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Climate Risk, Bank Lending and Monetary Policy

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October 2023

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Abstract

Combining euro-area credit register and carbon emission data, we provide evidence of a climate risk-taking channel in banks' lending policies. Banks charge higher interest rates to firms featuring greater carbon emissions, and lower rates to firms committing to lower emissions, controlling for their probability of default. Both effects are larger for banks committed to decarbonization. Consistently with the risk-taking channel of monetary policy, tighter policy induces banks to increase both credit risk premia and carbon emission premia, and reduce lending to high emission firms more than to low emission ones. While restrictive monetary policy increases the cost of credit and reduces lending to all firms, its contractionary effect is milder for firms with low emissions and those that commit to decarbonization.

Keywords: climate risk, carbon emissions, interest rate, lending, monetary policy

JEL Classifications: E52, G21, Q52, Q53, Q54, Q58

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1 Introduction

We combine granular credit register data for all euro-area banks and carbon emission data to address two related research questions: do banks penalize climate risk in their lending activity, over and above its effect on credit risk? If so, is the climate risk premium that they require affected by monetary policy? Neither one is an obvious question.

In principle, banks should care about their clients' exposure to climate risk only insofar as this affects their default risk: for instance, a bank lending to an oil company should take into account the risk that carbon taxes or environmental regulations may end up forcing the company into default. However, the typical models that banks use to assess credit risk may be unable to capture tail-risk events such as future changes in regulation or in technology. Moreover, these models may fail to capture the systemic risk arising from adverse environmental shocks or unforeseen changes in carbon taxes, and to allow for the resulting concerns of macroprudential regulators: indeed the climate stress test carried out in 2022 by the European Central Bank (ECB) on the most significant euro-area banks may have raised banks' attention to climate risk over and above its effects on individual clients' solvency. Last but not least, banks may internalize social concerns about climate risk for reputational reasons, in response to pressure from the media, depositors and activist shareholders. However, media attention and investors' activism may be less successful in affecting banks' environmental record than that of, say, a mutual fund or a pension fund, because banks' loan portfolios are typically far more opaque than the securities portfolios of institutional investors. This probably explains why so far the evidence on whether banks price climate risk in their lending policies is far less clear cut than that regarding the pricing of climate risk in bond and stock markets.

Our evidence is that euro-area banks not only price the current climate risk exposure of the firms they lend to, but also their future exposure: they charge a higher interest rate to firms with higher current carbon emissions, controlling for their probability of default, but a lower rate to those that commit to reduce their emissions in the future. Moreover, we find that banks that publicly commit to environmentally responsible lending policies charge a higher climate risk premium to high-emission firms and give a larger discount to firms that commit to lower their future emissions.

Whether changes in monetary policy may affect the climate risk premia charged by banks on polluting firms is an even less obvious question, and in fact a still unexplored one. Two standard models of the effects of monetary policy on financial intermediation yield opposite predictions on this issue.

On one hand, models of the risk-taking channel of monetary policy can be extended to encompass climate risk. Recall that these models predict that expansionary monetary policy induces banks to reduce monitoring efforts and lend to riskier borrowers, engaging in yield-seeking policies, while restrictive monetary policy has the opposite effect (Acharya and Naqvi, 2012; Adrian and Shin, 2009; Borio and Zhu, 2012; Dell'Ariccia, Laeven, and Marquez, 2014). Extending these models to climate risk, a monetary expansion should lead banks to lower the climate risk premium they charge to high-emission firms relative to low-emission ones, and symmetrically a monetary restriction should induce banks to raise this premium: in this framework, monetary expansions would be less environmentally friendly than monetary restrictions.

On the other hand, firms with a larger carbon footprint typically have more tangible capital assets than low-emission firms, and therefore can offer more collateral to banks (Iovino, Martin, and Sauvagnat, 2023). Thus, insofar as monetary policy affects more credit extended to collateral constrained firms (Bernanke and Gertler, 1989, 1995), one may expect restrictive monetary policy to curtail the debt capacity of low-emission firms more than that of comparable high-emission ones, and symmetrically expansionary monetary policy to facilitate lending to the former more than to the latter. Hence, insofar as low-emission firms are more financially constrained than high-emission ones, monetary expansions should be more environmentally friendly than monetary restrictions, which is exactly the opposite prediction to that implied by the risk-taking channel of monetary policy.

Our evidence on the effects of monetary policy strongly supports the first of these two predictions: it uncovers a "climate risk-taking channel of monetary policy". Unexpected increases in the ECB's policy rate are associated with an increase in the climate risk premium charged to high-emission firms, over and above the increase in risk premium charged on firms with high probability of default. Moreover, such restrictive monetary policy shocks are associated with a smaller increase in the climate risk premium charged to firms that are committed to lower their emissions. Symmetrically, over the subsequent year they result in a significantly greater contraction of lending to high emission firms than to low emission ones, and in a lower contraction of lending to firms that commit to a target level of emissions. Of course, these findings do not amount to saying that a monetary restriction is good for the environment: insofar as restrictive monetary policy generally tighten financing conditions and slow down investment, it will also slow down investments aimed at reducing carbon emissions (Levine, Lin, Wang, and Xie, 2018). But our evidence suggests that a monetary tightening worsens financing conditions more for high-emission firms and for those that do not commit to reduce them. These findings are quite relevant to assess the environmental effects of the current monetary policy stance of central banks, where concerns have been voiced that "monetary policy tightening may ultimately slow down the pace of decarbonisation".[1]

The rest of the paper proceeds as follows. Section 2 places the paper against the backdrop of recent research on the pricing of climate risk and on the effects of monetary policy on the pricing of risk. Section 3 describes the data. Sections 4 and 5 present the empirical analysis. Section 6 concludes.

[1] "Monetary policy tightening and the green transition," speech by Isabel Schnabel, Member of the Executive Board of the ECB, Stockholm, 10 January 2023. The concern that monetary policy may have undesirable costs for climate risk also transpires from the ECB's statement that it considers climate risk for its corporate sector asset purchases and will include climate change considerations in its monetary policy strategy (press release of 8 July 2021). This is particularly relevant in view of fact that "brown firms" usually issue relatively more bonds, so that central bank open market purchases designed to be market-neutral actually end up channeling more funds to "brown firms" (Papoutsi, Piazzesi, and Schneider, 2022).

2 Literature

This paper contributes to two distinct, and so far disconnected, strands of research: on one hand, the rapidly growing literature on the pricing of climate risk in financial markets and more specifically in credit markets; on the other hand, the research on the effect of monetary policy on risk taking by banks.

Due to the growing concern about global warming, climate risk has started playing a growing role in the valuation of financial assets. Climate risk is generally broken down into two components: physical risk, which refers to the economic harm caused by natural hazards, such as floods and wildfires, and transition risk, stemming from regulatory changes aimed at reducing emissions and facilitating the transition towards a greener economy. Most empirical studies have analyzed the asset pricing implications of transition risk, using different measures of carbon intensity or environmental friendliness as proxies of firm exposure to climate risk.

In equity markets, there is evidence that firms with higher carbon emissions are valued at a discount (Bolton and Kacperczyk, 2021, 2022; Bolton, Halem, and Kacperczyk, 2022), high-pollution intensity firms pay larger average annual returns than low-pollution firms in the same industry (Hsu, Li, and Tsou, 2023), and firms with high environmental scores have higher returns at times of negative news about future climate change (Engle, Giglio, Kelly, Lee, and Stroebel, 2020). In option markets, the cost of hedging extreme downside risks is larger for more carbon-intensive firms, especially at times of heightened public attention to climate risk (Ilhan, Sautner, and Vilkov, 2020). Transition climate risk is also priced in fixed income markets: corporate bonds that perform better at times of bad news about climate change, hence less exposed to climate risk, pay lower returns (Huynh and Xia, 2021), and "green bonds", whose proceeds are expressly linked to environmentally friendly projects, trade at lower yields than bonds with similar characteristics but without a green designation according to Baker, Bergstresser, Serafeim, and Wurgler (2022), although Flammer (2021) reports no such difference in yields.

For credit markets, instead, so far the evidence on the pricing of transition risk is far less clear cut and only refers to the syndicated loan market, which only represents a segment of the credit market, mostly catering to the largest companies. According to Beyene, De Greiff, Delis, and Ongena (2021), banks in the syndicated loan market do not significantly price the risk stemming from the potential stranded assets held by fossil fuel firms, while bond markets price this risk. Ehlers and de Greiff (2021) instead find that, following the 2015 Paris Agreement, polluting firms started paying a "carbon premium" on their syndicated loans.[2] Our evidence addresses this issue by relying on panel data for the entire euro-area credit market, rather than on data for syndicated loans only, which in Europe are around 10 per cent of all loans, and reveals that banks not only price their loans based on firms' current carbon emissions, but also based on firms' commitments to reduce future emissions.

While the Paris Agreement binds entire countries, other initiatives such as the Net-Zero Banking Alliance and the United Nations' Environmental Programme Finance Initiative, have been directly addressed to financial intermediaries, committing them to environment-friendly financing policies. Whether banks abide by these commitments or not is also controversial: Kacperczyk and Peydro (2021) find that banks adhering to the Science Based Targets initiative (SBTi) honored their commitment by lending less to high-emission firms in the syndicated loan market, and Degryse, Goncharenko, Theunisz, and Vadasz (2020) document that after 2015 "green banks", i.e., those that commit to lend preferentially to low emission companies, reward "green firms" by offering them cheaper syndicated loans.[3] However, Ehlers and de Greiff (2021) find that "green banks" do not price carbon risk differently from other banks, and Giannetti, Jasova, Loumioti, and Mendicino (2023) report that banks with extensive environmental disclosures in fact lend more to "brown firms" and do not provide more credit to firms in green indus-

[2]There is also evidence that banks price physical climate risk: firms in locations with higher exposure to climate change pay higher spreads on their bank loans (Javadi and Al Masum, 2021), and so do borrowers with collateral consisting of properties exposed to a greater risk of sea level rise (Nguyen, Ongena, Qi, and Sila, 2022).

[3]Houston and Shan (2021) also find assortative matching of banks and firms based on their respective ESG scores.

tries. Our own evidence indicates that SBTi signatories not only require greater loan premia from high emission firms, but also charge lower premia to those committing to emission-reducing investments.

In the aftermath of the Paris climate agreement, several governments enacted environmental regulations, such as carbon taxes. Ivanov, Kruttli, and Watugala (2023) exploit the design of the cap-and-trade bill in California to investigate its effects on banks' lending policies, and find that, since its enactment, polluting firms face shorter maturities and have lower access to bank financing. However, the effect of domestic environmental policies may be reduced by banks' tendency to exploit more lenient regulations in other countries: Benincasa, Kabas, and Ongena (2022) find that, upon facing more stringent regulations in their home country, banks increase cross-border lending to firms located in countries with lighter policies; similarly, Laeven and Popov (2022) find that the introduction of a carbon tax is associated with an increase in domestic banks' lending to coal, oil, and gas companies in foreign countries. But there seem to be important exceptions to such regulatory arbitrage: European banks reduced credit to U.S. polluting firms after President Trump's announcement of withdrawal from the Paris Agreement, possibly for reputational reasons, in response to strong public pressure in favor of environmental policies (Reghezza, Altunbas, Marques-Ibanez, Rodriguez d'Acri, and Spaggiari, 2022).

The second strand of research to which we contribute is that on the risk-taking channel of monetary policy: when monetary policy is expansionary, lending standards become softer, particularly for riskier borrowers, so that banks' loan portfolios become riskier; conversely, when monetary policy becomes tighter, banks raise their lending standards and de-risk their loan portfolios. Incentive problems within banks may be at the origin of such changes in their risk-taking behavior. Acharya and Naqvi (2012) propose a model where banks elicit effort from loan officers by tying their compensation to the volume of loans: in the presence of abundant liquidity, volume-based compensation induces greater risk taking, lowers the sensitivity of bankers' payoffs to downside risks and induces excessive credit volume. Relatedly, Dell'Ariccia, Laeven, and Marquez (2014) propose a model where banks can reduce the credit risk of their loan portfolio via costly monitoring, and show that if they can adjust their capital structure in response to interest rate shocks, in equilibrium they will respond to a drop in risk-free rates by increasing leverage, reducing monitoring and increasing exposure to risk. Gambacorta (2009) points out that the risk-taking channel of monetary policy may not only result from banks' greater yield-seeking incentives when monetary policy is expansionary, but also from the impact of low interest rates on the value of firms' assets and cash flows, which can in turn can affect banks' valuation of their default risk.

Several studies offer evidence consistent with the risk-taking channel of monetary policy. Using U.S. data, Dell'Ariccia, Laeven, and Suarez (2017) document that ex ante risk-taking by banks (measured by banks' internal risk rating of new loans) is negatively associated with increases in short-term interest rates. Using very granular Spanish credit register data, Jiménez, Ongena, Peydró, and Saurina (2014) show that a lower overnight interest rate induces less capitalized banks to accept more loan applications to ex-ante risky firms and to commit larger loan volumes with fewer collateral requirements to these firms, although they have a higher ex-post likelihood of default. Anderson and Cesa-Bianchi (2023) investigate whether monetary policy surprises based on high-frequency data have different impact on firms with different leverage, hence different ex-ante risk, and find that high leverage firms experience a more pronounced increase in credit spreads than firms with low leverage in response to a monetary policy tightening, and that most of this increase reflects an increase in risk premia charged by banks, rather than a revision of the firms' expected default risk.

We also investigate the differential impact of an unexpected monetary tightening on firms' credit spreads, but we focus on its differential effect on firms arising both from their credit risk, as measured by their PD, and from their climate risk, as captured by their current and planned carbon emissions, rather than on its differential effect on firms with different leverage, as done by Anderson and Cesa-Bianchi (2023). As such, our approach is based on an extended version of the risk-taking channel of monetary policy, where changes in monetary policy should also affect banks' pricing of climate risk: restrictive monetary policy should induce banks to penalize high-emission more than comparable low-emission firms, while expansionary monetary policy should induce them to offer lower interest rates and more abundant funding to high-emission firms than to otherwise similar low-emissions ones. In both cases, the effect of monetary policy shocks on interest rates charged to more polluting firms should be mitigated if these credibly commit to investments aimed to reduce their carbon footprint, as this would reduce their future exposure to climate risk.

3 Data

We draw loan-level information obtained from AnaCredit, a proprietary and confidential database of the ECB and the national central banks of euro-area countries (the Eurosystem). AnaCredit is a granular (transaction-level) database that reports 94 loan-level attributes on a monthly frequency in a harmonised way for all euro-area countries. The minimum reporting threshold for loans to firms is set at €25,000 for all countries participating in the database.

AnaCredit covers a comprehensive set of credit instruments: overdrafts, revolving credit, credit lines, reverse repurchase agreements, and other loans, including term loans.[4] For each instrument, it reports the interest rate charged by the issuing bank and its estimate of the probability of default (PD), i.e., the likelihood that the borrower will not make scheduled repayments over a one-year horizon. The sample period ranges from September 2018 (the first available month in AnaCredit) to December 2022. The descriptive statistics shown in Table 1 show that our key variable of interest, i.e., the monthly interest spread charged by banks on their loans over the contemporaneous duration-matched risk-free rate, averages to 151 basis points, with a standard deviation of 76 basis points, ranging from 18 basis points for firms in the lowest decile to 276 basis points for those

[4]The complete list of instruments also includes credit card debt, trade receivables, financial leases and deposits other than reverse repurchase agreements.

in the top decile.[5] The PD is defined at the firm-time level as a weighted average of the estimate reported by each bank lending to the firm. Compared to the spread, it has a somewhat more right-skewed cross-sectional distribution, with above-mean PD values being concentrated in the top decile.

For each listed firm in the euro area, we merge AnaCredit data regarding its credit relationships with all its lenders with data about the firm's current carbon emissions and its planned carbon reduction targets, both drawn from the Refinitiv database. Under the Greenhouse Gas (GHG) protocol, a firm's GHG emissions are classified in three categories for accounting and reporting purposes: Scope 1 emissions are those directly produced by sources owned or controlled by the firm; Scope 2 emissions are those associated with the consumption of purchased energy; Scope 3 emissions include all those that occur in the value chain of the firm, excluding Scope 2 ones. We measure the current emissions of firm f as the sum of Scope 1 and Scope 2 emissions of CO2 (and CO2 equivalents) in the previous year (or quarter, depending on the firm's reporting frequency), in thousands of tonnes scaled by net revenues in million US dollars ($Carbon_{f,t}$). This transformation removes the obvious bias otherwise arising from large firms featuring higher emissions due to the scale of their operations. We exclude Scope 3 emissions, as this information is less reliable.

Table 1 shows that the distribution of carbon emissions is heavily right-skewed, the mean being 0.18 and the median 0.03: only the top decile features emissions larger than the mean. Hence, insofar as a firm's PD and its current emissions are taken as measures of a firm's credit and climate risk, respectively, Table 1 indicates that both types of risk are concentrated in the top 20% of the firms' distribution. Yet, even the emissions of firms in the top decile of our sample (530 tons emissions per million US dollars) is about half the size of emissions by firms in the top decile of the international sample of companies in Ehlers and de Greiff (2021).

[5] As an example, for a 5-year fixed rate loan the spread is computed relative to the 5-year OIS, whereas for a loan of the same maturity with a variable rate resetting every 3 months it is benchmarked against the 3-month OIS rate.

While the level of emissions refers to firms' current environmental performance, we also consider a forward-looking variable that measures firm's commitment to reduce future emissions, namely, a dummy variable that equals 1 if in month t a given firm f has disclosed an emission reduction target and 0 otherwise ($Target_{f,t}$). Table 1 indicates that 58% of the firm/month observations in our sample refer to firms that have committed to reduce emissions. Disclosing an emission target appears to be a mechanism enabling high-emission firms to signal their plan to reduce their carbon footprint: the emission intensity of committed firms is 0.23, against 0.12 for non-committed firms. Bolton and Kacperczyk (2023) show that indeed firms disclosing an emission target subsequently reduce their emissions, and find that in Europe a greater fraction of high emitters have announced such a target than in North America.

We complement these data regarding firms' commitment to reduce emissions with information regarding banks' environmental commitment. Following Kacperczyk and Peydro (2021), we identify the banks that signed a commitment letter in the context of the Science Based Targets initiative (SBTi). The SBTi is a joint initiative by Carbon Disclosing Project (CDP), the UN Global Compact, the World Wide Fund for Nature (WWF), and the World Resources Institute (WRI), whose purpose is to define and promote net-zero targets in line with the climate science. The overall goal of the initiative is to induce companies to commit to decarbonization pathways, so as to increase the chance that global emissions are reduced to a level that limits average temperature rise below 1.5°C. To join the SBTi, a company must first sign a commitment letter stating that it will work to set a science-based emission reduction target.

The Refinitiv database provides information about whether at date t a given bank b is a signatory of the SBTi letter or not ($Commit_{b,t}$). Table 1 shows that only 11% of the bank/month observations in our sample refer to banks that have signed the SBTi letter. A small number of non-financial companies have also had their target reduction emission validated by STBi, but Carbone, Giuzio, Kapadia, Krämer, Nyholm, and Vozian (2021) find very similar patterns of emission reductions for firms with an SBTi verified target and those with a self-disclosed emission reduction target only, based on Refinitiv: we rely on the latter, since it dominates the former in terms of data coverage.

Finally, as a measure of monetary policy shocks, we use high-frequency monetary policy surprises based on the Euro Area Monetary Policy Event-Study Database (EA-MPD) developed by Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa (2019). These surprises are calculated by measuring changes in risk-free rates in a narrow time window around official monetary policy announcements. More precisely, for each Governing Council meeting, the realised policy surprise (MP_t) is measured as the change in interest rates from 15 minutes before the press release to 15 minutes after the press conference. We use the "target" factor as defined in Altavilla, Brugnolini, Gürkaynak, Motto, and Ragusa (2019), with estimated loadings reaching the maximum at very short maturities (1-3 months) and monotonically decreasing across the maturity spectrum. In other words, this factor summarises the footprint of a policy rate shock on the term structure. Table 1 reveals that in our sample period the median monetary policy surprise is zero, but the mean is positive (1.09 basis points), due to the tightening announcements that occurred since July 2022. Such high-frequency measures of monetary policy shocks, pioneered by Gurkaynak, Sack, and Swanson (2005), have recently been used by Jarociński and Karadi (2020) and Anderson and Cesa-Bianchi (2023), among others.

4 Do Banks Price Climate Risk?

In this section, we use the euro-area data described in Section 3 to answer two related questions. First, do banks price climate risk in their lending rates? Second, do committed banks place a higher price on climate risk? We leave the analysis of the impact of monetary policy on banks' pricing of climate risk to Section 5.

4.1 Banks' pricing of climate risk

We start by providing descriptive evidence on banks' pricing of climate risk, by plotting the interest rates charged by the banks in our sample to firms with different carbon footprints between September 2018 and December 2022. Figure 1 plots monthly values of the mean rate charged to firms in the top quartile by carbon emissions and that charged to firms in the bottom quartile: throughout the sample period, the rates charged to high-emission firms exceed those charged to low-emission firms. The difference between the two averages to 14 basis points over the whole period, and ranges from a minimum of 5 to a maximum of 24 basis points. Figure 2 instead compares the rates charged to firms that have not committed to reduce future emissions with those charged to committed firms (based on the indicator drawn from Refinitiv data): also in this case, the former systematically exceed the latter, the overall difference averaging to 20 basis points, with a minimum of 13 and a maximum of 26 basis points. Hence, on average banks appear to differentiate their lending rates also based on their clients' prospective carbon emissions, not just their current ones – indeed even more so, as the average difference between the prices charged to non-committed and committed firms exceeds by 6 basis points that between high-emission and low-emission firms.

While this preliminary evidence suggests that euro-area banks do price climate risk, it may be vitiated by composition effects, as firms with different carbon footprints may differ in many other respects, such as credit risk, size, location, etc. To take these important concerns into account, in what follows we provide evidence based on panel estimation, which enables us to control for heterogeneity in firm and bank characteristics. To investigate whether banks price climate risk in their lending rates, in Table 2 we estimate variants of the following specification:

$$r_{f,b,t} = \beta_1 PD_{f,b,t} + \beta_2 Carbon_{f,t} + \beta_3 Target_{f,t} + \beta_4 Carbon_{f,t} \times Target_{f,t} + \theta_{f,b,t} + \epsilon_{f,b,t}, \quad (1)$$

where $r_{f,b,t}$ is the average credit spread charged by bank b on its loans to firm f in month t relative to maturity-matched risk-free rate in the same month: hence, it varies across banks, firms and time. The coefficients β_1 and β_2 capture the credit risk and carbon risk premia respectively, β_3 measures the carbon risk premium differential for firms announcing a target, β_4 allows this differential to depend on firm f's current emissions, $\theta_{f,b,t}$ is a set of firm, bank and time fixed effects, and $\epsilon_{f,b,t}$ is an error term. Including firm fixed effects, hence only relying on within-firm variation, is particularly demanding in our setting, given the length of our sample period. For this reason, we also consider specifications where instead of firm fixed effects we include industry-location-size (ILS) fixed effects, which compare firms with different emissions within the same industrial sector, country and size class. We also present specifications where ILS fixed effects are interacted with time effects as in Degryse, De Jonghe, Jakovljević, Mulier, and Schepens (2019) and Acharya, Eisert, Eufinger, and Hirsch (2019), but cannot include firm fixed effects interacted with time effects as this would prevent identification of the coefficients of interest. Standard errors are clustered at bank-month level.

The estimates reported in Column 1, which includes bank fixed effects and time effects, shows that β_1 and β_2 are positive, while β_3 is negative: banks charge higher credit spreads to firms with greater credit risk, as measured by their average PD, and to firms with higher current carbon emissions, but lower spreads to firms that disclose an emission target, suggesting that they assess the climate risk of their clients not only on the basis of their current abut also their future policies. All coefficient estimates are statistically significant. Column 2 shows that these results also hold upon including ILS fixed effects.

Column 3 shows the estimates of the full specification (1), including the interaction $Carbon_{f,t} \times Target_{f,t}$, to investigate whether the mitigating effect of the firm's commitment depends on its current emissions level: the coefficient β_4 of this interaction is estimated to be negative and strongly significant, indicating that the mitigating effect of a firm's commitment on interest premia is particularly strong if currently the firm is highly polluting. This suggests that bank interest rates are set so as to encourage firms' investments in the abatement of emissions where such investments are particularly needed.

In the specifications of Columns 4 and 5, we include ILS-time fixed effects instead of ILS fixed effects, and in the last two columns we exploit only within-firm variation by including firm fixed effects. The signs and statistical significance of the estimates remain largely unaffected.

To assess the economic significance of these estimates, in the specification of Column 1 that only includes bank and time fixed effects, the premium on firms with high emissions (at the 90^{th} percentile) is 4 basis points, while the discount for firms committed to reduce emissions is 10 basis points.[6] This indicates that, in pricing climate risk, banks assign greater weight to firms' planned investment to reduce emissions than to their current level of emissions, in line with the descriptive evidence shown in Figures 1 and 2. To place these estimates in perspective, recall that in our sample the standard deviation of the spread is 76 basis points, and notice that the magnitude of the implied climate premia exceeds that of credit risk premia that banks charge to the same firms, the premium for high-PD firms (at the 90^{th} percentile) being only 3 basis points. In the specification shown in Column 3, which includes the ILS fixed effect and controls for the interaction among current emissions and firms' commitment, the premium on emissions is 2 basis points and the discount on the disclosure of a commitment target is 7 basis points, while the premium charged to high PD firms (at the 90^{th} percentile) amounts to 2 basis points.

[6]The order of magnitude of this result is similar to that of the premium for emissions found for syndicated loans to international firms in Ehlers and de Greiff (2021). The authors report a magnitude of 3-4 basis points on average and 7 basis points for firms at the 90^{th} percentile of emissions. However, in their international sample the emissions produced by firms are much larger: the 90^{th} percentile corresponds to firms producing more than 1000 tonnes of emissions per $ million of revenues while in our European sample firms at the 90^{th} percentile produce 530 tonnes of emissions per million dollars of revenues. For firms producing more than 1000 tonnes per million dollars of revenues, our estimates would also imply a premium of 7 basis points. Magnitudes are similar for the climate risk premia reported for corporate bonds by Huynh and Xia (2021), although they rely on a very different approach: they construct a climate change news beta that captures a bond's covariance with a climate change news risk index and show that bonds with a 1-standard-deviation higher beta feature a 6 basis points reduction in the subsequent month's bond excess return.

4.2 Role of banks' commitment in climate risk pricing

The next question of interest is whether banks committed to environmental objectives place a higher price on climate risk than non-committed banks. To answer it, we augment specification (1) with additional interactions of banks' SBTi commitment dummy variable ($Commit_{b,t}$) with their customers' PD, current emissions and target emission dummy:

$$\begin{aligned} r_{f,b,t} = \beta_1 PD_{f,b,t} + \beta_2 Carbon_{f,t} + \beta_3 Target_{f,t} + \beta_4 Carbon_{f,t} \times Target_{f,t} \\ +(\gamma_1 PD_{f,b,t} + \gamma_2 Carbon_{f,t} + \gamma_3 Target_{f,t}) \times Commit_{b,t} + \theta_{f,b,t} + \epsilon_{f,b,t}, \end{aligned} \tag{2}$$

In Table 3, which reports the estimates of equation (2), the model is gradually saturated with fixed effects, as in Table 2. Starting from a basic specification with bank and time fixed effects (Column 1), we first add ILS fixed effects (Column 2), then replace them with ILS-time effects (Column 3), next we exploit within-firm variation by including firm fixed effects (Column 4), culminating with the most saturated specification that includes firm-time effects (Column 6). [7]

The estimates indicate that banks committed to decarbonization place a higher price on climate risk than uncommitted banks: they charge a higher premium to polluters, the coefficient γ_2 being positive in all the specifications, and significantly different from zero in those that do not include firm or firm-time effects, which are very demanding given the short time span of our data. Moreover, in all six specifications in the table the coefficient γ_3 is estimated to be negative and statistically significant: committed banks charge a lower premium to firms that disclose a target reduction plan. On the other hand, the coefficient γ_1, which refers to the pricing of credit risk by committed banks, varies across specifications and is negative and statistically significant in three of them. This alleviates the concern that the greater premium that they place on climate risk may simply reflect higher risk aversion of these banks: if anything, banks that are more sensitive to climate risk appear to price credit risk less than others.

[7] Notice that here, differently from Table 2, we can include firm fixed effects interacted with time effects because our variables of interest vary at bank level.

Banks' environmental commitment also has sizeable quantitative significance for the pricing of climate risk: in the specification of Column 2, which includes bank, time and ILS effects, committed banks reduce the spread by 16 basis points (21% of its standard deviation) more to firms that set an emission target and charge 2 basis points (3% of the premium's standard deviation) more to high emitters, and 1 basis point less than other banks to firms with higher credit risk (i.e., firms whose PD is at the 90$^{\text{th}}$ percentile).

5 Does Monetary Policy Affect Banks' Pricing of Climate Risk?

The evidence in Section 4 indicates that euro-area banks do price the climate risk of their loans, especially when they publicly commit to decarbonization. In this section we investigate whether the price that they place on climate risk is affected by monetary policy shocks, namely, whether these shocks affect the credit premia they charge to firms with different current and expected emissions and, relatedly, the amount of lending extended to these firms. We start by estimating the contemporaneous response of credit premia to monetary policy shocks via panel regressions (Section 5.1), relying on specifications similar to those used in the previous section. Next, to take into account that the credit premia that banks charge to their clients and their loan volumes can gradually respond to monetary policy shocks over time, we estimate local projection regressions for both premia and lending volumes (Section 5.2). Taking into account such a delayed response appears warranted for at least two reasons. First, insofar as firms are funded via long-term and medium-term loans, their rates and debt levels are insulated from high-frequency changes in banks' lending policies. Second, monetary policy shocks can be expected to affect the demand for loans with a considerable lag, as firms adjust their production, investment and hiring decisions to take changes in bank lending standards into account (Friedman, 1961).

5.1 Impact Effects on Credit Spreads

We start by investigating the immediate response of credit spreads to monetary policy surprises. To this purpose, Column 1 of Table 3 reports the estimates of a credit spread regression on monetary policy shocks that includes bank and firm fixed effects, but not time effects, as these would absorb changes in the monetary policy stance (as in fact is the case in other columns of this table).

Since the monetary policy shock, MP_t, is defined as an unexpected increase in policy rates, the positive estimate of its coefficient in Column 1 indicates that contractionary monetary policy shocks are associated with larger credit spreads. The positive and significant coefficient of the interaction between credit risk and monetary policy surprises, $MP_t \times PD_{f,t}$, indicates that the "traditional" risk-taking channel of monetary policy is indeed at play in our data: restrictive monetary policy leads banks to tighten lending standards more for firms featuring higher credit risk; symmetrically, expansionary monetary policy induce banks to relax their lending standards more for riskier firms. In terms of economic significance, the estimated coefficient implies that a monetary policy surprise of 25 basis points is associated with an increase of 35 basis points in banks' credit spreads.

In subsequent columns of the table, we estimate a richer model, which enables to investigate the effect of monetary policy shocks on banks' climate risk pricing but include time effects that absorb the direct effect of monetary policy on credit spreads:

$$\begin{aligned} r_{f,b,t} = {} & \beta_1 PD_{f,b,t} + \beta_2 Carbon_{f,t} + \beta_3 Target_{f,t} + \beta_4 Carbon_{f,t} \times Target_{f,t} \\ & + (\delta_1 PD_{f,b,t} + \delta_2 Carbon_{f,t} + \delta_3 Target_{f,t}) \times MP_t + \theta_{f,b,t} + \epsilon_{f,b,t}, \end{aligned} \tag{3}$$

As in previous tables, the specifications are gradually saturated with a growing set of fixed effects. The estimate of the coefficient δ_2 is positive and significant and that of δ_3 is negative and significant (except in Column 4), which indicates that the risk-taking channel of monetary policy applies not only to credit risk but to climate risk as well: restrictive monetary policy induces banks to place a higher price on climate risk, tightening lending standards more for clients with higher emissions, and less for those that commit to reduce emissions. In the specification with bank, time and ILS fixed effects (Column 3), the increase in bank lending premia associated with a 25 basis-point unexpected rise in policy rates is estimated to be 1.4 basis points larger for high emitters, but 5 basis points smaller for firms committed to decarbonization. By the same token, expansionary monetary policy induces banks to place a lower price on climate risk, relaxing lending standards more for more polluting firms, and less for those committed to reduce emissions.

5.2 Dynamic Responses of Credit Spreads and Bank Lending

To evaluate the dynamic impact of monetary policy on lending spreads and loan volumes, we estimate impulse response functions using local projections (LP) methods (Jordà, 2005), which are in general equivalent to those obtained via vector autoregression (VAR) models (Plagborg-Møller and Wolf, 2021). The LP method is flexible enough to accommodate a panel structure in a very simple and computationally convenient way. In practice, we estimate the following panel model:

$$y_{b,f,t+h} = \lambda_{1h} MP_t + \lambda_{2h} MP_t \times Carbon_{f,t} + \lambda_{3h} MP_t \times Target_{f,t} + \theta_b + \epsilon_{f,b,t+h}, \qquad (4)$$

where the outcome variable $y_{b,f,t+h}$ is either the lending spread charged or the (logarithm of the) amount lent by bank b to firm f between month t and month $t+h$; MP_t is our high-frequency measure of the monetary policy shock; θ_b are bank fixed effects. The model includes interaction effects that capture the link between monetary policy and climate variables.

The three upper charts in Figure 3 illustrate the cumulative response of lending spreads to a change in monetary policy at time t from impact up to month $t+12$, while the three lower charts illustrate the the cumulative response of lending volumes to the same shock. The figure is drawn for a 25 basis-point shock. The box plots show the distribution of the coefficients λ_{1h}, λ_{2h}, λ_{3h} for each horizon h. The whiskers are the 95%

confidence intervals, while the box shows the 90% interval. Standard errors are clustered at the bank-time level.

The first chart in the top panel of Figure 3 shows that the spread charged by banks on loans reacts substantially to the monetary tightening on impact and increases over time until reaching 39 basis points after 1 year. The second figure illustrates the differential effect of the shock for the spread charged to high-emission companies: for firms in the 90$^{\text{th}}$ percentile there is an additional increase in spread of around 2 basis points on impact, which decreases to 1 basis points after 1 year. The third figure shows that for firms committed to lowering emissions the increase in premia is reduced by around 5 basis points on impact and about 9 basis points after 1 year.[8] Hence, the dynamic effects of the monetary tightening are qualitatively consistent with the estimates reported in Table 3 above, and show that the mitigation of the increase in lending spreads for firms committed to lowering emissions is persistent and increasing in the year after the shock.

The three charts in the bottom panel of the figure show that for loan volumes the effects are negligible on impact, but become economically significant over time. The estimates in the first chart imply that the effect of the monetary tightening on lending volume reaches 2.5% of the initial lending. The next two charts show that this gradual negative effect is larger for high-emission firms, but smaller for firms that commit to an emission target, for which the interaction term is positive and significant in the last two quarters after the shock. In terms of economic significance, the estimates shown in these two charts imply that a 25-basis-points surprise monetary tightening triggers an additional 2.7% drop in lending for high emitters (those in the top decile by emissions) in 1 year, with a 1.5% mitigation effect for firms that commit to an emission target.[9]

[8]The effects on loan premia after 1 year are computed by multiplying by 25 (basis points) the relevant coefficients and interacted variables. In the first chart, the relevant product is $0.0155 \times 25 = 0.39$; in the second chart, it is $0.0009 \times 0.53 \times 25 = 0.01$, where 0.0009 is the relevant coefficient and 0.53 is the value of emissions for top decile firms; in the third chart, it is $0.0034 \times 1 \times 25 = 0.09$, where 0.0034 is the relevant coefficient.

[9]The percentage effects on volumes after 1 year are computed by multiplying by 25 (basis points) the relevant coefficients and interacted variables. In the first chart, the relevant product is $-0.001 \times 25 = -0.025$; in the second chart, it is $-0.002 \times 0.53 \times 25 = -0.027$, where -0.002 is the relevant coefficient and 0.53 is the value of emissions for top decile firms; in the third chart, it is $0.0006 \times 1 \times 25 = 0.015$, where -0.0006 is the relevant coefficient.

Hence, the delayed effects of monetary policy shocks on lending are symmetric in sign with respect to their effects on credit premia shown in the top panel of the figure and in Table 3.

5.3 Survey-based Evidence

Survey-based evidence provides an interesting complementary source of information on the impact of climate change on bank lending to firms in the euro area. Euro-area banks provided such self-reported information in responding to the July 2023 round of the Bank Lending Survey (BLS), in which they were asked about the impact of climate change on their lending policies, on top of the standard questions regarding changes in their lending policies. July 2023 is a particularly interesting date for our purposes, since it comes after a whole year of increasingly restrictive monetary policy stance by the ECB, and therefore it may be informative whether euro-area banks perceived their own lending policies as responding differently to the monetary policy shock depending on the different environmental impact of their borrowers.

The BLS is a quarterly survey maintained at the European Central Banks where euro-area banks (158 banks in the July 2023 round) report on the evolution of their internal guidelines or loan approval criteria ("credit standards") and the actual terms and conditions agreed in their loan contracts ("terms and conditions"). Banks' credit standards can be broadly taken to measure their stance in setting loan volumes, while terms and conditions gauge their stance in setting the interest rates charged to their clients. The survey's results are reported in terms of the net percentage of banks changing their lending policies, where net percentage is defined as the difference between the percentage of banks reporting a tightening (an increase) and the percentage of banks reporting an easing (a decrease).

In the July 2023 round of the BLS, conducted between 19 June and 4 July 2023, banks were also required to classify their clients in three groups: "green firms", defined as those that do not contribute or contribute little to climate change; "firms in transition", namely, those that contribute to climate change but are making considerable progress in the transition; and "brown firms", namely, those that contribute significantly to climate change and have not yet started the transition or have made little progress. Then they were asked to indicate how they had changed (if at all) their credit standards and their terms and conditions to each of these three groups of clients over the previous 12 months.

To compare our estimates with the survey results, we match individual responses from euro-area credit institutions surveyed in the BLS to the banks included in our sample. The questionnaire responses indicate that on the whole banks tightened their credit standards as well as terms and conditions for loans or credit lines to firms between July 2022 and July 2023, as one would expect at a time of monetary tightening. More interestingly, the survey results indicate that the tightening of banks' lending policies appears to differentiate between "green firms", "firms in transition" and "brown firms" in a way that is very consistent with the estimates reported in Sections 4 and 5, for interest rates as well as for loan quantities.

First, as shown in top left panel of Figure 4, firms' climate risk appears to have had a net easing impact on their terms and conditions for loans to green firms and, to a lesser extent, for loans to firms in transition, while it had a net tightening impact for loans to brown firms.

Second, as shown in top right panel of the figure, banks committed to decarbonization amplified these changes: committed banks eased more their terms and conditions for loans to green firms and for firms in transition than non-committed banks, and symmetrically tightened them more for brown firms.

Third, the results regarding the impact of climate change on banks' credit standards shown in the two lower panels of the figure are very similar. This indicates that banks differentiated not only their interest rate policies but also their decisions on loan quantities across firms depending on their perceived environmental impact, and that committed banks were more generous in extending credit to green firms and firms in transition than non-committed banks.

6 Conclusion

In this paper we combine euro-area credit register and carbon emission data, to explore (i) whether and to what extent bank interest rates price the climate risk of their client firms, (ii) whether banks committed to decarbonization apply higher prices to the climate risk of their clients, (iii) whether monetary policy shocks impact banks' pricing of climate risk and, if so, in which direction.

We find that euro-area banks charge higher interest rates to firms with larger carbon emissions, and lower rates to firms that commit to green transition, even after controlling for firms' credit risk as measured by their probability of default.

In contrast with other recent findings, banks appear to live up to their word on the issue of climate risk pricing: those that signed a commitment letter within the Science Based Targets initiative (SBTi) indeed provide cheaper loans to firms that commit to decarbonization and, to a smaller extent, penalize more polluting firms.

Finally, we find that the monetary policy of the ECB affects lending to firms not only via a credit risk-taking channel but also via a climate risk-taking channel. Contractionary monetary shocks induce banks to increase both credit risk premia and carbon emission premia, and reduce lending to high emission firms more than to low emission ones. While restrictive monetary policy increases the cost of credit and reduces lending to all firms, its contractionary effect is milder for firms with low emissions and those that commit to decarbonization. These results align quite strikingly with euro-area banks' self-reported information from a survey conducted in July 2023, which shows that banks – especially those committed to decarbonization – differentiate their terms and conditions and their credit standards depending on their clients' perceived environmental impact.

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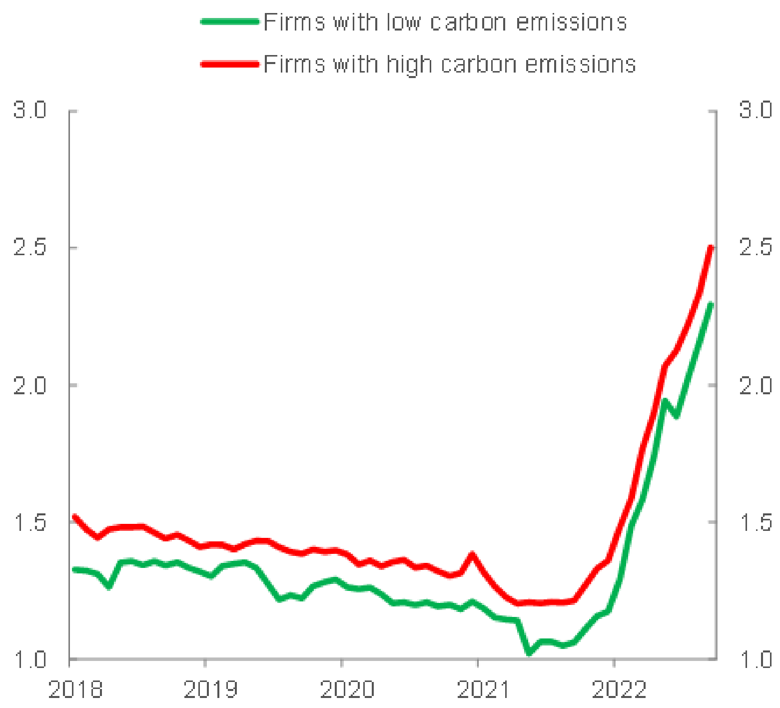

Figure 1: Average interest rates charged to high-emission and low-emission firms

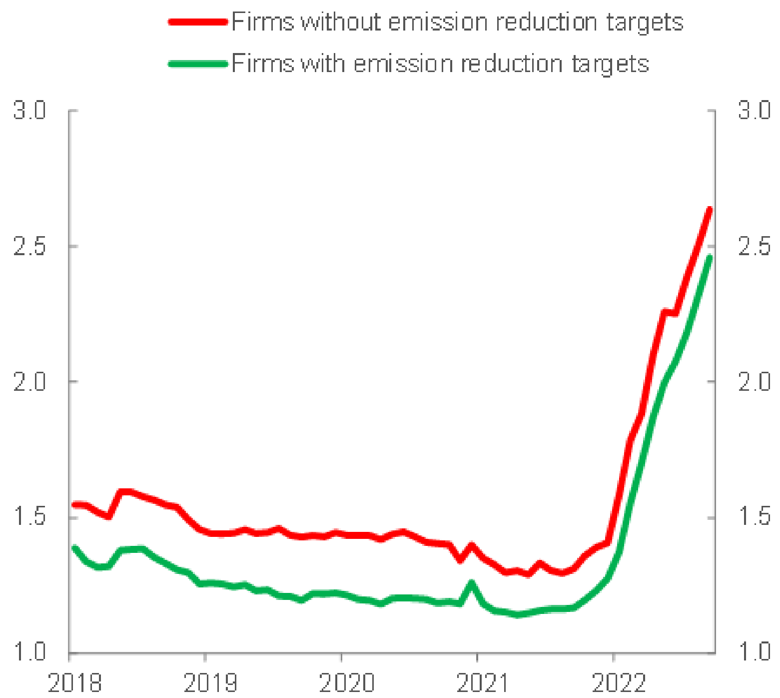

Figure 2: Average interest rates charged to firms non-committed and to those committed to lower carbon emissions

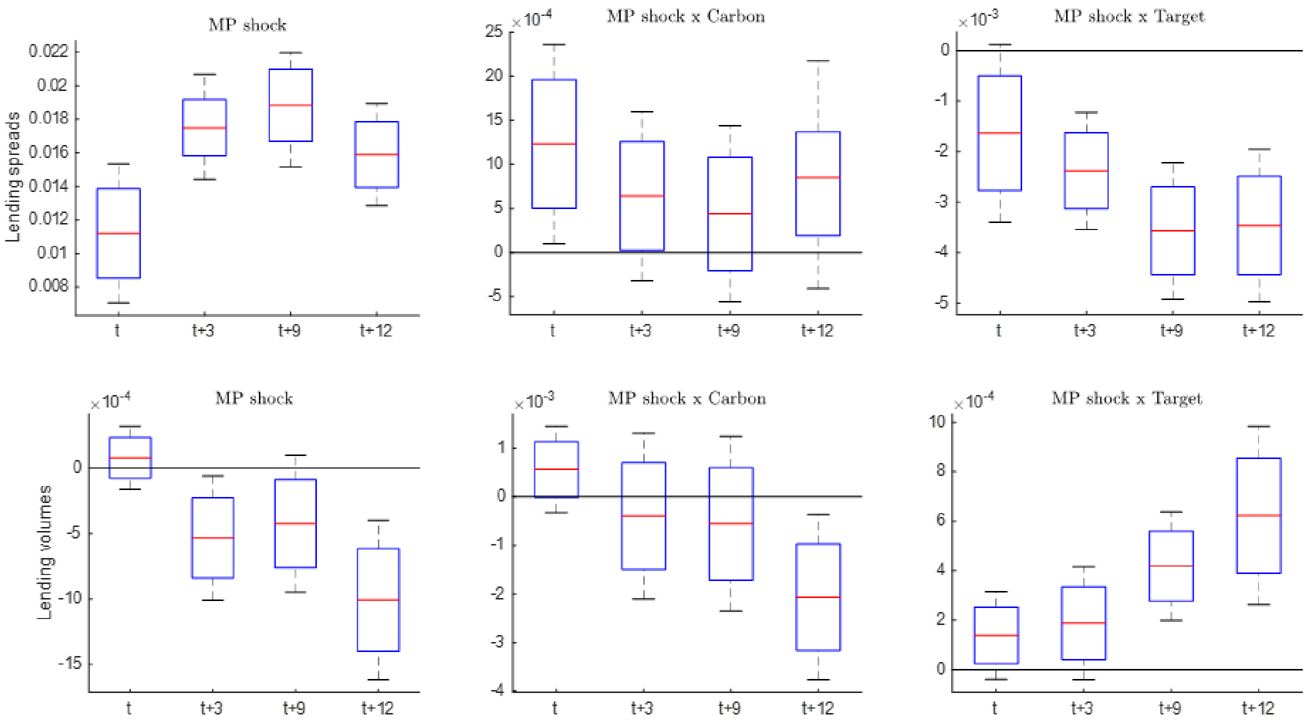

Figure 3: Local projection estimates of the response of lending spreads and volumes to a 25-basis-points restrictive monetary policy shock (rise in MP_t)

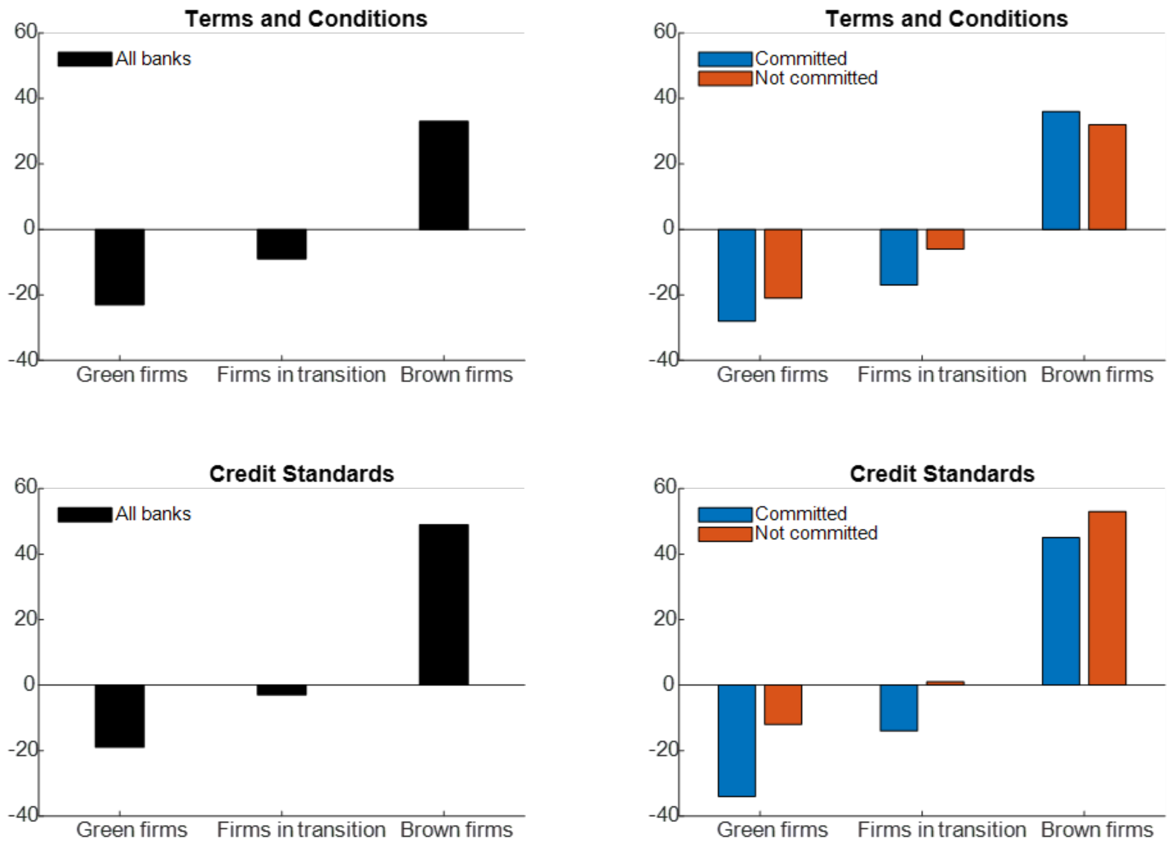

Figure 4: Net percentages of banks reporting changes in terms and conditions or credit standards in the past 12 months, based on the July 2023 BLS Survey.

Table 1: Summary statistics

This table shows means, standard deviations and number of observations for the variables used in the empirical analysis. Data are at the monthly frequency, and the sample period is from September 2018 to December 2022. Spread$_{b,f,t}$ is the monthly average credit spread charged by bank b on its loans to firm f in month t relative to maturity-matched risk-free rate in that month. PD$_{f,t}$ is the weighted average probability of default of firm f in month t reported in AnaCredit. $Carbon_{f,t}$ are Scope 1 and Scope 2 CO2 (and CO2 equivalents) emissions of firm f in month t in thousands of tonnes divided by the firm's net sales in million US dollars in the same month. $Target_{f,t}$ is a dummy variable that equals 1 if firm f has disclosed a target emission reduction, and 0 otherwise. Commit$_{b,t}$ is a dummy variable that equals 1 if bank b has committed to decarbonization within the Science Based Targets initiative (SBTi) as of month t. MP$_t$ is a monthly measure of the monetary policy surprises extracted from high-frequency intraday yields at short-term maturity at dates of policy announcements in month t. The sample is restricted to publicly listed firms for which data for C02 emissions and the emission target disclosure are available in the Refinitiv database.

Variables	Observations	Mean	St. Dev.	p5	p10	p25	p50	p75	p90	p95
$Spread_{b,f,t}$	325,180	1.51	0.76	0.18	0.54	1.08	1.55	2.00	2.41	2.76
$PD_{f,t}$	442,469	0.96	3.49	0.07	0.09	0.15	0.26	0.50	1.18	2.48
$Carbon_{f,t}$	435,263	0.18	0.47	0.00	0.00	0.01	0.03	0.09	0.53	0.82
$Target_{f,t}$	453,231	0.58	0.49	0.00	0.00	0.00	1.00	1.00	1.00	1.00
$Commit_{b,t}$	453,231	0.11	0.31	0.00	0.00	0.00	0.00	0.00	1.00	1.00
MP_t (basis points)	453,231	1.09	5.56	-1.53	-1.20	-0.53	0.00	0.06	4.21	14.14

Table 2: Do Banks Price Climate Risk?

This table reports estimates of regressions of the monthly average credit spread charged by bank b on loans to firm f in month t (Spread$_{b,f,t}$) on measures of credit and climate risk of its client firms. PD$_{f,t}$, $Carbon_{f,t}$, $Target_{f,t}$ are defined as in Table 1. ILS Fixed Effects stands for the interaction of the firm's industry (2-digit NACE code), country and size effects. Standard errors clustered at the bank-time level are shown in parentheses below the respective coefficient estimate. *** p<0.01, ** p<0.05, * p<10.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$PD_{f,t}$	0.0241***	0.0167***	0.0167***	0.0260***	0.0261***	0.00528***	0.00527***
	(0.000543)	(0.000592)	(0.000592)	(0.000770)	(0.000770)	(0.000641)	(0.000641)
$Carbon_{f,t}$	0.0709***	0.0199***	0.0432***	0.0187***	0.0898***	0.0334**	0.0861***
	(0.00261)	(0.00615)	(0.00884)	(0.00664)	(0.0118)	(0.0169)	(0.0201)
$Target_{f,t}$	-0.103***	-0.0667***	-0.0681***	-0.0671***	-0.0778***	-0.0345***	-0.0342***
	(0.00244)	(0.00254)	(0.00260)	(0.00281)	(0.00323)	(0.00340)	(0.00339)
$Carbon_{f,t} \times Target_{f,t}$			-0.0319***		-0.103***		-0.0454***
			(0.00804)		(0.0139)		(0.00860)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	-	-	Yes	Yes
ILS Fixed Effects	-	Yes	Yes	-	-	-	-
ILS $\times$Time Fixed Effects	-	-	-	Yes	Yes	-	-
Firm Fixed Effects	-	-	-	-	-	Yes	Yes
Observations	306871	306788	306788	305401	305401	306864	306864
R^2	0.468	0.550	0.550	0.602	0.603	0.617	0.617

Table 3: Do Committed Banks Place a Higher Price on Climate Risk?

This table reports estimates of regressions of the monthly average credit spread charged by bank b on loans to firm f in month t ($\text{Spread}_{b,f,t}$) on measures of credit and climate risk of its client firms and of the bank's commitment to reducing carbon emissions. $\text{PD}_{f,t}$, $Carbon_{f,t}$, $Target_{f,t}$ and $Commit_{b,t}$ are defined as in Table 1. ILS Fixed Effects stands for the interaction of the firm's industry (2-digit NACE code), country and size effects. Standard errors clustered at the bank-time level are shown in parentheses below the respective coefficient estimate. *** p<0.01, ** p<0.05, * p<0.10.

	(1)	(2)	(3)	(4)	(5)
$PD_{f,t}$	0.0248***	0.0176***	0.0270***	0.00512***	
	(0.000566)	(0.000627)	(0.000794)	(0.000660)	
$Carbon_{f,t}$	0.0414***	0.0313***	0.0815***	0.0823***	
	(0.00730)	(0.00907)	(0.0121)	(0.0200)	
$Target_{f,t}$	-0.0913***	-0.0591***	-0.0750***	-0.0238***	
	(0.00267)	(0.00267)	(0.00331)	(0.00340)	
$Commit_{b,t}$	0.241***	0.207***	0.0175	0.213***	0.0133
	(0.0247)	(0.0235)	(0.0223)	(0.0234)	(0.0210)
$Carbon_{f,t} \times Target_{f,t}$	0.0328***	-0.0229***	-0.0999***	-0.0394***	
	(0.00767)	(0.00796)	(0.0139)	(0.00852)	
$Commit_{b,t} \times PD_{f,t}$	-0.00669***	-0.00744***	-0.00772***	0.000438	0.00500***
	(0.00174)	(0.00151)	(0.00152)	(0.00149)	(0.00144)
$Commit_{b,t} \times Carbon_{f,t}$	0.0336***	0.0339***	0.0310***	0.00158	0.00907
	(0.0115)	(0.0115)	(0.00936)	(0.0124)	(0.0100)
$Commit_{b,t} \times Target_{f,t}$	-0.166***	-0.157***	-0.0572***	-0.163***	-0.0431***
	(0.0194)	(0.0203)	(0.0154)	(0.0205)	(0.0146)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	-	Yes	-
ILS Fixed Effects	-	Yes	-	-	-
ILS $\times$ Time Effects	-	-	Yes	-	-
Firm Fixed Effects	-	-	-	Yes	-
Firm $\times$ Time Effects	-	-	-	-	Yes
Observations	306871	306788	305401	306864	303466
R-squared	0.469	0.551	0.603	0.618	0.694

Table 4: How Does Monetary Policy Impact the Pricing of Climate Risk?

This table reports estimates of regressions of the monthly average credit spread charged by bank b on loans to firm f in month t ($\text{Spread}_{b,f,t}$) on measures of credit and climate risk of its client firms, of the bank's commitment to reducing carbon emissions, and on a measure of monetary policy surprises. $\text{PD}_{f,t}$, $Carbon_{f,t}$, $Target_{f,t}$, $Commit_{b,t}$ and MP_t are defined as in Table 1. ILS Fixed Effects stands for the interaction of the firm's industry (2-digit NACE code), country and size effects. Standard errors clustered at the bank-time level are shown in parentheses below the respective coefficient estimate. *** p<0.01, ** p<0.05, * p<10.

	(1)	(2)	(3)	(4)	(5)
$PD_{f,t}$	0.00777***	0.0242***	0.0168***	0.0261***	0.00540***
	(0.000724)	(0.000546)	(0.000593)	(0.000769)	(0.000643)
$Carbon_{f,t}$		0.0506***	0.0425***	0.0893***	0.0856***
		(0.00758)	(0.00885)	(0.0118)	(0.0201)
$Target_{f,t}$		-0.103***	-0.0688***	-0.0780***	-0.0349***
		(0.00252)	(0.00260)	(0.00323)	(0.00340)
$Carbon_{f,t} \times Target_{f,t}$		-0.0260***	-0.0308***	-0.102***	-0.0443***
		(0.00788)	(0.00806)	(0.0139)	(0.00862)
MP_t	0.0150***				
	(0.000876)				
$MP_t \times PD_{f,t}$	0.000263**	0.000399***	0.000348***	0.000340**	0.000274***
	(0.000118)	(0.000110)	(0.000105)	(0.000154)	(0.0000914)
$MP_t \times Carbon_{f,t}$		0.00111*	0.00107*	0.00233*	0.000990*
		(0.000673)	(0.000587)	(0.00138)	(0.000585)
$MP_t \times Target_{f,t}$		-0.00329***	-0.00205***	-0.000509	-0.00162***
		(0.000575)	(0.000554)	(0.000686)	(0.000528)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	-	Yes	Yes	-	Yes
ILS Fixed Effects	-	-	Yes	-	-
ILS × Time Fixed Effects	-	-	-	Yes	-
Firm Fixed Effects	Yes	-	-	-	Yes
Observations	321331	306871	306788	305401	306864
R-squared	0.366	0.468	0.550	0.603	0.617

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