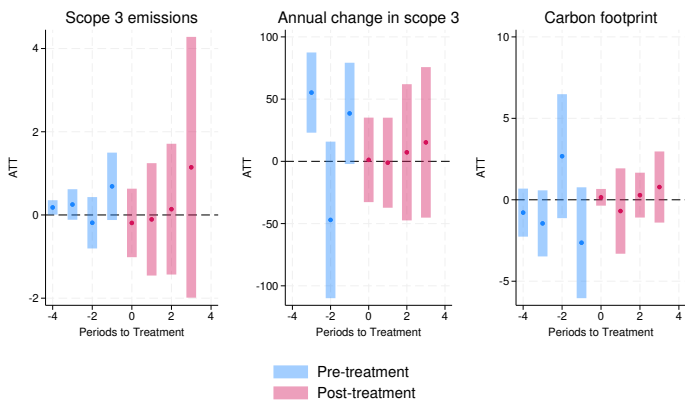
The results for the average treatment effects by the length of exposure to the treatment are reported in the following figures along with a simultaneous 95% confidence band. The plots display pre-treatment estimates relative to the years before the banks commit, which can be used to visually test the parallel trends assumption; they also display the effect estimates in post-treatment periods (i.e., the years following the target setting).

Climate performance. Figure 16 shows that banks with at least one commitment do not change their scope 3 emissions or carbon footprint differently from non-committed banks.²⁰ This result holds for most of the targets considered in the analysis. It is also confirmed in Table A10 in the appendix, reporting the aggregated weighted treatment effect estimates, as in Callaway & Sant’Anna

²⁰The plots also show that banks that commit before the treatment have higher annual change in scope 3 emissions than other banks.

(2021).

Figure 16: Pre and post commitments' effect on climate performance



Note: The figure displays the effect of setting at least one decarbonization target on the bank's climate metrics. The target is set when the period of treatment is 0. Blue bars show point estimates and simultaneous 95% confidence bands for pre-commitment periods. Under the null hypothesis of the conditional parallel trends assumption holding in all periods, estimates should be equal to 0. Pink bars provide point estimates and simultaneous 95% confidence bands for the effect after setting a decarbonization target.

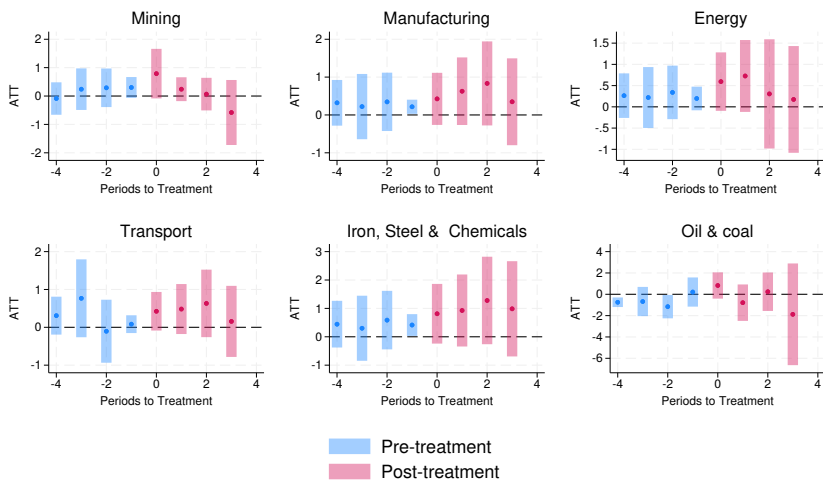
Lending and exposure to high-emitting sectors. Figure 17 shows that setting at least one decarbonization target does not affect the quantity of loans granted to high-emitting sectors.

Note that these results are affected by the composition of groups, which is not constant over all the horizons as it depends on the year the commitment was announced. In particular, the number of committed banks decreases as the time since commitment passes (i.e., the number of committed banks is higher when the period of treatment is 0 and it is very limited when it is equal to 3).

Figure 18 documents that setting at least one carbon pledge does not affect the exposure to the carbon-intensive sectors. As in the previous Section, here the exposure to a given sector refers to the share of loans granted by a bank to that sector relative to the total loans of the same bank to non-financial corporations. This share provides us with information about the concentration of the loan portfolios and the associated transition risk.

However, these results hide some heterogeneity in the effects across different types of commitments. Notably, committing or setting targets with SBTi appear to significantly affect banks' sectoral credit allocation, while joining GFANZ or pledging to reduce the portfolio-related and financed emissions according to CDP and MSCI do not have a significant effect on lending and exposure to high-emitting sectors.

Figure 17: Pre and post commitments' effect on lending to high-emitting sectors



Note: The figure displays the effect of setting at least one decarbonization target on the bank's amount of loans (in log) to a given sector. See Figure 16 for more explanations.

More precisely, having targets validated by SBTi seems to induce banks to reduce the amount granted and their exposure to certain sectors, such as manufacturing (iron, steel and chemicals) and transport.²¹ Albeit interesting, these results should be interpreted cautiously given the minimal number of banks in the sample with SBTi-validated targets. Banks committed to setting science-based targets with SBTi, instead, appear to reduce lending to a few high-emitting sectors, such as energy, while increasing lending to others, such as iron, steel and chemicals. Similar results are observed for the exposure. Nevertheless, also in this case the caveat of the limited number of observations applies.

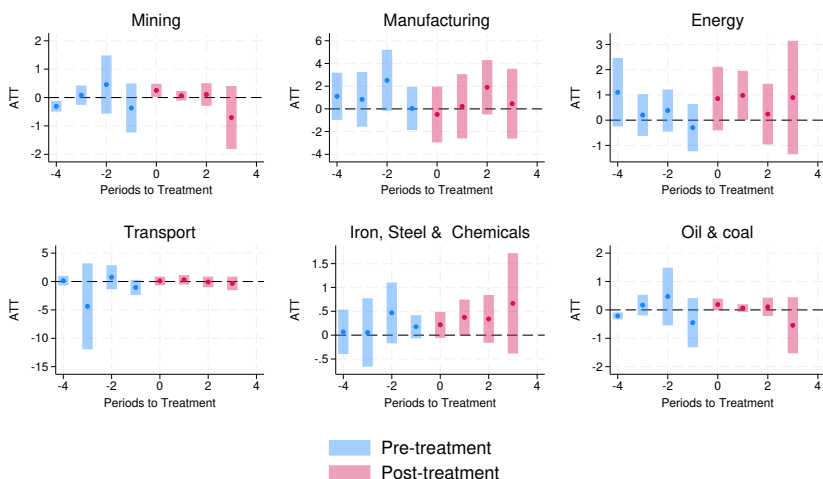
Since the impact of the commitments becomes apparent over time after the pledge, the aggregate average treatment effect (over periods and groups) is not meaningful in most of the cases (see Table A11 in the appendix). The same holds if we employ a standard diff-in-difference set-up (two-way fixed effect regression) as explained by Callaway & Sant'Anna (2021).

Credit pricing to high-emitting sectors. Finally, we test whether commitments affect the banks' credit pricing policies. Figure 19 shows that setting a target does not significantly affect the weighted average interest rate that banks charge to high-emitting sectors. Still, in this case, the effects are also heterogeneous across types of commitment and sectors. The commitment to set science-based targets with SBTi leads banks to charge a higher interest rate

²¹Results for the different types of targets are available upon request.

to most of the high-emitting sectors. At the same time, validated targets by SBTi lead banks to decrease lending pricing to all high-emitting sectors relative to the other credit institutions. Although we cannot test this hypothesis, the observed reduction in the interest rate charged to high-emitting sectors might reflect banks' engagement with their clients within carbon-critical industries to finance their decarbonization goals.

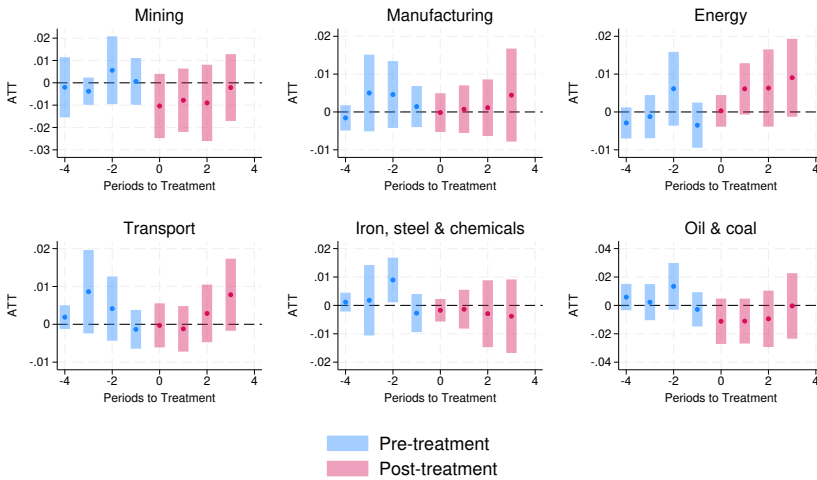
Figure 18: Pre and post commitments' effect on exposure to carbon-intensive sectors



Note: The figure displays the effect of setting at least one decarbonization target on the bank's exposure to a given sector, computed as the share of loans of a bank to the sector relative to the total loans granted by the same bank to non-financial corporations. See Figure 16 for more details.

In summary, this Section provides two key insights. Firstly, different climate commitments have varying implications for banks' sectoral lending and pricing, arguably due to risk management policies. Among these commitments, those related to SBTi appear to be more influential in steering banks' lending policies toward a carbon-risk-aware behavior, at least via disinvestment or credit reallocation at the sector level. This influence may be attributed to the pressure for soundness and accountability exerted by external verification. Secondly, we emphasize that the effects on banks' behaviour do not materialize immediately after the commitment, highlighting the long-term effect of the pledges. These results play a crucial role in reconciling and interpreting the mixed evidence provided by the aforementioned recent literature on the banks' lending strategy and practices to meet their decarbonization targets.

Figure 19: Pre and post commitments' effect on credit interest rate



Note: The figure displays the effect of setting at least one decarbonization target on the weighted average interest rate charged by the bank to a given sector. See Figure 16 for more details.

7 Challenges in evaluating and comparing pledges using the implied temperature rise

Given the proliferation of carbon pledges, there is a growing need for methods to measure the alignment of companies and investment portfolios with the Paris Agreement's goals of limiting the global temperature increase and to compare multiple and heterogeneous objectives. Different forward-looking metrics also are being used by financial institutions to assess the alignment of their portfolios to climate goals, including the implied temperature rise (ITR), as discussed by GFANZ (2022).

The ITR is a common and intuitive metric that translates the companies' or portfolios' carbon pledges into projected emissions trajectories and assesses the potential temperature rise at the end-of-century. It has the benefit of evaluating the alignment based on the latest scenarios and bearing a direct relationship between climate targets and temperature rise.²² For this reason, it is easy to interpret despite the complexity of the computation. In addition, it makes it possible to evaluate and compare the level of ambition of each single target and company, and it can be aggregated across companies and at the portfolio level. This metric is computed by a handful of providers with different assumptions

²²Data providers usually employ scenarios developed by the IEA, the Intergovernmental Panel on Climate Change (IPCC), or the Network for Greening the Financial System (NGFS).

(e.g. on the reference climate scenarios, the green technological innovation, the climate policies, and the contribution of the companies without pledges), target and projection horizons (i.e. medium or long-term), models (i.e. single-scenario benchmark or warming function), data on GHG emissions and carbon pledges as well as internal methodologies to assess the commitments' credibility.

In this section, we analyze and compare the ITR data provided by Bloomberg and MSCI for our bank sample with the final aim of providing an estimate of the alignment of the European banking sector to the Paris Agreement's climate goals and investigating the challenges in using ITR data for the banking sector. More precisely, we look at the ITR in 2100 for the banks' scope 3 emissions as reported at the end of 2023: this is the temperature increase that would occur by the end of the century if the whole economy had the same scope 3 emissions of the bank analyzed, based on its most recent scope 3 pledges and the respective projected emissions up to 2050.²³ The two data providers differ in the methodology employed: the procedure used by MSCI is aligned with the GFANZ framework (GFANZ 2022, MSCI 2023). In contrast, Bloomberg uses the open-source methodology provided by SBTi (2020).

The data coverage is limited for both sources: each one covers about 70 banks, and only 35 institutions are covered by both providers. As shown in Figure 20, the estimates provided by the two data providers at the end of 2023 for our sample of banks differ, both in the weighted average value and the distribution, and they are not correlated.²⁴ The same is confirmed using the Bloomberg long-term ITR only (see Figures A9 and A10 in the appendix).

The differences might be due to several reasons. First of all, Bloomberg assigns the default values of 3.2°C to most of the sample; this default temperature is applied to all non-disclosing companies according to the SBTi methodology, which assumes that firms with no forward-looking targets will follow a business as usual pathway that will lead to a rise in the global temperature of 3.2°C.²⁵ In our sample, the default score of 3.2°C is assigned to all the banks that do not have credible long-term pledges on their scope 3 emissions. MSCI, instead, uses the current emissions to estimate the ITR of the companies without targets and assumes they will slightly increase over time.²⁶ However, there must be other reasons behind the observed disagreement. Indeed, the two metrics are uncorrelated even if we restrict the sample to the banks with an ITR lower than 3.2°C according to Bloomberg.²⁷ Differences might also be due to the data used for the scope 3 emissions (i.e. if estimated with different methodologies)

²³MSCI computes the cumulative scope 3 emissions between 2020 and 2050. Bloomberg, instead, considers the scope of 3 emissions over 3 horizons: short-term (2021-2024), medium-term (2025-2035), and long-term (2036-2050). The analysis compares the average ITR over the three horizons provided by Bloomberg with the MSCI estimate. The results do not change if we consider the Bloomberg long-term horizon only.

²⁴The correlation is 0.2 and is not significant. It is -0.13 when considering only the Bloomberg long-term horizon.

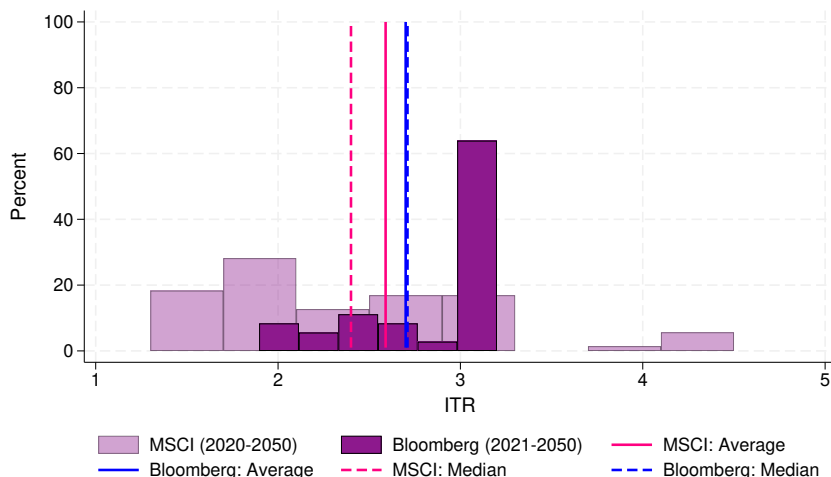
²⁵This score is based on the Climate Action Trackers' 2100 warming projections with current pledges at a 66% probability.

²⁶By 1.5% per year.

²⁷In this case, the correlation is close to zero.

and the carbon pledges (i.e. if obtained from different sources). Finally, the disagreement might derive from the provider’s credibility assessment of the carbon pledges and the methodology employed.²⁸

Figure 20: Banks’ implied temperature rise (ITR) by source



Note: The ITR provided by MSCI refers to the scope 3 cumulative emissions between 2020 and 2050. The ITR provided by Bloomberg instead considers the scope 3 emissions over three horizons: short-term (2021-2024), medium-term (2025-2035), and long-term (2036-2050). This figure displays the average over the three horizons; it does not change substantially with the long-term ITR only (see Figure A9 in the appendix). The average and median values are computed using total loans to non-financial corporations as weights.

Despite the differences, according to both data sources, the European banking system (proxied by our sample of large banks) is not aligned with the target of limiting the increase of the temperature to well below 2°C relative to the pre-industrial levels due to a lack of action and ambition of both the banking and non-financial sectors. Therefore, additional efforts are needed to meet the global climate goals established by the Paris Agreement. However, the degree of misalignment depends on the source considered and is particularly severe according to Bloomberg.²⁹ Using the total loans as weights, the weighted average is 2.7°C for Bloomberg versus 2.58°C for MSCI. Using the scope 3 emissions as weights, the average ITR is lower: 2.4°C for Bloomberg and almost 2.47°C for MSCI. In this case the average values are lower because we lose some observations, for which no scope 3 emissions data are available, which have relatively

²⁸For instance, MSCI compares the companies’ projections with the carbon budget based on a single-scenario benchmark (the NGFS Net Zero scenario). SBTi, instead, employs a warming function (based on the IPCC scenarios) to estimate the relationship between emission trends and temperature rise.

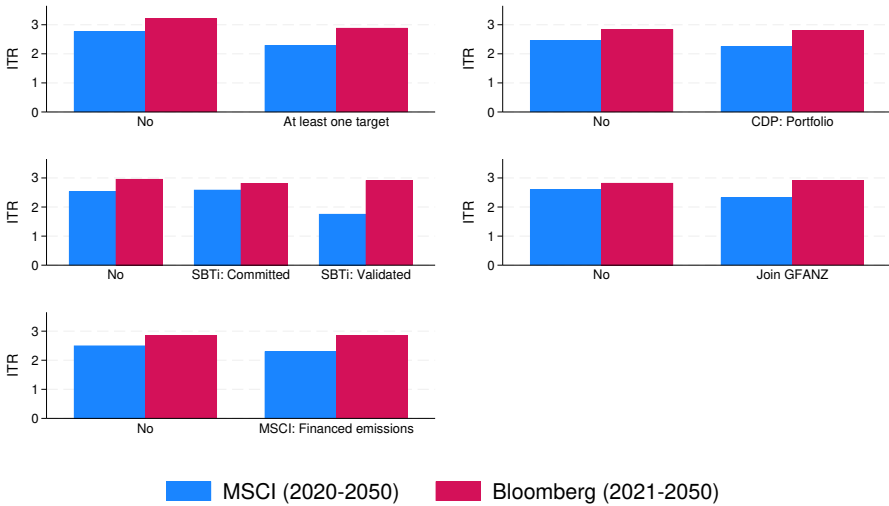
²⁹Considering the long-term horizon for Bloomberg, the weighted average is the same.

high ITR estimates. The median values are similar or slightly lower but always above 2°. The estimates fall within the range of 2.1-2.8°C forecast of the first UN Global Stocktake conducted in 2023.

As visible in Figure 21, different bank’s commitments do not seem to be meaningful drivers of the ITR estimates.

MSCI ITR data are also mainly unrelated to the lenders’ financial characteristics, exposure to high-emitting sectors, or the countries’ climate policies (Figures A11-A12 in appendix).

Figure 21: ITR by banks’ commitments



Note: The ITR provided by MSCI refers to the scope 3 cumulative emissions between 2020 and 2050. The ITR provided by Bloomberg instead considers the scope 3 emissions over three horizons: short-term (2021-2024), medium-term (2025-2035) and long-term (2036-2050). *At least one target* is equal to 1 if the bank has at least one of the targets considered in the analysis and 0 if not.

Despite its advantages, the opaqueness of the underlying assumptions and the heterogeneity across data providers make it challenging to employ the ITR both for financing and investment decisions and for micro- or macro-prudential analysis. Indeed, these differences in computation lead to divergent results across providers and increase the uncertainty around the pledges’ evaluation, as also noted by GFANZ (2022). Therefore, we conclude that ITR estimates still suffer challenges that impair a sound assessment and comparison of the lenders’ carbon strategies.

Finally, we acknowledge that an additional layer of complexity rests on the

evaluation of banks’ implied temperature rise (relative to non-financial firms), which not only echoes the banks’ lending and investment strategies but also the underlying actions of relevant non-financial counterparts in moving towards the transition.

8 Biodiversity-related commitments

This Section analyses how banks’ pledges concerning nature issues are related to climate commitments. Along with public initiatives to raise awareness of the growing importance of nature-related risks and the interconnection with climate-related risks (i.e., NGFS (2023b)), banks are taking the first steps to integrate these considerations in their decision-making processes. In particular, the CDP questionnaire asks respondents about their biodiversity-related analyses, actions, and commitments. According to the data available for our sample, in 2023, 30 banks (out of 45 for which data are available) declare to have already assessed their impacts on biodiversity, while 14 plan to do so within the next 2 years (Table 6).

Table 6: CDP biodiversity-related impact assessment and oversight

| | Impact assessment | Oversight |
|------------------------|-------------------|-----------|
| No | 1 | 3 |
| Planned within 2 years | 14 | 3 |
| Yes | 30 | 39 |
| <i>Direct</i> | 11 | |
| <i>Portfolio</i> | 25 | |
| <i>Upstream</i> | 5 | |
| Total | 45 | 45 |

Note: In italics details on the scope of the biodiversity impact assessment; each bank may cover more than one area. Oversight refer to board or executive-management level oversight on biodiversity issues. Source: CDP responses provided by Bloomberg.

Most of the analysis undertaken by banks so far refers to their portfolio’s impact. Regarding the governance adaptation, most of the institutions in the sample have established an oversight responsibility for biodiversity-related issues at board-level and/or executive management-level, while 2 banks plan to establish this within the next 2 years.

The announcements made vary substantially across banks; data need to be standardized, and detailed information can only be extrapolated from a careful reading of the textual description provided by each bank. An example of the most frequent words that appear in the description of the commitments provided to CDP is displayed in Figure 22.

Figure 22: World cloud on the CDP bank’s biodiversity-related commitments



Source: CDP responses provided by Bloomberg.

Overall, 38 banks have made a public commitment or endorsed biodiversity-related initiatives (Table 7). Most pledges refer to avoiding the negative impacts on threatened and protected species or preserving and avoiding the exploration of legally designated protected areas. In other cases, banks mention protocols or initiatives they have signed or specific actions they intend to take, such as enabling forest conservation, offsetting emissions through reforestation projects that aim to increase biodiversity, or introducing requirements to clients working in specific sectors (i.e., palm oil, cocoa, fishing, cattle farming). In addition, 36 banks declared they had already taken actions to progress their biodiversity-related commitments; most of these initiatives targeted internal staff and refer to increasing education and awareness of biodiversity issues and land/water management and protection. Disclosure about the organization’s response to biodiversity-related issues and pledges is published via financial reports, regulatory filings, or voluntary sustainability reports and communications.

There is a close relationship between climate and biodiversity pledges of banks. Within the sub-sample of institutions for which we have CDP biodiversity-related data, almost all (more than 80%) of the banks with a portfolio decarbonization commitment also have established a biodiversity-related target.³⁰ Indeed, banks committed to reducing biodiversity losses have similar characteristics as those described above for the climate-related commitments: these are banks with large loan portfolios and granting a large share of loans to the high-emitting sectors (Figure A13 in the appendix).

In addition to the information reported by CDP, MSCI also provides information on whether a bank has established biodiversity-related commitments. Nevertheless, the data from the two sources differ from one another. Indeed,

³⁰Almost all the banks that have already taken actions to achieve their biodiversity-related commitments according to CDP have also set at least one climate-related pledges according to the data provided by SBTi, GFANZ, CDP or MSCI, discussed above.

according to MSCI, only 25 banks within our sample adopted biodiversity protection policies by 2023.

Table 7: CDP biodiversity-related commitments and action taken

| | Commitments | Action taken |
|---|-------------|--------------|
| No | 7 | 8 |
| Yes | 38 | 36 |
| <i>Education & awareness</i> | | <i>27</i> |
| <i>Land/water management</i> | | <i>7</i> |
| <i>Livelihood, economic & other</i> | | <i>3</i> |
| Total | 45 | 44 |

Note: In italics keywords mentioned in the actions taken to achieve biodiversity-related goals. Some actions mentioned more than one keywords and hence are counted twice. Source: CDP responses provided by Bloomberg.

9 Conclusions

The transition to a low-carbon economy entails risks and opportunities for the banking sector, which plays a key role, particularly in Europe, where it is the core of the financial system. Our study investigates which banks commit to limit their emissions related to their lending (or investment) activity, how they plan to do so, as well as whether and how they take action after the commitments.

The analysis focuses on the pledges on the portfolio-related scope 3 emissions since these represent most of the emissions attributed to financial institutions. Still, it is fair to bear in mind that only scopes 1 and 2 emissions are directly under the control of banks, while scope 3 emissions are mainly related to their portfolios, which banks can reduce only via credit reallocation policies, pricing, or engagement with their clients. However, the bank’s effective capability to reduce their scope 3 emissions critically depends on the credibility and concrete progress on the transition of the underlying financed firms. In pursuing their objectives, financial institutions should avoid the potential risks of an abrupt transition and harness the opportunities stemming from green investment.

Within this background, this paper documents a few new findings on banks’ carbon pledges using data collected from several data repositories.

We conclude that banks set multiple and highly heterogeneous targets which cannot be easily compared and evaluated. Such features hinder comparison across targets and institutions despite various initiatives to set standards (e.g., TCFD, SBTi, and GFANZ).

Banks pledging to reduce their financed emissions are large institutions granting most of the credit to high-emitting sectors and at lower interest rates (relative to that applied to other sectors). This fact might be due to regulatory or public pressure, or to the awareness of the significant exposure to carbon-

intensive industries.

The effects of their commitments on their lending policies to the most high-emitting sectors afterwards are weak and varied. Among the others, goals and pledges set within the SBTi initiative seem more meaningful to induce changes in lending and pricing towards high-emitting sectors, although with a delayed effect. From a policy perspective, this evidence might hint at the pressure for accountability exerted by an external verification authority, thus suggesting broader and systematic regulatory initiatives. In addition, the delayed impact might reflect the willingness (or need) to avoid a harsh shift that could restrain rather than boost green investments.

Assessing the ambition of banks' goals by exploiting ITR estimates remains particularly challenging, given the scant transparency of such metrics and the disagreement across providers. Nevertheless, according to both data sources analyzed, more effort is needed to align the banking system to the Paris Agreement's target of limiting the increase of the temperature to well below 2°C relative to the pre-industrial levels. This outcome not only echoes banks' lending and investment strategies but also the limited actions of non-financial corporations in moving towards the transition.

Finally, banks often pair climate with biodiversity commitments to integrate nature-related considerations into their business decisions. That signals a growing awareness of banks about the interconnection between climate change and nature-related issues.

This study provides a detailed snapshot of euro-area banks' climate commitments to inform the relevant and growing literature on the link between banks' green commitments and lending policies. The work aims to fill some gaps of the existing studies, which rely on a smaller set of information on banks' commitments, often summarized via a dummy variable, without a deep analysis of the pledges' content, ambition, and credibility.

Research can build on our results to investigate further on how different commitments have evolved over time in connection with financial regulation, market practices, bank-specific features, and lending policies.

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Appendix

Table A1: Carbon-intensive sectors definition

| Carbon-intensive sector | NACE code |
|------------------------------------|--|
| Mining | B - Mining and quarrying |
| <i>Oil & coal</i> | <i>B5 - Mining of coal and lignite</i> <i>B6 - Extraction of crude petroleum & natural gas</i> |
| Manufacturing | C - Manufacturing |
| <i>Iron, steel & chemicals</i> | <i>C20 - Manufacture of chemicals & chemical products</i> <i>C23 - Manufacture of other non-metallic mineral products (i.e. including cement)</i> <i>C24 - Manufacture of basic metals (i.e. including iron & steel)</i> |
| Energy | D - Electricity, gas, steam & air conditioning supply |
| Transport | H - Transporting and storage |

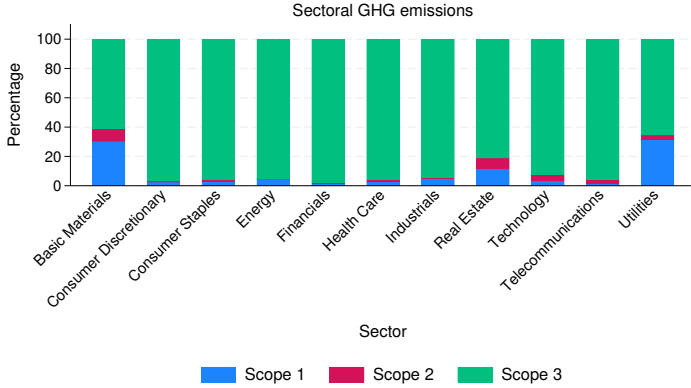
Note: *Oil & coal* are particularly carbon-intensive sub-sectors of the *Mining* sector. *Iron, steel & chemicals* are particularly carbon-intensive sub-sectors of the *Manufacturing* sector.

Table A2: Sample coverage in terms of lending to non-financial corporations

| | Total sample | | | At least one target | | No target | |
|--------------------------------|--------------|--------|-----------|---------------------|-----------|-----------|-----------|
| | Obs | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. |
| Loans to nfc | 741 | 66.598 | 5.192 | 50.185 | 5.029 | 16.293 | 2.075 |
| Mining | 741 | 69.037 | 8.733 | 61.575 | 8.528 | 7.220 | 2.460 |
| <i>Coal & oil</i> | 741 | 68.249 | 9.831 | 61.926 | 9.238 | 6.040 | 3.301 |
| Manufacturing | 741 | 74.042 | 5.452 | 61.512 | 6.645 | 12.298 | 1.415 |
| <i>Iron, steel & chem.</i> | 741 | 74.918 | 4.790 | 61.717 | 6.893 | 12.918 | 2.039 |
| Energy | 741 | 67.080 | 6.942 | 47.833 | 5.393 | 19.152 | 2.723 |
| Transport | 741 | 69.340 | 8.371 | 55.303 | 6.499 | 13.855 | 2.548 |

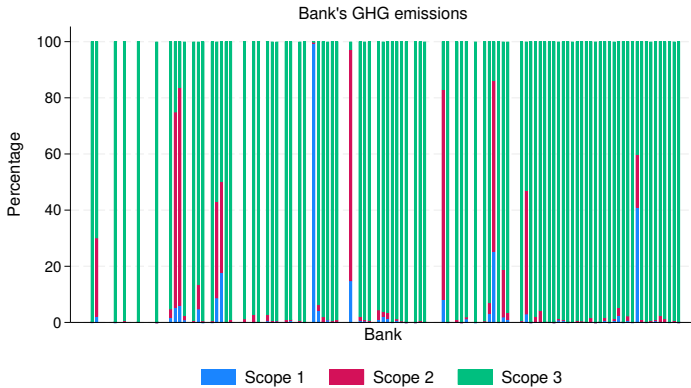
Note: In the first row, data refer to the bank-level share of loans granted by the banks in the sample (with and without targets on financed emissions) over the total loans granted by banks in the Euro Area according to Anacredit. In the other rows, data refer to the share of total loans granted by the banks in the sample to the mentioned sector over the total loans granted by banks in the Euro Area to the same sector according to Anacredit. Annual data between 2018 and 2023.

Figure A1: Share of scope 1, 2 and 3 on total sector's GHG emissions



Note: For each sector the figure plots the share of scope 1, 2 and 3 emissions over the total GHG sectoral emissions. Sectoral averages are computed on the firms within the STOXX500 as reported by Bloomberg for the 2022.

Figure A2: Share of scope 1, 2 and 3 on total bank's GHG emissions



Note: For each bank the figure plots the share of scope 1, 2 and 3 emissions over the total GHG bank's emissions. For each bank the data on the scope emissions is the average over the different providers (Bloomberg, MSCI, ISS and LSEG-Datastream) as of the end of 2022. Each bar refers to a bank in the sample. We consider 2022 data given the still limited availability of 2023 emissions data.

Table A3: Emissions: summary statistics

| Variable | Obs | Mean | Std. dev. | Min | Max |
|--------------------------|-----|----------|-----------|---------|----------|
| Scope 1 emissions | 587 | 70.280 | 468.025 | 0 | 4560 |
| Scope 2 emissions | 586 | 75.501 | 375.265 | 0 | 4989.256 |
| Scope 3 emissions | 485 | 8916.756 | 47359.4 | 0.002 | 462431.1 |
| Annual change in scope 3 | 384 | 15.854 | 71.874 | -99.998 | 100 |

Note: Average GHG emissions data provided by Bloomberg, MSCI, ISS and LSEG-Datstream, in thousands of tCO₂e. Annual data for the period 2018-2023.

Table A4: Financial data: summary statistics

| | Total sample | | | At least one target | | No target | |
|---------------------|--------------|--------|-----------|---------------------|-----------|-----------|-----------|
| | Obs | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. |
| Significant | 741 | 0.776 | 0.417 | 0.927 | 0.261 | 0.656 | 0.476 |
| Loans to nfc | 741 | 22.664 | 1.967 | 23.479 | 2.140 | 22.017 | 1.537 |
| Scope 3 emiss. | 485 | 11.676 | 3.211 | 12.055 | 3.137 | 11.067 | 3.243 |
| Carbon foot. | 485 | 1.525 | 7.904 | 1.381 | 7.877 | 1.757 | 7.963 |
| Total asset | 663 | 11.034 | 1.764 | 12.114 | 1.542 | 10.109 | 1.375 |
| Investments | 313 | 23.127 | 2.346 | 24.553 | 0.970 | 21.317 | 1.449 |
| Rating | 572 | 5.103 | 1.008 | 4.990 | 1.889 | 5.234 | 1.037 |
| Oper. margin | 633 | 23.51 | 36.738 | 23.597 | 22.073 | 23.435 | 45.736 |
| Deposit-asset ratio | 616 | 56.594 | 18.718 | 51.914 | 17.818 | 60.704 | 18.55 |

Note: *Significant* is a dummy variable equal to 1 if the bank is classified as "Significant institutions" by the SSM. *Loans to nfc* is the log of the total loans granted by the bank to the non-financial corporations (nfc) according to Anacredit. *Scope 3 emissions* is the log of the average scope 3 emissions provided by Bloomberg, MSCI, ISS and LSEG-Datstream, in thousands of tCO₂e. *Carbon footprint* is the ratio between the bank's scope 3 emissions (computed as average of those reported by Bloomberg, MSCI, ISS and LSEG-Datstream) and its loans to nfc. *Total asset* and *Investments* are the log of the bank's total assets and investments from Bloomberg and LSEG-Datstream respectively. *Operating margin* ratio measures a company's pricing strategy and operating efficiency, in percentage from Bloomberg. It is calculated as Operating Income (or Losses)/Total Revenue*100. *Rating* is the average between the ratings provided by Standard & Poor's, Fitch and Moody's. Deposit are from LSEG-Datstream. Annual data for the period 2018-2023.

Table A5: Country climate performance: summary statistics

| Variable | Total sample | | | At least one target | | No target | |
|------------------|--------------|-------|-----------|---------------------|-----------|-----------|-----------|
| | Obs | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. |
| Carbon - current | 708 | 5.962 | 0.615 | 6.024 | 0.588 | 5.909 | 0.527 |
| Carbon - trend | 708 | 7.866 | 0.933 | 7.905 | 0.895 | 7.828 | 0.852 |
| Renewable target | 656 | 70.75 | 20.12 | 71.57 | 17.96 | 70.01 | 21.897 |

Note: *Carbon - Current* is a score which measures a country's carbon historical and current carbon emissions performance and ranges from 0 (worst) to 10 (better). *Carbon - Trend* is a score which measures a country's carbon historical performance on an absolute CO2 emissions and the trend in CO2 intensity per GDP and ranges from 0 (worst) to 10 (better). Trends are computed as moving weighted average of logarithmic changes using a window spanning 15 years. *Renewable target* is the target for the renewable share of power generation that a country or region needs to achieve in 2030 to be on track for net-zero in 2050; this is a percentage and ranges from 0 to 100. Annual data for the period 2018-2023.

Table A6: Share of total lending to high-emitting sectors

| Variable | Total sample | | | At least one target | | No target | |
|--------------------------------|--------------|-------|-----------|---------------------|-----------|-----------|-----------|
| | Obs | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. |
| Loans nfc | 741 | 0.537 | 0.908 | 0.916 | 1.144 | 0.236 | 0.484 |
| Mining | 741 | 0.555 | 1.658 | 1.123 | 2.310 | 0.103 | 0.488 |
| <i>Coal & oil</i> | 741 | 0.548 | 1.999 | 1.130 | 2.835 | 0.086 | 0.559 |
| Manufacturing | 741 | 0.597 | 1.262 | 1.122 | 1.701 | 0.180 | 0.411 |
| <i>Iron, steel & chem.</i> | 741 | 0.605 | 1.260 | 1.126 | 1.678 | 0.190 | 0.479 |
| Energy | 741 | 0.540 | 1.001 | 0.873 | 1.089 | 0.275 | 0.837 |
| Transport | 741 | 0.557 | 0.975 | 1.010 | 1.253 | 0.198 | 0.411 |

Note: In the first row, data refer to the bank-level share of loans granted by the bank to non-financial corporations (nfc) relative to the total loans granted by the entire banking system to nfc. In the other rows, data refer to the bank-level share of loans granted by the bank to the mentioned sector relative to the total loans granted by the entire banking system to the same sector. Annual bank-level data from Anacredit for the period 2018-2023.

Table A7: Exposure to high-emitting sectors: share of bank's loans to non-financial corporations

| Variable | Total sample | | | At least one target | | No target | |
|--------------------------------|--------------|--------|-----------|---------------------|-----------|-----------|-----------|
| | Obs | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. |
| Mining | 741 | 0.457 | 1.168 | 0.679 | 1.499 | 0.281 | 0.771 |
| <i>Coal & oil</i> | 741 | 0.206 | 1.020 | 0.363 | 1.407 | 0.082 | 0.514 |
| Manufacturing | 741 | 13.565 | 10.227 | 14.958 | 8.582 | 12.459 | 11.254 |
| <i>Iron, steel & chem.</i> | 741 | 2.276 | 2.187 | 2.326 | 1.561 | 2.236 | 2.579 |
| Energy | 741 | 4.883 | 7.723 | 4.810 | 4.543 | 4.942 | 9.526 |
| Transport | 741 | 4.732 | 5.049 | 5.666 | 5.847 | 3.991 | 4.171 |

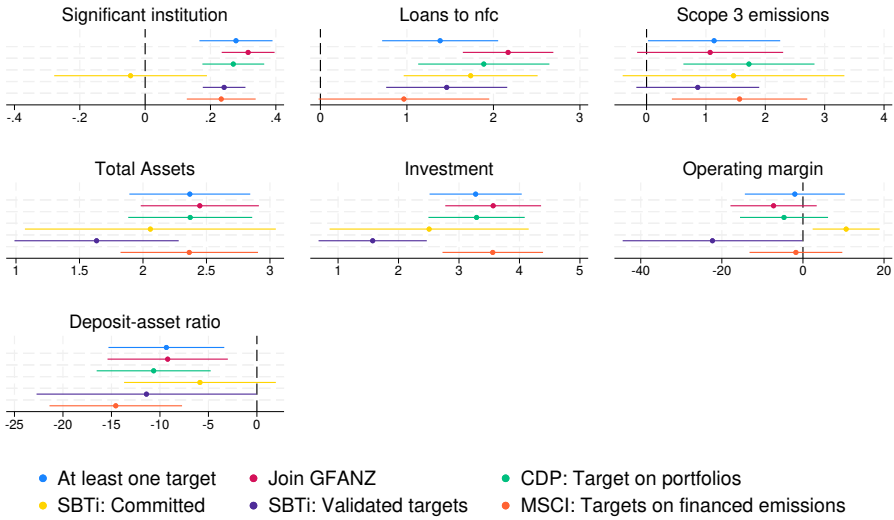
Note: Data refer to the bank-level share of loans granted by a bank to the mentioned sector relative to the total loans granted by the same bank to non-financial corporations. Annual bank-level data from Anacredit for the period 2018-2023.

Table A8: Credit pricing to high-emitting sectors

| Variable | Total sample | | | At least one target | | No target | |
|--------------------------------|--------------|--------|-----------|---------------------|-----------|-----------|-----------|
| | Obs | Mean | Std. dev. | Mean | Std. dev. | Mean | Std. dev. |
| Mining | 741 | 0.0160 | 0.0311 | 0.0085 | 0.0259 | 0.0219 | 0.0335 |
| <i>Coal & oil</i> | 741 | 0.0471 | 0.0371 | 0.0325 | 0.0395 | 0.0587 | 0.0305 |
| Manufacturing | 741 | 0.0015 | 0.0148 | 0.0028 | 0.0186 | 0.0005 | 0.0109 |
| <i>Iron, steel & chem.</i> | 741 | 0.0055 | 0.0238 | 0.0043 | 0.0213 | 0.0064 | 0.0256 |
| Energy | 741 | 0.0022 | 0.0200 | 0.0002 | 0.0201 | 0.0038 | 0.0199 |
| Transport | 741 | 0.0003 | 0.0153 | 0.0001 | 0.0172 | 0.0005 | 0.0136 |

Note: Data in absolute values computed as bank-specific differential between the weighted average interest rate charged by each bank to a given sector and the weighted average rate charged by the same bank to all loans to non-financial corporations. Annual bank-level data from Anacredit for the period 2018-2023.

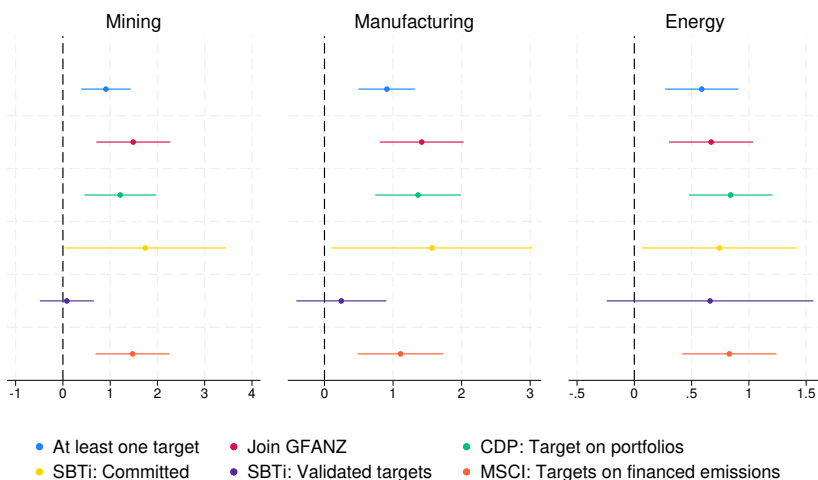
Figure A3: Banks' commitments and ex-ante characteristics



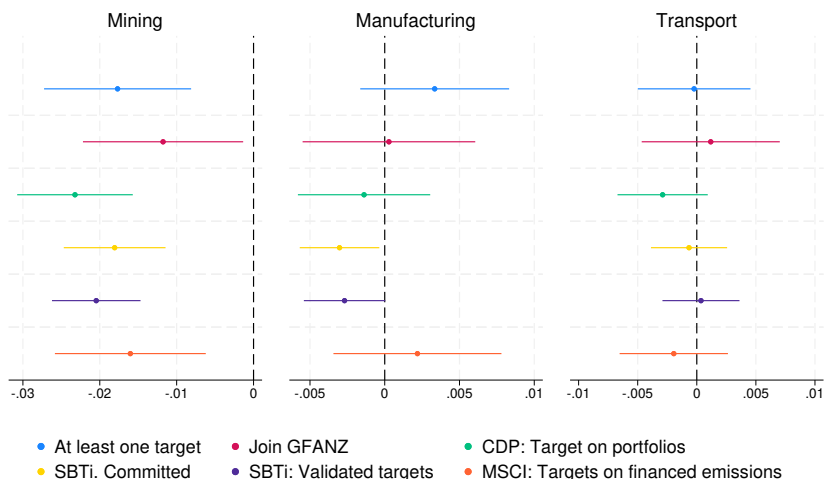
Note: These figures plot the coefficients - with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_b + e_{b,2020}$ with robust standard errors. $Y_{b,2020}$ is the of bank-level variable (i.e. Total assets etc.) measured at the end of 2020 and $Target_b$ is a dummy variable equal to 1 if the lender set a target (i.e. joined GFANZ etc.) by 2023 and 0 otherwise. For the variable definitions and summary statistics see Table A4. The significant coefficients are identified in the graphs as those with confidence intervals not crossing zero.

Figure A4: Banks' commitments and ex-ante lending and interest rates

a) Lending to high-emitting sectors



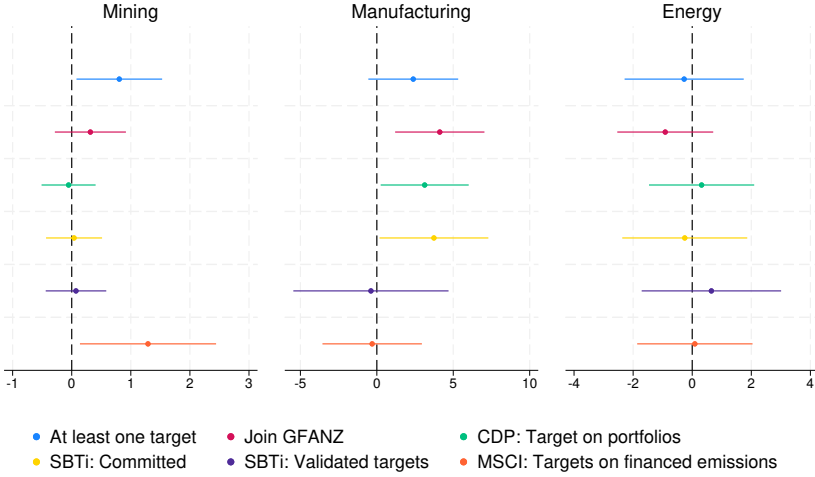
b) Interest rate spread paid by high-emitting sectors



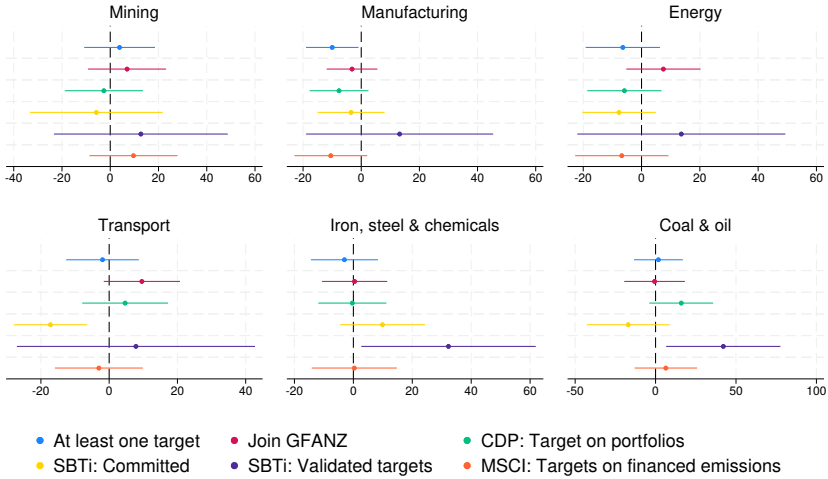
Note: These figures plot the coefficients - with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_b + e_{b,2020}$ with robust standard errors. In Panel a) $Y_{b,2020}$ is the of bank-level share of loans granted by the bank to the mentioned sector relative to the total loans granted by the entire banking system to the same sector measured at the end of 2020. In Panel b) $Y_{b,2020}$ is the bank-level differential (spreads) between the bank's weighted average interest rate to non-financial corporation and the weighted average interest rate charged to high-emitting sectors at the end of 2020. $Target_b$ is a dummy variable equal to 1 if the lender set a target (i.e. joined GFANZ etc.) by 2023 and 0 otherwise. The significant coefficients are identified in the graphs as those with confidence intervals not crossing zero.

Figure A5: Banks' commitments and ex-ante exposure to high-emitting sectors

a) Exposure to high-emitting sectors

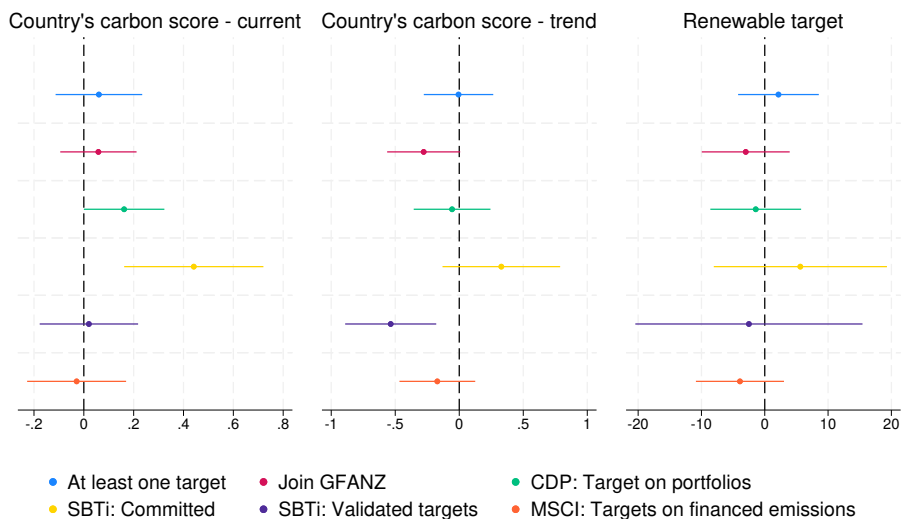


b) Change in exposure to high-emitting sectors



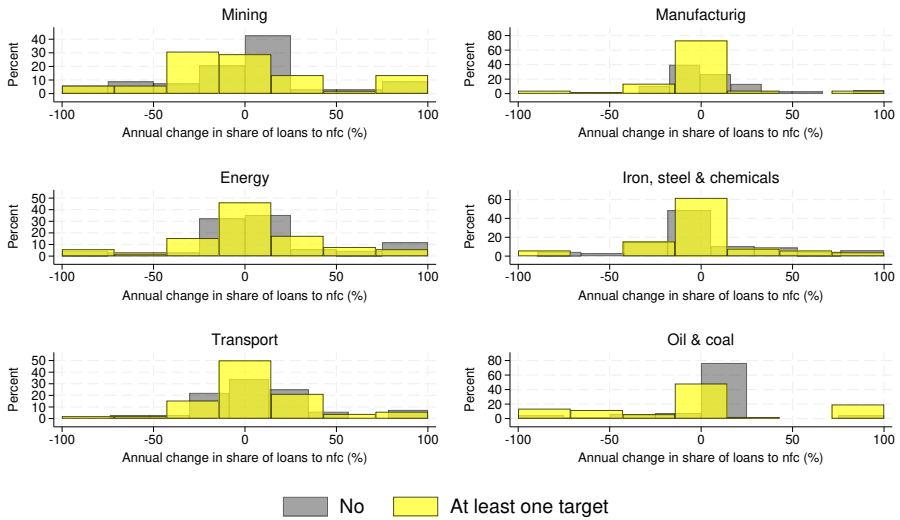
Note: These figures plot the coefficients - with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_b + e_{b,2020}$ with robust standard errors. In Panel a) $Y_{b,2020}$ is the of bank-level share of loans granted by a bank to the mentioned sector relative to the total loans granted by the same bank to non-financial corporations. In Panel b) $Y_{b,2020}$ is the percentage change - between 2020 and 2019 - in the share of loans granted by a bank to the mentioned sector relative to the total loans granted by the same bank to non-financial corporations. $Target_b$ is a dummy variable equal to 1 if the lender set a target (i.e. joined GFANZ etc.) by 2023 and 0 otherwise. The significant coefficients are identified in the graphs as those with confidence intervals not crossing zero.

Figure A6: Banks' commitments and country climate policy



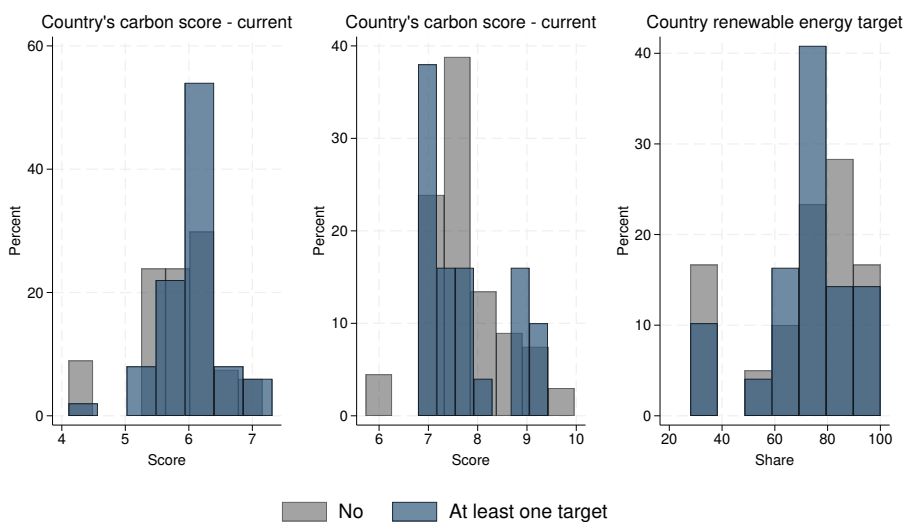
Note: These figures plot the coefficients with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_b + e_{b,2020}$ with robust standard errors. $Y_{b,2020}$ is the country's carbon score or renewable energy target and $Target_b$ is a dummy variable equal to 1 if the lender set a target (i.e. joined GFANZ etc.) by 2023 and 0 otherwise. We consider the country of the headquarter. The significant coefficients are identified in the graphs as those with confidence intervals not crossing zero. For the variable definitions and summary statistics see Table A5.

Figure A7: Banks' commitments and ex-ante change in exposure to high-emitting sectors



Note: These figures plot histograms of bank-level annual percentage change in the lenders' exposure to high-emitting sectors. They differentiate between banks with no targets (grey shaded), and those with at least one target on the financed emissions (yellow shaded) among those recorded by MSCI, GFANZ, CDP and SBTI (validated targets or commitments to set science-based targets). In each plot the x-axis displays the percentage change - between 2019 and 2020 - in the share of loans granted by the bank to the mentioned sector relative to the total loans granted by the bank to non-financial corporations.

Figure A8: Banks' commitments and country climate policy



Note: These figures plot histograms of countries' climate policy variables for each bank in the sample. We consider the country of the headquarter. They differentiate between banks with no targets (grey shaded) and those with at least one target on the financed emissions (blue shaded) among those recorded by MSCI, GFANZ or CDP and those collected by SBTi (validated targets or commitments to set science-based targets). For the variable definitions and summary statistics see Table A5.

Table A9: Determinants of the banks' commitments: robustness

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|----------------------|----------------------|----------------------|----------------------|--------------------|---------------------|
| | At least one | GFANZ | CDP | SBTi: Val. | SBTi: Com. | MSCI |
| Loans to nfc | 0.214 (0.340) | 0.728*** (0.010) | 0.308 (0.268) | 0.535 (0.295) | 0.153 (0.666) | -0.264 (0.184) |
| Total Assets | 1.266*** (0.000) | 1.319*** (0.001) | 1.228*** (0.000) | 0.393** (0.036) | 0.519* (0.078) | 1.420*** (0.000) |
| Int. rate to nfc | -34.55 (0.333) | -78.04* (0.086) | -23.44 (0.696) | 103.8** (0.041) | -119.0 (0.109) | 73.47 (0.403) |
| Exposure to carbon-intensive sectors | | | | | | |
| Coal & oil | 0.348*** (0.004) | 0.429*** (0.007) | -1.557 (0.179) | -0.437 (0.652) | -0.113 (0.742) | 0.539** (0.011) |
| Energy | -0.0876 (0.158) | -0.245** (0.018) | -0.0983 (0.149) | 0.0332 (0.320) | -0.0413 (0.524) | 0.00578 (0.916) |
| Transport | 0.239*** (0.000) | 0.231*** (0.001) | 0.281*** (0.003) | -0.380*** (0.008) | 0.0911 (0.494) | 0.132** (0.029) |
| Iron, steel & ch. | -0.0765 (0.527) | 0.200 (0.122) | -0.00695 (0.968) | 0.172 (0.393) | 0.00977 (0.945) | -0.163 (0.319) |
| Weighted average sectoral interest | | | | | | |
| Coal & oil | 0.939 (0.910) | 21.31** (0.038) | -16.87* (0.053) | 0.796 (0.972) | -0.270 (0.986) | -10.52 (0.164) |
| Iron, steel & ch. | 13.21 (0.247) | -12.78 (0.363) | -1.952 (0.900) | -16.11 (0.515) | -18.03 (0.280) | 29.77** (0.017) |
| Energy | -52.90* (0.059) | -30.76 (0.345) | -46.76 (0.167) | 38.17 (0.208) | -82.66* (0.086) | -102.7** (0.023) |
| Transport | 55.08** (0.029) | 58.45** (0.044) | 45.01 (0.145) | -1.720 (0.946) | 60.88 (0.174) | 0.788 (0.986) |
| Cons. | -19.87*** (0.009) | -34.25*** (0.000) | -21.93*** (0.004) | -21.65 (0.119) | -9.659 (0.346) | -11.59* (0.078) |
| Obs. | 122 | 122 | 122 | 122 | 122 | 122 |

Note: The table display the estimates from a set of logit models with robust standard errors. The dependent variable varies across the columns is a dummy variable equal to 1 if the bank set at least one target/commitment by 2023 (column 1); if it joined GFANZ (column 2); if it set a target on its portfolios according to CDP (column 3); if it has targets validated by SBTi (column 4); if it committed to set targets with SBTi (column 5); if it has targets on the financed emissions according to MSCI (column 6). For the other variables definitions see Figures 8-14.

Table A10: Average treatment effect on the treated (ATT) on climate performance

| Scope 3 emissions | Annual change in Scope 3 | Carbon footprint |
|-------------------|--------------------------|------------------|
| -0.024 | 2.39 | -0.08 |
| (0.474) | (15.323) | (0.613) |

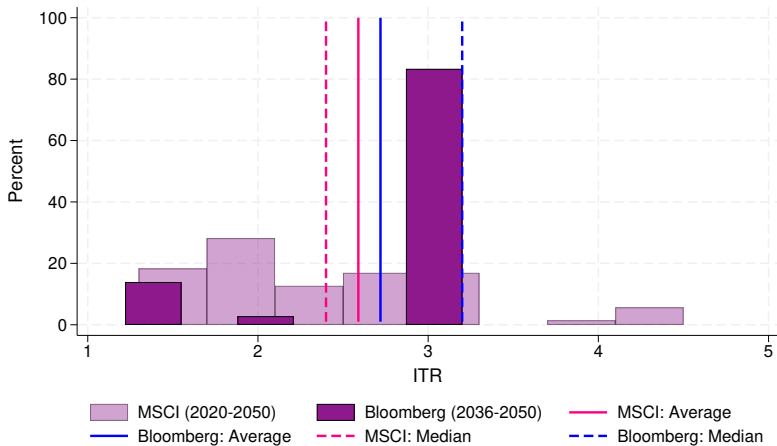
Note: Weighted average (by group size) of all available group-time average treatment effects as in Callaway & Sant'Anna (2021). P-values in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A11: Average treatment effect on the treated (ATT) on credit policies

| (1) Mining | (2) Manufact. | (3) Energy | (4) Transp. | (5) Iron, steel & c. | (6) Oil & coal |
|--|------------------|---------------|----------------|-------------------------|-------------------|
| Log loans to high-emitting sectors | | | | | |
| 0.35 | 0.591 | 0.546 | 0.482 | 0.978 | -0.06 |
| (0.222) | (0.428) | (0.429) | (0.327) | (0.628) | (0.492) |
| Exposure to high-emitting sectors | | | | | |
| 0.105 | 0.379 | 0.753 | 0.101 | 0.322 | 0.09 |
| (0.086) | (1.18) | (0.493) | (0.358) | (0.186) | (0.064) |
| Interest rate to high-emitting sectors | | | | | |
| -0.008 | 0.0006 | 0.004 | 0.0005 | -0.001 | -0.010 |
| (0.007) | (0.0027) | (0.003) | (0.0026) | (0.640) | (0.003) |

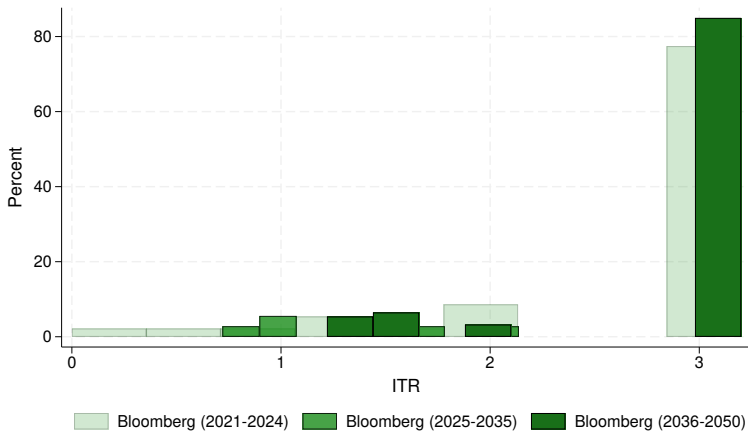
Note: Weighted average (by group size) of all available group-time average treatment effects as in Callaway & Sant'Anna (2021). P-values in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure A9: Banks' scope 3 emissions implied temperature rise (ITR) by source



Note: The ITR provided by MSCI refers the scope 3 cumulative emissions between 2020 and 2050, while the ITR provided by Bloomberg refers to the scope 3 emissions for the period 2036-2050. Average and median values are computed using total loans to non-financial corporations as weights.

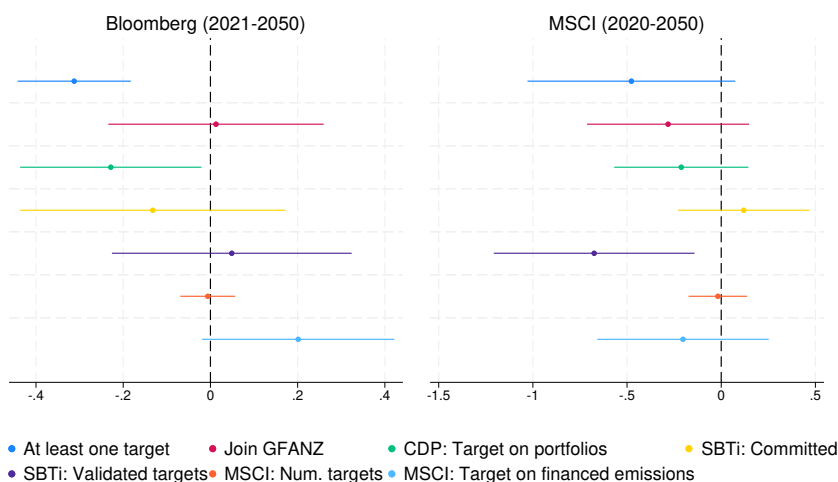
Figure A10: Banks' scope 3 ITR by Bloomberg



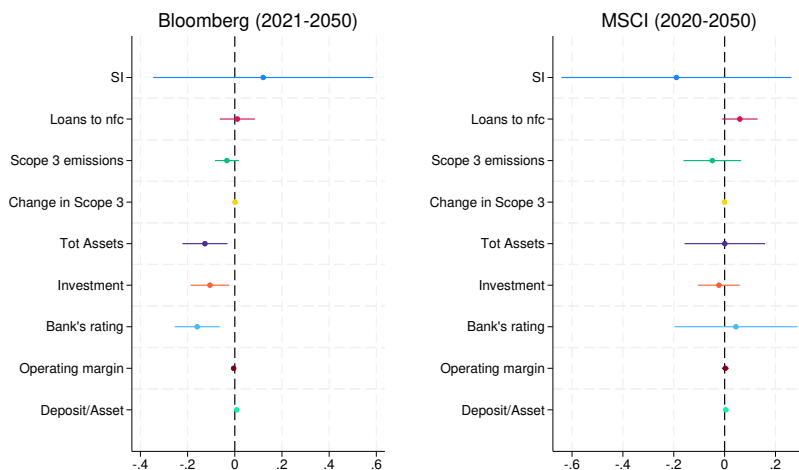
Note: The ITR provided by Bloomberg for the scope 3 emissions over three horizons: short-term (2021-2024), medium-term (2025-2035) and long-term (2036-2050).

Figure A11: Banks' ITR, commitments and features

a) Commitments



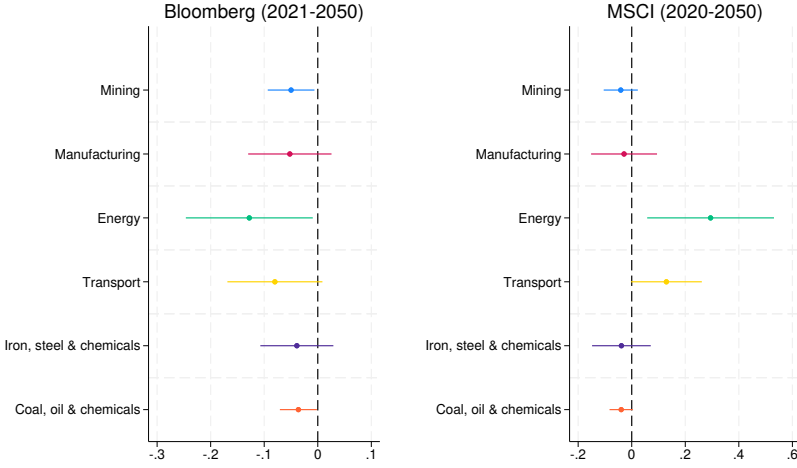
b) Financial characteristics



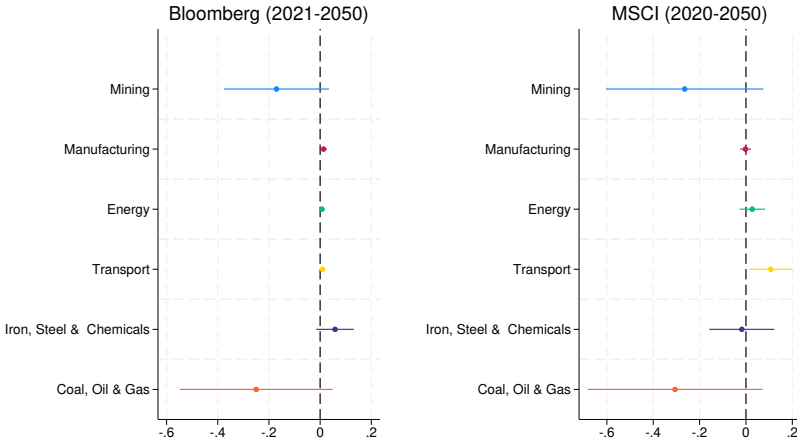
Note: In Panel a) the figures plot the coefficients with 90% confidence intervals - obtained from a set of regressions $Y_{b,2023} = \alpha + \beta Target_{b,2023} + e_{b,2023}$ with robust standard errors. $Y_{b,2023}$ is the bank's ITR estimate according to MSCI or Bloomberg. $Target_{b,2023}$ is a dummy variable if the lender set a decarbonization target as of 2023. In Panel b) the figures plot the coefficients with 90% confidence intervals - obtained from a set of regressions $Y_{b,2023} = \alpha + \beta Var_{b,2023} + e_{b,2023}$ with robust standard errors. $Y_{b,2023}$ is the bank's ITR estimate according to MSCI or Bloomberg. $Var_{b,2023}$ are bank-level variables at the end of 2023. The significant coefficients are identified in the graphs as those with confidence intervals not crossing zero.

Figure A12: Banks' ITR, lending and exposure to high-emitting sectors

a) Lending to high-emitting sectors

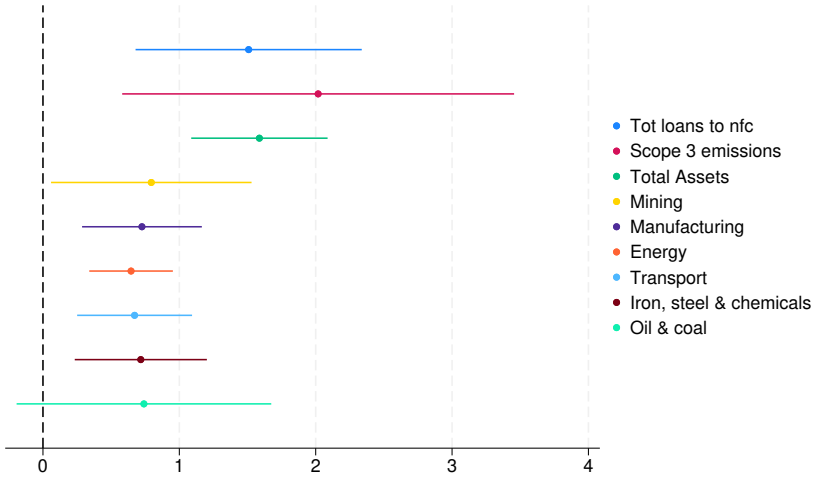


b) Exposure to high-emitting sectors



Note: In Panel a) the figures plot the coefficients with 90% confidence intervals - obtained from a set of regressions $Y_{b,2023} = \alpha + \beta Share_{b,2023} + e_{b,2023}$ with robust standard errors. $Y_{b,2023}$ is the bank's ITR as of 2023. $Share_{b,2023}$ is the share of loans granted by the bank to the mentioned sector relative to the total loans granted by the entire banking system to the same sector measured at the end of 2023. In Panel b) the figures plot the coefficients with 90% confidence intervals - obtained from a set of regressions $Y_{b,2023} = \alpha + \beta Exposure_{b,2023} + e_{b,2023}$ with robust standard errors. $Y_{b,2023}$ is the bank's ITR as of 2023. $Exposure_{b,2023}$ is the share of loans granted by the bank to the mentioned sector relative to the total loans granted by the bank to non-financial corporations at the end of 2023. The significant coefficients are identified in the graphs as those with confidence intervals not crossing zero.

Figure A13: Banks' bio-diversity related commitments and features



Note: These figure plots the coefficients with 90% confidence intervals - obtained from a set of regressions $Y_{b,2020} = \alpha + \beta Target_b + e_{b,2020}$ with robust standard errors. $Y_{b,2020}$ is the bank's characteristic or is the of bank-level share of loans granted by the bank to the mentioned sector relative to the total loans granted by the entire banking system to the same sector measured at the end of 2020. $Target_b$ is a dummy variable if the lender adopted a biodiversity-related target. The significant coefficients are identified in the graph as those with confidence intervals not crossing zero.