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Isabella Mueller, Eleonora Sfrappini

Climate Change-Related Regulatory Risks and Bank Lending

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Abstract

We identify the effect of climate change-related regulatory risks on credit reallocation. Our evidence suggests that effects depend borrower's region. Following an increase in salience of regulatory risks, banks reallocate credit to US firms that could be negatively impacted by regulatory interventions. Conversely, in Europe, banks lend more to firms that could benefit from environmental regulation. The effect is moderated by banks' own loan portfolio composition. Banks with a portfolio tilted towards firms that could be negatively affected by environmental policies increasingly support these firms. Overall, our results indicate that financial implications of regulation associated with climate change appear to be the main drivers of banks' behavior.

JEL classification: G21, Q51, Q58

Keywords: climate change, climate risk, credit reallocation, Paris Agreement

Non-technical summary

Climate change poses a substantial threat to the global economy and makes transitioning towards a more sustainable and greener future a first-order challenge. Overcoming this challenge relies, to some extent, on the introduction of regulation to align short-term profit-maximizing decisions of firms with long-term interests of society. Hence, firms face regulatory risks related to climate change. While some can be negatively impacted by the introduction of regulation - e.g. due to increasing operating and input costs - others may benefit - e.g. due to subsidies. Climate change-related regulatory risks can affect banks' lending patterns. Understanding the financial sector's response to regulatory risks is important, as it is central in not only setting the incentives for a green transformation but also providing the necessary funding to achieve it.

This study investigates how banks' lending behavior responds to firms' regulatory risks. We exploit the Paris Agreement as a shock to banks' prevailing perceptions of regulatory risks related to climate change and investigate resulting changes in lending. To do so, we rely on detailed, worldwide loan-level information between 2010 and 2019 at quarterly frequency enriched with a firm-level measure of regulatory risks related to climate change. The granularity of this measure allows distinguishing between lending to firms that could benefit from regulatory invention and to those that are likely to be negatively affected by the introduction of regulation.

We find large heterogeneity in how banks react to the Paris Agreement depending on firms' exposure and location. In the United States, banks lend relatively more to firms that are likely to lose from future regulation. We find no evidence that this is directed to firms that have a higher likelihood of transition. Moreover, low-capitalized banks exploit lending to this group of firms to boost profits. Our findings point toward banks' behavior representing an obstacle to the transition in the United States. Conversely, banks shift credit supply to European firms that consider themselves to benefit from future regulation. Hence, banks' credit allocation seems to facilitate the transformation of the economy. We further analyze if the effects are influenced by banks' indirect exposure via their loan portfolios and find that banks' exposure appears to be a hindering factor in Europe.

Shedding light on the drivers of banks' behavior, we distinguish between two potential channels. The Paris Agreement could have led not only to a shift in the awareness of the financial risks associated with regulation related to climate change, but also to a change in banks' preferences for sustainable lending. We find that the risk channel appears to dominate the preference channel. Our results indicate that the stringency of the existing regulatory environment is more important than banks' public commitments in determining lending behavior.

This project has important policy implications, as it provides insights into the scope of banking regulation in fostering the transition toward a greener economy. A solid empirical understanding of the present serves as the basis for the exploration of possible future policies. Our research evaluates how banks alter their lending behavior on their own accord, highlighting aspects wherein regulatory action is needed. We show the importance of the stringency of the existing regulatory environment in determining how banks engage in the transition.

1 Introduction

Climate change poses a substantial threat to the global economy and makes transitioning toward a more sustainable and greener future a first-order challenge. Overcoming this challenge relies, to some extent, on the introduction of regulation to align short-term profit-maximizing decisions of firms with long-term interests of society. Hence, firms face regulatory risks related to climate change. While some can be negatively impacted by the introduction of regulation - e.g. due to increasing operating and input costs - others may benefit - e.g. due to subsidies. Climate change-related regulatory risks can affect banks' lending patterns. Understanding the financial sector's response to regulatory risks is important as it is central in not only setting the incentives for a green transformation but also in providing the necessary funding to achieve it (UNEP, 2011).

We analyze how banks' lending behavior responds to firms' regulatory risks. Our findings identify large heterogeneity depending on firms' regulatory risks and locations. In the United States, banks lend more to firms that are more likely to be negatively affected by regulatory intervention. We do not find evidence that this is directed toward firms that have a higher likelihood of transitioning toward a more sustainable business model. Hence, credit seems to be reallocated in such a way that hinders the transition in the United States. In contrast, banks lend more to European firms that could benefit from regulation. We further analyze whether the effects are influenced by banks' indirect exposure via their loan portfolios. Banks with a portfolio more tilted towards firms that could be negatively affected by environmental policies increasingly support such firms. Thus, banks' behavior seems to facilitate the transformation of the economy in Europe, while banks' own exposure appears to be a hindering factor. Upon evaluating what motivates banks' behavior, we find that a shift in the awareness of the financial implications of regulation associated with climate change appears to be the main driver of banks' behavior. Hence, this work helps to understand the impact of banks' credit reallocation on the transition towards a greener economy.

Our empirical design centers around the 2015 Paris Agreement as a shock that raises banks' awareness of firms' regulatory risks. Specifically, the Paris Agreement is the first comprehensive agreement at the global level to coordinate actions to tackle climate change. The main goal set forward by the Agreement is to limit global warming below an average temperature increase of 2°C, aiming at a maximum increase of 1.5°C. Given the high uncertainty around whether an agreement can be achieved at the Paris Summit and the surprisingly ambitious extent of the final outcome, it seems unlikely that this event is anticipated. We argue that this event shifts banks' prevailing perceptions of transition risks, as recent evidence has shown to be the case (Bolton and Kacperczyk, 2020; Degryse et al., 2021; Delis et al., 2018; Kruse et al., 2020; Monasterolo and De Angelis, 2020; Seltzer et al., 2020). By updating their beliefs about these risks, banks may adjust their lending accordingly. Meanwhile, the Paris Agreement may lead banks to update their beliefs about their own exposure to regulatory risks, as the perception of the riskiness of their loan portfolios may have changed.

The use of a difference-in-differences (DID) setting allows us to evaluate how banks adjust their credit supply following this shock. We employ a measure of firms' regulatory risks constructed on the basis of quarterly earnings conference calls by Sautner et al. (2020). The measure captures a forward-looking view from within the firm and facilitates the differentiation of firms that could be negatively impacted by regulatory interventions and those that could benefit from it.

In the analysis, we distinguish between three types of firms. Firms that consider themselves to be negatively impacted by the introduction of climate change regulation are referred to as *negatively exposed firms*. For these firms, the introduction of regulation can negatively influence operating costs, earnings, and cash flows as well as it can relate to an increased loss probability (Huang et al., 2018; Nguyen, 2018; Seltzer et al., 2020). Meanwhile, certain firms consider themselves to benefit from the introduction of regulation as these policies might, for example, correct relative cost disadvantages of greener business models, by either providing subsidies to greener technologies or increasing the operating costs of more polluting competitors (Holburn, 2012). We refer to these firms as *positively exposed firms*. Finally, we identify those firms in our sample that do not consider themselves exposed to climate change-related regulatory risks, and we employ them as our control group. To investigate whether banks' own exposure plays a role in their lending decisions, we construct a measure of exposure to firms' regulatory risks that stems from their portfolio structure and borrowers' exposure. This allows us to identify *negatively exposed banks* in our sample, that is, banks that predominantly lend to firms that are negatively exposed.

We implement our research design on granular loan-level information covering worldwide syndicated lending between 2010 and 2019. We combine the syndicated loan data with a new database by Sautner et al. (2020), that provides a firm-level measure of climate change-related regulatory risks. The measure is constructed using textual analysis of transcripts of conversations between analysts and management in quarterly earnings conference calls. It reports the proportion of conversations during the conference call that is centered on regulatory topics related to climate change as well as its sentiment. In the syndicated loan market, it is plausible to assume that banks acting as lead arrangers are aware of firms' regulatory exposure, at least to the extent that they are able to judge whether firms would benefit or lose from policy intervention. The nature of lending in this market and the reputational damage associated with a failure in due diligence when assessing a loan incentivizes lead arrangers to conduct proper ex-ante screening and monitoring (Gopalan et al., 2011). Moreover, lead banks can be expected to be aware of regulatory risks given the financial significance of the material risks faced by borrowers if climate change-related regulation is eventually introduced (Ehlers et al., 2021).

Our results can be summarized as follows: we find large heterogeneity in how banks adjust their lending behavior depending on firms' regulatory exposure and location after the Paris Agreement. In the sample of US firms, banks lend 17.6% more to negatively exposed firms compared to firms with zero exposure to regulatory risks. This corresponds to US$ 61.4 million more. As we observe a similar effect when limiting the post-shock period to before the election of Donald Trump in 2016, we do not find that this result is driven by his election and subsequent deregulating agenda with respect to climate change policy. Lending to European firms follows a very different pattern. Banks lend 50% more to firms that are positively exposed compared to to non-exposed firms. This is extensive in terms of economic magnitude, as this corresponds to US$ 223 million more.

Regional differences also prevail when considering the role played by banks' own exposure. By extending the regression set-up to include an interaction with a measure of banks' negative exposure, we evaluate whether more negatively exposed banks behave differently. In particular, they could be interested in diversifying their portfolios or avoiding a devaluation of legacy positions. While banks' exposure does not matter for lending directed towards US firms, negatively exposed banks adjust credit supply differently in Europe. We find evidence that the more negatively exposed a bank is, the more it lends to negatively exposed European firms.

In the United States, we find no evidence that the shift in credit towards negatively exposed firms is directed towards those that have a higher likelihood of achieving the transition. To test this, we consider the degree of negative exposure and investments in research and development (R&D) to indicate firms' capacity to transition. Moreover, using banks' capitalization as an indicator of their risk-taking behavior, we find that low-capitalized banks appear to exploit lending to negatively exposed firms to boost their profits. Thus, our findings point towards banks' behavior representing an obstacle to the transition in the United States. In contrast, banks' credit reallocation seems to facilitate the transformation of the economy in Europe. Nevertheless, banks' own exposure seems to be a hindering factor given the increased support of negatively exposed firms by negatively exposed banks.

Shedding light on the drivers of banks' behavior, we distinguish between two potential channels. The Paris Agreement could have led to not only a shift in the awareness of the financial risks associated with regulation related to climate change, but also a change in banks' preferences for sustainable lending (Krueger et al., 2020). We use variation in environmental stringency within our two regions as a proxy for the financial risks associated with regulation. As an indicator of banks' preferences, we employ membership in the United Nations Environment Program Finance Initiative (UNEP FI) (Degryse et al., 2021). Our results indicate that the stringency of the existing regulatory environment is more important than banks' public commitments in driving lending behavior. Thus, differences in the existing regulatory environment between the United States and Europe may be determining different reallocation patterns across regions.

Our work contributes to two strands of the literature. First, we add to the recent literature on the awareness of transition risks in the financial sector. Evidence on investors' reactions to these risks suggests the existence of a carbon premium on stock returns, the creation of shareholder value by mitigating risks and the pricing of risks in corporate bond markets (Bolton and Kacperczyk, 2021; Chava, 2014; Fernando et al., 2017; Krueger et al., 2020; Sautner et al., 2020). In terms of quantity adjustments, investors have started to divest from firms or industries with higher transition risks (Boermans and Galema, 2019; Ceccarelli et al., 2020).

The literature on whether and how banks consider transition risks in their lending decisions is growing rapidly. Evidence suggests that banks charge higher interest rates to firms holding more fossil fuel reserves or with higher carbon emissions, while they give preferential terms to firms that voluntarily disclose environmental data (Chava, 2014; Degryse et al., 2021; Delis et al., 2018; Ehlers et al., 2021). However, the literature on how banks' awareness of transition risks changes their credit supply is scarcer. Notable exceptions that investigate how banks adjust their lending volumes are Kacperczyk and Peydró (2021) and Reghezza et al. (2021), considering firms' carbon emissions, and Degryse et al. (2020), using firms' exposure to green technology disruptions. We add to this by considering how banks respond to firms' regulatory risks on the basis of a measure that captures a forward-looking view of key firm stakeholders on their own exposure rather than a historical record of the current business model as measures that focus on carbon emissions. Furthermore, we can identify firms that could be negatively impacted by regulatory interventions, as well as those that could benefit from it. This provides a fuller picture of whether banks' credit reallocation decisions hinder or support the transition to a more sustainable economy.

Second, we speak to the large literature on banks' responses to shocks in terms of their lending decisions. Closely related studies analyze banks' reactions to physical climate shocks. Importantly, evidence shows that banks are aware of the physical risks related to climate change that firms face and reallocate credit accordingly (Rehbein and Ongena, 2020; Faiella and Natoli, 2019). Moreover, many studies analyze the effects of indirect shocks on banks' lending behavior, such as substantial changes in global trade patterns. Looking at China's entry into the WTO, Federico et al. (2020) and Müller (2020) investigate banks' response by constructing a measure of banks' exposure to the trade shock also by relying on the composition of borrowers in their loan books. We contribute to this by evaluating a new type of indirect shock to banks stemming from regulatory risks related to climate change faced by firms in their lending portfolios.

2 Hypotheses

2.1 The effect of regulatory risks on banks' lending

At the core of this study lies the question of whether banks account for regulatory risks faced by firms in their credit reallocation. In light of the recent discussions on whether to regulate the financial system to disclose and manage climate change-related risks, answering this question not only is relevant but is also a precondition for policy intervention.

We exploit a shock that increases banks' awareness of regulatory risks to investigate credit reallocation depending on firms' exposure. Following such a shock, there are several possible and, at times, contrasting incentives that might drive banks' decision-making and a priori it is unclear which ones would prevail. Banks may lend less to negatively exposed firms as they become more aware that firms might face challenges in repaying their loans or have a higher probability of default, as future regulation can decrease earnings, cash flows, and asset value (Park and Kim, 2020).

Alternatively, banks may lend more to negatively exposed firms. This can have two potential but contrasting reasons. On the one hand, banks may want to shift lending to these firms before regulation is actually introduced, thereby benefiting from the fact that negative externalities are not yet internalized (Reghezza et al., 2021). On the other hand, banks may lend more to those negatively exposed firms that have a strategy or potential to transition to a more sustainable business model (Engle et al., 2020; Faccini et al., 2021). Finally, it is possible that banks do not adjust their behavior if the Paris Agreement does not alter banks' perceptions of regulatory risks.

With regard to lending towards positively exposed firms, banks may now consider that these firms could benefit from the introduction of legislation owing to their business model or increasing public support and supply more funding. However, several factors, such as policy uncertainty and the existing financial regulatory regime, may still act as a barrier to lending to positively exposed firms. A challenge for firms that stand to benefit from the introduction of favorable regulation is that they often rely on the introduction and continuous upholding of said regulation. This is because of relative cost disadvantages compared to a more polluting or less environmentally friendly business model as well as the inherent 'carbon bias' in existing financial regulation such as in the Basel Accords (Campiglio, 2016; D'Orazio and Popoyan, 2019; Holburn, 2012). Therefore, we may not observe shifts in lending towards positively exposed firms.

2.2 The role of banks' exposure

Another layer of analysis is the investigation of the role of banks' own exposure to firms' regulatory risks. Banks are themselves, albeit indirectly, exposed to regulatory risks related to climate change via their loan portfolios. This may lead them to face different incentives when reallocating credit.

Herein, we focus on banks that are negatively exposed. This is partly due to the form that climate change regulation is likely to take (e.g., carbon tax, emission trading, and removal of harmful subsidies), as more firms are likely to be negatively affected than to benefit from regulation. This results in most banks being either negatively exposed or not exposed through their loan portfolios, while only a few banks in our sample are positively exposed and, if so, only marginally. Another reason to focus on banks' negative exposure is related to the fact that banks are only indirectly exposed in our setting. If regulation is indeed introduced and, as a consequence, a firm defaults on its debt, lenders to the firm are negatively affected by the default. However, if a firm benefits from regulation, its lenders do not directly benefit from the regulation's positive impact on the firm's outcomes.

Negatively exposed banks can have the incentive to reduce their exposure by either (or both) lending more to positively exposed firms or less to negatively exposed firms to diversify their portfolios. This hypothesis rests on the predictions of the classical banking theory and empirical evidence that diversification reduces risks and is associated with many other benefits, such as improved performance (Boyd and Prescott, 1986; Diamond, 1984; Rossi et al., 2009; Shim, 2019; Tabak et al., 2011). Hence, we expect in particular negatively exposed banks to shift lending to positively exposed firms and/or away from negatively exposed firms.

Alternatively, negatively exposed banks might be reluctant to lend more to positively exposed firms. Upon investigating banks' incentives to fund a green economic transition, Degryse et al. (2020) find that banks reduce lending to green firms that endanger the positions of incumbent clients. This would prevent (or at least delay) a devaluation of legacy positions and protect the credit value of the firms already in their books. In our setting, this might imply that banks might not shift funding to positively exposed firms in the same market and potentially even support more negatively exposed incumbent clients. In this case, we would expect no change in lending to positively exposed firms, but rather negatively exposed banks that lend more to negatively exposed firms.

3 The Paris Agreement

The Paris Agreement, signed in December 2015, aims to coordinate actions among 196 nations to mitigate climate change by limiting global warming. The goal is to keep the temperature increase at a maximum of 1.5°C by reducing greenhouse gas emissions. The Paris Summit was accompanied by intensive media attention characterizing it as a landmark accord (Kruse et al., 2020). It marks the first comprehensive agreement at a global level to address climate change.

We argue that this event has raised public awareness of transition risks and may have shifted banks' prevailing perceptions of these risks (Bolton and Kacperczyk, 2020; Degryse et al., 2021; Kruse et al., 2020). Survey evidence from institutional investors presented in the paper by Krueger et al. (2020) points to the recent increased attention to climate risks in investment decisions. Investors adjust their investments not only because of the belief that climate risks can have significant financial implications for firms, but also because of a shift in the preferences of clients and managers. Banks, analogous to institutional investors, are exposed to the same shifts in knowledge, attitudes, and perceptions of climate change-related risks. Hence, banks may update their beliefs about these risks and adjust their lending accordingly. This may include banks' perceptions of the riskiness of their loan portfolios.

To exploit the Paris Agreement as a shock in our setting, we need to further discuss which of its aspects were unexpected. First, the fact that an agreement was reached was in itself not an assured outcome. A series of failures to reach a global climate treaty preceded the Paris Agreement, creating “a virtual consensus among academics, who have argued that UN talks cannot succeed” (Dimitrov, 2016, p. 8). Mere weeks before the conclusion of the negotiations, high-level European officials warned that the outcome of the negotiation process was highly uncertain (Seltzer et al., 2020). Second, the extent of the Agreement with regard to the number of nations signing it as well as in terms of the ambitious goals set forward was largely unforeseen (Obergassel et al., 2015; PIK, 2015; Seltzer et al., 2020). It represents the first time that all nations, including both China and India, committed to actions against climate change on an international level. Moreover, the goals set out were considered much more ambitious than previously expected. Nevertheless, we conduct several robustness checks to illustrate that anticipation effects do not drive our results in Section 7.

4 Data and summary statistics

4.1 Data and measurement

Loan-level data We retrieve detailed loan-level information from Thomson Reuters LPC's DealScan, which covers the universe of syndicated loans. It encompasses information on lending volumes, the date of origination, maturity, as well as lender and borrower identities. Data are aggregated using the ultimate parent-level information from DealScan for both banks and firms. We start with all active facilities between 2010 and 2019. The start of the sample period is determined by the failure of a previous climate summit at the end of 2010, and the need to exclude effects stemming from the global financial crisis. The sample ends in 2019 to avoid the influence of the economic crisis following the COVID-19 outbreak. We exclude firms in the financial sector (SIC codes between 6000 and 6999) from the sample.

We treat each facility as an individual loan (see e.g., Ferreira and Matos, 2012). We convert facility volumes to millions of US dollars if applicable utilizing the spot exchange rate that DealScan provides at loan origination. Following De Haas and Van Horen (2013), we allocate loan shares according to the breakdown provided by DealScan, or if this information is missing, we distribute the loan amount equally among all syndicate members.

Loans in DealScan are generally granted by a syndicate of banks among which one or more can act as lead arrangers and have a more active role in the setting up and negotiation of the loan. As is standard in the literature, we restrict the sample to include only lead arrangers, which we define in a manner similar to Chakraborty et al. (2018).[1] Lead arrangers can be expected to be aware of a firm's regulatory exposure, at least to the extent of being able to judge whether a firm would benefit or lose from policy intervention. Large loan sizes, longer maturities, reputational damage, and economical costs associated with a failure in due diligence incentivize lead banks to conduct proper ex-ante screening and monitoring (Gopalan et al., 2011). Furthermore, Ehlers et al. (2021) document the financial significance of material risks faced by borrowers if climate change-related regulation is introduced. Hence, lead arrangers are expected to be aware of regulatory risks and are shown to be pricing them.

Given that DealScan captures loan information only at the time of origination, we use loan proportions to construct a stock variable proxying the outstanding loan volume between each bank-firm pair (Chakraborty et al., 2018; Doerr and Schaz, 2021). Hence, each loan enters a bank's loan book from the time of its origination until it matures. We aggregate outstanding loan volumes in each quarter for each pair such that our level of observation is the bank-firm-quarter.

Firm-level climate change exposure We rely on a new database by Sautner et al. (2020), who construct a detailed measure of regulatory risks at the firm level. It initially covers more than 10,000 publicly listed firms from 34 countries. The authors base their work on the transcripts of conversations between management, financial analysts, and other market participants in quarterly earnings conference calls. They extract the proportion of the conversation during the conference call centered on regulatory topics related to climate change as well as its sentiment. Earnings calls are major corporate events during which material aspects of a firm's current and future developments are discussed. Specifically, the measure is constructed as follows:

$$\text{CCExposure}_{f,t} = \frac{1}{\mathrm{B}_{f,t}} \sum_{b}^{\mathrm{B}_{f,t}} (1[b \in \mathbb{C}]) \times \sum_{b}^{\mathrm{B} \in S} \tau(b) \tag{1}$$

where $\mathbb{C}$ is a set of bigrams developed on the basis of text analysis that captures regulatory

[1] We consider lead arrangers lenders classified as: "Admin Agent", "Lead bank", "Lead arranger", "Mandated lead arranger", "Mandated arranger", and lenders denoted with a "yes" for lead arranger credit.

shocks related to climate change, $b = 0, 1, ..., B_{f,t}$ are the bigrams of firm f in quarter t, $1[.]$ is an indicator function, S encompasses sentences containing $b = 0, 1, ..., B_{f,t}$, and $\tau(b)$ assigns sentiment to each b. The set of bigrams $\mathbb{C}$ is taken to the conference call of firm f in quarter t to count their frequency of occurrence. The total count is scaled by the total number of bigrams in the call, while taking into account different call durations. The first part of the product captures the relative frequency with which related bigrams occur in the conference call transcripts of a firm. The second part of the product assigns sentiment to each bigram with

$$\tau(b) = \begin{cases} 1 & \text{if } b \text{ has a positive tone} \\ -1 & \text{if } b \text{ has a negative tone} \\ 0 & \text{otherwise.} \end{cases} \tag{2}$$

Hence, $CCExposure_{f,t}$ can be negative, positive or zero.[2] *Negatively exposed firms* are firms for which regulatory topics or developments constitute bad news as they can negatively influence firms' operating costs, earnings, and cash flows as well as relate to an increased loss probability (Huang et al., 2018; Nguyen, 2018; Seltzer et al., 2020). An example of a negatively exposed firm in our sample is GenOn Energy, which, e.g. in its Q1 2012 conference call, discusses the costs associated with compliance with the Maryland Healthy Air Act.

A positive exposure, in turn, suggests that the firm expects to benefit from regulatory developments or at least considers them as good news for its business. These policies might correct the relative cost disadvantages of greener business models, either by providing subsidies to greener technologies or by increasing the operating costs of more polluting competitors (Holburn, 2012). We refer to these firms as *positively exposed firms*. An example of a positively exposed firm in our sample is Fortum Oyj, which, e.g. in Q2 2015, discusses that the future development strategy of the firm will be even more targeted towards renewable energy. Finally, we consider firms in our sample with zero exposure as not exposed or neutrally exposed to climate change-related regulatory risks and employ them as our control group. In our empirical analysis, we rely on the average pre-shock exposure of each firm - $\overline{CCExposure}_f$ - to construct indicators for whether a firm is negatively or positively exposed. Banks should at least be able to judge whether

[2]This corresponds to $CCSentiment^{Reg}$ from the database by Sautner et al. (2020). In this paper, the authors provide further information on the specific bigrams underlying the exposure measure.

a firm would benefit or lose from policy intervention due to the financial significance of regulatory risks (Ehlers et al., 2021). Moreover, this approach reduces endogeneity concerns.

The use of this dataset to capture firms' exposure to regulatory risks has three main advantages. First, we are able to identify not only firms that could be negatively impacted by regulatory interventions, but also those who could benefit from it. This is contrariwise to carbon emission data that do not allow for the differentiation between 'good' and 'bad' emissions.[3] Second, this measure captures a forward-looking view of key stakeholders in the firm rather than a historic record of the current business model as measures that focus on carbon emissions or on fossil fuel reserves do. This is particularly important when considering regulatory risks as the measure reflects an internal evaluation of the firms' exposure rather than an outsider estimate based on observable factors. The stakeholders in a firm have access to more intangible information, such as the future direction the firm plans to take. Therefore, they can better estimate their exposure. Third, it suffers less from selection bias because earnings conference calls are a common practice and take place on a regular basis for large firms. This is in contrast to carbon emission data or environmental, social, and governance (ESG) reports that are provided voluntarily.

A key concern regarding the measure might relate to greenwashing efforts by management. Greenwashing refers to the "selective disclosure of positive information about a company's environmental or social performance, without full disclosure of negative information on these dimensions, so as to create an overly positive corporate image" (Lyon and Maxwell, 2011, p. 9). However, conference calls are less prone to greenwashing than annual or ESG reports. Even if management evades climate change topics or selectively addresses only positive achievements, financial analysts are actively involved in the calls and can participate in the discussions (Hollander et al., 2010). This is reflected in the difference between exposures based on the presentation and Q&A sessions separately. In the latter part, climate change-related topics are generally discussed in a more negative way (Sautner et al., 2020). This highlights the importance of including Q&A sessions in the construction of the exposure measure. Nevertheless, we conduct further tests to ensure that greenwashing does not affect our results in Section 7.

Another possible concern related to this measure in our setting is that it might be endogenous with respect to banks' credit supply choices. This would be the case if,

[3] Emissions are considered 'good' when contributing to the transition to a greener economy by e.g. increasing energy efficiency (Seltzer et al., 2020).

for instance, a new loan leads to an increase in firms' exposure. While bank lending might have an impact on firms' exposure in the long term, we calculate the correlation between having received a loan and firms' average exposure one year after the loan. The correlation is 0.005. Thus, we find no systematic change in firms' exposure immediately after receiving a new loan.

Bank-level climate change exposure To construct a measure that captures banks' own exposure to firms' regulatory risks, we rely on financial institutions being predominantly exposed to regulatory risks due to the financial activities they undertake (Giuzio et al., 2019). A large part of these activities encompasses the provision of credit to the real economy. Hence, banks are exposed through their lending to firms that are subject to regulatory risks.[4] Data availability restricts our sample to lending on the syndicated loan market, which is, however, a substantial part of banks' lending activity. We use banks' syndicated loan portfolios to construct a proxy for bank exposure as follows:

$$\text{Bank Exposure}_b = \sum_{f=1}^{N} \left(\frac{\text{lending}_{b,f}}{\text{lending}_b} \times \text{CCExposure}_f\right). \tag{3}$$

Thus, bank b's exposure is defined as the sum of all firms' ($f = 1, ..., N_b$) pre-shock average share of lending to total lending weighted by their average pre-shock exposure to regulatory risks, $CCExposure_f$. Correspondingly, banks' exposure can take on negative or positive values if a bank predominantly lends to negatively or positively exposed firms, respectively. Alternatively, it can be zero if a bank only lends to firms with zero exposure over the pre-shock period. The resulting variable is not winsorized in the baseline analysis, but a robustness test is conducted, showing that outliers do not affect the results in Section 7.

Firm-level characteristics As there is no direct link between firms' exposure data and DealScan, we first merge the exposure data to Worldscope and, if missing in Worldscope, to Orbis using firms' ISIN numbers. This allows us to obtain the characteristics, names, and locations of firms in the climate change exposure dataset. Following Almeida et al. (2004), we consider mergers and acquisitions by excluding firm-quarters with annual asset or sales growth exceeding 100%. We require the total assets to be non-zero and

[4]This abstracts from the fact that banks could also be exposed to climate-related risks via their invested capital as well as their other types of lending.

non-negative. All variables are winsorized at the 1st and 99th percentiles.

We then use a string matching approach to identify the firms that borrow in DealScan. We link the two datasets based on firm name, ticker, country, and city, and manually approve each non-perfect match. From the 11,461 firms included in the data by Sautner et al. (2020), we arrive at 3,826 firms that borrow in the syndicated loan market, for which we have exposure information as well as firm characteristics. Further sampling (e.g., dropping financial firms or requiring non-missing information on SIC codes and location) leads to a final number of 2,155 firms in our regressions. A total of 1,638 firms are located in the United States, 295 in Europe, and 222 elsewhere in the world.

Bank-level characteristics To saturate several descriptive statistics and further regressions with bank characteristics, we add bank-level information from Compustat. Given that there is no common identifier between DealScan and Compustat, we rely on the link file provided by Schwert (2018). We then expand on this by linking the two datasets based on bank name, ticker, country, and city, and manually confirm all non-perfect matches. This process delivers bank-level characteristics for a subset of 122 lenders in our baseline sample.

4.2 Descriptive statistics

Table 1 contains the definitions of all variables used in this analysis, and Table 2 comprises the corresponding summary statistics.

[Table 1 and Table 2]

Industry variation To illustrate the industry variation of the data by Sautner et al. (2020), which serves as the basis of our analysis, Table 3 shows the top- and bottom-five exposed industries at the two-digit SIC code level in our sample. The top-five encompasses industries that have the highest negative average pre-shock exposure. Electric, gas, and sanitary services, as well as coal mining, have a high negative exposure to regulatory shocks. The bottom-five includes industries that appear to have no material average pre-shock exposure to regulatory risks or appear to potentially even benefit from the introduction of new legislation. This includes, for example, personal services. Comparing the top- to bottom-five industries, it becomes apparent that the degree to which firms consider themselves positively affected is much lower than the extent to which firms stand to lose from future regulation. However, this is not surprising given the form that future regulation related to climate change is likely to take.

[Table 3]

Firm and bank exposure variation To illustrate exposed firms in our sample, Figure 1a shows the distribution of the average pre-shock exposure, $\overline{CCExposure}$, at the firm level in our sample. In line with the expectation that more firms are likely to be negatively affected than to benefit from regulatory intervention, we observe approximately three times as many negatively exposed firms as positively exposed ones. Roughly 7% of firms are positively exposed, while close to 20% are negatively exposed. Furthermore, the average negative exposure of firms is higher than the average positive exposure.

[Figure 1]

Figure 1b presents a similar picture of the distribution of *Bank Exposure* at the bank level. It highlights that the majority of banks are negatively exposed, and only approximately 8% are positively exposed. While this corresponds only to a small number of banks, it is unsurprising that only very few banks predominantly lend to the very few positively exposed firms. Furthermore, 15% of the banks exhibit zero exposure to regulatory risks as they lend predominantly to firms that have, on average, zero exposure over the pre-shock period.

5 Identification

5.1 Empirical specification

We employ a DID design to identify whether and how banks adjust their credit supply after the Paris Agreement, depending on firms' exposure to climate change-related regulatory risks:

$$\begin{aligned} \mathrm{y}_{b,f,t} = {} & \beta_1 \mathrm{Positive}_f \times \mathrm{Post}_t + \beta_2 \mathrm{Negative}_f \times \mathrm{Post}_t \\ & + \zeta_{b,f} + \zeta_{j,l,s,t} + \zeta_{b,t} + \varepsilon_{b,f,t}. \end{aligned} \tag{4}$$

The dependent variable is the log of outstanding credit between bank b and firm f in quarter t. $Positive_f$ is a binary variable assuming a value of one if a firm has a positive exposure to regulatory risks related to climate change, and zero otherwise. It is constructed on the basis of $\overline{CCExposure}_f$, which is the average pre-shock exposure to regulatory risks of firm f. Correspondingly, $Negative_f$ is equal to one if a firm has a negative exposure to regulatory risks, and zero otherwise. Hence, the comparison group always comprises firms with zero exposure. We employ indicator variables, as banks should at least be able to judge whether a firm would benefit or lose from policy intervention (Ehlers et al., 2021). $Post_t$ divides the sample into a pre- and post-shock period. The cut-off point is the last quarter of 2015, as the Paris Agreement was signed in December of that year.

A key challenge for identification is to isolate credit supply from credit demand. This is important because firms might substitute equity with debt when their own exposure increases, given the positive correlation between exposure and cost of equity (Chava, 2014). While it is common in the banking literature to control for firm demand via the inclusion of firm-time fixed effects, our empirical setup does not allow their inclusion as they subsume the interaction terms of interest. Following Degryse et al. (2019), we overcome this using borrowers' industry-location-size-time (ILST) fixed effects ($\zeta_{j,l,s,t}$).[5] They show that this works equivalently well as a demand control. Moreover, we additionally include loan characteristics, as well as firm controls that importantly relate to firms' demand for credit in later specifications (see Table 8).

In addition, $\zeta_{j,l,s,t}$ implicitly captures any macroeconomic developments that affect all banks and firms in the sample. Furthermore, we saturate the equation with bank-firm fixed effects ($\zeta_{b,f}$) to capture differences across firms that are constant over time as well as unobservable time-invariant characteristics that influence loan outcomes of each bank-firm pair, such as relationship or distance. Bank-time fixed effects ($\zeta_{b,t}$) control for time-varying differences across banks. Hence, we ultimately compare relationships over time by the same bank to a negatively (positively) exposed firm and a non-exposed firm in the same industry-location-size cluster. $\varepsilon_{b,f,t}$ is the idiosyncratic error term. The single terms $Positive_f$, $Negative_f$, and $Post_t$ are absorbed by the fixed effects.

Hence, β_1 illustrates how banks change their lending to positively exposed firms after the shock compared to firms with zero exposure. Correspondingly, β_2 outlines the difference in lending to negatively exposed firms compared to the group of firms with zero exposure.

To investigate the role that banks' own exposure plays in this context, we extend

[5]Industry fixed effects are at two-digit SIC code level, location fixed effects are at state level for the United States given that the US states can implement climate change regulation themselves and at country level in all other cases.

Equation (4) by interacting $Negative_f \times Post_t$ and $Positive_f \times Post_t$ with a proxy that captures banks' exposure to regulatory risks related to climate change:

$$\begin{aligned} \mathrm{y}_{b,f,t} = {} & \gamma_1 \mathrm{Positive}_f \times \mathrm{Post}_t + \gamma_2 \mathrm{Negative}_f \times \mathrm{Post}_t \\ & + \gamma_3 \mathrm{Positive}_f \times \mathrm{Post}_t \times \mathrm{NegBank}_b \\ & + \gamma_4 \mathrm{Negative}_f \times \mathrm{Post}_t \times \mathrm{NegBank}_b \\ & + \eta_{b,f} + \eta_{j,l,s,t} + \zeta_{b,t} + \epsilon_{b,f,t}. \end{aligned} \tag{5}$$

$NegBank_b$ takes on the absolute value of bank b's exposure if $Bank\ Exposure_b$ is negative and takes a value of zero if bank b's exposure is zero or positive.[6] Hence, γ_3 and γ_4 allow us to identify whether there is a differential effect for positively exposed firms (compared to firms with zero exposure) and negatively exposed firms (compared to firms with zero exposure), depending on a bank's level of exposure.

5.2 Parallel trends

The validity of any DID design crucially depends on the assumption that the treatment and control groups would follow the same trend in the absence of treatment. To provide evidence that this assumption holds in our setting, we first report the pre-shock averages of various bank and firm characteristics for each group of firms. This includes negatively and positively exposed firms as well as firms with zero exposure. Table 4 shows the normalized differences by treatment status in the fashion of Imbens and Wooldridge (2009). A difference smaller than ± 0.25 indicates no significant difference between the groups and the adequateness of linear estimation methods.

[Table 4]

Importantly, the credit made available to each group of firms is sufficiently equal, as apparent in Panel A. This applies when considering both the loan volume and loan growth. The average pre-shock outstanding loan volume in the sample of all firms is US$ 258 million. Irrespective of their exposure to regulatory shocks, firms exhibit similar trends before the Paris Agreement as illustrated in Panel B. Similarly, Panel C shows that banks that lend to the three groups do not follow statistically different trends in the pre-shock period. Moreover, we use placebo tests in our robustness checks in Section 7

[6] In a test included in the Internet Appendix we show that employing *Bank Exposure* instead of *NegBank* does not lead to different results. Using *NegBank* simplifies interpretation.

to establish that 'treatment' effects are not observable in the absence of a shock. Figure A1 in the Appendix supports the parallel trends assumption.

Our results should not be driven by negatively exposed banks and non-negatively exposed banks developing in fundamentally different ways and lending to fundamentally different borrowers. To verify this, we illustrate that these two groups of banks, as well as the firms connected to each group of banks, develop similarly in the pre-shock period. Table 5 displays the normalized differences for negatively and non-negatively exposed banks separately.

[Table 5]

Panel A illustrates that negatively exposed banks provide higher loans than non-negatively exposed banks before the Paris Agreement. Reassuringly, this difference in levels does not translate into differences in trends. Loan volumes develop sufficiently similar in the two groups. Panel B further demonstrates that the firms that these two groups of banks lend to follow sufficiently equal trends, irrespective of the variables considered. Panel C, in turn, identifies that banks' characteristics do not evolve in a systematically different manner.

Overall, there is no evidence that firms or banks develop differently over the pre-shock period.

6 Results

6.1 The effect of regulatory risks on banks' lending

Column (1) in Table 6 displays the results of estimating Equation (4) for the full sample. Standard errors are clustered at bank level. β_1 illustrates that banks do not lend differently to positively exposed firms after the Paris Agreement compared to firms with zero exposure. However, β_2 instead is negative and statistically significant. This implies that banks lend relatively more to firms that are negatively exposed to regulatory risks compared to firms with zero exposure.

[Table 6]

The full sample results hide large heterogeneity at the regional level. We split the sample and estimate Equation (4) separately for three regions: Columns (2), (3), and (4) display the results for subgroups of firms in the United States, Europe, and the rest of the world (ROW), respectively. This illustrates that lending to US firms drives the effect in the full sample. Banks supply 17.6% more credit to negatively exposed firms in the United States after the shock compared to firms with zero exposure. Hence, the Paris Agreement leads banks to lend US$ 61.4 million more to negatively exposed firms.[7] This finding contrasts the hypothesis that banks would lend less to these firms due to increased awareness about potentially worse prospects in terms of earnings and asset values.

We proposed two potential hypotheses for shifts in lending towards these firms. Banks that lend to US firms might want to exploit the free ride on the negative externalities by increasing lending to negatively exposed firms (Reghezza et al., 2021). An alternative explanation is that our results could hint that banks supply relatively more credit to those negatively exposed firms that have a strategy and the potential to transition to a greener business model (Engle et al., 2020; Faccini et al., 2021). Hence, from these results alone, it is unclear whether banks' lending behavior impedes or facilitates the transition to a greener economy in the United States.

Lending to European firms shows a very different picture. We find that banks extend more credit to European firms that appear to benefit from future regulation after the Paris Agreement compared to European firms with zero exposure. More specifically, banks lend 50% more to positively exposed firms. This implies that the shock to banks' awareness leads them to lend US$ 223 million more to positively exposed firms in Europe.[8] These results are in line with the hypothesis that banks now consider that these firms could benefit from the introduction of regulation. Hence, banks' credit reallocation behavior could be seen as facilitating the transition in Europe.

Column (4) illustrates the results for firms in the ROW, for which we do not find an effect on bank lending. This might be due to the large heterogeneity among ROW countries and data availability, which does not allow us to analyze more homogeneous groups within the ROW.

In Table 7, we now test whether the results that we observe for the sample of US firms in our baseline are driven by changes in lending supply after the election of President Trump or the US withdrawal announcement in June 2017.[9] We test if they were already

[7]The product of the mean loan volume in the sample of US firms over the full period and the exponent of the coefficient, i.e., $(e^{0.176} - 1)\times$ US$ 319 million.

[8]The product of the mean loan volume in the sample of European firms over the full period and the exponent of the coefficient, i.e., $(e^{0.52} - 1)\times$ US$ 327 million.

[9]The United States officially withdrew from the Agreement in November 2020. Article 28 of the

present in the period after the Paris Agreement during the Obama Administration or until the withdrawal announcement. In Column (1), we reduce the post-shock period and exclude all observations after Q3 2016, which corresponds to the quarter Trump was elected President. This leads to an estimate for $Negative \times Post$, which is very similar to the baseline.

[Table 7]

In Column (2), we estimate a similar coefficient for $Negative \times Post$ when excluding this first period from the estimation and using only observations following the Trump election in the post-shock period. Hence, we do not find that the election of Donald Trump changed lending supply choices differently than the shift that was already observed in the period that directly followed the Paris Agreement. In Column (3), we further test whether our findings vary if we consider the withdrawal announcement in June 2017 instead of the Trump election as the beginning of the post-shock period. In Column (4), we use an indicator variable, *Agreement*, which is equal to one in the period between the announcement of the Paris Agreement and the US announcement of withdrawal and zero otherwise, instead of the baseline *Post* indicator. We still observe a relative shift in credit supply towards negatively exposed firms in the United States, even when the treatment period is reduced to include only the period in which the United States committed to the Agreement. We conclude that the results that we observe in the US sample are not driven by the effect of the Trump election or his subsequent deregulating agenda with regard to climate policy.

Next, Table 8 includes controls for other loan characteristics as well as time-varying firm variables to ensure that the results are not driven by firms' demand for credit. In Columns (1) and (3), we include the average spread and average maturity, which are constructed in the same fashion as loan volumes. In Columns (2) and (4), we introduce firm characteristics lagged by one quarter, which importantly relate to firms' demand for credit. This encompasses firms' return on assets as a measure of their profitability, the

Agreement prevented signatory countries from withdrawing in the first three years after signing. Moreover, a one-year period has to pass between the official notification and final withdrawal. Hence, the first possible withdrawal date was four years after the Agreement was signed. Nevertheless, we consider the official announcement of the Trump administration in June 2017 as a credible signal that the US would leave the Agreement and not take the necessary steps to pursue the long-term goals of the Agreement during the withdrawal period.

ratio of common equity to total assets to proxy firms' capital structure, R&D expenditure to total assets to capture firms' innovative activities, capital expenditure to total assets to control for firms' investment decisions, and sales to total assets as this closely relates to firms' liquidity.[10] The latter can also be considered to quite directly capture the effect of changes in consumer preferences due to the Paris Agreement on firms' demand for credit.

[Table 8]

6.2 The role of banks' exposure

Banks' own, indirect exposure might lead to different incentives when reallocating credit. Table 9 shows the results of estimating Equation (5) for the full sample in Column (1) and separately for firms located in the United States, Europe, and ROW in Columns (2), (3), and (4), respectively.

[Table 9]

Column (1) provides evidence for a differential response to firms' regulatory risks, depending on banks' exposure. Here, the positive coefficient for the triple interaction $Negative \times Post \times NegBank$ indicates that the more negatively a bank is exposed through its loan portfolio, the more it shifts its credit supply towards negatively exposed firms relative to non-exposed firms after the Paris Agreement. However, negatively exposed banks do not reallocate credit differently from non-negatively exposed banks to firms that appear to benefit from the introduction of new legislation. The differential response of negatively exposed banks observed in the full sample is mainly driven by lending to negatively exposed European firms (Column (3)), as we do not find any differential effect of banks' exposure in the sample of US or ROW firms (Columns (2) and (4)).

The lower part of the table shows the estimated marginal effect on credit volumes for banks at the 90th percentile of the *NegBank* distribution, that is, those banks in our sample that are very negatively exposed.[11] In Europe, we see that also the most negatively exposed banks shift their credit supply toward positively exposed firms. However, at the same time, they lend more to negatively exposed firms. The size of this effect is non-negligible. For banks at the 90th percentile of the *NegBank* distribution, we observe

[10] We set missing R&D expenditures to zero (Bena et al., 2017)

[11] A bank at the 90th percentile has a negative exposure of 0.015.

a relative shift in lending toward negatively exposed firms of approximately 42% after the Paris Agreement. Hence, we cannot confirm our hypothesis that it is particularly negatively exposed banks that attempt to diversify their portfolios. Rather, all banks lend relatively more to positively exposed firms, which could lead to higher levels of diversification for all banks. Figure 2 depicts this development, highlighting a slight shift in the distribution of banks' exposure to the right in the period after the Paris Agreement while holding firms' exposure constant.

[Figure 2]

These results partially align with the hypothesis of Degryse et al. (2020), while revealing a more nuanced picture. While we do find evidence that banks that are negatively exposed support their incumbent clients, our results deviate from the proposition that these banks do not support green firms, which could threaten the stability of incumbent clients in the same industry and location. This implies a negative and significant coefficient for $Positive \times Post \times NegBank$, which we do not find. This credit reallocation behavior of negatively exposed banks could either hinder or support the transition to a greener economy in Europe, depending on the reasons for the support of negatively exposed firms.

6.3 Does bank behavior fuel or hinder the transition?

The picture that the baseline results present leaves room for interpretation regarding how banks' behavior interacts with the need to transition towards a greener economy. In the United States, banks could facilitate the transition by providing credit to support the transformation of negatively exposed firms. The results could, however, also indicate that banks lend relatively more to negatively exposed firms to take advantage of the lack of internalization of negative externalities while they still can, which could pose an obstacle to the transition. In Europe, it appears that banks' behavior supports a transition, as banks lend more to positively exposed firms. Nevertheless, the results on the differential role of banks' exposure in Europe could point toward a more nuanced picture if negatively exposed banks lend more to negatively exposed incumbent clients without funding their transition. Given the key role that is assigned to banks in this context, this section sheds more light on how their actions impact the transition to a greener economy. We introduce interactions with firm and bank characteristics that could provide some indicative evidence on whether banks' credit reallocation hinders or supports the transition.

We start by taking a closer look at the types of firms toward which credit is directed. We consider firm characteristics that could indicate their capacity to transition: the degree of negative exposure and investments in R&D. The underlying rationale is that slightly negatively exposed or more innovative firms might have higher potential or fewer difficulties in adapting their business model to new regulation. Thus, if lending to negatively exposed US firms is driven by lending to slightly exposed or more innovative firms, this could be evidence in favor of banks facilitating the transition in the United States. Similarly, the differentiation among negatively exposed European firms might uncover evidence of how banks adjust lending to negatively exposed firms in Europe.

Table 10 presents the results. $VeryNegative$ is equal to one for firms with an exposure smaller than the 75th percentile, and zero otherwise. $LessNegative$ takes a value of one if firms' exposure is larger than the 75th percentile, and zero otherwise. Hence, in both cases, we still compare them to non-exposed firms. Column (1) shows that banks extend relatively more credit to both very negatively and slightly exposed US firms. In Column (2), $HighR\&D$ is defined as assuming a value of one if firms have a ratio of R&D expenditure to total assets equal or larger than the 75th percentile, and zero otherwise. Banks do not adjust their lending differentially, depending on US firms' investment in R&D, as illustrated by the fact that neither $Negative \times Post \times HighR\&D$ nor $Positive \times Post \times HighR\&D$ is significant. Thus, banks' lending to negatively exposed US firms is not directed specifically toward slightly negatively exposed or highly innovative firms, which could have been seen as supporting the transition toward a greener economy.

[Table 10]

Column (4), in turn, displays the results for lending to European firms when differentiating on the degree of negative exposure. Unfortunately, data availability does not allow for the analysis using R&D expenditure for Europe. Banks lend more to slightly negatively exposed European firms after the Paris Agreement compared to non-exposed firms, as indicated by $LessNegative \times Post$ being positive and significant. This provides additional evidence for banks' credit reallocation facilitating the transition in Europe. However, $VeryNegative \times Post \times NegBank$ identifies that the more negatively exposed a bank is, the more it lends toward very negatively exposed firms compared to non-exposed firms. This indicates that banks' own exposure plays a role in hindering the transition toward a greener economy in Europe.

Investigating whether specific types of banks reallocate credit differently might provide more evidence on the impact of banks' decisions on the transition. To this end, we exploit heterogeneity in banks' capital constraints. The previous literature indicates that less-capitalized banks might have a stronger incentive to gamble for resurrection and engage in attempts to increase earnings (Dell'Ariccia et al., 2011). This implies that it might, in particular, be low-capital banks that lend relatively more to negatively exposed firms to cream off the market. Alternatively, if it is well-capitalized banks that especially lend more to negatively or positively exposed firms, this can be interpreted as evidence in favor of facilitating the transition. Well-capitalized banks have more room for maneuver or more capital space and might therefore be better able to support the transition of negatively exposed firms or the expansion of positively exposed ones.

Columns (3) and (5) in Table 10 illustrate the results when we differentiate between low- and well-capitalized banks.[12] $LowCapital$ takes a value of one if banks' capital ratios are lower than the 25th percentile. Column (3) indicates that, when lending to US firms, low-capital banks lend more to negatively exposed firms compared to well-capitalized banks as $Negative \times Post \times LowCapital$ is positive and statistically significant. This provides some evidence that low-capitalized banks try to exploit lending to negatively exposed firms in the United States to boost their profits. However, this tendency, is not observable in Europe (Column (5)).

In summary, the evidence that we can provide points toward banks' behavior representing an obstacle to the transition in the United States. In Europe, banks' credit reallocation seems to facilitate the transformation of the economy, although their own exposure is a hindering factor.

6.4 What is driving banks' behavior?

While the previous section addresses the effect of banks' credit reallocation on the transition, this section aims to shed light on the drivers of banks' behavior. Krueger et al. (2020) present evidence that following the Paris Agreement institutional investors adjust their investments not only due to the awareness that climate risks can have significant financial implications for firms, but also due to a shift in the preferences of clients and

[12] As we do not have data on all banks' capital ratios, this analysis is estimated on a sub-sample. The baseline results are largely the same for this sub-sample except for the coefficient of $Negative \times Post \times NegBank$ in the European sample. The significance diminishes because the average negative bank exposure is lower in this sample.

managers. In this section, we distinguish between these two channels to identify whether banks' behavior is driven by a shift in preferences and/or the increased awareness of the financial risks associated with regulation related to climate change.

To investigate the preference channel, we introduce an interaction with an indicator of banks' public commitment to lend in a sustainable way. We consider membership in the UNEP FI before the Paris Agreement, $UNEPMember$. The initiative has run since 1991 and has counted over 400 members to date. Furthermore, it has already been used in the literature as an indicator of banks' attitude toward environmental and climate change issues, for example, by Degryse et al. (2021) and Delis et al. (2018).[13] If preferences are an important determinant of banks' behavior, we would expect, in particular, UNEP FI members to either refrain from acting in a way that hinders the transition or actively foster it.

In Table 11, Column (1) shows that when lending to US firms, committed banks do not adjust their lending differentially. Thus, we do not find evidence that UNEP FI members refrain from lending more to negatively exposed firms in the United States. In the sample of European firms, $Positive \times Post \times UNEPMember$ is marginally significant (Column (3)). Hence, there is some weak evidence that UNEP FI members support positively exposed firms relatively more than non-members when lending to European firms. Overall, preferences seem to play only a marginal role in driving credit allocation.

[Table 11]

To investigate the risk channel, we evaluate whether banks adjust their behavior differently depending on the stringency of climate change policies before the adoption of the Paris Agreement. We use the variation in environmental stringency within our two regions as a proxy for the financial risks associated with regulation related to climate change. The more stringent the existing regulatory environment, the more likely this trend is to continue and, thus, the higher the financial risks involved. To this end, we exploit variation across states in the United States and across European countries. $Target$ is an indicator of whether US states had greenhouse gas emission targets before the adoption of the Paris Agreement. Eleven states enacted legislations that enshrined reduction targets and mandatory reporting.[14] For Europe, we retrieve each country's Climate Change

[13]The data is hand-collected from the official website: http://www.unepfi.org/members/ (accessed on July 20, 2021)

[14]To which states this is applicable, is retrieved from https://www.ncsl.org/research/energy/greenhouse-gas-emissions-reduction-targets-and-market-based-policies.aspx.

Performance Index in the year 2015 issued by Germanwatch.[15] *HighScore* indicates a country with a stringency score above the median.

Column (2) in Table 11 shows that banks do not adjust credit differently when lending to US firms, depending on regulatory stringency. This might be because the political environment at the federal level might be overpowering across state variation in regulatory stringency. One important consideration in this context is that, although the United States was very active in facilitating the Paris Agreement, 2016 was an election year making imminent policy efforts rather unlikely. Furthermore, following the election of Donald Trump as President of the United States in November 2016, his administration signalled and actively pursued a deregulating agenda to scale back or eliminate federal climate mitigation and adaptation measures.[16] This culminated in June 2017 with the Trump administration formally announcing the withdrawal from the Paris Agreement. In sum, more stringent climate regulation at the federal level were seen as less likely in the aftermath of the Paris Agreement.

Conversely, the European Union, in particular, was seen to have quickly finalized legislative processes ratifying the Agreement and was expected to meet 2030 climate targets in 2016 (Dröge, 2016). Thus, we again observe a different pattern in Europe, where the stringency of the initial regulatory environment plays a key role in determining the credit supply to negatively exposed firms. Column (4) demonstrates that banks lend relatively less to negatively exposed firms in countries that have more stringent climate policies. However, they supply relatively more to firms in countries with a more relaxed regulatory environment.

Hence, differences in the existing regulatory environment and, therefore, the credibility of regulation being introduced in the future between the United States and Europe might determine credit reallocation. Our evidence suggests that the existing regulatory environment is more important than public commitments in driving banks' behavior. The risk channel appears to dominate the preference channel.

[15] Detailed information is retrieved from https://germanwatch.org/sites/default/files/publication/10407.pdf.

[16] The Climate Deregulation Tracker run by the Sabin Center for Climate Change Law lists 176 deregulating actions in climate law taken by the Trump administration (Sabin Center for Climate Change Law, 2021)

7 Robustness checks

7.1 Robustness on the effect of regulatory risks on banks' lending

Alternative exposure measures and control group In Table A1, we use two alternative approaches to create the exposure measure. First, we use a cumulative exposure measure over the pre-shock period as the basis on which *Positive* and *Negative* are consequently constructed (Columns (1) and (5)). Second, we take the full period average to create *Positive* and *Negative* (Columns (2) and (6)). Third, we drop firms for which we do not have at least four consecutive observations in the pre-shock period to construct $\overline{CCExposure}$ (Columns (3) and (7)). The results are robust to these checks.

Furthermore, we drop all firms with zero exposure from the sample, such that we can directly compare lending to positively and negatively exposed firms. This leads to $Positive \times Post$ dropping from Equation (4) and β_1 identifying the difference between positively and negatively exposed firms after Paris. The results in Columns (4) and (8) confirm that even in a direct comparison, negatively exposed US firms receive a higher loan volume after the shock compared to positively exposed US firms. The opposite holds true for European firms.

Alternative specifications Next, we sequentially introduce our fixed effects structure in Table A2 for the sub-sample of US and European firms. Columns (1) and (5) show the baseline regression without fixed effects. This seems to indicate that in the United States, positively exposed firms generally receive less funding than the control group, while negatively exposed firms receive more funding. In Europe, both groups seem to obtain more funding than the control group. Columns (2) and (6) introduce bank-firm fixed effects, thereby controlling for bank and firm time-invariant characteristics as well as for all aspects specific to the bank-firm pair. In the United States as well as Europe, the coefficient for $Positive \times Post$ is negative and significant, indicating that without controlling for either time-varying bank characteristics, which affect banks' supply, or for loan demand, the overall effect of the Paris Agreement on the allocation of credit to these positively exposed firms is negative. This could be related to the fact that positively exposed firms might have resorted to other types of financing (e.g., green bonds or public equity) and therefore demand less or it could be driven by time-varying differences across banks. In Columns (3) and (4), and (7) and (8) for the European sample, we therefore include bank-time and ILST fixed effects, respectively. Only when controlling for loan demand does $Positive \times Post$ become insignificant in the US sample and switches signs in Europe. The positive and significant coefficient in the United States for $Negative \times Post$ that can be observed once bank-firm fixed effects are introduced in Column (2) remains significant despite the introduction of further fixed effects in Columns (3) and (4). This indicates that this shift in lending toward negatively exposed firms in the US is driven neither by time varying differences across banks nor by demand-side effects.

Timing and location of regulation In Table A3, we test whether our results are driven by a shift in lending toward a shorter time horizon, particularly in the United States, by reducing the sample to loans with a longer maturity. Banks might be more concerned about firms' risks when granting loans with longer maturity, as in the long term, it is more difficult to predict whether regulation will be introduced. However, once we restrict the sample to loans that have a minimum maturity of three years, Columns (1) and (5) qualitatively show the same results. Another aspect to consider in our context is firms' location. For example, regulation to curb carbon emissions is likely introduced at the location where emissions are generated and not at the headquarter level. Our data for regulatory risks are, however, at the headquarter level, and we treat loans from subsidiaries as if they originate from the parent firm in our baseline. To test that this is not confounding our results, we run our baseline specification on a sample that excludes loans from foreign subsidiaries. Columns (2) and (6) confirm the results for the United States and Europe, respectively.

We further test whether our results are indeed caused by the Paris Agreement or just spurious and would arise in any other year. Figure A1 plots the estimates for $Negative \times Post$ and $Positive \times Post$ and 95% confidence intervals for regressions in which we define twelve placebo events between Q1 2003 and Q4 2005 for the United States and Europe separately. We find insignificant effects in each placebo regression, indicating that our results are indeed driven by the Paris Agreement in 2015.

Anticipation effects While we have put forward arguments that anticipating the Paris Agreement seems questionable, we formally ensure that anticipation effects do not drive our findings. Therefore, we exclude observations from Q2 2014 to Q3 2015 in the creation of $\overline{CCExposure}$. This ensures that corroborating events such as reform proposals related to climate change by the Obama administration in summer 2014 or the endorsement of the UN Sustainable Development Goals in early 2015 do not influence our measure of regulatory risks. Columns (3) and (7) in Table A3 demonstrate that the results are qualitatively the same.

Greenwashing efforts To ensure that greenwashing efforts by management do not bias our results, we illustrate that our findings hold when looking at a sub-sample of firms, which previous literature has shown to be less likely to greenwash. Greenwashing can be deterred by intense scrutiny. A particular instance of a firm being subject to intensified scrutiny is when it is cross-listed, that is, listed at, at least, one international stock exchange in addition to a listing at the domestic exchange. Exposure to foreign investors and regulators dissuades firms from engaging in greenwashing (Del Bosco and Misani, 2016; Yu et al., 2020). Hence, Columns (4) and (8) in Table A3 display the results from estimating Equation (4) for the sub-sample of firms, which are listed at multiple exchanges. We are encouraged that our results are not driven by greenwashing, as we find similar results in this sub-sample.

Further robustness Further checks are available in an Internet Appendix.[17] First, we employ different clustering schemes at the firm, location, bank-firm, and bank-time level. Second, we sequentially relax the definition used to construct ILST fixed effects, as this should deliver more variation at the expense of more precision in controlling for demand. We construct industry clusters using 1-digit SIC codes, relax the size bins, and employ fixed effects at year instead of at quarter level. Third, we include banks' country of origin fixed effects to additionally control for any time-invariant heterogeneity emerging from banks' country-specific characteristics, such as differences in banking regulations.

To ensure that the main results are not dependent on data preparation choices or decisions particular to working with DealScan, we conduct the following checks. First, we run Equation (4) on a sub-sample comprising only credit lines and term loans. These two types are the most common and most important type of loans in the syndicated loan market (Berg et al., 2017; Wix, 2017). Second, we exclude all loans, which are *de facto* no syndicate, as they are arranged by a single lender (Doerr and Schaz, 2021).

In unreported results, we drop each firm, bank, industry, or location sequentially from the regression to verify that our results are not driven by a particular firm, bank, industry, or location. Our findings remain the same.

[17]The Internet Appendix is available upon request.

7.2 Robustness on the role of banks' exposure

Banks' alternative exposure measures In Table A4, we test that results are not driven by outliers or how banks' exposure is defined. In Columns (1) and (5), we winsorize *NegBank* at the 1st percentile. Next, we construct the bank exposure measure in a cumulative manner (Columns (2) and (6)) and on the basis of the average over the full sample period (Columns (3) and (7)). In the regressions, we then use *Positive* and *Negative* constructed in a consistent manner. Finally, we exclude firms from the sample for which we do not have four consecutive observations to construct their firm exposure in Columns (4) and (8). Results are unaffected.

Anticipation effects In anticipation of the Paris Summit, banks might have changed their portfolio compositions to adjust exposure to certain firms or sectors. To show that anticipation effects do not drive the results on the role of banks' exposure in this context, we exclude observations from Q2 2014 to Q3 2015 in the construction of banks' and firms' exposure. Columns (1) and (3) in Table A5 illustrates that results are virtually unchanged.

Securitization Loan securitization poses another challenge for our empirical strategy. If banks sell off the loans after origination, they might not be concerned about firms' regulatory risks. This might imply that *NegBank* is not adequately capturing the exposure of banks' loan portfolios. However, our data preparation process largely mitigates this concern, as our sample encompasses only lead arrangers. They typically retain a fraction of the loans on their balance sheets (Benmelech et al., 2012). Nevertheless, Blickle et al. (2020) outlines that in around 12% of all loans lead banks still sell off their entire loan shares. To therefore fully address this issue, we identify loans that are especially likely to be sold off and exclude them from the sample as well as the construction of banks' exposure. This applies, in particular, to Term B loans and to loans by a syndicate that encompasses at least one Collateralized Loan Obligation at the time of origination.[18] Columns (2) and (4) in Table A5 show that our results hold.

Further robustness In an Internet Appendix, we enrich our estimation set-up with banks' country of origin fixed effects to ensure that our results are not driven, for exam-

[18]Blickle et al. (2020) also highlights that if lead banks sell their shares, they do so shortly after origination.

ple, by differences in banks' regulatory environment. We further show that employing *Bank Exposure* instead of *NegBank* does not lead to different results.

8 Conclusion

This paper provides an assessment of how banks' lending behavior interacts with the need to fund the transition toward a greener economy. Using the Paris Agreement as a shock to banks' prevailing perceptions of regulatory risks related to climate change, this paper sets out to investigate how banks adjust credit supply, depending on firms' regulatory risks and banks' own, indirect exposure. To do so, we rely on detailed, worldwide, loan-level information between 2010 and 2019 enriched with a firm-level measure of regulatory risks.

Robust to various checks, we find large heterogeneity in how banks react to the Paris Agreement, depending on firms' exposure and location. In the United States, banks lend relatively more to firms, which exhibit a negative exposure to regulatory risks. In Europe, in turn, banks shift credit supply to firms, which consider themselves to benefit from future regulation. Investigating whether banks' exposure might lead them to face different incentives when reallocating credit, we find that it only plays a role in Europe. The more negatively exposed a bank is, the more it reacts to the Paris Agreement by lending more to European negatively exposed firms.

Considering the types of firms towards which credit is directed as well as specific bank characteristics provides some indicative evidence on whether banks' credit reallocation hinders or supports the transition. To this end, we exploit variation in the degree of firms' negative exposure as well as their R&D expenditure and in banks' capitalization. These are indicators for firms' likelihood to transition and banks' risk-taking, respectively. In the United States, we find no evidence that credit is directed toward firms that have a higher likelihood to achieve the transition. Moreover, low-capitalized banks appear to exploit lending to negatively exposed firms to boost their profits. In Europe, lending to negatively exposed is shifted toward those firms that have a higher potential to transition. Nevertheless, the more negatively exposed a bank is, the more it supports the most negatively exposed firms. Thus, our findings point toward banks' behavior representing an obstacle for the transition in the United States. In Europe, banks' credit allocation seems to facilitate the transformation of the economy, although their own exposure is a hindering factor.

In a final step, we shed light on the drivers of banks' behavior by investigating whether changes in lending are driven by increased awareness about financial risks associated with regulation related to climate change or shifts in preferences. We find none to marginal shifts in credit supply due to banks' preferences, proxied by public commitments to lend in a sustainable way. However, financial risks, proxied by the ex-ante regulatory stringency, seems to be an important driver of credit allocation. Hence, the risk channel appears to dominate the preference channel. Thus, differences in the existing regulatory environment between the United States and Europe might be determining different reallocation patterns across regions.

Our paper contributes to the literature on the current role of the financial sector in mitigating transition risks: we identify the effect of regulatory risks related to climate change on credit reallocation. We add to this literature by considering how banks respond to firms' regulatory risks on the basis of a measure that captures a forward-looking view from within the firm. Furthermore, being able to differentiate between positively and negatively exposed firms allows to provide a fuller picture of whether banks' credit reallocation hinders or supports the transition to a more sustainable economy. Additionally, previous literature has not focused on the role of banks' exposure in determining these changes.

In addition, this project has important policy implications, as it provides insights on the scope of banking regulation in fostering the transition to a greener economy. A solid empirical understanding of the present serves as the basis for the exploration of possible future policies. Our research evaluates whether and how banks alter their lending behavior on their own accord, highlighting aspects in which regulatory action is needed. We show how important the stringency of the existing regulatory environment is in determining how banks engage in the transition.

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Figures and Tables

Table 1: Variable definitions

Variable name	Description
Loan volume	Outstanding loan volume in million US Dollars between bank b and firm f in quarter t
Post	An indicator for whether the Paris Agreement was already adopted ($Post$=1) or not ($Post$=0)
Agreement	An indicator for the period between the announcement of the Paris Agreement in Q4 2015 and the US announcement of withdrawal in Q2 2017 (*Agreement*=1). In the rest of the sample period (*Agreement*=0)
Firm characteristics	
Positive	An indicator for whether a firm has a positive average pre-shock exposure to regulatory risks
Negative	An indicator for whether a firm has a negative average pre-shock exposure to regulatory risks
VeryNegative	An indicator for whether a firm has a negative average pre-shock exposure to regulatory risks below the 75th percentile
LessNegative	An indicator for whether a firm has a negative average pre-shock exposure to regulatory risks above the 75th percentile
CCExposure	The relative frequency with which bigrams that capture regulation shocks related to climate change are mentioned together with positive and negative tone words
ROA	Ratio of net income to total assets
Equity ratio	Ratio of common equity to total assets
R&D inv. ratio	Research and development expenditure divided by total assets
Capital exp. ratio	Ratio of capital expenditures (additions to fixed assets) to total assets
HighR&D	An indicator if a firm's R&D expenditure ratio is above (*HighR&D*=1) or below (*HighR&D*=0) the 75th percentile of the sample's distribution
Sales ratio	Ratio of net sales to total assets
Bank characteristics	
NegBank	The absolute value of a bank's exposure if its exposure is negative and zero otherwise
Bank Exposure	A bank's loan share to firm f weighted by firm f's exposure to regulatory risks averaged across all firms a bank lends to
Deposit ratio	Ratio of deposits to total assets
ROA	Net income divided by total assets
Equity ratio	Common equity divided by total assets
Retained earnings	Retained earnings divided by total assets
Short-term funding	Ratio of current liabilities to total assets
Non-performing assets	Ratio of non-performing assets to total assets
UNEPMember	An indicator for membership in the United Nations Environmental Programme Finance Initiative (UNEP FI) before the Paris Agreement
LowCapital	An indicator for whether a bank has a capital ratio below the 25th percentile of the sample's distribution
Country or state characteristics	
Target	An indicator for whether a US state had greenhouse gas emission targets before the adoption of the Paris Agreement
HighScore	An indicator for whether a European country had a 2015 climate change performance index above the median

Table 2: Summary statistics

	Mean	SD	P25	Median	P75
Panel A: Bank-firm level					
Loan volume	247.61	403.06	58.57	130.38	271.77
Loan spread	194.64	128.28	104.73	167.54	261.96
Loan maturity	61.23	23.93	53.31	60.00	65.00
Panel B: Firm level					
Positive	0.07	0.25	0.00	0.00	0.00
Negative	0.19	0.40	0.00	0.00	0.00
VeryNegative	0.15	0.35	0.00	0.00	0.00
LessNegative	0.05	0.21	0.00	0.00	0.00
HighR&D	0.30	0.46	0.00	0.00	1.00
CCExposure	-0.02	0.07	-0.01	0.00	0.00
Total assets (bio)	10.01	27.60	0.77	2.35	7.27
ROA	3.83	9.20	1.74	4.73	7.99
Equity ratio	41.87	18.60	28.32	41.62	54.63
R&D inv. ratio	0.47	0.96	0.00	0.00	0.38
Capital exp. ratio	0.44	0.55	0.11	0.26	0.53
Sales ratio	25.04	18.37	12.65	20.74	32.13
Panel C: Bank level					
Bank Exposure	-0.00	0.01	-0.00	-0.00	-0.00
Total assets (bio)	751.85	799.16	143.53	379.98	1420.62
Deposit ratio	58.52	16.90	48.38	62.00	71.95
ROA	0.17	0.19	0.05	0.19	0.31
Equity ratio	7.46	2.41	5.16	7.55	9.46
Retained earnings	3.93	2.71	2.16	3.17	5.57
Short-term funding	6.12	6.13	1.08	4.37	8.77
Non-performing assets	1.71	1.50	0.64	1.14	2.27
USBank	0.32	0.47	0.00	0.00	1.00
EuropeanBank	0.34	0.48	0.00	0.00	1.00
UNEPMember	0.40	0.50	0.00	0.00	1.00
LowCapital	0.15	0.36	0.00	0.00	0.00

Note: This table provides summary statistics for relevant variables at bank-firm level in Panel A, at firm level in Panel B, and at bank level in Panel C. All means are constructed over the full sample period. See Table 1 for variable definitions.

Table 3: Industry distribution of firms' exposure

	Mean	SD	Median	# of firms
Top-5 Industries				
49 Electric, Gas and Sanitary Svcs.	-0.194	0.308	-0.051	119
76 Miscellaneous Repair Svcs.	-0.110	0.164	-0.031	3
12 Coal Mining	-0.057	0.054	-0.063	11
45 Transportation by Air	-0.034	0.056	0.000	14
34 Fabricated Metal Prdcts	-0.028	0.073	0.000	25
Bottom-5 Industries				
56 Apparel and Accessory Stores	0.001	0.005	0.000	25
59 Miscellaneous Retail	0.001	0.006	0.000	48
25 Furniture and Fixtures	0.001	0.004	0.000	10
22 Textile Mill Prdcts	0.002	0.005	0.000	6
72 Personal Svcs.	0.002	0.007	0.000	8

Note: This tabel reports firms' average pre-shock exposure measure ($\overline{CCExposure}_f \times 10^3$) for the top-5 and bottom-5 industries at the two-digit SIC level. We rank sectors by the average values of the regulatory exposure measure.

Table 4: Parallel trends

	Negative exposure		*Zero exposure*		*Positive exposure*		*Normalized difference*		
	Mean	SD	Mean	SD	Mean	SD	Neg-No	Neg-Pos	Pos-No
Panel A: Bank-firm level									
Loan volume (Mio)	288.488	522.760	243.387	500.374	350.891	591.596	0.06	-0.08	0.14
Δ Loan volume	34.321	587.766	25.788	246.517	59.846	1,884.898	0.01	-0.01	0.02
Δ Loan spread	7.665	46.264	5.972	44.062	9.357	99.586	0.03	-0.02	0.03
Δ Loan maturity	3.474	38.281	2.024	16.465	2.577	19.106	0.04	0.02	0.02
Panel B: Firm level									
Δ Total assets	19.319	91.174	21.799	98.343	27.191	120.859	-0.02	-0.05	0.04
Δ ROA	-18.944	331.098	-6.196	310.938	-31.540	276.695	-0.03	0.03	-0.06
Δ Equity ratio	-5.305	65.717	-6.149	93.566	-9.704	91.192	0.01	0.04	-0.03
Δ R&D inv. ratio	-10.444	66.177	-3.917	49.688	-4.171	29.435	-0.08	-0.09	-0.00
Δ Capital exp. ratio	18.519	157.102	37.040	218.177	28.964	233.113	-0.07	-0.04	-0.03
Δ Sales Ratio	2.102	14.068	4.999	42.894	0.900	8.069	-0.06	0.07	-0.09
Panel C: Bank level									
Δ Total assets	2.018	8.826	2.368	9.308	2.167	9.227	-0.03	-0.01	-0.02
Δ Deposit ratio	3.156	2.442	3.415	2.338	3.350	2.415	-0.08	-0.06	-0.02
Δ ROA	112.684	941.256	74.939	859.487	78.977	827.443	0.03	0.03	0.00
Δ Equity ratio	5.316	10.489	5.932	11.214	6.181	9.953	-0.04	-0.06	0.02
Δ Retained earnings	4.083	63.416	4.127	60.868	7.435	10.995	-0.00	-0.05	0.05
Δ Short-term funding	9.580	154.264	12.344	150.408	1.794	23.732	-0.01	0.05	-0.07
Δ Non-performing assets	91.255	787.057	109.185	854.029	90.854	787.102	-0.02	0.00	-0.02

Note: This table shows summary statistics of relevant variables at the bank-firm level in Panel A, at the firm level in Panel B, and at the bank-firm level in Panel C for each of the three subgroups of firms in the analysis: negatively exposed, non-exposed, and positively exposed firms. The last three columns report normalized differences between negatively-exposed and non-exposed firms in Column (8), negatively exposed and positively exposed firms in Column (9), and non-exposed and positively exposed firms in Column (10). All means are constructed over the pre-shock period between Q1 2010 and Q3 2015. Besides *Loanvolume* which is in millions of US dollars, all other variables are average annual percentage changes.

Table 5: Parallel trends: Negatively exposed vs. non-negatively exposed banks

	NegBank		*Non-NegBank*		*Normalized difference*
	Mean	SD	Mean	SD	Neg-No
Panel A: Bank-firm level					
Loan volume (Mio)	267.950	519.171	68.279	99.346	0.38
Δ Loan volume	31.626	685.300	4.969	51.226	0.04
Δ Loan spread	6.812	52.660	1.251	18.646	0.10
Δ Loan maturity	2.480	24.865	2.353	9.552	0.01
Panel B: Bank-firm level					
Δ Total assets	15.590	72.966	11.509	21.795	0.05
Δ ROA	-14.861	260.760	-51.984	325.739	0.09
Δ Equity ratio	-3.026	76.407	-1.559	84.315	-0.01
Δ R&D inv. ratio	-0.884	64.461	22.037	102.501	-0.19
Δ Capital exp. ratio	20.146	172.925	22.045	112.016	-0.01
Δ Sales ratio	2.117	19.725	9.397	48.285	-0.14
Panel C: Bank level					
Δ Total assets	6.623	8.701	4.297	3.971	0.24
Δ Deposit ratio	1.973	3.553	1.400	1.908	0.14
Δ ROA	168.477	1,070.281	13.352	79.576	0.15
Δ Equity ratio	1.613	21.536	5.642	2.791	-0.19
Δ Retained earnings	-36.067	207.100	-3.801	51.939	-0.15
Δ Short-term funding	118.278	477.440	174.055	396.938	-0.09
Δ Non-performing assets	276.054	1,298.695	-14.975	26.173	0.23

Note: This table shows summary statistics of relevant variables at the bank-firm level in Panel A, at the bank-firm level in Panel B, and at the bank level in Panel C for two subgroups of banks respectively: Negatively exposed banks and banks are not exposed or positively exposed. The last column reports normalized differences between the negatively and non-negatively exposed banks. All means are constructed over the pre-shock period between Q1 2010 and Q3 2015. Besides *Loan volume*, which is in millions of US dollars, all other variables are average annual percentage changes.

Table 6: The effect of regulatory risks on lending: Regional differences

	(1) All	(2) USA	(3) Europe	(4) ROW
Positive × Post	0.128	-0.094	0.519***	-0.012
	(0.097)	(0.126)	(0.114)	(0.102)
Negative × Post	0.164***	0.176***	0.055	0.124
	(0.048)	(0.060)	(0.112)	(0.107)
Observations	299,550	162,394	93,805	40,325
Bank-Firm FE	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.912	0.890	0.906	0.926
Number of banks	261	96	148	160
Number of firms	2,155	1,637	295	218
Clustering	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their credit supply following the Paris Agreement, as specified in Equation (4). The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the time period after the adoption of the Paris Agreement. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at bank level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Impact of Trump's election and withdrawal announcement in the United States

	(1) Only Obama period	(2) Only Trump period	(3) Until announcement	(4) USA in Agreement
Positive × Post	-0.089	-0.091	-0.066	
	(0.085)	(0.124)	(0.092)	
Negative × Post	0.161***	0.153**	0.167***	
	(0.044)	(0.066)	(0.049)	
Positive × Agreement				-0.057
				(0.050)
Negative × Agreement				0.068**
				(0.031)
Observations	97,211	143,343	106,900	162,394
Bank-Firm FE	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.908	0.888	0.907	0.890
Number of banks	92	96	94	96
Number of firms	1,515	1,634	1,540	1,637
Clustering	Bank	Bank	Bank	Bank

Note: This table investigates the impact of the election of President Trump in the United States in Q4 2016 and the withdrawal announcement from the Paris Agreement in Q2 2017 on banks' credit supply in the sub-sample of US firms. The regression is estimated as specified in Equation (4). The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the period following the the announcement of the Paris Agreement. In Column (1), the post-shock period ends in Q3 2016. Hence, the effect captured by the interaction terms is estimated during the last quarters of the Obama Administration. In Column (2), the period between Q4 2015 and Q3 2016 is left out of the analysis. Hence, the impact of the treatment is estimated during the Trump Administration. In Column (3), the sample is cut in Q2 2017, i.e. before the announcement of withdrawal from the Paris Agreement. $Agreement_t$, as used in the specification in Column (4), is defined as indicating the period between the announcement of the Paris Agreement in Q4 2015 and the announcement of withdrawal from the agreement in Q2 2017. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at bank level and reported in parentheses. $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

Table 8: Loan and firm controls

	(1) USA	(2) USA	(3) Europe	(4) Europe
Positive × Post	-0.056	-0.010	0.439***	0.366***
	(0.124)	(0.072)	(0.105)	(0.079)
Negative × Post	0.150***	0.106**	0.031	0.282
	(0.057)	(0.049)	(0.097)	(0.186)
Loan Spread	-0.000		0.001**	
	(0.000)		(0.000)	
Loan Maturity	-0.011***		-0.007***	
	(0.002)		(0.001)	
ROA		-0.001		0.024***
		(0.002)		(0.006)
Equity ratio		-0.003*		0.004
		(0.002)		(0.008)
R&D inv. ratio		0.048		1.010***
		(0.032)		(0.189)
Capital exp. ratio		-0.007		0.081***
		(0.006)		(0.019)
Sales ratio		-0.005**		0.028***
		(0.002)		(0.007)
Observations	159,017	62,908	92,452	35,412
Bank-Firm FE	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.892	0.912	0.912	0.929
Number of banks	92	84	148	122
Number of firms	1,621	1,301	292	182
Clustering	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their credit supply following the Paris Agreement, as specified in Equation (4). In Columns (1) and (3), the baseline regression is expanded to include controls for loan characteristics such as the average spread and maturity at the bank-firm-quarter level. In Columns (2) and (4), the estimation saturated with lagged time-varying firm characteristics: Equity ratio, ROA, R&D investment ratio, capital expenditure ratio and sales ratio. The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the time period after the adoption of the Paris Agreement. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at the bank level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: The differential role of banks' own exposure

	(1) All	(2) USA	(3) Europe	(4) ROW
Positive × Post	0.127	-0.111	0.507***	0.014
	(0.098)	(0.134)	(0.113)	(0.101)
Positive × Post × NegBank	0.288	119.980	10.244	-90.690
	(15.270)	(108.050)	(18.535)	(76.847)
Negative × Post	0.154***	0.176***	0.029	0.119
	(0.046)	(0.060)	(0.106)	(0.103)
Negative × Post × NegBank	22.460***	-3.912	25.324***	-4.629
	(8.237)	(9.188)	(9.639)	(23.384)
Marginal effect at 90th percentile of NegBank				
Positive × Post		1.729	0.664**	
		(1.592)	(0.291)	
Negative × Post		0.116	0.418**	
		(0.163)	(0.182)	
Observations	299,550	162,394	93,805	40,325
Bank-Firm FE	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.912	0.890	0.906	0.926
Number of banks	261	96	148	160
Number of firms	2,155	1,637	295	218
Clustering	Bank	Bank	Bank	Bank

Note: This table explores whether banks adjust their credit supply following the Paris Agreement differentially depending on their own exposure to the shock, as specified in Equation (5). The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the time period after the adoption of the Paris Agreement. $NegBank_b$ takes on the value of bank b's exposure if $Bank\ Exposure_b$ is negative and takes a value of zero if bank b's exposure is zero or positive, the absolute value of the exposure is used to simplify the interpretation. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at bank level and reported in parentheses.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 10: Does banks' behavior fuel or hinder the transition?

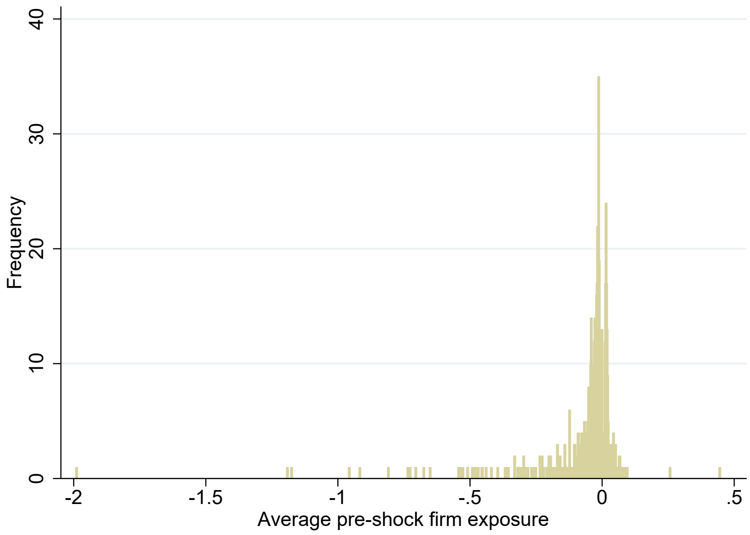
	(1) USA	(2) USA	(3) USA	(4) Europe	(5) Europe
Positive × Post	-0.110	-0.093	-0.115	0.503***	0.399***
	(0.135)	(0.139)	(0.156)	(0.111)	(0.131)
Positive × Post × NegBank	114.725	121.323	142.436	13.404	16.786
	(111.034)	(107.788)	(135.855)	(19.156)	(20.594)
Positive × Post × HighR&D		-0.035			
		(0.202)			
Positive × Post × LowCapital			-0.072		0.002
			(0.074)		(0.096)
VeryNegative × Post	0.162**			-0.013	
	(0.064)			(0.112)	
VeryNegative × Post × NegBank	-2.618			32.975**	
	(9.704)			(13.147)	
LessNegative× Post	0.210*			0.314***	
	(0.108)			(0.108)	
LessNegative× Post × NegBank	-190.181			5.915	
	(213.348)			(11.661)	
Negative × Post		0.153***	0.141**		0.023
		(0.056)	(0.058)		(0.131)
Negative × Post × NegBank		-4.125	-6.489		17.682
		(9.194)	(8.414)		(12.525)
Post × HighR&D		-0.034			
		(0.068)			
Negative × Post × HighR&D		0.064			
		(0.132)			
Negative × Post × LowCapital			0.086**		-0.066
			(0.040)		(0.043)
Observations	162,394	160,389	145,470	93,805	66,064
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.890	0.891	0.889	0.907	0.906
Number of banks	96	96	59	148	74
Number of firms	1,637	1,624	1,582	295	275
Clustering	Bank	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their behavior following the Paris Agreement depending on firms' degree of negative exposure and R&D expenditures as well as banks' capitalization. We run the regressions as specified in Equation (5). The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $VeryNegative_f$ indicates if firm f has a negative exposure above the 75th percentile of the negative exposure distribution. $LessNegative_f$ indicates if firm f has a negative exposure below the 75th percentile. $Post_t$ indicates the time period after the adoption of the Paris Agreement. $NegBank_b$ takes on the value of bank b's exposure if $Bank\ Exposure_b$ is negative and takes a value of zero if bank b's exposure is zero or positive, the absolute value of the exposure is used to simplify the interpretation. *HighR&D* is an indicator for firms with an R&D expenditure ratio above the the 75th percentile. $LowCapital_b$ is an indicator for bank's capital ratio lower than the 25th percentile. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at bank level and reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

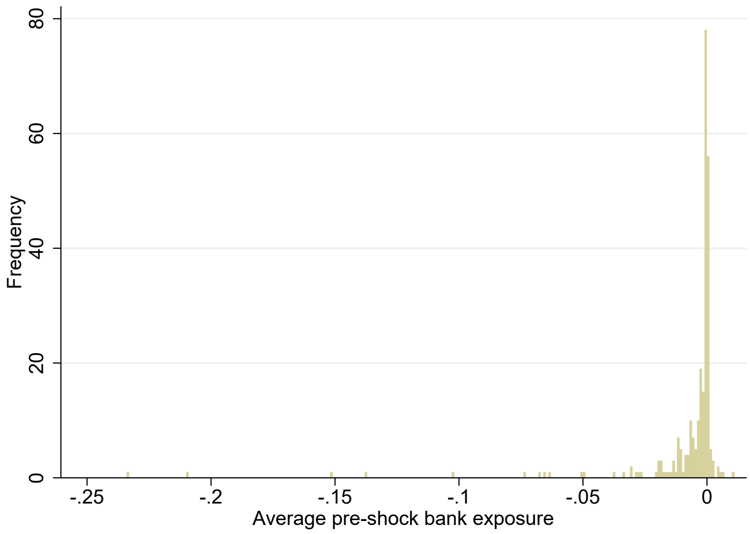
Table 11: The drivers of banks' behavior

	(1) USA	(2) USA	(3) Europe	(4) Europe
Positive × Post	-0.100	-0.095	0.424***	0.410***
	(0.131)	(0.165)	(0.125)	(0.134)
Positive × Post × NegBank	130.351	117.438	18.547	7.748
	(107.777)	(110.243)	(18.729)	(18.844)
Positive × Post × UNEPMember	-0.038		0.141*	
	(0.075)		(0.081)	
Positive × Post × Target		-0.039		
		(0.154)		
Positive × Post × HighScore				-0.346
				(0.261)
Negative × Post	0.176***	0.162***	-0.004	0.445***
	(0.062)	(0.055)	(0.106)	(0.138)
Negative × Post × NegBank	-3.899	-4.225	26.931***	22.355***
	(9.253)	(9.072)	(9.896)	(8.377)
Negative × Post × UNEPMember	-0.002		0.058	
	(0.033)		(0.043)	
Negative × Post × Target		0.049		
		(0.162)		
Negative × Post × HighScore				-1.072***
				(0.154)
Observations	162,394	162,394	93,805	91,490
Bank-Firm FE	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.890	0.890	0.907	0.907
Number of banks	96	96	148	147
Number of firms	1,637	1,637	295	284
Clustering	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their behavior following the Paris Agreement depending on banks' public commitment to sustainable lending and the stringency of climate change policies. We run the regressions as specified in Equation (5). The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the time period after the adoption of the Paris Agreement. $NegBank_b$ takes on the value of bank b's exposure if $Bank\ Exposure_b$ is negative and takes a value of zero if bank b's exposure is zero or positive, the absolute value of the exposure is used to simplify the interpretation. $UNEPMember_b$ is an indicator for banks' membership in the UNEP FI before the Paris Agreement. $Target_c$ is an indicator for US states having emission targets before the Paris Agreement. $HighScore_c$ is an indicator for European countries having a 2015 Climate Change Performance Index above the median. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at bank level and reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.



(a) The distribution of ex-ante firms' exposure



(b) The distribution of ex-ante banks' exposure

Figure 1: The distribution of firms' and banks' exposure

Note: Panel (a) shows the distribution of firms' ex-ante exposure to the Paris shock, $CCExposure_f \times 10^3$ averaged at the firm level. It is constructed as in Equation (1). The bin size is 0.002 and non-exposed firms are not included in the graph to better observe the distribution of exposed firms. The baseline sample includes 1,723 firms with an exposure of zero, 157 positively exposed firms and 450 negatively exposed firms. Panel (b) shows the distribution of banks' average ex-ante exposure to the Paris shock, $Bank\ Exposure_b$, at the bank level. It is constructed as in Equation (3). The bin size is 0.001 and the highest bar is not the one including the non-exposed, it includes the marginally negatively exposed banks (i.e. from -0.001 to 0 not included). The sample includes 50 banks with a exposure of zero.

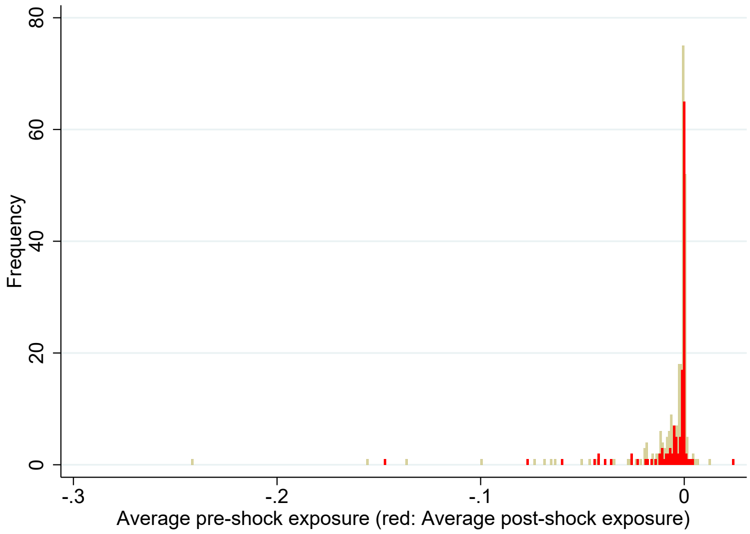


Figure 2: The distribution of banks' exposure before and after the Paris Agreement

Note: This figure shows the distribution of banks' average exposure over the pre-shock period (yellow) as well as over post-shock period (red) at the bank level. It is constructed as in Equation (3) however averaged across the period before and after the Paris Agreement respectively. Firms' exposure is held constant. For better visualization, one bank is dropped from the underlying sample.

Appendix

Table A1: Alternative exposure measures + control group

	(1) USA Cumulative	(2) USA Full	(3) USA 4Seq	(4) USA Only Exposed	(5) Europe Cumulative	(6) Europe Full	(7) Europe 4Seq	(8) Europe Only Exposed
Post × Positive	-0.094	-0.023	-0.094		0.519***	0.406***	0.518***	
	(0.126)	(0.107)	(0.126)		(0.114)	(0.114)	(0.115)	
Post × Negative	0.176***	0.159***	0.177***	0.439***	0.055	-0.051	0.052	-0.671***
	(0.060)	(0.060)	(0.060)	(0.118)	(0.112)	(0.077)	(0.122)	(0.206)
Observations	162,394	162,394	161,538	50,100	93,805	93,805	93,408	37,331
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.890	0.890	0.890	0.886	0.906	0.906	0.906	0.907
Number of banks	96	96	95	56	148	148	147	100
Number of firms	1,637	1,637	1,624	404	295	295	290	89
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their credit supply following the Paris Agreement, as specified in Equation (4). Panel A and B report results for the samples of US and European firms respectively. The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. Both variables are constructed on the basis of a cumulative exposure measure in Columns (1) and (5) or on the basis of the average exposure over the full period in Columns (2) and (6). In Columns (3) and (7), we exclude firms for which we do not have 4 consecutive observations to construct $\overline{CCExposure}_f$. $Post_t$ indicates the time period after the adoption of the Paris Agreement. In Columns (4) and (8), non-exposed firms are dropped. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at bank level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Fixed effects cascades

	(1) USA	(2) USA	(3) USA	(4) USA	(5) Europe	(6) Europe	(7) Europe	(8) Europe
Positive × Post	-0.002	-0.080***	-0.092***	-0.094	-0.138**	-0.141***	-0.156***	0.519***
	(0.043)	(0.026)	(0.027)	(0.126)	(0.055)	(0.050)	(0.053)	(0.114)
Positive	-0.121**				0.545***			
	(0.049)				(0.054)			
Negative × Post	0.040	0.090***	0.067***	0.176***	0.091**	0.020	0.028	0.055
	(0.033)	(0.022)	(0.018)	(0.060)	(0.036)	(0.026)	(0.029)	(0.112)
Negative	0.174***				0.207***			
	(0.040)				(0.035)			
Post	0.405***	0.375***			0.075**	-0.087***		
	(0.026)	(0.023)			(0.029)	(0.023)		
Observations	162,394	162,394	162,394	162,394	93,805	93,805	93,805	93,805
Bank-Firm FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Bank-Time FE	No	No	Yes	Yes	No	No	Yes	Yes
ILST FE	No	No	No	Yes	No	No	No	Yes
Adjusted R^2	0.038	0.799	0.818	0.890	0.025	0.813	0.818	0.906
Number of banks	96	96	96	96	148	148	148	148
Number of firms	1,637	1,637	1,637	1637	295	295	295	295
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their credit supply following the Paris Agreement, as specified in Equation (4) for the sub-sample of US and European firms. The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the time period after the adoption of the Paris Agreement. Industry-location-size-time, bank-time, as well as bank-firm fixed effects are introduced sequentially from Column (2) in the US sample, and from Column (6) for the European sample, onward. Standard errors are clustered at bank level, except for Columns (1) and (5) where no fixed effects scheme is applied, and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Timing and location of regulation, anticipation effects and greenwashing

	(1) USA Timing	(2) USA Location	(3) USA Anticipation	(4) USA Greenwash	(5) Europe Timing	(6) Europe Location	(7) Europe Anticipation	(8) Europe Greenwash
Positive × Post	-0.015	-0.061	-0.094	-0.136	0.768***	0.447***	0.519***	0.412***
	(0.130)	(0.122)	(0.126)	(0.211)	(0.110)	(0.115)	(0.114)	(0.133)
Negative × Post	0.180***	0.179***	0.176***	0.278***	0.171	0.071	0.055	-0.477***
	(0.058)	(0.061)	(0.060)	(0.077)	(0.116)	(0.113)	(0.112)	(0.075)
Observations	146,951	152,041	162,394	75,767	86,992	84,850	93,805	34,617
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.896	0.888	0.890	0.890	0.908	0.899	0.906	0.885
Number of banks	92	93	96	76	137	144	148	92
Number of firms	1,588	1,604	1,637	537	286	293	295	92
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their credit supply following the Paris Agreement, as specified in Equation (4). In Columns (1) and (5), the estimation is conducted on a sub-sample encompassing only loans with a minimum maturity of three years. In Columns (2) and (6), the baseline regression is estimated on a sub-sample that excludes loans by subsidiaries that are not located in the same country as the parent. In Columns (3) and (7), exposures are constructed on the basis of $\overline{CCExposure}_f$ that, in contrast to the baseline, rests on a shortened pre-shock period ending in Q1 2014. In Columns (4) and (8), estimation is conducted only on the sub-sample of firms that are listed at multiple exchanges. The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the time period after the adoption of the Paris Agreement. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at the bank level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Bank: Alternative exposure measures

	(1) USA Winsorized	(2) USA Cumulative	(3) USA Full	(4) USA 4Sequ	(5) Europe Winsorized	(6) Europe Cumulative	(7) Europe Full	(8) Europe 4Sequ
Positive × Post	-0.111	-0.112	-0.033	-0.110	0.507***	0.509***	0.389***	0.505***
	(0.134)	(0.136)	(0.112)	(0.134)	(0.113)	(0.113)	(0.114)	(0.114)
Positive × Post × NegBank	119.980	6.565	85.257	118.905	10.244	0.420	14.235	10.221
	(108.050)	(5.924)	(130.292)	(109.027)	(18.535)	(0.958)	(14.169)	(18.534)
Negative × Post	0.176***	0.176***	0.160***	0.177***	0.029	0.034	-0.061	0.025
	(0.060)	(0.060)	(0.059)	(0.060)	(0.106)	(0.107)	(0.077)	(0.116)
Negative × Post × NegBank	-3.912	-0.176	-14.893	-3.980	25.324***	1.178**	16.784***	25.369***
	(9.188)	(0.426)	(12.920)	(9.186)	(9.639)	(0.530)	(5.526)	(9.656)
Observations	162,394	162,394	162,394	161,538	93,805	93,805	93,805	93,408
Bank-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.890	0.890	0.890	0.890	0.906	0.906	0.906	0.906
Number of banks	96	96	96	95	148	148	148	147
Number of firms	1,637	1,637	1,637	1,624	295	295	295	290
Clustering	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their credit supply following the Paris Agreement differentially depending on their own exposure to the shock, as specified in Equation (5). The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the time period after the adoption of the Paris Agreement. $NegBank_b$ takes on the value of bank b's exposure if $Bank\ Exposure_b$ is negative and takes a value of zero if bank b's exposure is zero or positive, the absolute value of the exposure is used to simplify the interpretation. In Columns (1) and (5), $NegBank_b$ is winsorized at the 1st percentile. In Columns (2)/(6) and (3)/(7), exposures are constructed on cumulative measures and on averages for the full period respectively. In Columns (4) and (8), we exclude firms for which we do not have 4 consecutive observations to construct $\overline{CCExposure}_f$. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at bank level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Bank: Anticipation effects and securitization

	(1) USA	(2) USA	(3) Europe	(4) Europe
Positive × Post	-0.111	-0.045	0.507***	0.519***
	(0.134)	(0.123)	(0.113)	(0.117)
Positive × Post × NegBank	119.980	114.035	10.244	8.269
	(108.050)	(80.679)	(18.535)	(18.064)
Negative × Post	0.176***	0.131***	0.029	0.032
	(0.060)	(0.044)	(0.106)	(0.106)
Negative × Post × NegBank	-3.912	-5.790	25.324***	24.581**
	(9.188)	(8.869)	(9.639)	(9.537)
Observations	162,394	152,070	93,805	92,622
Bank-Firm FE	Yes	Yes	Yes	Yes
Bank-Time FE	Yes	Yes	Yes	Yes
ILST FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.890	0.898	0.906	0.911
Number of banks	96	93	148	146
Number of firms	1,637	1,615	295	296
Clustering	Bank	Bank	Bank	Bank

Note: This table explores how banks adjust their credit supply following the Paris Agreement, as specified in Equation (5). The dependent variable is the log of outstanding credit at bank-firm-quarter level. $Positive_f$ assumes a value of one if firm f has a positive exposure to regulatory risks and zero otherwise. $Negative_f$ assumes a value of one if firm f has a negative exposure to regulatory risks and zero otherwise. $Post_t$ indicates the time period after the adoption of the Paris Agreement. $NegBank_b$ takes on the value of bank b's exposure if $Bank\ Exposure_b$ is negative and takes a value of zero if bank b's exposure is zero or positive, the absolute value of the exposure is used to simplify the interpretation. In Columns (1) and (3), Q2 2014 until Q3 2015 are excluded from the construction of banks' and firms' exposure. In Columns (2) and (4), we exclude loans that are likely to be securitized. Each specification includes bank-firm, bank-time, as well as industry-location-size-time fixed effects. Standard errors are clustered at bank level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

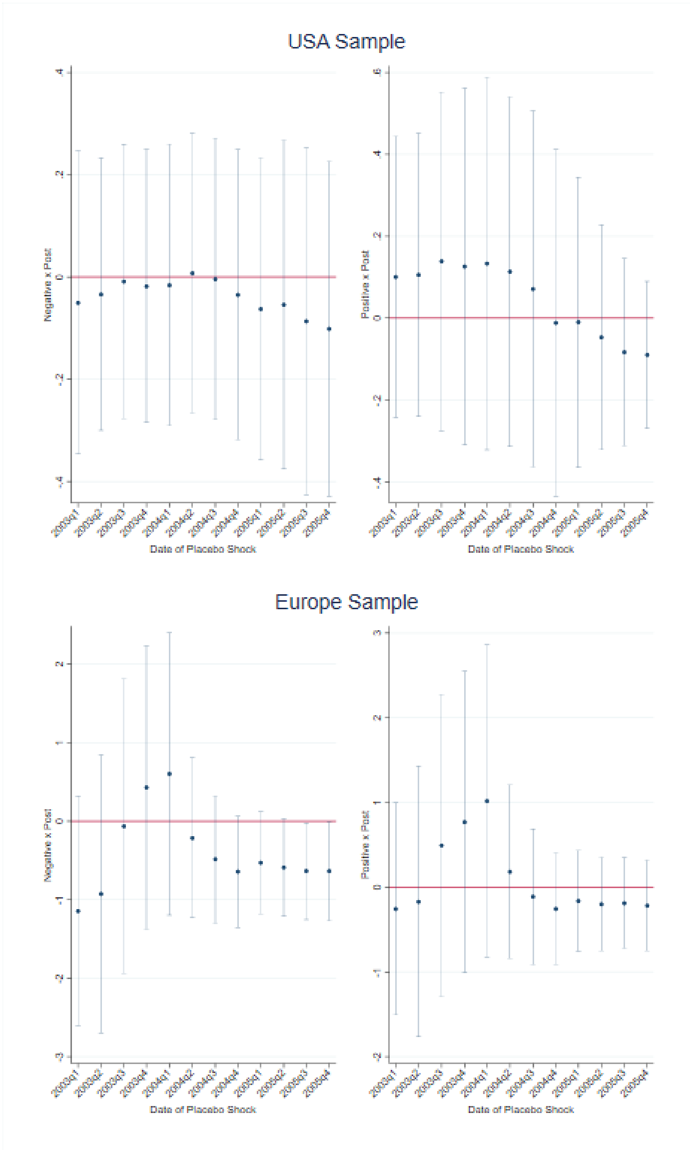


Figure A1: Placebo tests

Note: This figure illustrates the results of several placebo tests in which the shock is simulated to hit at different points in time. For each sub-sample, the estimated coefficient for $Positive_f \times Post_t$, $Negative_f \times Postt$, and 95% confidence bands are plotted for twelve alternative placebo shocks in each quarter between Q1 2003 and Q4 2005. For each placebo test, we use a sample of bank-firm level observations for the banks and firms in our respective baseline sample for a period that predates the time frame employed in our analysis (Q1 2002 to Q4 2007).

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Isabella Mueller

Halle Institute for Economic Research; email: Isabella.Mueller@iwh-halle.de

Eleonora Sfrappini

Halle Institute for Economic Research; email: Eleonora.Sfrappini@iwh-halle.de

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.ecb.europa.eu

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