Measurement and Effects of Bank Exit Policies*

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January 13, 2024

Abstract

We study whether exit policies by financial institutions have financial and real consequences on the firms they target, using bank coal exit policies as a laboratory. In contrast to theories assuming high capital substitutability, we find large effects of these policies. Bank exit policies negatively affect both the financing and operation of coal assets. Substitution to other sources and providers of capital appears to be limited. Coal power plants owned by firms exposed to bank exit policies are more likely to be retired, translating into lower CO2 emissions. Exit policies have reduced coal CO2e emissions by an estimated one gigaton.

*We are indebted to Sayyam Mubeen, Jiawei Fan, Jipeng Liu, and James Blume for outstanding research assistance. We thank Ian Appel (discussant), Malcolm Baker, Jonathan Karpoff (discussant), Jacopo Ponticelli, Paola Sapienza, Adi Sunderam, Luke Taylor, Ivan Ivanov (discussant), Victoria Ivashina, conference and seminar participants at NBER Corporate Finance, USC FOM conference, Colorado Finance Summit, Harvard Business School, UT Austin, University of Houston, Texas A&M, University of Wyoming, Australian National University, Johns Hopkins University, University of Rochester, University of Illinois Urbana-Champaign, INSEAD, and HEC Paris for their suggestions. We are grateful to Reclaim Finance, in particular to Yann Louvel, for insightful discussions and facilitating data access. All errors are ours only.

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Our banking relationships are strong, we are really well supported. That might come as a little bit of a surprise to people who aren't familiar with coal.

Kevin Ball, CFO of Whitehaven Coal, **2020**

It is increasingly difficult being a coal producer to attract external funding.

Kevin Ball, CFO of Whitehaven Coal, **2023**

1 Introduction

Business are increasingly expected to take actions toward addressing societal challenges, with potentially easier implementation than regulatory or individual actions. Among private actors, financial institutions are highlighted as disproportionately important, given their central role in allocating capital across economic activities.

Most prominently, facing unprecedented pressure from activists, investors, and even regulators, a broad set of financial institutions have begun to enact fossil fuel exit policies, also known as divestment policies in an investing context. In these policies, institutions such as endowments, asset managers, banks, and insurance companies pledge to limit, phase out, or stop altogether intermediating or investing capital in producers and heavy users of fossil fuels. Given the growing adoption of exit policies and public interest in business initiatives to pursue non-financial goals, it is important to understand whether such policies are achieving their stated goals. Do they affect the supply of capital to the fossil fuel industry? If so, to what extent does this affect operations of carbon-intensive activities and reduce carbon emissions?

Theoretically, exit policies from major capital providers should reduce the supply of capital to targeted projects and firms, resulting in an increase in their cost of funding and/or a rationing of their access to capital. However, material effects can only be realized if substitution to other sources of capital is limited. Further, the extent to which reductions in capital supply have real effects depends on the output sensitivity to funding cost and quantity for the industry. It is thus ultimately an empirical question whether these policies have significant financial and real impacts and in what settings.

In this paper, we aim to answer this question by studying the impact of bank exit policies targeting the global coal industry. Due to its high carbon intensity, coal is the main target of bank exit policies aiming at reducing global carbon emissions. The coal industry also represents the ideal setting for exit policies by debt capital providers to have an impact because it is highly capital intensive and heavily relies on debt for funding that is either issued or underwritten by banks. A dependence on relationship-based bank-intermediated borrowing, combined with the large amount of capital required for coal projects, should make it particularly difficult for companies to find replacement capital when their relationship lenders enact exit policies. If divestment has any effects, they should be observable in the coal industry. Our results should bear some external validity to other industries that are similarly similarly capital intensive and dependent on bank-intermediated financing.

We first develop a comprehensive set of strength measures to capture the rich heterogeneity and multi-dimensionality of the coal exit policies announced by banks across the world. We identify bank characteristics that are predictive of policy adoption and strength. Bank size is the main determinant of policy adoption and strength. Indeed, we estimate that banks that have to date adopted coal exit policies were previously providing 60% of the coal industry's debt financing. This suggests such policies have the potential to significantly constrain the supply of capital to the industry. Bank ESG ratings and geography further explain variation in exit policies. In contrast, characteristics of banks' coal portfolios do not predict policy strength.

We next document that bank exit policies affect their supply of capital to coal firms. Bank intermediation of credit to coal companies declines significantly after a bank adopts a coal policy, and measures of the policy's strength further predict the decline in the bank's supply of capital to the coal industry.[1] To establish causality and rule-out a demand-based mechanism, we run econometric specifications that include borrower-year fixed effects. We find that banks with strong exit policies provide significantly less financing to a given firm in a given year than banks that have weak or no exit policies.

[1]This is in contrast to the findings of Haushalter et al. (2023), who study earlier bank exit polices related to mountaintop removal mining, and find no evidence banks adopting such policies reduce lending to targeted firms.

These policies significantly affect coal firms' ability to raise capital. To provide causal identification, we construct a shift-share instrument for exposure to coal exit policies based on borrowers' banking relationships–measured before the adoption of these policies–as well as the timing and strength of their subsequent adoption. This instrument is motivated by the stickiness of banking relationships and the fact that they were formed prior to the development of coal exit policies. We then regress firms' debt issuance on this instrument in a panel setting and find a significant reduction in the debt issuance of firms that are exposed to bank exit policies. The magnitude of this effect is large: a one standard deviation increase in exposure to exit policies results in a 20% reduction in annual debt issuance. These effects are more pronounced for small firms, mining firms, and firms whose activities are concentrated on coal. There is limited evidence that firms are able to substitute away from exiting lenders and obtain replacement capital from non-exiting lenders or equity markets, an important concern around the effectiveness of such policy. Consistently, borrowers exposed to bank exit policies also reduce their overall long-term debt.

Finally, we find evidence that bank exit policies are also affecting real activity in the coal sector. At the firm level, borrowers more exposed to bank exit policies exhibit a contraction of their total assets. More strikingly, we show that in a large sample of coal-fired power plants, those with parent companies more exposed to bank exit policies are more likely to be decommissioned in the years following the 2015 Paris Climate Agreement. Consistently, carbon emissions decrease for plants owned by firms exposed to exit policies. These reductions come not only from plant retirement, but also from operating plants decreasing their emissions. Overall, our results show that the existence and strength of these policies matter and generate material effects aligned with their stated goals. A back-of-the-envelope calculation suggests that current bank exit policies are responsible for a cumulative reduction in greenhouse gas emissions from coal power plants of one gigaton CO2e over the 2015-2021 period, which is equivalent to the lifetime emissions of 20 million gasoline-powered vehicles.[2]

[2] Buberger et al. (2022) estimates the lifecycle emissions of a VW Passat 2.0 TSI is 49.6 tons CO2e.

Our empirical strategy identifies causal effects of bank coal policies under only weak assumptions on the joint determinants of banks' coal policies and coal borrowers' relationship exposure to these banks.[3] The variation in our shift share instrument is driven by variation in bank-borrower historic relationships as well as by variation in the strength and timing of banks' coal exit policies. Our main specification, which employs borrower-country by year fixed effects, ensures our estimates are unbiased by the concurrent evolution of coal borrower credit demand and bank policy strength at the country level. Potential bias could emerge if, within a country, coal borrowers with declining demand for credit, or facing declining credit supply unrelated to bank divestment, have stronger ex-ante relationships with banks that eventually adopt strong exit policies. However, although our analysis shows that coal exit policies can be, to a degree, predictable, they are not predicted by any preexisting trends in banks' coal portfolios or growth in credit issuance of their relationship coal borrowers. These facts substantially limit the extent to which variation in bank exit policy strength can be endogenously related to *changes* in borrower outcomes, our main identifying assumption. We thus interpret our results as robust, causal evidence of the impact of bank exit policies on the financial and operating activities of coal companies.

This paper connects to several strands of the literature. First, our paper contributes to the burgeoning literature on how investors and financial institutions pursue non-financial objectives. Such objectives include pro-social ones, as in this study, but may also cover political ones (Siriwardane et al., 2023). This literature covers a range of methods financial institutions use to reach such objectives: capital allocation strategies like divestiture or deliberate investment in socially valuable firms such as impact investing (Green and Roth, 2023), ESG strategies (Pastor et al., 2023), activist strategies such as shareholder voting (Broccardo et al., 2022), or innovative security design (Kim et al., 2022, Loumioti and Serafeim, 2022).

The central goal of this literature is to assess the effectiveness of such methods. Broc-

[3] Our shift-share instrument is valid as long as, conditional on observables, borrowers' exposure to strong bank exit policies is not correlated with contemporaneous *changes* in borrower credit demand or access to credit through mechanisms other than exposure to bank exit policies (Goldsmith-Pinkham et al., 2020).

cardo et al. (2022) argue that divestment policies are relatively ineffective because capital is easily substitutable, while in contrast activism or voting strategies can be more effective.[4] Similarly, capital allocation policies have limited impact on positively affected firms if they simply crowd out existing sources of capital (Green and Roth, 2023). Edmans et al. (2022) argues that tilting strategies may be more impactful than blanket industry divestment. Policies that succeed at rationing capital or changing its cost are only impactful if activities of affected firms are sensitive to these changes (Hartzmark and Shue, 2023). Finally, a widespread concern over pro-environmental discourse by financial institutions is that they might be cheap talk, or even intentionally shroud detrimental activities such as financing to brown industries (Giannetti et al., 2023). For commitments by financial institutions to be effective toward their stated goals, our findings reinforce the necessity that they be precise, verifiable, and based on a clear economic mechanism through which they operate.

Empirical studies tackling this question have to date largely focused on specific campaigns or segments of the financial markets. Teoh et al. (1999) documents a negligible effect for the South African equity divestment on targeted firms' value. Consistently, Berk and van Binsbergen (2021) do not find any effect from ESG-motivated equity divestment on targeted firms' cost of capital and real investment decisions. Studies of debt market interventions find mixed results. Sachdeva et al. (2023) finds borrowers affected by the Department of Justice's "Operation Choke Point" perfectly substitute into new sources of capital. Sastry et al. (2023) documents that banks adopting broad climate commitments do not divest more than other banks. Kacperczyk and Peydró (2022) finds banks joining the Science-Based Targets Initiative (SBTi) affect borrowers' ability to raise capital, but do not generate an impact on environmental outcomes. Closest to our setting, Haushalter et al. (2023) finds no effects of bank exit policies targeting mountaintop removal coal mining.

Our contributions to this literature are to document empirically that exit strategies can in fact achieve their stated goals, and to clarify the set of necessary conditions under

[4] Oehmke and Opp (2023) demonstrate the importance of consequentialist preferences in generating impact in the context of activist strategies. Gupta et al. (2022) highlight dynamic considerations that limit the impact of such strategies.

which they do. Haushalter et al. (2023) show banks do not seem to comply with their own mountaintop mining exit policies and thus that they have no impacts on targeted firms. Our novel measurement exercise shows, in an international sample, banks do comply with their broader coal policies–both the adoption of policies and the intensity of adopted policies predict subsequent declines in a bank's coal financing. Sachdeva et al. (2023) shows strikingly that firms can substitute into new lending relationships when the set of banks subject to an exit policy is small. In contrast, we show that in the context of coal, the majority of banks have adopted exit policies and that there is no statistically detectable substitution of affected borrowers into non-exiting banks. Finally, our paper speaks to how the design of capital allocation strategies affects their success. Hartzmark and Shue (2023) demonstrate that carbon emissions of "brown" firms are much more sensitive to their cost of capital than the emissions of "green" firms. While Kacperczyk and Peydró (2022) show credit allocation is affected by broad bank sustainability commitments, they find the effect is driven in part by new credit issued to green firms, and find no impact on the emissions of brown firms. Answered by our paper, importantly, is whether policies solely focused on brown firms achieve their intended effects on emissions.

An additional condition for exit policy effectiveness is the absence of "leakage", i.e. the migration of assets or activities to segments of the global economy where they will be less exposed to the policies that target them. Andonov and Rauh (2023) find limited evidence for this channel, in particular noting that private, institutional, and foreign ownership accounts for only 11% of US coal-fired power capacity. In a broader setting, Duchin et al. (2022) find that ESG concerns induce sales of polluting assets, but pollution does not change under new ownership.

Lastly, our paper contributes to the growing field studying climate finance, which explores the interaction between climate change and the financial system. Giglio et al. (2021) provides a comprehensive review of this literature. While the literature has so far mostly focused on how climate change is affecting financial markets and how they are adapting to it, our study focuses on how financial markets can be a tool to address or mitigate climate change. In that sense, our paper connects with studies analyzing the effect of other major tools to address climate change: regulatory actions, such as cap and trade policies (Ivanov et al., 2021, Colmer et al., 2022), carbon taxes (Laeven and Popov, 2022), or technological innovation (Aghion et al., 2023, Bolton et al., 2023). Our study also relates to Adrian et al. (2022), who perform a cost-benefit analysis of a worldwide coal phase-out and estimates the amount of financing required to achieve it.

The remainder of the paper is organized as follows. In Section 2, we provide some background on the exit movement and develop hypotheses about its effects. In Section 3, we describe our data and the data collection process. In Section 4, we develop a comprehensive methodology to measure exit policy strength. Section 5 explores determinants of exit policy adoption and strength and banks' compliance with their own policies. In Section 6, we use a shift-share instrument approach to provide causal evidence for the financial effects of exit policies. Section 7 documents the real effects of exit policies in coal-fired power plants. Section 8 conducts a back-of-the-envelope exercise to determine the aggregate emissions impact of bank exit policies. Section 9 concludes.

2 Background

2.1 Economic Rationale for Exit

Exit policies, by financial institutions or economic agents more broadly, aim at affecting the nature and the scale of operations of targeted firms.[5] The economic mechanism supporting such an effect is that reductions in the supply of capital available to targeted firms induce changes in the availability or cost of capital, which in turn impact operating decisions.[6] The ability of exit to induce change thus depends on the elasticity of capital supply to targeted firms, and on the sensitivity of their output to the availability and cost of external capital.

[5]Providing a normative framework for whether financial institutions should implement such policies is outside of the scope of this study. For such an exercise for corporations, see for instance de Bettignies et al. (2020).

[6]The endogenous and targeted nature of this supply shocks makes them fundamentally different from broad exogenous credit supply shocks that have been largely studied in the literature.

A substantial literature argues that the highly substitutable nature of capital prevents exit policies from achieving meaningful impact (i.e. Heinkel et al. (2001), Pastor et al. (2021), Berk and van Binsbergen (2021)). In the absence of frictions, imperfect substitutability of capital arises from diversification motives. Exit of some capital providers from an industry reduces the extent to which its risk can be distributed across investors, therefore increasing its risk premia and thus cost of capital. Calibrations of equilibrium asset pricing models in equity markets suggest these effects are small unless a very large share of investors engage in exit.[7]

On the other hand, in parts of the capital markets where frictions are high, such as bank-intermediated debt markets, exit policies can be effective even if the share of exiting entities is relatively low. Examples of important frictions in debt markets are information asymmetry, which creates large switching costs for firms willing to change banks (Darmouni, 2020), or segmentation, either geographic or by types of capital providers (Becker, 2007, Mitchell et al., 2007), which limits the pool of capital providers that can replace divesting ones.

Of equal importance to the capital markets where exit occurs is the characteristics of the firms and industries it targets. Exit policies will have limited impact on output for firms and industries that are less dependent on external finance–either because production is not capital intensive or because retained earnings are a sufficient source of financing. Within an industry, firms facing greater financial constraints are more likely to be affected by the exit of their existing external capital providers.

Taken together, these observations suggest exit policies are most likely to be effective in precisely targeted settings–e.g. when directed at firms that generate large externalities, are largely reliant on external capital, and face important financial frictions. Broader exit policies, for example tilt strategies in public equity markets or bank lending portfolios, may fail to achieve significant impact because they do not focus on the most effective targets of

[7] There is, however, substantial empirical debate on whether there are in equilibrium price effects. See, for example, Hong and Kacperczyk (2009), Baker et al. (2022), Larcker and Watts (2020), Aswani et al. (2023), Bolton and Kacperczyk (2021).

capital rationing.

2.2 The Coal Industry as a Research Laboratory

In our empirical study, we focus on the coal industry, defined as both coal mining and coal-fired power generation. The set of conditions described above for exit policies to achieve impact further motivates our choice to study bank coal exit policies. The coal industry is highly capital intensive and returns from investment are realized over long horizons, increasing sensitivity to funding costs. In 2021, the capital share of value added in petroleum and coal products was 81%.[8] The typical coal-fired powerplant operates for decades, with some operating more than 80 years. Construction of new coal assets often relies on bank-intermediated project financing, which is both a geographically segmented market and has famously large informational frictions.

Activists have made financial institution exit from coal the focus of their efforts because of the industry's its dependence on external capital and its large carbon footprint . The burning of coal represents over 40% of global CO2 energy emissions, and approximately 72% of total greenhouse gas (GHG) emissions from the electricity sector, making it the largest source of CO2 emissions globally.[9] In addition, no substitute source of energy is more carbon-intensive than coal. Despite its high emissions, global coal production is still growing, as shown in Figure C1.

A coal firm exposed to exit policies should therefore experience capital rationing, which should translate in economically meaningful real effects, such as a reduction of coal activities, facility decommissioning, and ultimately a reduction in CO2 emissions. We should further expect the strength of these mechanisms to vary within the coal industry. Smaller companies may have less access to alternative financing and thus be more impacted by exposure to divesting banks. Firms with a large share of their activity related to coal will also suffer more from the exit policies. We might also expect less profitable firms, with

[8] U.S. Bureau of Economic Analysis, "Components of Value Added by Industry as a Percentage of Value Added" (accessed Friday, September 15, 2023).

[9] International Energy Agency, https://www.iea.org/reports/global-energy-review-co2-emissions-in-2021-2

lower retained earnings, to be more affected by bank exit. In addition, some coal firms might exhibit less pronounced financial effects because they are raising capital to diversify or change their business model, as is often fostered by the design of exit policies. We explore each of these hypotheses in detail in Section 6.

3 Data

For the purpose of our study, we develop a comprehensive and global dataset centered on the interaction of the financial system with the coal industry. Our dataset combines information on debt and equity transactions by coal firms —obtained by consolidating a comprehensive set of financial databases— with firm-level financial statements and asset-level operational metrics. We also incorporate manually-collected bank coal exit policies. The assembled dataset covers the period 2005 to 2021.

3.1 Firm-level data: financing and real outcomes

The Global Coal Exit List (or "GCEL"), which covers both coal producers and users, is the basis for our sample of coal companies. This list, which was created by the NGO Urgewald, is a comprehensive list of companies that play a significant role in the coal sector and is the one used by the United Nations Principles for Responsible Investments (PRI). The companies in the GCEL have to meet one of the three criteria: i) The company's coal share of revenue or power production should be at least 20%, ii) The company's annual thermal coal production should be at least 10 megatons or generation capacity should be at least 5 GW, iii) The company is involved in expansion or development of new coal infrastructure. These criteria ensure all the major players in the coal industry are covered and thus, are included in our sample. There are 935 parent companies covered in the GCEL as of 2021. We conduct our analysis at the parent company level and use the names and locations of subsidiaries to improve matching across datasets. The GCEL also provides us with firm-level information related to its inclusion criteria, such as capacity (power), output (mining), fraction of revenue from coal and the share of power generated that is through coal. This sample of firms accounts for 85% of estimated worldwide annual coal production and 82% of installed coal power capacity.[10] To observe the firms' debt issuance activity, we use a combination of DealScan, the standard syndicated loan dataset, IJGlobal, a dataset focused on project financing of assets in the energy sector, and SDC Platinum to track bond issuances. These datasets have global coverage and their overlap in terms of transactions is small.[11] While some debt transactions or even some firms are likely to be missing from these sources, for instance bilateral loans for corporate finance purposes or smaller firms in the GCEL, these sources are the gold standard in terms of coverage of the large scale financing associated with the development or expansion of new facilities such as mines or powerplants, which is the focus of this study. We match firms from the GCEL to these datasets to form a subsample of 486 out of the 935 parent companies in the GCEL. This subsample of firms accounts for 75% of estimated worldwide annual coal production and 76% of installed coal power capacity.

The debt issuance dataset consists of 7,023 loan facilities and 12,886 bonds issued from 2005 to 2021 across 486 GCEL borrowers and their subsidiaries. For each transaction we observe which banks participated (as a lender or underwriter) but do not always observe shares of the transaction associated with each bank. In these cases we assign shares equally across banks. We complement this debt issuance dataset with equity issuances, which we also obtain from SDC Platinum. The equity issuance dataset contains 801 equity issues from 177 GCEL companies.

We also use Orbis to obtain financial statements for the companies in our sample. We obtain annual statements from 2012 to 2020 for 818 parent companies on the GCEL. Combining data sources, we have both external capital raising and financial data for 352 parent companies, representing 60% and 69% of worldwide coal production and installed coal power capacity, respectively.

[10] Worldwide installed coal power capacity comes from Global Energy Monitor, GEM (2022). Worldwide annual coal production comes from IEA (2021).

[11] We remove duplicates between the loan transactions in both IJ Global and Dealscan, defining them as any transaction between a bank and a firm which are at most 100 days apart and the difference in the amounts between the two dataset is less than 10 million USD.

Panel A of Table 1 provides some summary statistics for this data.

INSERT TABLE 1 HERE

3.2 Bank-Level Data

3.2.1 Lending and Underwriting Activity

We build a list of banks having participated as a lender or underwriter in debt financing transactions reported in Dealscan, IJGlobal, or SDC Platinum over our sample period. Table 2 provides summary statistics over their lending activity related to the coal and energy industry at large. These statistics illustrate that the coal industry represents a small fraction of the median bank lending activity, but that certain banks are highly exposed to the industry. For banks with substantial coal lending activity we also collect their 2020 MSCI ESG scores.

INSERT TABLE 2 HERE

3.2.2 Exit Policies

We obtain an initial list of bank exit policies from the NGO Reclaim Finance, which actively tracks and publishes the release of such bank policies. This list comprises all the banks that have released an exit policy as of March 2021, as well as a timeline of when the initial policies were released and if there were any updates to the existing policies. We use this list to identify exiting banks and manually check for large banks not appearing on this list to confirm they do not have such a policy. We obtain both initial policy announcements and their updates from bank websites. In total, we identify 82 banks that have released 126 policy statements specifically covering the coal industry between 2014 and 2021, 74 of which we can link to debt transactions with our sample of coal firms.

As shown in Figure 1, the adoption of coal exit policies has been ramping up since the 2015 Paris Climate Agreement.

INSERT FIGURE 1 HERE

3.3 Asset-Level Data: Coal-fired Power Plants

We collect data on coal fired power plants to study how bank coal exit policies affects the operating decisions of exposed firms. We use the Global Coal Plant Tracker (2022 release) from Global Energy Monitor to obtain facility-level information on coal-fired power plants. This datasets covers 13,727 individual power generation units at 4,633 facilities. It contains information on operating status over time, capacity, facility characteristics, geographic location, and current ownership. We use current ownership information to link to GCEL firms and obtain a sample of 4,100 individual units at 1,313 facilities. Summary statistics are provided in Panel B of Table 1.

We also collect CO2 emissions data at the facility level from regulatory sources when they are publicly available. We obtain such data for 396 facilities located in the US, the European Union, and Australia. The sources are the EPA's Greenhouse Gas Reporting Program (GHGRP), Europe Beyond Coal: European Coal Plant Database, and the Australian Government Clean Energy Regulator "Greenhouse and Energy Information by Designated Generation Facility" database, respectively. Summary statistics are provided in Panel B of Table 1.

4 Characterizing Bank Coal Exit Policies

A large number of financial institutions have an exit policy for coal in place. How binding are these policies in practice? Answering this question is complex as coal exit policies are nuanced and multidimensional. In this section we describe the general structure of banks' coal exit policies, implement a methodology to quantitatively assess these policies, and document the substantial heterogeneity in the measured strength of bank exit policies.

4.1 How are exit policies structured?

Bank coal policies typically do not state that the bank will immediately abstain from any financing of coal projects or coal industry borrowers. Instead, policies are structured to ban specific types of coal-related financing. Many policies handle differently project versus corporate financing, financing related to coal mining versus coal power generation, and the financing supporting the construction or expansion of coal assets versus the maintenance of assets in place. Similar to legal or tax documents, some policies introduce carve-outs, for instance allowing certain types of financing that they generally ban for existing banking clients or for firms that only derive a small share of their revenues from coal activities. These criteria often vary over a future time horizon to implement a progressive strengthening of the policy.

For illustration, consider the exit policies of two different banks: MUFG, a leading Japanese bank, and UK-based Barclays, which we provide in Appendix D. MUFG's policy prevents it from financing, from 2020 onward, new coal fired power plants and any mountain top removal coal mining projects. Barclays policy design is more complex. Beginning in 2019 it bans financing to new mining and powerplant projects, as well as to expansions of existing facilities. Starting in 2020 it progressively phases out corporate financing to coal firms based on the share of revenue they derive from coal mining and or power generation.

4.2 Assessing Exit Policy Strength

The first step to systematically analyze these potentially complex exit policies is to encode them in a way that captures their heterogeneity in design. As described above, this heterogeneity stems from which types of financing activities these policies allow or disallow, to which customers, and at what points in time. To this end, we identify a list of 16 attributes describing potential financing activities that can comprehensively capture the complexity embedded in our sample of policies.

The variables are listed and defined in Panel A of Figure 2. We code each bank policy as boolean logical statements that describes the set of hypothetical financing activities that are allowed by a given bank in a given year.

Consider again the exit policies at MUFG and Barclays. MUFG's policy is coded as:

```
ban = year >= 2020 & ((isNew & isPowerProj) | isMountaintopProj)
```

and Barclays policy is coded as:

```
ban =
  (year >= 2019 & isProjFin & isPowerProj  & (isNew | isExpansion)) |
  (year >= 2019 & isProjFin & isMiningProj & (isNew | isExpansion) & isThermal) |
  (year >= 2019 & isMountaintopProj) |
  (year >= 2020 & isThermal & (isMiningCo | isPowerCo) & CoalFracRevParent > 0.5) |
  (year >= 2025 & isThermal & (isMiningCo | isPowerCo) & CoalFracRevParent > 0.3) |
  (year >= 2030 & isThermal & (isMiningCo | isPowerCo) & CoalFracRevParent > 0.1)
```

We use this coding to characterize the heterogeneity of bank exit policies. The last column of Panel A of Figure 2 shows what fraction of banks in our dataset with exit policies have policies that are *sensitive* to a given attribute of a potential financing. This captures the extent to which policies make explicit bans (or carveouts) along a particular dimension. The most common attributes coal policies are sensitive to are whether the financing is project or corporate financing, whether or not it is related to development of new coal assets, and if the financing is related to coal mining or coal power generation.

INSERT FIGURE 2 HERE

In Figure 3 we show the evolution over time of the share of bank policies that prohibit financing based on these dimensions. Several facts stand out: Bank policies become stronger over time and they have a stronger and earlier emphasis on project finance than corporate finance, on coal-fired power generation over coal mining, and on financing of new facilities.

INSERT FIGURE 3 HERE

We now turn to assessing the *strength* of these policies and the heterogeneity of strength across banks and over time. We define $\textit{Exit Policy Strength}_{b,t}$ to be the fraction of a comprehensive set of potential financing activities that, according to its policy, bank b bans in year t. This variable is set to zero for banks in our sample for which we do not identify a coal exit policy. The set of financing activities we use for this purpose is reported in Panel

B of Figure 2.[12] A policy that prohibits none of these potential financings has a strength of zero, and a policy that prohibits all of them has a strength of one. In addition, we define $\mathbb{1}\{Has\ Exit\ Policy\}_{b,t}$ as an indicator variable capturing if a bank has *any* active policy in a given year. Together these measures capture the intensive and extensive margins of bank exit policies in a robust yet parsimonious manner. To capture both intensive and extensive margin jointly, we define

To describe bank policy strength cross-sectionally, we define $Max\ Strength_b$ as the bank's maximum policy strength over the years defined in the bank's policy. For illustration, MUFG stands at 0.14 on this measure, while Barclays stands at 0.93. Figure 4 highlights the substantial heterogeneity in cross-section of policy strength among banks with an exit policy. This figure shows a trimodal distribution of exit policy strength–some policies are very weak, some are very strong, and many are in between. This heterogeneity motivates incorporating policy strength when estimating the effects of bank exit policies, as opposed to simply relying on the existence of such a policy.

INSERT FIGURE 4 HERE

Finally, we include or develop several alternative measures of policy strength. *Reclaim Finance Score* is the general measure of policy strength as attributed by the NGO Reclaim Finance. *Reclaim Finance Phaseout Score* is the subscore focusing on whether the policy is consistent with a phasing-out of lending to coal firms. The *Complexity Score* is the fraction of the 16 financing attributes described above to which a given policy is sensitive to in a given year. A genuine phasing-out of coal lending by a bank active in this industry typically calls for a complex policy as it requires a schedule of criteria. The final panel of Table 2 reports summary statistics of these measures of exit policy strength.

[12]Using all possible financing scenarios spanned by our variables provides similar results, but makes the exercise less intuitive.

5 Exit Policies and Bank Financing of the Coal Industry

5.1 Determinants of Exit Policy Strength

Appendix Figure C2 displays the share of banks having an active coal exit policy in place for a given year (Panel A), and the average strength of such policies, conditional on having a policy (Panel B), both broken down by geographic region. European banks appear to have been leading the movement, both in terms of exit policy penetration and strength. North America and Asia are however catching up on both dimensions.

To further explore the determinants of exit policies, we estimate in Table 3 cross-sectional regressions relating policy adoption and policy strength to observable characteristics of a bank. We focus on the $\textit{Max Strength}_b$ measure, which measures the strength of existing exit policies as they apply in 2030 and is set to zero for banks without exit policies. We limit the sample to banks with at least $1 billion of debt financing to coal firms in the pre-2015 period of our sample. Column 1 shows that bank size alone explains nearly 30% of the variation in policy adoption and strength. By contrast, characteristics of banks' coal loan portfolios do not explain variation in exit policies. We also identify bank's ESG scores and geographic location as important determinants of exit policies. Importantly, we control for the "E" subscore, showing that the broader pro-social concerns of the bank are a driver of exit policies. Together, these characteristics explain more than half of the variation in exit policies. This analysis also provides supportive evidence that bank adoption of coal exit policies is not driven by pre-existing trends in either credit supply or credit demand to coal firms.

INSERT TABLE 3 HERE

5.2 Policy Strength and Bank Financing of Coal

To assess whether banks are following through on their policies, and validate our measures of strength, we study the annual coal lending and underwriting activity of banks with strong exit policies. In Figure 5, we plot the aggregate amount of loan issuance over time, scaled by the 2010 amount, for banks with a strong exit policy, i.e with a strength measure above the median conditional on having a policy, and for the other banks in our sample. Banks with a strong exit policy reduce their lending significantly more over our sample period than banks with no or weak policies. This reduction is particularly evident from 2015, the date of the Paris Climate agreement that kickstarted the bank coal exit policies.

INSERT FIGURE 5 HERE

Table 4 reports regressions of bank financing activity on measures of exit policy existence and strength. In column 1, we regress the log of a bank's annual debt origination to firms in our sample on an indicator variable of whether the bank has a coal exit policy in place in that year. Debt origination includes both loan issuance and bond underwriting. We group these two types of debt to abstract from substitution between loans and debt, in particular because bank exit policies typically cover both loan issuance and bond underwriting activities. Aggregating both types of transactions also reduces the amount of zeroes in our outcome variable, which increases statistical power. We include both bank and year fixed effects to absorb the composition effects on bank time-invariant characteristics previously documented, as well as general trends in coal debt issuance. In columns 2 to 5, we interact an indicator for being after 2015 with the maximum strength of a bank policy, therefore focusing exclusively on the cross-sectional heterogeneity in policy strength. This intensive margin effect is robust to alternative measures of strength. Conditional on having an active coal exit policy, a one standard deviation increase in the maximum bank policy strength is associated with a 19 to 24 percent decline in coal financing in the post 2015 period, which is economically large and suggests the policy design is of first-order importance. In general, the existence of a coal exit policy, and its strength are associated with decreased coal lending and bond underwriting.

INSERT TABLE 4 HERE

6 Effects of Exit Policies

6.1 Exit Policies and Supply Effects

A central empirical challenge to measuring the effects of exit policies is that coal firms' demand for debt financing might be correlated with the adoption and strength of banks' exit policies. Such a correlation could result from banks being more likely to adopt an exit policy if their client base in the coal industry is on a downward trend, and would limit the causal interpretation of any relationship between exit policies and firm-level outcomes.

To isolate the causal effects of bank exit policies on the supply of debt financing to coal firms, we therefore start our empirical analysis of the effects of exit policies by implementing a regression specification that controls for the latent credit demand of coal borrowers. For this purpose, we build a firm-bank-year panel from our transaction data. For each borrower, we consider the set of banks that participated in a loan or a bond underwriting to a given firm over the 2009-2021 period. We run the following specification on the firm-bank-year panel:

$$Y_{f,b,t} = \beta Exit\ Policy\ Strength_{b,t} + \delta_{f,t} + \gamma_b + \eta_{f,b,t} \tag{6.1}$$

where $Y_{f,b,t}$ is the log of one plus debt issuance by borrower f with bank b in year t, $Exit\ Policy\ Strength_{b,t}$ is the measure defined in the previous section, $\delta_{f,t}$ are firm-year fixed effects, and γ_b are bank fixed effects. Crucially, the firm-year fixed effects absorb coal firms' time-varying demand for debt financing.

Results are displayed in Table 5. When absorbing coal firms' demand for debt financing through firm-year fixed effects, we observe that these firms are significantly less likely to raise debt from banks with a strong exit policy. Such effect is more pronounced for firms with a high share of their revenues coming from coal, and is present for both small and large firms, as well as for both power and mining firms.

INSERT TABLE 5 HERE

6.2 Firm-level Financial Effects

Having established that bank exit policies affect firm debt financing through the supply channel, we turn to estimating the net firm-level financial effects across all creditors. Coal firms are indeed likely to attempt to offset the reduction in credit supply from exiting banks with non-exiting banks. The extent to which such substitution may undo the previously documented supply effect of exit policies is an empirical question. To measure these firm-level financial effects we exploit the plausibly exogenous variation in exposure to bank exit policies at the borrower level resulting from heterogeneity in pre-existing banking relationships, and bank-level variation in exit policy existence.

We thus construct a shift-share instrument capturing a borrower's exposure to exiting banks based on the banks with whom it had a lending or bond underwriting relationship for the period 2009-2013.[13] Let $w_{f,b}$ be the share of firm f financing volume with bank b over this period. Our main instrument is defined as:

$$Bank\ Exit\ Exposure_{f,t} = \sum_{b} w_{f,b} \times Exit\ Policy\ Strength_{b,t} \tag{6.2}$$

We then precisely measure the effects of being exposed to exit policies on firm outcome $Y_{f,t}$ by running the following specification:

$$Y_{f,t} = \beta Bank\ Exit\ Exposure_{f,t} + \beta X_{f,t} + \epsilon_{f,t} \tag{6.3}$$

where $X_{f,t}$ captures a combination of firm, year, country-year, and size quintile-year fixed effects based on the specification. The country-year fixed effects aim at absorbing possible confounding factors such as local demand, local price of competing energies, or regulatory action targeting coal. Most of these factors are likely to be mostly uniform at the country level, and will therefore be adequately absorbed. The size quintile fixed effects mitigate concerns over possible trends correlated with size, for instance if small firms in

[13]We fix the set of relationship banks for a given borrowers to avoid variation in our instrument resulting from using a rolling-window to identify relationship banks.

general have a harder time getting financing over time.

Overall, our identifying assumption for this test is that our instrument is not correlated with firm-level time-varying unobserved characteristics directly affecting the outcome variable. Given our panel setting, such characteristics would need to correlate cross-sectionally with the exit policy existence and strength, and in the time-series with the timing of the implementation of the ban, while being orthogonal to country-level and firm size trends. We discuss threats to the identification assumption and how we mitigate them in Section 6.5.

We first plot in Figure 6 the aggregate amount of loan issuance over time, scaled by its 2010 amount, for coal firms with high treatment over the period, i.e. with above median cumulative bank exit exposure conditional on being treated, and the rest of coal firms from our sample. The figure suggests that firms highly exposed to bank exit policies decrease their borrowing more than firms with no or low exposure to such policies.

INSERT FIGURE 6 HERE

We then estimate the causal net effects of being exposed to bank exit policies on financing by estimating Equation 6.3. We use as the dependent variable the log of one plus the total amount of bank loans and corporate bonds issued by firm f in year t.

Regression coefficients are displayed in Panel A of Table 6. The regression coefficients in columns 1 and 2 show that a borrower's exposure to exit policies results in a decline in their debt issuance, and that this is robust to the inclusion of country by year and borrower-size quintile by year fixed effects. The magnitude of this effect is large. In column 2, a one standard deviation increase in exit policy exposure results in a change in annual borrowing of $\exp(-0.219) - 1 \approx -20\%$. Columns 3 and 4 show the results are stronger for firms more heavily involved in coal and for smaller firms. These results are consistent with the prediction that the effects of bank exit policies should be more pronounced for firms likely to be treated more stringently under the policies and those more likely subject to financial constraints.

Columns 5 and 6 show that the financial effects of bank exit policies are concentrated in firms involved in coal mining rather than power production. This finding is in contrast to the fact that exit policies more intensely target coal fired power generation than coal mining, as shown in Figure 3. These facts can be reconciled by electricity producing firms having a greater ability to substitute away from coal and raising financing to do so, which in many cases would not be subject to exit policies.

INSERT TABLE 6 HERE

We establish the robustness of these results by using the previously described set of alternative measures of ban strength in the same specification: *Reclaim Finance Score*, *Reclaim Finance Phaseout Score*, and *Complexity score*. Results are displayed in Appendix Table C1. All measures of exit exposure give quantitatively consistent results.

To mitigate concerns over pre-existing trends that could confound our analysis, we plot in Figure 7 the coefficients from regressing the cumulative amount of debt financing since 2010 for a given firm on the interaction between year fixed effects and the previously used indicator variable for being highly exposed to bank exit policies. We observe a lack of pre-trend for the 2010-2014 period. However, the effects we identify might have started the year before the Paris Climate Agreement, which is consistent with our interpretation of exit policy disclosure as not necessarily representing a sharp discontinuity in banks lending and underwriting policies, and potentially slightly lagging their initiation.

Finally, in Appendix Table C2, we explore whether our results are driven by firm exposure to banks' broader climate commitments, or it is specific exposure to targeted coal exit policies that limits coal firm debt issuance. To do this we study firm exposure to banks adopting the Science Based Targeting Initiative (SBTi) studied in Kacperczyk and Peydró (2022). We construct a new shift share instrument, SBTi Adoption Exposure, analogous to the definition of our main instrument in Equation 6.2, replacing the strength of a bank's exit policy in year t with whether it has adopted SBTI commitments as of year t. Controlling for exposure to broader bank climate commitments does not significantly affect the magnitude of the impact of exposure to bank coal exit policies, which highlights the relevance of exit policies for the effects we measure.

6.3 Adjustment Margin for Financing Transactions

We now turn to studying from whom firms that face exposure to bank exit policies reduce borrowing and the extent to which they substitute to different lenders or other forms of capital. First, we decompose the amount of debt financing into components from banks with and without coal exit policies, and into components from relationship and non-relationship banks. We replace the dependent variable in equation 6.3 by these quantities, and report the regression coefficients in Panel B of Table 6.

Columns 1 and 2 show that exposure to coal exit policies results in debt financing contraction mostly from exiting banks. However, there is no evidence of substitution through forming new relationships with non-exiting banks. Some substitution may still be happening at the intensive margin: relationship lenders without exit policies may increase their participation share in a transaction to replace exiting lenders. However, measurement of participation shares in our data is noisy. Columns 3 and 4 show that most of the debt financing contraction associated with policy exposure comes from relationship banks.

Next, columns 5 and 6 decompose observed borrowing declines into the extensive and intensive margin. In column 5 the dependent variable is an indicator of whether the firm issued debt in that year. In column 6 the dependent variable is the log of debt issuance and the sample is limited to firm-years in which there is positive debt issuance. We find significant effects only on the extensive margin. A one standard deviation higher bank exit policy exposure corresponds to a 3.2 percentage point decline in the probability of a firm issuing debt in a given year, or equivalently a 5.6% reduction in the baseline rate of debt issuance.

Finally, column 7 shows that firms do not seem to compensate for reduced debt financing through equity issuances. Overall, these findings are consistent with the important switching costs in debt markets previously documented in the literature, although the lack of substitution towards equity issuance is also striking.

6.4 Effects on Capital Structure

We then turn to test whether these effects on financing transactions translate into measurable effects on firm capital structure. We run similar specifications as in equation 6.3, using the log of long term debt and book leverage as the dependent variables. Regression coefficients are displayed in Panels A and B of Table 7. This exercise also mitigates potential concerns over our transaction data lacking private debt transactions that have become popular in certain segments of the economy (Chernenko et al., 2022).[14]

Exposure to exit policies translate into a lower amount of long term debt, and a reduction in book leverage. Turning to the cross-section of coal firms, we observe that these effects are larger for small firms than for large firms, but are of similar magnitude for low vs. high coal share of revenues. We reconcile this latter result with the transaction level results as follows. There are two drivers to debt stock: new issuance, and debt repayment. New issuance appears to react much more to bank exit exposure for high coal share firms. However, debt repayment sensitivity might also differ between these two groups, and thus leads to net effect on debt stock to be of comparable magnitude.

INSERT TABLE 7 HERE

6.5 Potential Threats to Identification

We now provide further evidence that our shift share instrument estimates the causal effects of bank exit policies. First, we flesh-out the assumptions required for valid identification in our shift-share methodology and articulate the set of alternate hypotheses that could explain this result. Second, we provide evidence that such channels are not supported by the data. Third, we conduct a Rotemberg decomposition (Rotemberg, 1983) of our shift-share estimator to explore potential endogeneity in exposures to banks that are the largest contributors to our estimates.

[14]To further alleviate this concern, we conduct a manual data collection exercise described in Appendix A.

Recall the main explanatory variable in our analysis is *Bank Exit Exposure*$_{f,t}$, which is the weighted average of the policy strength of the coal firm's historic lenders in a given year. Our main specification employs borrower-country by year and borrower-size quintile by year fixed effects. Our estimates are thus identified from the correlation between within-firm time variation in debt issuance and within-firm time variation in exposure to strong exit policies that is not independently explained by geography and size-specific time trends. Crucially, as explained in Goldsmith-Pinkham et al. (2020), identification in shift-share designs exploits the relative exposures (here, historic banking relationships) to a given set of shocks (here, bank exit policies) and does not require these shocks themselves to be exogenous to the initial *levels* of the outcome of interest.

These econometric properties of our design substantially limit the set of alternative explanations for our results. For example, our results cannot directly be explained by the hypothesis that bank policy strength and the quantity of coal firm debt issuance are jointly determined by government regulation, political pressure, or the declining economic viability of coal. To the extent such mechanisms operate at the country level, our country by time fixed effects absorb them. For such a bias to arise, it would have to be that coal firms of similar size and located in the same country faced these drivers to differing degrees and, that the banks these firms have established prior relationships with face positively correlated differences in drivers to adopt exit policies.

A potentially more likely alternative explanation for our results is that banks endogenously design their coal exit policies based on future trends in the credit demand of their relationship borrowers. For example, banks with declining coal customers may adopt stronger policies because they will be less costly to follow. However, several pieces of empirical evidence are inconsistent with this explanation. First, as shown in Table 5, within a given borrower-year, credit contracts relatively more from banks with stronger exit policies. If a demand-based channel was driving our results on net financing, we would not expect to see disproportionate contraction in financing from banks with stronger policies. Second, Table 3 pretrends in the borrowing of banks' ex-ante coal client base do not significantly predict the adoption or strength of coal exit policies. Evidence at the borrower level casts further doubt on this alternative explanation. Table C3 explores whether there is evidence of pre-trends in firm-level debt issuance that correlate with exposure to strong bank exit policies. Column 1 shows there is no economically meaningful relationship between the 2009-2013 growth in a firm's borrowing and its bank exit exposure.[15] A one standard deviation increase in bank exit exposure is associated with a 0.15 standard deviation higher pre-trend, a coefficient of low magnitude and of opposite sign to the one predicted by the alternative explanation. Controlling for country and size quintile fixed effects in column 2 and 3 takes out the statistical significance and further reduces the coefficient. Column 4 repeats the baseline specification of Table 6 and column 5 controls for the extrapolated trend in debt issuance based on debt issuance growth in the 2009-2013 period. The extrapolated trend strongly predicts future debt issuance. However, it does not meaningfully affect the coefficient on *Bank Exit Exposure*.

Finally, to provide more transparency about the sources of identification embedded in our shift share instrument, we follow Goldsmith-Pinkham et al. (2020) in reporting and analyzing the Rotemberg decomposition of the estimated coefficient on our shift share instrument. This decomposition is an application of the more general analysis of estimate sensitivity to misspecification developed in Andrews et al. (2017), and allows us to study which banks have the largest influence on the estimation. Table C4 shows the results. The five most influential banks for the estimation account for 88 percent of the Rotemberg weights. Reassuringly, these banks have non-trivial shares of the coal finance market.

7 Real Effects

Having documented that bank exit policies translate into a reduction in the external financing of targeted firms, we now turn to exploring effects on investment policy and operations.

In theory, facing limited access to finance their coal assets, affected firms may choose not

[15] Both measures are standardized by their sample cross-sectional standard deviations. Coefficients and standard errors are thus interpretable in units of standard deviations of the pre-trend variable.

to invest in their existing assets. They may also decide to change the operation of existing assets, for example by selling assets, closing plants, and reducing output quantity or quality. On the other hand, they may react by acquiring new assets, or start new projects, either to maximize short-term profitability, or to pivot towards less carbon-intensive activities.[16]

We first use our central specification to test whether firms exposed to exit policies reduce their total assets. Panel C of Table 7 uses the log of total assets as the dependent variable in equation 6.3. The negative coefficients are consistent with a shrinkage of firms exposed to such policies. As expected, such shrinkage is also concentrated in firms exhibiting a high share of their activity tied to coal.

To fully trace-down the effects of exit policies on coal assets, we focus on coal-fired power plants, for which we have more granular data than coal mines. In particular, we are able to observe the age and capacity of each plant and track its operating status over time, including its retirement. We hypothesize that owners of coal plants with limited access to finance may choose to retire plants earlier than otherwise expected, in line with the exit policies' objective. To test this hypothesis we estimate a Cox Proportional Hazard model at the plant level, estimating determinants of the hazard rate of plant retirement. We depart from our previous time-varying measure of policy strength and instead interact a cross-sectional measure of borrower exposure to coal exit policies with a post-2015 indicator. We adopt this formulation because plant closure decisions are unlikely to line up exactly with the timing of coal exit policies at a borrower's relationship banks. Firms exposed to strong exit policies, even those not currently binding, may make operating decisions in anticipation of future difficulty in raising capital. Alternatively, firms may react with a lag.

Panel A of Table 8 shows that coal-fired power plants owned by firms more exposed to coal exit policies are more likely to face early retirement than plants owned by less exposed firms. Coefficients higher than one indicate the variable increases the hazard rate of plant retirement. The first column shows the cross sectional measure based on exposure to strong exit policies does not predict plant retirement in the pre-2015 sample period when

[16]Thus, exit policies could affect firm real outcomes even in the absence of (firm-level) financial effects.

exit policies were not binding. However, as shown in column 2, this variable significantly predicts early retirement in the post 2015 period. All else equal, after 2015 a plant with a one standard deviation higher exposure to coal exit policies is 41% more likely to be retired in a given year than a plant with no exit policy exposure. Column 3 shows that the magnitude of the effect is significantly amplified for plants owned by small firms. Column 4 shows that plants owned by borrowers with a low share of coal activity are more likely to close because of coal exit policies, but not significantly so. This is consistent with the notion that more diversified firms are better able to substitute into different investment opportunities. Column 5 shows that large plants are equally likely to be retired as smaller ones because of exposure to exit policies.

INSERT TABLE 8 HERE

Last, in Panel B of Table 8, we study the effects of coal exit policies on CO2 emissions for the coal fired power facilities for which we can obtain such data. We regress facility annual CO2 emissions (scaled by 2014 levels) on a cross-sectional measure of borrower exposure to coal exit policies interacted with a post-2015 indicator. Higher exposure to exit policies results in lower emissions. We then decompose this effect into the extensive margin effect identified in the retirement analysis, as well as a potential intensive margin effect on plants that continue to operate. Column 2 studies the intensive margin by limiting the sample to plant-years with continued operations. A one standard deviation higher exposure to bank exit policies has large negative effects on the emissions of operating plants. Though we lack the data to verify, it is likely this effect is coming from reduced plant utilization rather than increase emissions abatement, given the relatively large magnitude of the effect. By using as a dependent variable an indicator of whether the plant is active in a given year, column confirms that in this subset of coal fired power plants we still see the effect on plant retirement documented above.

8 Sizing Aggregate Effects

Having established that bank exit policies affect the operating status of individual coal plants, we now turn to gauging the aggregate impact of these effects in terms of GHG emissions, which is the ultimate goal of those advocating for the adoption of these policies. We consider two main counter-factual exercises. First, how much higher would GHG emissions from coal-powered electricity generation be in absence of coal exit policies by banks? Second, what additional reduction in emissions can be achieved if strong exit policies are adopted by every bank?

We therefore estimate the evolution of aggregate coal-fired power plant emissions over the 2015-2100 period under these scenarios based on comprehensive data on existing and planned coal-fired power plants, a survival process of these plants, and how that survival is affected by bank coal exit policies as estimated in Section 7. The results of this quantification exercise are shown in Figure 8, and the methodology is described in detail in Appendix B.[17]

INSERT FIGURE 8 HERE

The results illustrate the first-order impact of bank exit policies on aggregate GHG emissions, while also highlighting the need for much broader actions to reach the Paris Climate Accords objectives. The black line in Figure 8 shows the emissions from coal-fired power plants projected under current bank policies. The brown dashed line shows counterfactual emissions in the absence of any bank policies. The shaded brown region thus represents the total avoided emissions from coal power production attributable to bank exit policies. This reduction corresponds to approximately 1 gigaton of CO2-equivalent emissions (Gt CO2e) through 2022 and 15 Gt CO2e through 2050.[18] The dotted green line

[17]While exit policies appear to affect both operating status and emissions conditional on operating, we only incorporate the former in our analysis for tractability, and because the intensive margin effect is by nature shorter-lived. Our analysis is therefore conservative in that dimension.

[18]These figures do not account for emissions generated to replace power production from retiring coal power plants, and should therefore be interpreted as an upper bound of the net effect. Coal power plants have nearly double the emissions intensity of current aggregate power generation, so a conservative estimate of net emissions reduction would scale these figures by half.

plots coal power emissions estimated from a scenario for wider bank exit policies, which assumes all coal-fired power plants are exposed to coal exit policies to the same extent as the average treated plant in our main sample. Such a scenario would see a cumulative reduction in coal emissions of around 54 Gt CO2e by 2050 when compared to the scenario without any exit policies.

How significant are the current and potential reductions in emissions resulting from bank coal exit policies in terms of reaching the target set by the Paris Climate Accords? The red line in Figure 8 shows the target emissions from coal-fired power emissions consistent with a pathway to achieve a below 2°C average warming by 2100 with a probability higher than 66%. Such a target requires a cumulative reduction in GHG emissions from coal-fired power generation until 2050 of 126 Gt.[19] Our estimated effects of the current policies, and of their wider adoption, therefore corresponds to 12% and 43% of this targeted reduction.

9 Conclusion

We study whether exit policies are an effective tool to address non-financial objectives, using climate-motivated bank coal exit policies around the world as a laboratory. We first develop a comprehensive measure of policy strength, and document a large heterogeneity along this dimension. Using a shift-share instrument combining the lending ban strength measure and timing with borrower-bank relationships, we document large effects of the policies on coal firm debt issuance, outstanding debt and total assets, and the operating status of coal power plants. We do not find significant evidence of substitution between divesting lenders and non-divesting ones.

In contrast to previous work on more limited exit policies and broader bank decarbonization commitments, we find evidence that banks comply with their own policies, that exposure to these policies materially limit the ability of firms to issue debt, and that they affect the operating decisions of impacted firms, thus reducing carbon emissions.

[19] In turn, the reduction in GHG issuances from all human activities required over that period to stay below 2°C is 772 Gt.

There are two likely explanations for these new findings. First, consistent our economic framework on the effectiveness of exit policies, we detect these effects in a setting where substitution to alternative sources of capital is difficult, both due to credit market frictions and because of the wide adoption of coal exit policies. Second, our careful measurement of the strength of bank exit policies affords increased precision in measuring these effects at both the bank and firm levels.

Whether exit policies and other investor strategies will be effective at inducing similar outcomes in other contexts is ultimately an empirical question. However, our analysis provides relevant guidance for investors who seek to impact non-financial outcomes and researchers looking to analyze related initiatives.

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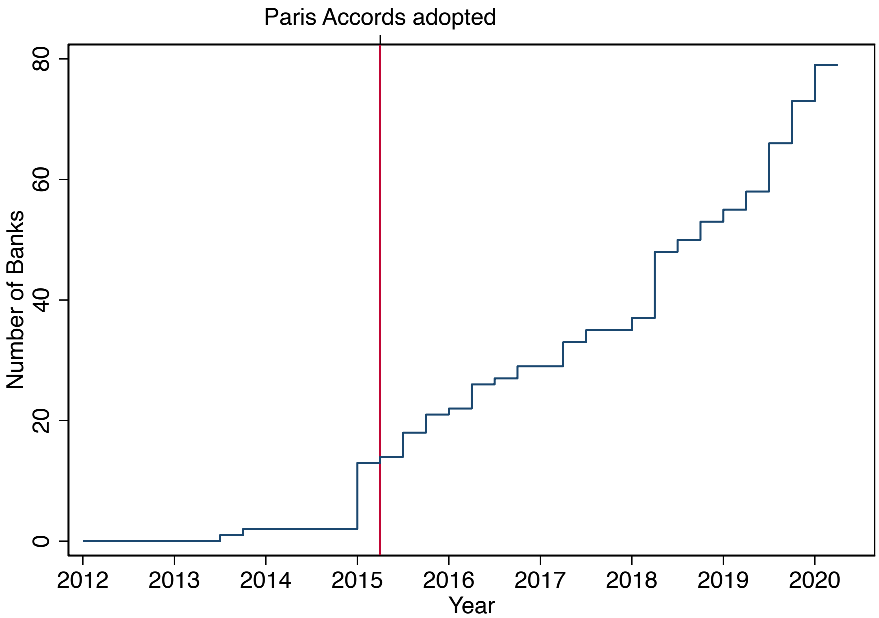
Figures

Figure 1: **Number of Banks with Active Coal Exit Policies**



Notes: This figure shows the number of banks that have announced a coal exit policy in a given year. The data is from Reclaim Finance.

Figure 2: **Measuring Exit Policy Strength**

Panel A: Variable List

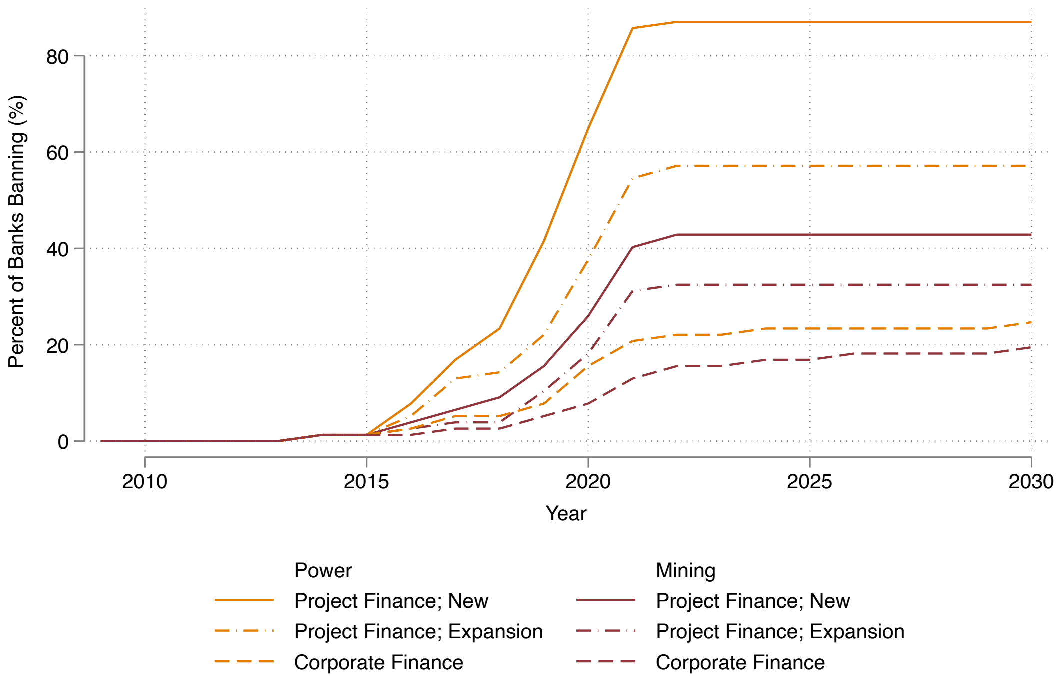
Variable Name	**Definition**	**Share of Policies Conditioning**
isNew:	= 1 if proceeds used for new coal assets/project	82%
isPowerProj:	= 1 if project is a power project	77%
isMiningProj:	= 1 if project is a mining project	51%
isMiningCo:	= 1 if company a mining company	46%
isPowerCo:	= 1 if company a power company	42%
CoalFracRevParent:	= fraction of revenue from coal of parent company	42%
isExpansion:	= 1 if proceeds used for expansion of capacity/life of coal assets	41%
isThermal:	= 1 the project uses thermal coal	35%
hasDecarbonStrat:	= 1 if Company has plan to decarbonize/diversify from carbon	30%
TimeRestriction:	= 1 if ban has a time schedule	28%
isMountaintopComp:	= 1 if company is doing mountaintop mining	26%
isNewCustomer	= 1 if the borrower a new customer	24%
isLowCarbonProj:	= 1 if proceeds used for carbon transition / low carbon project	20%
isProjFin:	= 1 for project finance	18%
CoalSharePowerParent:	= coal share of power production of parent company	15%
GeographicalRestriction:	= 1 if ban only applies to certain country or continent	11%
isMountaintopProj:	= 1 if proceeds used for mountaintop mining	7%

Panel B: Scenario List

	Share of Banks Prohibiting	
Scenario	As of 2020	At maximum
isPowerProj=1, isNew=1, isNewCustomer=1, isProjFin=1	73%	96%
isPowerProj=1, isNew=1, isNewCustomer=0, isProjFin=1	69%	93%
isPowerProj=1, isExpansion=1, isNewCustomer=1, isProjFin=1	54%	74%
isPowerProj=1, isExpansion=1, isNewCustomer=0, isProjFin=1	46%	69%
isPowerProj=1, isNewCustomer=1, isProjFin=0	38%	55%
isPowerProj=1, isNewCustomer=1, isProjFin=0, CoalFracRevParent $\geq$ 0.2	22%	36%
isPowerProj=1, isNewCustomer=0, isProjFin=0, CoalFracRevParent $\geq$ 0.2	19%	34%
isMiningProj=1, isNew=1, isNewCustomer=1, isProjFin=1	50%	73%
isMiningProj=1, isNew=1, isNewCustomer=0, isProjFin=1	30%	43%
isMiningProj=1, isExpansion=1, isNewCustomer=1, isProjFin=1	41%	59%
isMiningProj=1, isExpansion=1, isNewCustomer=0, isProjFin=1	32%	50%
isMiningProj=1, isNewCustomer=1, isProjFin=0	38%	53%
isMiningProj=1, isNewCustomer=1, isProjFin=0, CoalFracRevParent $\geq$ 0.2	19%	34%
isMiningProj=1, isNewCustomer=0, isProjFin=0, CoalFracRevParent $\geq$ 0.2	15%	30%

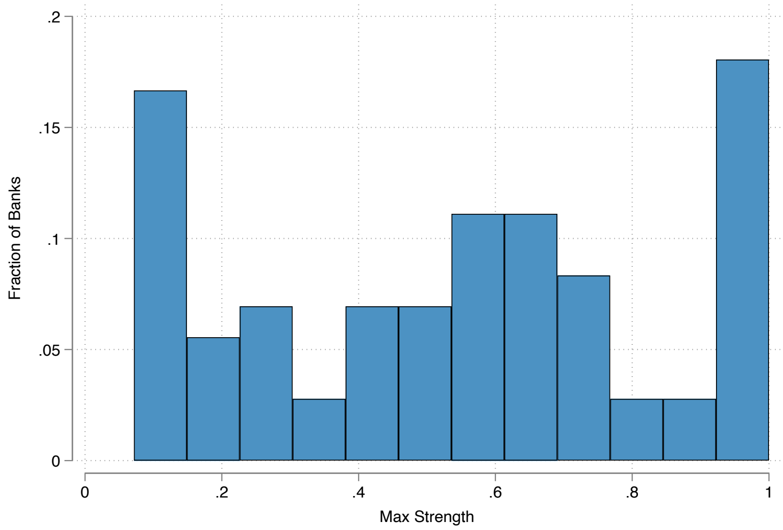
Notes: Panel A provides the list of variables used to encode bank coal exit policies, and the share of policies conditioning on each variable. Panel B provides the list of scenarios we consider in constructing our baseline measure of ban intensity, and the share of banks banning each of them, as per their policy applicable in 2020, and at its peak as it applies in the future.

Figure 3: **Bank Exit Policies By Activity Type**



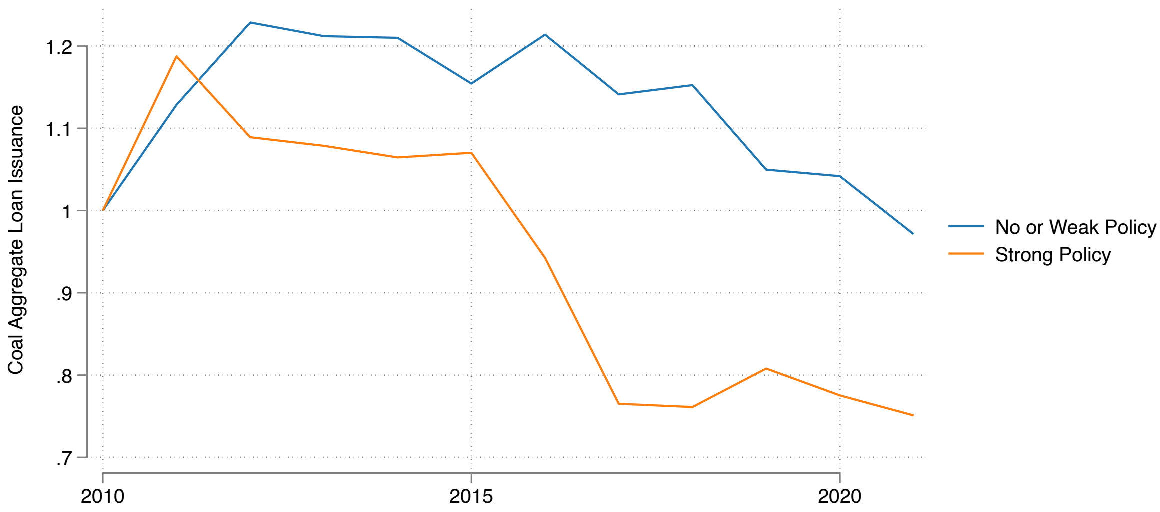
Notes: This figure plots for six selected scenarios the share of banks with an exit policy that would ban such a project in a given year, according to their stated policies. Scenarios related to coal-fired power plants are in orange, and scenarios related to coal mining projects are in maroon. For each sector, we consider: (i) project finance for a new project, (ii) project finance for an expansion of an existing project and (iii) corporate finance for general purpose.

Figure 4: **Heterogeneity in Exit Policy Strength**



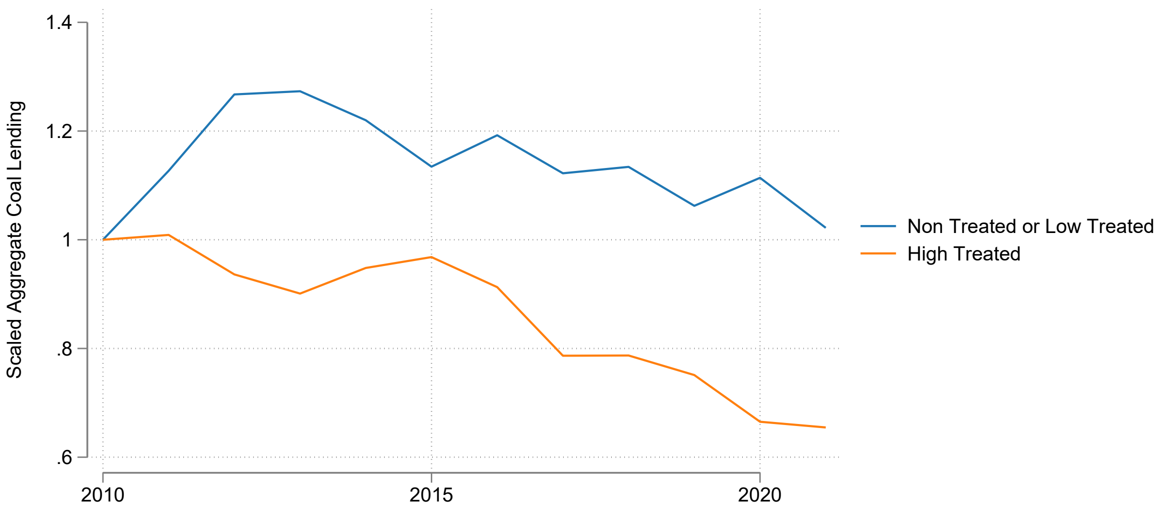
Notes: This histogram shows the cross-sectional distribution of exit policy strength across banks that have adopted coal exit policies. Max Strength is defined as maximum exit policy strength of the bank over all years the coal policy is defined into the future.

Figure 5: **Aggregate Loan Issuance by Bank Exit Policy Strength**



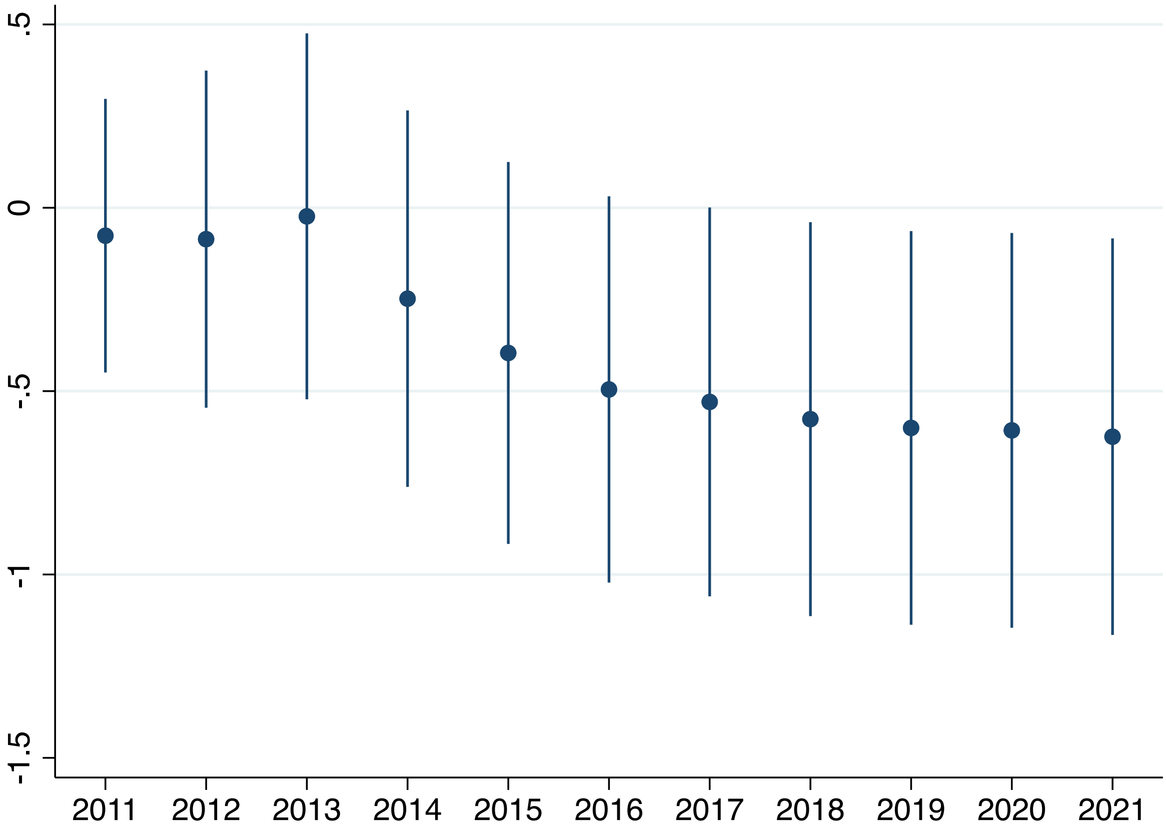
Notes: This figure plots the three year moving average aggregate amount of loan issuance in a given year, scaled by the 2010 issuance amount, for banks with an exit policy above median strength, and banks with no exit policy or an exit policy of below median strength. Exit policy strength is measured as the maximum share of scenarios that are banned by a bank under its policy as of 2021.

Figure 6: **Aggregate Loan Issuance by Borrower Treatment**



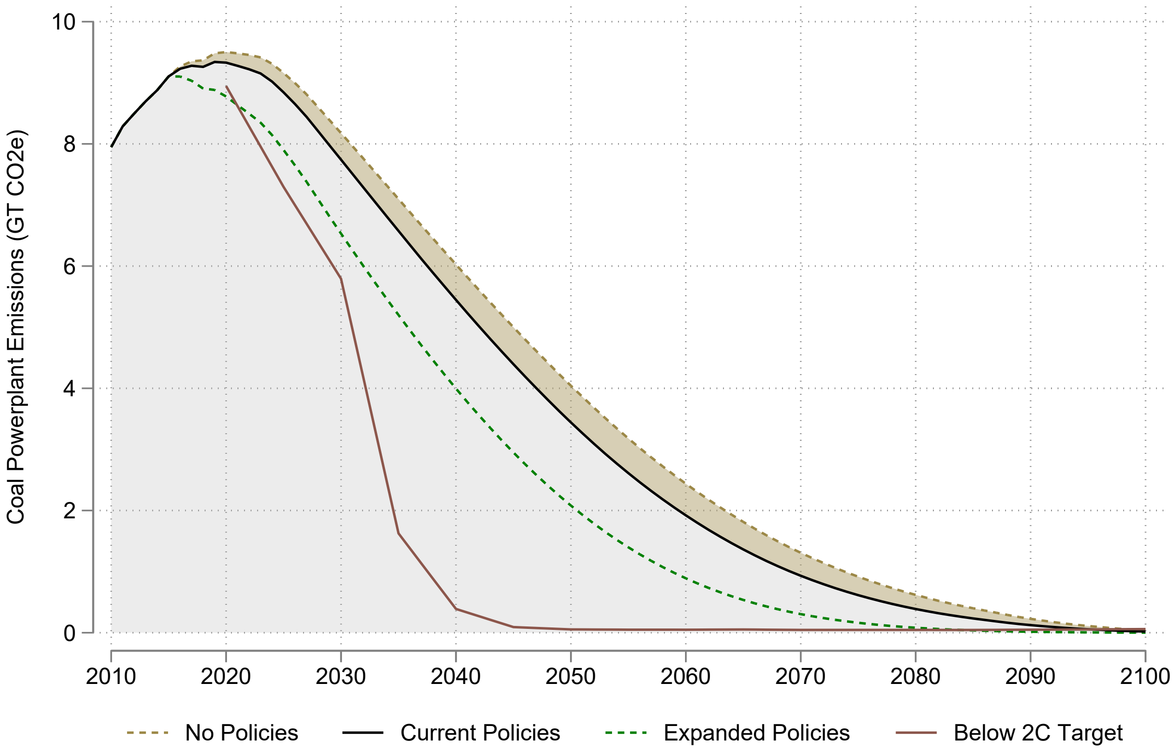
Notes: This figure plots the three year moving average aggregate amount of loan issuance in a given year, scaled by the 2010 issuance amount, for coal firms with high treatment over the period, i.e. above-median cumulative *Bank Exit Exposure* over the 2015-2020 period conditional on being treated at any point, and the rest of coal firms from the sample. *Bank Exit Exposure* is defined in Section 4.

Figure 7: **Cumulative Effects on Firm Debt Issuance**



Notes: This figure plots the OLS coefficients and their corresponding 90% confidence intervals obtained when regressing the log of the cumulative amount of debt financing since 2010 of a given firm on the interaction between year fixed effects and an indicator variable for being a highly treated firm, i.e. above-median cumulative *Bank Exit Exposure* over the 2015-2020 period conditional on being treated at any point. Regressions include firm and year fixed effects and standard errors are clustered at the borrower level.

Figure 8: **Bank Exit Policy Counterfactuals**



Notes: This figure illustrates aggregate coal-fired power emissions that would occur under different scenarios of adoption of bank coal exit policies, based on the estimates in Section 7 and described in Appendix B. The dotted yellow line shows estimated emissions from coal fired power plants in the absence of bank coal exit policies. The solid black line shows estimated emissions given current policies. The dotted green line shows estimated emissions in a wider bank exit policy scenario, i.e. where every plant is treated in line with the average treated plan in our sample. The dark red line shows the emissions target set for coal-fired power generation to limit global warming to below 2°C by 2100 with a probability higher than 66%. This target trajectory is obtained from the scenario CO Bridge applied to the model Witch 5.0, as per the AR6 Scenarios Database hosted by IIASA, and is plotted from 2020 for clarity purpose.

Tables

Table 1: **Summary Statistics: Coal Industry Firms and Assets**

Panel A: GCEL firms with financing transaction data available ***(N=486)***					
Active in:	Count	Share (%)	*Geography:*	Count	Share (%)
Mining	213	52	North America	79	19
Power Generation	298	73	Europe	55	13
Services	166	40	Asia	222	54
			Others	54	14

Firm Characteristics	Mean	Median	SD	p10	p90
Annual Coal Production (Mt)	28.4	10.9	60.7	1.6	65.25
Installed Coal Power Capacity (MW)	4,888	1,655	13,506	128	9,634
Coal Share of Power	0.62	0.64	0.33	0.18	1.00
Coal Fraction of Revenue	0.45	0.37	0.30	0.10	0.90
Firm Financials ***(N=352)***					
Assets	26,726	5,841	84,322	273	57,851
Debt	6,255	1,232	12,352	0	17,304
Net Income	498	90	1,345	-116	1,602
ROA	0.34%	1.90%	10.55%	-6.40%	6.65%
Bank Exit Exposure Variables					
Mean Exit Exposure	0.03	0.00	0.05	0.00	0.10
Max Exit Exposure	0.18	0.00	0.24	0.00	0.54
Max Exit Exposure (Complexity)	0.13	0.00	0.17	0.00	0.41
Exit Exposure (Reclaim Finance)	0.07	0.00	0.10	0.00	0.24
Exit Exposure (Phaseout)	0.05	0.00	0.10	0.00	0.16

Panel B: Coal Fired Power Plants linked to GCEL Firms ***(N=4,100)***					
	Mean	Median	SD	p10	p90
Age (as of 2014)	26.6	26	19	3	54
Capacity (in MW)	380.5	300	355	57	800
Emissions Data Available ***(N=396)***					
CO_2 emissions in 2014 (in Mt)	4.2	2.7	4.9	0.3	11.0
CO_2 emissions in 2020 (in Mt)	3.1	1.6	4.0	0.1	8.3

Notes: Panel A provides summary statistics for the sample of firms resulting from the merge of the Global Coal Exit List (GCEL) with Dealscan, IJGlobal, and SDC Platinum financing transactions. Firm characteristics are from the GCEL. Financial characteristics are obtained from Orbis. Assets, Debt, and Net Income are expressed in millions of US dollars. Bank Exit Exposure variables are defined as per the methodology described in section 4. Panel B provides summary statistics for a sample of coal fired power plants owned by GCEL firms. Age, Capacity and active status is from Global Plant Tracker, and CO_2 emissions are from regulatory sources.

Table 2: **Summary Statistics: Banks**

	Mean	Median	SD	p10	p90
All Banks (N=1058):					
Coal share of lending volume	0.11	0.04	0.17	0	0.35
Energy share of lending volume	0.23	0.11	0.29	0	0.72
Coal lending average volume ($m)	286	13	1291	0	392
Banks with Substantial Coal Lending (N=224):					
Coal share of lending volume	0.17	0.10	0.17	0.03	0.36
Energy share of lending volume	0.26	0.19	0.22	0.04	0.60
Coal lending average volume ($m)	1266	353	2581	61	3452
MSCI ESG Score	5.7	5.6	2.0	2.9	8.3
MSCI Environmental Score	4.7	4.3	2.8	1.0	8.7
Banks with a Coal Exit Policy (N=74):					
Coal share of lending volume	0.08	0.06	0.10	0.01	0.15
Energy share of lending volume	0.17	0.15	0.12	0.08	0.28
Coal lending average volume ($m)	2680	1208	3942	58	7331
Exit Policy Strength Measures (N = 74):					
Average Exit Policy Strength 2015-2030	0.28	0.27	0.18	0.07	0.54
Max Exit Policy Strength 2015-2030	0.55	0.57	0.32	0.14	1
Max Strength (Complexity)	0.34	0.31	0.19	0.06	0.63
Strength (Reclaim Finance)	7	8	2.5	4	10
Strength (Reclaim Finance Phaseout)	1.8	0	2.8	0	7

Notes: This table provides summary statistics for the sample of banks active in financing the coal industry (as per Dealscan, IJGlobal, and SDC Platinum) over the period 2009 to 2021. The second panel considers the subset of banks with at least $1 billion in lending to coal firms in the pre-2015 sample. Lending volume variables are calculated based on Dealscan and IJGlobal data. Exit policy strength measures are described in Section 4.

Table 3: **Determinants of Bank Exit Policy Adoption and Strength**

	Policy Existence and Strength				
	(1)	(2)	(3)	(4)	(5)
Bank Size	0.253***	0.248***	0.251***	0.184***	0.175***
	(0.031)	(0.034)	(0.035)	(0.041)	(0.043)
Coal Share of Lending		-0.106	-0.059	0.385	0.708*
		(0.263)	(0.337)	(0.475)	(0.419)
Bank Coal Financing Growth			0.116	0.048	0.114
			(0.099)	(0.124)	(0.125)
Coal Borrowers' Credit Growth			0.120	0.144	0.146
			(0.164)	(0.199)	(0.181)
2020 Bank ESG Score				0.085**	0.047
				(0.036)	(0.032)
2020 Bank E Score				0.090***	0.071**
				(0.032)	(0.027)
Asia					-0.089
					(0.115)
Europe					0.849***
					(0.242)
North America					-0.384*
					(0.223)
Constant	-1.643***	-1.583***	-1.642***	-1.961***	-1.713***
	(0.233)	(0.293)	(0.306)	(0.368)	(0.390)
Observations	224	224	221	169	169
R^2	0.274	0.274	0.290	0.367	0.521

Notes: This table reports the coefficients of bank-level OLS regressions in which the dependent variable is $MaxStrength_b$, which measures the strength of existing exit policies as they apply in 2030 and is set to zero for banks without exit policies. We limit the sample to banks with at least $1 billion of debt financing to coal firms in the pre-2015 period of our sample. The explanatory variables are the coal share of lending for a given bank from 2009 to 2013, the bank's share of lending to the energy industry from 2009 to 2013, bank size (measured by the log of the aggregate lending in the 2009-2013 period), the bank's 2009-2013 coal credit supply growth and the 2009-2013 debt issuance growth of its relationship borrowers. The bank coal lending growth variable is obtained as the slope coefficient from bank-level regressions of the log of annual coal lending on a time trend. The customer borrowing growth measure is obtained as value-weighted average of similar borrower-level coefficients. The bank ESG score is the 2020 MSCI industry-adjusted ESG score, and the bank E score corresponds to the 2020 MSCI environmental sub-score. Robust standard errors are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table 4: **Bank Financing of Coal Activity**

	Coal Debt Origination (log)				
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}\{\text{Has Exit Policy}\}_{b,t}$	-0.373**	-0.304	-0.306	-0.303	-0.299
	(0.190)	(0.193)	(0.187)	(0.201)	(0.191)
$\mathbb{1}\{\text{Year} \geq 2015\} \times$ Max Exit Policy Strength$_b$		-0.189*			
		(0.107)			
$\mathbb{1}\{\text{Year} \geq 2015\} \times$ Max Exit Policy Strength (Reclaim Finance)$_b$			-0.205**		
			(0.101)		
$\mathbb{1}\{\text{Year} \geq 2015\} \times$ Max Exit Policy Strength (Reclaim Finance Phaseout)$_b$				-0.235**	
				(0.099)	
$\mathbb{1}\{\text{Year} \geq 2015\} \times$ Max Exit Policy Strength (Complexity)$_b$					-0.241**
					(0.095)
Bank FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	1,001	1,001	1,001	897	1,001
Adj-R^2	0.770	0.770	0.770	0.761	0.771

Notes: This table reports the coefficients of bank-year level OLS regressions in which the dependent variable is the log of the total coal debt origination (loan issuance and bond underwriting) by a given bank in a given year from 2009-2021. The first column relates the amount of debt financing to whether the bank has an active exit policy in place in that given year. The second column uses instead the maximum exit policy strength of a bank interacted with a post-2015 indicator. The remaining columns use alternative definitions of exit policy strength in a similar fashion. All ban strength measures are standardized by their cross-sectional standard deviation. Robust standard errors are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table 5: **Bank Exit Policies Effects: Isolating the Supply Channel**

	Debt Issuance (log)				
				Power	Mining
	(1)	(2)	(3)	(4)	(5)
Exit Policy Strength$_{b,t}$	-0.227**			-0.240*	-0.215**
	(0.101)			(0.130)	(0.105)
Low Coal Share$_f$ $\times$ Exit Policy Strength$_{b,t}$		-0.154			
		(0.126)			
High Coal Share$_f$ $\times$ Exit Policy Strength$_{b,t}$		-0.410***			
		(0.114)			
Small Firm$_f$ $\times$ Exit Policy Strength$_{b,t}$			-0.207*		
			(0.114)		
Large Firm$_f$ $\times$ Exit Policy Strength$_{b,t}$			-0.295**		
			(0.130)		
Bank FE	Yes	Yes	Yes	Yes	Yes
Borrower x Year FE	Yes	Yes	Yes	Yes	Yes
Observations	138,463	128,830	124,748	63,713	74,750
Adj-R^2	0.271	0.272	0.264	0.292	0.267

Notes: This table reports the coefficients of firm-bank-year level OLS regressions in which the dependent variable is the log of 1+debt issuance raised by a given firm, intermediated by a given bank, in a given year. Debt issuance includes loans and bonds. The explanatory variables include the time-varying measure of exit policy strength described in Section 4, as well as firm-year fixed effects, as per Khwaja and Mian (2008). We also present the regression coefficients interacting *Exit Policy Strength*$_{b,t}$ with the firm's coal share (of revenue or of electricity produced) and whether it is above or below the median borrower size in our sample, as measured by total book assets. Column 4 and 5 split the sample between coal firms active in power and the ones in mining. Standard errors are two way clustered at the borrower and bank level and are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table 6: **Effects of Bank Exit on Coal Firm Debt Issuance**

Panel A: Baseline Results

	Debt Issuance (log)					
					Power	Mining
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Exit Exposure$_{f,t}$	-0.167**	-0.219**			-0.074	-0.320**
	(0.070)	(0.097)			(0.136)	(0.144)
Low Coal Share$_f$ × Bank Exit Exposure$_{f,t}$			-0.116			
			(0.112)			
High Coal Share$_f$ × Bank Exit Exposure$_{f,t}$			-0.422***			
			(0.147)			
Small Firm$_f$ × Bank Exit Exposure$_{f,t}$				-0.447**		
				(0.175)		
Large Firm$_f$ × Bank Exit Exposure$_{f,t}$				-0.151		
				(0.124)		
Borrower FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country x Year FE	No	Yes	Yes	Yes	Yes	Yes
Size x Year FE	No	Yes	Yes	No	Yes	Yes
Observations	4,472	4,199	3,887	3,432	1,833	2,184
Adj-R^2	0.477	0.530	0.534	0.518	0.557	0.520

Panel B: Adjustment Margin

	Debt Issuance (log)						Equity
	Coal Policy Bank		Relationship Bank		Margin		
	Yes	No	Yes	No	Extensive	Intensive	
Bank Exit Exposure$_{f,t}$	-0.186**	-0.074	-0.210***	-0.098	-0.032**	-0.093	0.043
	(0.081)	(0.076)	(0.074)	(0.084)	(0.016)	(0.070)	(0.043)
Borrower FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,199	4,199	4,199	4,199	4,199	2,333	4,199
Adj-R^2	0.635	0.498	0.564	0.566	0.399	0.612	0.185

Notes: Panel A of the table above reports the coefficients of the OLS regressions in which the dependent variable is the log of 1 + debt issuance. Debt issuance includes loans and bonds. The explanatory variable is the main instrument developed in this study and described in Section 4. We also present the regression coefficients interacting *Bank Exit Exposure*$_{f,t}$ with the firm's coal share (of revenue or of electricity produced) and whether it is above or below the median borrower size in our sample, as measured by total book assets. Panel B present coefficients from similar regressions where the dependent variable is changed to study whether firms exposed to exit policies substitute away to different forms or providers of capital. The first two columns separate out debt provided by banks that do and do not have coal exit policies. The third and fourth columns separate debt provided by ex-ante relationship banks or non-relationship banks. Columns 5 and 6 decompose observed borrowing declines into the intensive and extensive margin. In column 5 the dependent variable is an indicator of whether the firm issued debt in that year. In column 6 the dependent variable is the log of debt issuance and the sample is limited to firm-years in which there is positive debt issuance. The dependent variable in the final column is the log of 1 + public equity issuance. Standard errors in both panels are clustered at the borrower level and are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table 7: **Balance Sheet Effects**

					Power	Mining
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Long-Term Debt (log)						
Ban Exposure$_{f,t}$	-0.142***	-0.332***			-0.358**	-0.317**
	(0.053)	(0.101)			(0.139)	(0.139)
Low Coal Share$_f$ × Bank Exit Exposure$_{f,t}$			-0.371***			
			(0.110)			
High Coal Share$_f$ × Bank Exit Exposure$_{f,t}$			-0.347**			
			(0.134)			
Small Firm$_f$ × Bank Exit Exposure$_{f,t}$				-0.394***		
				(0.143)		
Large Firm$_f$ × Bank Exit Exposure$_{f,t}$				-0.217***		
				(0.074)		
Panel B: Leverage (log)						
Ban Exposure$_{f,t}$	-0.081*	-0.264***			-0.278**	-0.243**
	(0.043)	(0.084)			(0.120)	(0.100)
Low Coal Share$_f$ × Bank Exit Exposure$_{f,t}$			-0.301***			
			(0.093)			
High Coal Share$_f$ × Bank Exit Exposure$_{f,t}$			-0.239**			
			(0.106)			
Small Firm$_f$ × Bank Exit Exposure$_{f,t}$				-0.327***		
				(0.117)		
Large Firm$_f$ × Bank Exit Exposure$_{f,t}$				-0.166***		
				(0.059)		
Panel C: Total Assets (log)						
Ban Exposure$_{f,t}$	-0.047***	-0.074**			-0.066**	-0.060
	(0.018)	(0.031)			(0.032)	(0.042)
Low Coal Share$_f$ × Bank Exit Exposure$_{f,t}$			-0.037			
			(0.031)			
High Coal Share$_f$ × Bank Exit Exposure$_{f,t}$			-0.081*			
			(0.048)			
Small Firm$_f$ × Bank Exit Exposure$_{f,t}$				-0.078*		
				(0.047)		
Large Firm$_f$ × Bank Exit Exposure$_{f,t}$				-0.059*		
				(0.032)		
Borrower FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country x Year FE	No	Yes	Yes	Yes	Yes	Yes
Size x Year FE	No	Yes	Yes	No	Yes	Yes
Observations	2,115	1,953	1,792	1,954	871	968
Adj-R^2	0.644	0.650	0.669	0.649	0.704	0.631

Notes: This table reports the coefficients from OLS regressions where the dependent variables are the log of long term debt (Panel A), log of total assets (Panel B), and log leverage, defined as the debt to assets ratio (Panel C). Explanatory variables are as per Table 6. Standard errors are clustered at the borrower level are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table 8: **Facility Level Effects**

Panel A: Effects on Coal-fired Power Plant Closures

	Plant Closure				
	Pre-Period	Full Sample			
	(1)	(2)	(3)	(4)	(5)
Bank Exit Exposure (Max)$_f$	1.018	0.832	0.826	0.809	0.837
	(0.068)	(-1.295)	(-1.198)	(-0.872)	(-1.224)
$\mathbb{1}\{Year \geq 2015\}$ × Bank Exit Exposure (Max)$_f$		1.414**	1.498***	1.333	1.372**
		(2.474)	(2.826)	(1.260)	(2.117)
$\mathbb{1}\{Year \geq 2015\}$ × Bank Exit Exposure (Max)$_f$ × Small Firm			4.098*		
			(1.915)		
$\mathbb{1}\{Year \geq 2015\}$ × Bank Exit Exposure (Max)$_f$ × Low Coal Share				1.346	
				(1.110)	
$\mathbb{1}\{Year \geq 2015\}$ × Bank Exit Exposure (Max)$_f$ × Large Plant					1.167
					(0.616)
Country Strata	Yes	Yes	Yes	Yes	Yes
Observations	14256	30621	30621	29827	30621

Panel B: Effects on Coal-fired Power Plant CO2 Emissions

	Emissions	Active Facilities Only	Active (1/0)
	(1)	(2)	(3)
$\mathbb{1}\{Year \geq 2015\}$ Bank Exit Exposure (Max)$_f$	-0.085**	-0.057*	-0.045***
	(0.034)	(0.027)	(0.016)
Facility FE	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes
Observations	3,676	3,337	3,739
Adj-R^2	0.497	0.471	0.411

Notes: Panel A reports the hazard ratios from a Cox proportional hazard model of the survival of a sample of coal-fired power plants. Plant status data is from Global Plant Tracker. The main explanatory variable is a standardized cross-sectional measure of a plant's exposure to bank coal exit policies. Standard errors are clustered at the country level and reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. Panel B reports the coefficients of OLS regressions where the dependent variable is the CO2 emissions for a given plant in a given year relative to 2014 levels for columns 1 and 2. In column 2, we restrict the sample to plant-year observations where the plant is active. In column 3, the dependent variable is an indicator variable for the plant being active in the given year. The sample corresponds to coal-fired power plants from USA, European Union and Australia, for which we can obtain CO2 emission data from regulatory sources. t-statistics are adjusted for clustering at the borrower level and are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Appendix A Potential bias arising from non-bank lending

Our main empirical result shows that bank exit policies significantly decrease coal firms' debt issuance. However, coal firms might also borrow from other capital sources besides those we are able to observe in our sample of loan and bond issuances. For example, it is possible that affected firms may substitute into the non-bank loan market (Chernenko et al., 2022). To the extent substitution such unobservable forms of capital may occur, our methodology would overestimate the impact of the exposure to bank exit policies on the ability to raise external capital.

To tackle this concern, following the methodology of Chernenko et al. (2022) we conduct a detailed analysis of US publicly traded companies in our sample, for which we are able to observe all debt contracts. Publicly traded firms are required to make disclosures about all materially important agreements, including debt issuance. The goal is to explore the extent to which our sample of debt issuance transactions captures the full set of debt issuance conducted by these firms. For the 38 US publicly traded coal companies in our sample, we obtained through CapitalIQ all credit agreements, debt and loan agreements, underwriter agreements and security purchase agreements from 2015 to 2021. Following the main analysis of the paper we exclude amendments to existing credit agreements. We read through each document, recording each debt issuance we were unable to match to our main sample.

In total, we find through SEC disclosures only 41 transactions we could not match to our dataset, compared with 1633 total transactions in our main dataset for these 38 companies during the 2015-2021 period. These missing transactions occur for only 16 of the 38 companies in the analysis. In aggregate, these transactions amount to $11.9 billion of debt capital, or around 1.4% of the $836 billion in debt transactions recorded in our dataset. None of the 41 transactions missing in our dataset involved exclusively non-bank lenders. Unconditionally, for US publicly traded borrowers in our sample, our data on average fails to capture 1.7% of their debt issuance volume. Further, among these 38 firms, there is no correlation between exposure to bank exit policies and the extent to which our dataset under-reports debt transactions.

Overall, this analysis suggests it is unlikely that our results are being driven by failing to capture substitution into sources of external financing not observable in our data. Unobservable borrowing could of course be higher in private US companies or international companies in our analysis. However, the extremely low prevalence of such borrowing in the US public coal firm sample and its lack of correlation with exit policy exposure suggests any effects in the broader sample are likely quite limited.

Appendix B Counterfactual Exercise Methodology

For simplicity, we focus on modeling the operating status of powerplants over time and abstract from changes in plant-level utilization or emissions intensity. In a given scenario, for each plant-year we estimate the probability the plant is active in that year, and multiply that by annual plant emissions. Summing across plants gives the expected aggregate coal power plant emissions in each year. We use as our sample the universe of plants in the Global Coal Plant Tracker database. We assume plants announced but not cancelled or shelved will come online in the year estimated in the GCPT database. We assume no currently unannounced coal plants will come online.

We model plant operating statuses in three scenarios–under current bank exit policies, in the absence of bank exit policies, and under stronger exit polices. First, to model operating status under current policies, we use the GCPT database to estimate the unconditional historical survival probability of plants $S(t)$ as a function of their age t. We assume plant age at retirement follows a two parameter Weibull distribution. Thus the survival function is $S(t) = \exp(-\lambda * t^p)$, and the retirement hazard function is $h(t) = \lambda p t^{p-1}$ where λ and p are two parameters to estimate empirically.

Figure C3 shows the empirical survival function and the parametric fit we use in our analysis. We apply our estimated survival function at the plant level, starting in 2015 or when the plant becomes operational, whichever is later, to estimate the probability each plant i with age a_{it} in year t is active each year t through 2100.

$$p_{i,t}^{baseline} = \hat{S}(a_{i,t}) \tag{B.4}$$

Next, to model outcomes in the absence of policies and under expanded policies, we incorporate our estimates of how exposure to bank exit policies affects the hazard rate of plant retirement. To be conservative we assume that the plants that are not part of our hazard model estimation, either because they cannot be matched to a GCEL firm, or because they can be matched to one but that firm has no financial transactions during our sample period, are not exposed to bank exit policies. Under this assumption, the (capacity weighted) average plant is roughly 20% more likely to retire each year in the presence of bank exit policies. Thus, to model plant operating status in the absence of bank exit policies, we modify the baseline survival function by scaling the annual hazard rate by $1/1.2 \approx 83\%$.

$$p_{i,t}^{no\ exit} = p_{i,t-1}^{no\ exit} \cdot (1 - \hat{h}(a_{i,t})\frac{1}{1.20}) \tag{B.5}$$

Our scenario for stronger exit policies assumes that all coal plants in the GCPT database would have the exposure to bank exit policies as does the average treated plant, i.e. a plant whose headquarter firm is historically banking with at least one exiting bank. This implies the average plant is roughly 88% more likely to retire each year than in the absence of any bank exit policies. We use this estimate to again compute a survival function to model plant operating statuses.

$$p_{i,t}^{no\ exit} = p_{i,t-1}^{no\ exit} \cdot (1 - \hat{h}(a_{i,t})\frac{1.88}{1.20}) \tag{B.6}$$

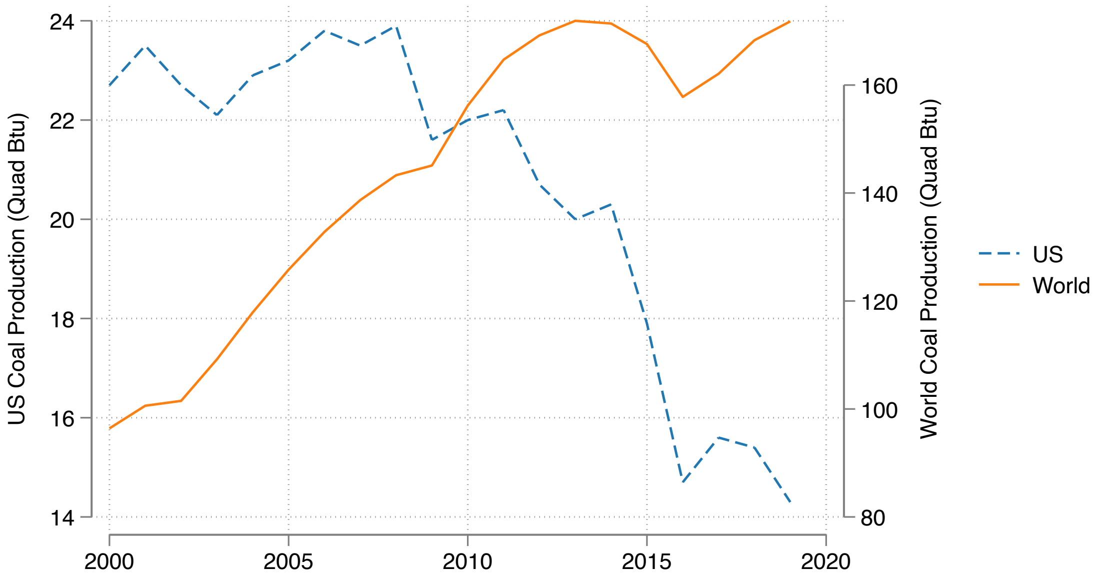
Now for in each of the three scenarios j, for each plant-year i, t we have the probability that plant has survived until that year. Combining with plant-level estimates of emissions $CO2e_i$, we can thus compute the expected aggregate emissions in each scenario in each year

$$\mathbb{E}[Emissions_{j,t}] = \sum_i p_{i,t}^j \times CO2e_i \tag{B.7}$$

We plot the resulting emissions scenarios in Figure 8.

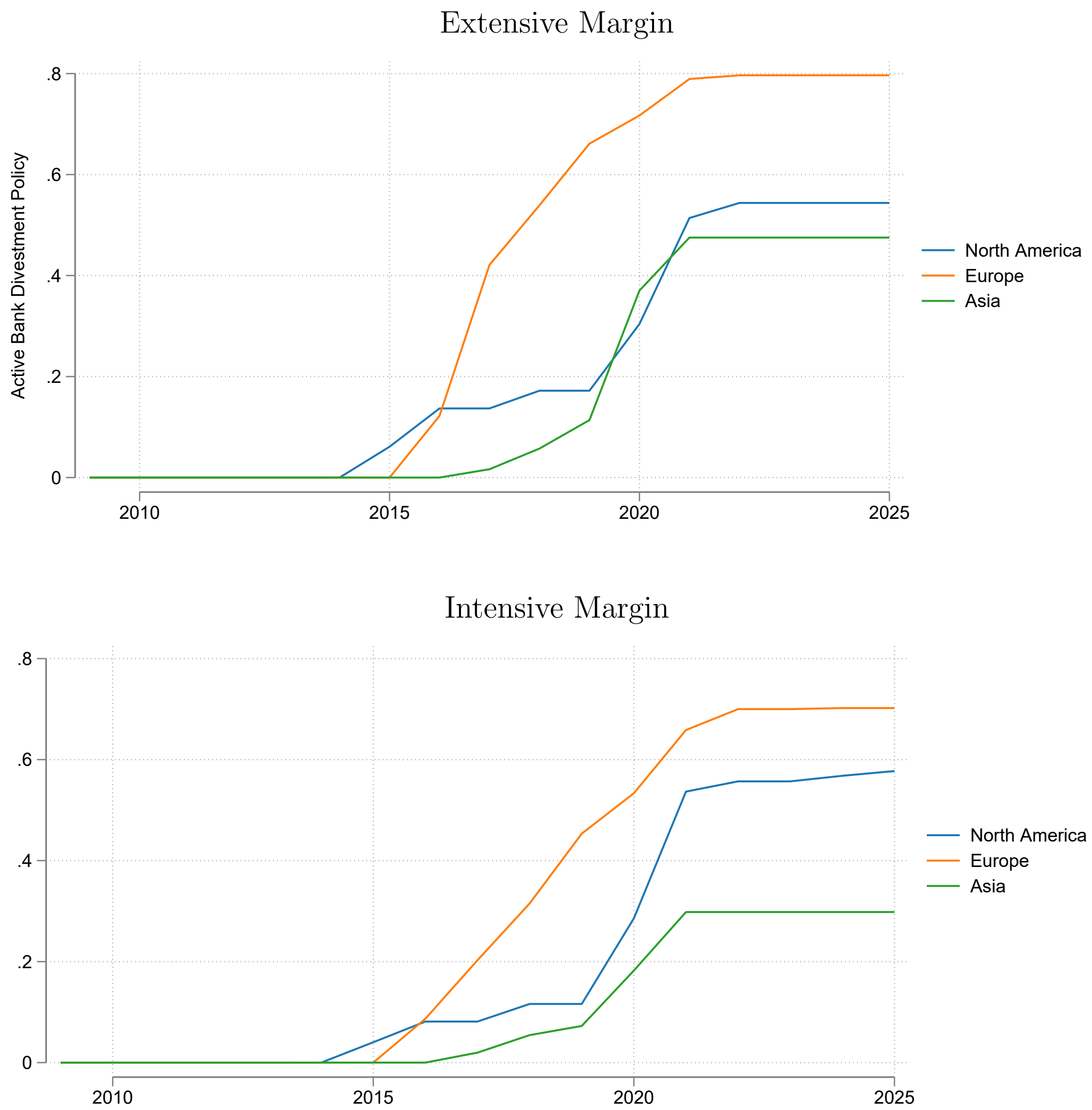
Appendix C Additional Figures and Tables

Figure C1: Evolution of World and US Production of Coal



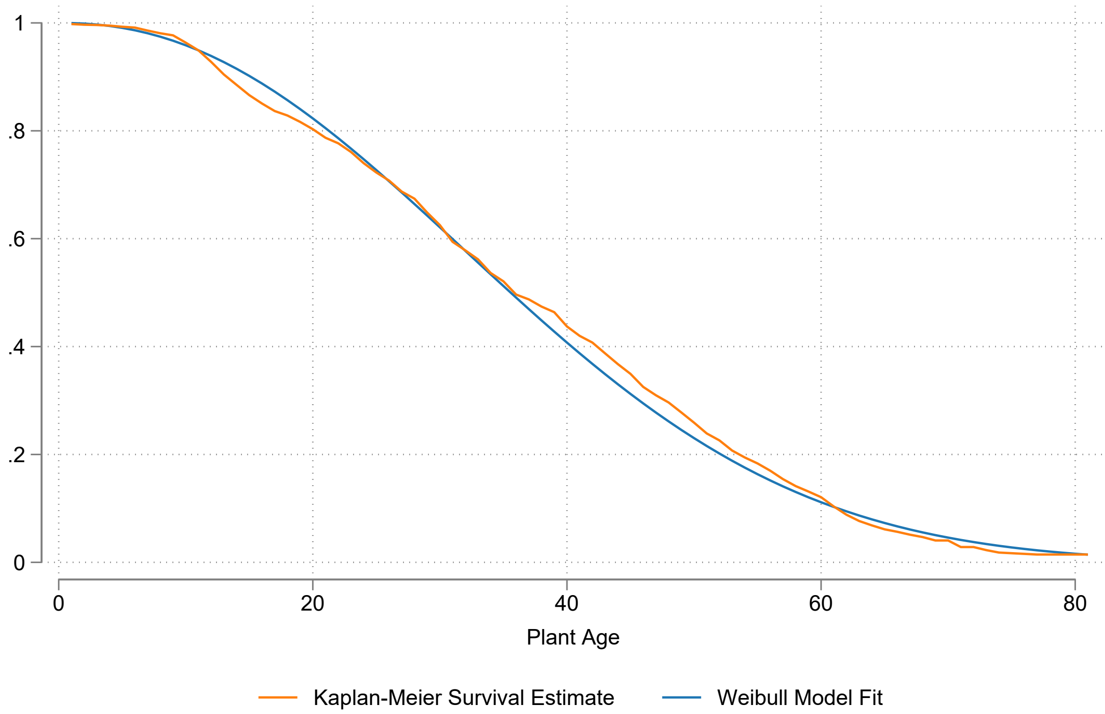
Notes: This figure displays the evolution of coal energy production for the US and globally over the 2000 to 2020 period. All data is from the EIA.

Figure C2: **Policy Strength by Region**



Notes: This figure shows the geographic breakdown and intensity of bank exit policies over time, according to their stated policies as of 2021. The upper graph shows the fraction of banks with any active policy in a given year, regardless of policy strength, weighted by the banks' fraction of aggregate syndicated loan origination in the 2009-2014 period. This captures the "extensive margin" of borrower exposure to coal exit policies. The lower graph captures the "intensive margin" by showing, conditional on the bank having released a exit policy, the average intensity of these policies over time. This is also weighted by the banks' fraction of aggregate syndicated loan origination in the 2009-2014 period.

Figure C3: **Coal Power Plant Survival Functions**



Notes: This figure shows the fitted survival functions as described in Appendix B. The orange line represents the Kaplan-Meier survival function of coal plant. The blue line represents the two parameter Weibull model fit. All data is from the GCPT database.

Table C1: **Effects of Exit Policies on Coal Firm Debt Issuance: Robustness with Other Measures of Ban Strength**

	Debt Issuance (log)			
	(1)	(2)	(3)	
Bank Exit Exposure$_{f,t}$	-0.219**			
	(0.097)			
Bank Exit Exposure (Reclaim Finance)$_{f,t}$		-0.316***		
		(0.108)		
Bank Exit Exposure (Reclaim Finance Phaseout)$_{f,t}$			-0.250***	
			(0.095)	
Bank Exit Exposure (Complexity)$_{f,t}$				-0.271***
				(0.094)
Borrower FE	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes
Size x Year FE	Yes	Yes	Yes	Yes
Observations	4,199	4,199	4,199	4,199
Adj-R^2	0.530	0.531	0.530	0.530

Notes: The table above reports the coefficients of the OLS regressions in which the dependent variable is the log of 1 + debt issuance. Debt issuance includes loans and bonds. Column 1 is the same as column 3 in the previous table. *Reclaim Finance Score* is the general measure of ban strength as attributed by the NGO Reclaim Finance. *Reclaim Finance Phaseout Score* is the subscore focusing on whether the policy is consistent with a phasing-out of lending to coal firms. *Complexity score* is the number of underlying variables on which the ban is conditioned. The explanatory variables are Standard errors are clustered at the borrower level and are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table C2: **Effects on Debt Issuance (SBTi)**

	Debt Issuance (log)			
	(1)	(2)	(3)	(4)
Bank Exit Exposure$_{f,t}$	-0.167**	-0.139*	-0.219**	-0.241**
	(0.070)	(0.084)	(0.097)	(0.112)
SBTi Adoption Exposure$_{f,t}$		0.384		-0.259
		(0.563)		(0.724)
Borrower FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Country x Year FE	No	No	Yes	Yes
Size x Year FE	No	No	Yes	Yes
Observations	4,472	4,472	4,199	4,199
Adj-R^2	0.477	0.477	0.530	0.530

Notes: The table above reports the coefficients of the OLS regressions in which the dependent variable is the log of 1 + debt issuance. Debt issuance includes loans and bonds. SBTi Adoption Exposure is defined as described in Section 6.2. Standard errors are clustered at the borrower level and are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table C3: **Pretrend Analysis**

	Debt Issuance Pretrend			Debt Issuance (log)	
	(1)	(2)	(3)	(4)	(5)
Bank Exit Exposure (Standardized)	0.146***	0.086	0.075		
	(0.047)	(0.076)	(0.080)		
Bank Exit Exposure				-0.219**	-0.236**
				(0.097)	(0.097)
Extrapolated Debt Issuance Pre-Trend					0.077***
					(0.019)
Country FE	No	Yes	Yes	Yes	Yes
Size FE	No	No	Yes	Yes	Yes
Borrower FE	No	No	No	Yes	Yes
Country x Year FE	No	No	No	Yes	Yes
Size x Year FE	No	No	No	Yes	Yes
Observations	344	323	323	4,199	4,199
Adj-R^2	0.019	0.062	0.075	0.530	0.534

Notes: This table reports the coefficients of the OLS regressions in which the dependent variables are the standardized 2009-13 debt issuance growth and the log of 1 + debt issuance. The first three columns regress standardized 2009-13 debt issuance growth on standardized bank exit exposure with varying sets of fixed effects. Column 4 regress log of 1 + debt issuance on bank exit exposure. Column 5 is the same as column 4, but includes a term for extrapolated debt issuance pre-trend. Extrapolated debt issuance pre-trend is derived using the coefficients from the OLS regression of log 1 + borrower debt on years from 2009-2013. Standard errors are clustered at the borrower level and are reported in the parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

Table C4: **Rotemberg Weights**

Panel A: Negative and Positive Weights

	Sum	Mean
Negative	-0.018	-0.001
Positive	1.018	0.018

Panel B: Correlations of Bank Ban Intensity

	α_k	g_k	β_k	Var(z_k)
α_k	1			
g_k	0.331	1		
β_k	0.030	-0.086	1	
Var(z_k)	0.644	0.090	0.023	1

Panel C: Variation Across Years

	Sum	Mean
2015-2021	0.999	0.002
2009-2014	0.001	0.000

Panel D: Top 10 Rotemberg Weight Banks

	$\hat{\alpha}_k$	g_k	$\hat{\beta}_k$	Bank Share
ING Group	0.372	0.396	-0.099	0.775
J. P. Morgan	0.138	0.121	-0.014	3.533
ANZ Banking Group	0.098	0.242	-0.069	1.076
Westpac Banking Corp	0.078	0.220	0.305	0.413
Standard Chartered Bank	0.053	0.104	-0.676	1.081
Citi Group	0.049	0.236	-1.113	3.007
Barclays	0.037	0.137	0.022	3.176
Development Bank of Singapore	0.022	0.077	-0.288	0.545
Societe Generale SA	0.020	0.352	-0.480	2.062
National Australia Bank	0.018	0.099	-0.055	0.879

Notes: This table reports statistics about the Rotemberg weights using the methodology from Table 4 of Goldsmith-Pinkham et al. (2020). Panel A reports the share of positive Rotemberg weights. Panel B reports correlation between the weights ($\hat{\alpha}_k$), average ban intensity (g_k), the just-identified coefficient estimates ($\hat{\beta}_k$), and the variation in bank shares across years (Var(z_k)). Panel C reports variation of the weights across the years. Panel D reports the top ten banks according to their Rotemberg weights. Bank Share is the bank's percentage share of 2009-2013 debt financing issued to all coal firms in our sample.

Appendix D Example Coal Exit Policies

MUFG Coal Policy[20]

A) Coal Fired Power Generation Sector

Protection of the environment, in particular actions which contribute towards combatting climate change and supporting development of more sustainable sources of power, is one of the most important issues for MUFG in fulfilling its social mission.

We support international initiatives that are aiming to reach the objectives set by the Paris Agreement and actively provide financing to renewable energy businesses, such as solar and wind power generation, to promote sustainable growth and support the transition to a low-carbon future through our business activities.

MUFG will not provide financing to new coal fired power generation projects. The exceptions of this policy may be considered where we will take into consideration the energy policies and circumstances of the related countries, international standards such as the OECD Arrangement on Officially Supported Export Credits, and the use of other available technologies when deciding whether to provide financing. We concurrently support the adoption of advanced technologies for high efficiency power generation and Carbon Dioxide Capture and Storage (CCS) technologies which contribute to a reduction in the emission of greenhouse gases.

B) Mining Sector (Coal)

MUFG recognizes that coal mining operations, if not managed responsibly, can have negative social and environmental impacts, including death and injuries from mine collapse, human rights abuse, and impacts on local biodiversity from toxic mine waste. Moreover, coal burning in power generation emits relatively large amounts of greenhouse gases compared to other energy sources. We recognize that the development of new coal mines to supply thermal coal for power generation projects could result in an increase in greenhouse gas emissions in the future.

When considering whether to provide finance to the development of new coal mines we assess the status of such client's consideration for environmental and social impacts. The assessment includes how the client addresses the impacts of the development on local ecosystems, relationships with local residents, and occupational safety and health issues. We will not provide any financing to coal mining projects using the mountaintop removal (MTR) method which has severe and negative impacts on the natural environment.

[20] Excerpt of 2020 Revision to MUFG Environmental and Social Policy Framework. Source: https://www.mufg.jp/dam/pressrelease/2020/pdf/news-20200513-002_en.pdf

Barclays' Coal Policy[21]

Coal

We are working to adjust our financing portfolio to mirror the trajectory in energy emissions required to meet net zero, taking the International Energy Agency's (IEA) Sustainable Development Scenario (SDS) as our starting point. Our January 2019 Energy and Climate Change Statement outlined our initial restrictions regarding the thermal coal industry, which are still in place as follows:

- No project finance to enable the construction or material expansion of coal-fired power stations anywhere in the world;
- No project finance for the development of greenfield thermal coal mines anywhere in the world.

In recognition of the fact that Barclays needs to go further in the approach taken to this industry, we are also now introducing the following restrictions:

- From 2020, we will not provide any financing to clients that generate more than 50% of revenue from thermal coal activities (mining and/or coal fired power generation);
- By 2025, we will no longer provide any financing to clients that generate more than 30% of revenue from thermal coal activities;
- By 2030, we will no longer provide any financing to clients that generate more than 10% of revenue from thermal coal activities;
- We will provide transition finance for companies reducing their thermal coal portfolio (including retro fitting of existing facilities). For those unable to transition their portfolio, we will provide financing for decommissioning plants;
- We will also not provide general corporate financing that is specified as being for new or expanded coal mining or coal-fired power plant development.

Restrictions relating to % revenue generated by clients from thermal coal activities listed above applies to the entity being financed, whether transacting with a group parent, subsidiary or joint venture.

Mountain Top Removal Coal Mining

Mountain Top Removal (MTR) coal mining refers to surface coal mining (and the associated reclamation operations) that remove entire coal seams running through the upper fraction of a mountain, ridge, or hill, by removing all of the overburden and creating a level plateau or gently rolling contour with no high-walls remaining.

Barclays recognises that MTR in the Appalachian region of the USA is a legal mining method, overseen by a robust regulatory framework. MTR has also, however, been subject to intense political, judicial and regulatory debate over the last decade, due to its negative environmental and social impacts on one hand, and positive local benefits on the other. The following additional restrictions are in place for clients active in MTR:

- Barclays does not directly finance MTR projects or developments;
- We apply EDD to financing facilities involving clients which practice MTR.

[21]Excerpt of relevant sections from Barclays Environmental Social Governance Report 2019. Source: https://home.barclays/content/dam/home-barclays/documents/citizenship/ESG/Barclays-PLC-ESG-Report-2019.pdf