Banking on Forest*

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Abstract

This paper examines whether a firm's exposure to deforestation risk affects loan terms. We find that forest-dependent firms face higher loan spreads than their peers when forest loss is driven by wildfires. In contrast, when forest loss is human-induced, the gap in spreads becomes significant only after the European Commission proposed the deforestation regulatory framework. Firms obtaining loans in the aftermath of human-induced deforestation subsequently reduce their reliance on forest-based inputs from suppliers in high-risk countries, initiate reforestation efforts, and divest from pollutive deforested plants. Our findings highlight banks' compliance role in green transition.

Keywords: deforestation, bank lending, environmental policy, green transition
JEL Classification: G21, G28, G30, Q54

1 Introduction

Forest loss can be the reason for economic loss in the form of natural disasters, or the consequence of economic activities such as agricultural land use and urbanization. The first, mostly driven by wildfires, accounts for nearly a quarter of global forest loss[1], represents an *acute physical risk* that immediately reduces the ecosystem services essential to a firm's production[2]. In contrast, human-induced forest loss, mainly driven by the conversion of forests into agricultural land, contributes to *chronic physical risks* by driving long-term climate change, including increased carbon emissions and desertification (e.g., Van der Werf et al. 2009, Pan et al. 2011, Houghton et al. 2012).

Various international organizations have introduced initiatives and frameworks to encourage the green transition toward less forest-degrading production and supply chains.[3] [4] Among which, the European Union Deforestation Regulation (EUDR)[5] mandates due diligence for commodities linked to deforestation.[6] This creates significant *transitions risk* for firms whose production processes are tied to deforestation and rising costs from litigation for non-compliance and market disruptions driven by shifting supply and demand.

Given firms' exposure to forest-loss related climate risks (FSB 2017), banks, as primary creditors, must not only ensure regulatory compliance (see, e.g., Allen et al. 2024, De Haas 2023) and address scrutiny from their own shareholders (see, e.g., Krueger et al. 2020, Giglio

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[1] Studies show that over the past several decades, wildfire patterns have intensified regionally due to climate change, not past land uses (e.g., Westerling et al. 2006, Jolly et al. 2015).
[2] For instance, the California wildfires in 2018 caused an estimated \$148.5 billion damages (1.5% of state's GDP), including \$27.7 billion capital losses, \$32.2 billion health costs and \$88.6 billion indirect losses (Wang et al. 2021).
[3] Popp et al. (2014) estimate that, without land-use regulations, human-induced forest loss could contribute 13% of the global carbon budget needed to meet the Paris Agreement's 2°C target by 2050. With conservation measures like REDD+, this could be reduced to 7%.
[4] For example, REDD+ was launched under the 2013 UNFCCC Warsaw Framework, and the 2016 OECD-FAO Guidance aids agricultural risk management.
[5] EUDR's timeline: framework proposal (July 2019), legislative proposal (Nov 2021), agreement (Dec 2022), and entry into force (June 2023), with compliance due by Dec 2025 for large firms and June 2026 for small ones.
[6] Under EUDR Article 2(15), an operator is any entity placing or exporting regulated products. This includes firms transforming one Annex I (regulated) product into another, such as cocoa butter into chocolate. https://green-business.ec.europa.eu/deforestation-regulation-implementation_en.

et al. 2021), but also actively manage and adjust their lending portfolios. This paper sets to examine how banks use the syndicated loan contracts to cope with borrower's physical and transition risks associated with forest loss.

We compile a global sample from 2002 to 2024 from various datasets. The information on syndicated loan comes from DealScan. We use forest loss geospatial data from Global Land Analysis and Discovery (GLAD) laboratory at University of Maryland (Hansen et al. 2013; Tyukavina et al. 2022) and geocode firms' headquarters within a 10-kilometer radius to differentiate fire-induced and human-induced forest loss. We assess firms' reliance on forest-related ecosystem services with the tool of Exploring Natural Capital Opportunities, Risks and Exposure (ENCORE), which evaluates economic activities based on their dependency on ecosystem services and their impact on natural capital. Our final sample consists of 42,590 loan issuance, covering 6,329 borrowers and 1,298 lenders, with significant representation from the US, EU, and other OECD countries.

First, we find that banks charge higher loan spreads for forest-dependent firms affected by fire-induced forest loss, with firms facing a 12-65 basis point (bps) higher yield spread relative to other borrowers. Second, we examine the impact of the EUDR and observe that the effect of fire-induced forest loss on loan pricing remains stable before and after the EUDR proposal; in contrast, the effect of human-induced loss becomes significant only in the post-EUDR period: on average, one-standard-deviation change in human-induced loss is associated with an 8.1bps increase in yield spreads for forest dependent firms. Year-by-year regressions further suggest that yield spreads for firms experiencing human-induced loss began rising following the 2016 Paris Agreement and became significantly positive from 2020 onward, aligning with the timeline of the EUDR proposal.

Across banks and borrowers, EU banks charge significantly higher spreads to EU forest-dependent firms exposed to human-induced loss, compared to the others. The effect is significant for non-EU OECD banks lending to non-EU OECD borrowers, but the magnitude is smaller, suggesting that while the EUDR has a strong regulatory influence within the EU, its effects extend though less intensely to other OECD countries. Over the course of the EUDR's implementation, one-standard-deviation change in human-induced loss is associated with a 43.5 bps increase in yield spreads for EU banks lending to EU firms between the regulation's proposal in July 2019 and its entry into force in June 2023. The effect rises to 46.9 bps from July 2023 onward. In contrast, the effect is not significant for non-EU banks lending to non-EU firms. When incorporating country-level forest loss risk, the pricing effect for EU firms nearly doubles, highlighting how banks increasingly incorporate transition risks into lending decisions as compliance deadlines approach.

The analysis of heterogeneity underscores the role of deforestation-related commitment, by both banks and firms, in shaping differential loan pricing. From the credit supply side, only banks that publicly commit to deforestation issues exhibit a significant post-EUDR pricing response, suggesting an active compliance channel. On the borrower side, firms that disclose anti-deforestation commitments face reduced spread increases after the introduction of EUDR, indicating that proactive firms can mitigate the cost of transition risk.

To assess whether forest loss materially disrupts firm operations, we examine changes in cash flows following major fire-induced and human-induced forest loss events. We find that large fire-induced loss is associated with a decline in firm's operating cash flows, suggesting tangible operational impacts, while large human-induced loss has no significant effect on short-term cash flows, suggesting limited immediate impact on operations. These findings suggest that banks raise lending interest rates in response to fire-induced loss because it reflects real impact on short-term liquidity, whereas the absence of a similar response to human-induced loss is consistent with its lack of short-term operational consequences.

Next, we examine how borrowers adapt to rising financing costs associated with deforestation. Following substantial human-induced forest loss, firms do not reduce their overall reliance on forest-based inputs but shift sourcing toward countries with lower deforestation risk. Additionally, firms securing loans after human-induced loss demonstrate increased reforestation activity, as measured by the Normalized Difference Vegetation Index (NDVI), a proxy for vegetation greenness—an effect that is particularly strong among highly forest-dependent firms. In contrast, we find limited evidence that firms adjust their supply chains or engage in reforestation following fire-induced forest loss. Finally, we find that firms also respond to transition risks by adjusting their asset portfolios, notably through the divestment of pollutive, forest-dependent plants.

By examining how banks price syndicated loans for borrowers exposed to deforestation risk, this paper makes several key contributions to the literature. First, this paper introduces the concept of deforestation risk and the two types of forest loss to the finance literature. By linking these environmental disruptions to widely recognized climate risks, we show that financial institutions and firms acknowledge their threats and respond through risk management strategies and operational adjustments. This contributes to the literature on environmental action versus greenwashing (e.g., Kacperczyk and Peydró 2022, Giannetti et al. 2024, Sastry et al. 2024). In addition, we find forest-dependent firms' disclosures on addressing deforestation issues mitigate the loan pricing difference, aligning with Carbone et al. (2022), who show that firms' stating emission and reduction targets in disclosures is linked to lower credit risk, particularly for firms with more ambitious commitments.

Second, the study uncovers a new stylized practice of syndicated lenders in assessing and pricing climate risks, shedding light on how financial institutions integrate environmental factors into loan pricing. A few prior studies suggest that banks price climate physical risks such as natural disasters. For instance, Brown et al. (2021) show that after severe winter weather, banks respond to firms' increased demand for capital by raising loan costs. Besides, Correa et al. (2022) find that loan spreads rise even for firms not directly impacted by natural disasters but with a high likelihood of exposure, suggesting that higher borrowing costs stem from lenders adjusting their expectations of climate risks. We show that forest-dependent firms affected by fire-induced forest loss face a 12-65 bps higher yield spread, economically more significant than differences due to relationship lending (10-17 bps gap between relationship and non-relationship lending in Bharath et al., 2011). In addition, our work is related to the literature of how banks mitigate physical risks in lending, including banks' divestment (e.g., Blickle et al. 2021, Ilabaca et al. 2024) and price adjustment (e.g., Javadi and Masum 2021, Nguyen et al. 2022, Götz et al. 2024) in syndicated loans and mortgages, to manage the credit risks from firms affected by natural disasters.

Third, this paper highlights the pivotal role of regulation in shaping capital market practices and leveraging financial institutions as key agents for policy implementation. This underscores how regulatory frameworks and environmental policies, such as the EUDR, influence risk assessment and capital allocation. This observation echoes the prior findings that climate initiatives and regulations spur lenders to re-allocate capital and tighten the loan terms. For example, Kacperczyk and Peydró (2022) show that banks re-allocate credit from brown to green firms after committing to carbon neutrality Science Based Targets initiative (SBTi); Degryse et al. (2023) document that banks offer cheaper loans to green firms following the Paris Agreement; Ivanov et al. (2024) find that cap-and-trade bills tighten bank loan terms for high-emission firms.

Finally, we provide direct firm-level evidence that climate regulations like the EUDR can drive operational changes, prompting firms to adopt more environmentally sustainable practices. This demonstrates the tangible impact of financial and regulatory pressures in steering corporate behavior toward greener outcomes. This finding aligns with the existing literature showing that regulatory pressures push firms toward greener production and investment strategies. For instance, Goetz (2019) finds that firms reduce toxic emissions when lower capital costs enable greater investment in pollution prevention. Accetturo et al. (2022) show that increased credit supply raises the likelihood of firms' green investments in cleaner production technologies. Apicella and Fabiani (2023) document that firms exposed to carbon pricing expand credit demand and reduce emissions, highlighting how financing facilitates greener operations.

The remainder of the paper is structured as follows: Section 2 describes the data and sample. Section 3 outlines the empirical model and specifications, while Section 4 presents and discusses the empirical results. Section 5 concludes.

2 Data and sample construction

We compile a loan-level sample (2002-2024) from multiple sources for our main analyses. Geospatial data on global forest loss are obtained from the Global Land Analysis and Discovery (GLAD) laboratory at the University of Maryland (Hansen et al., 2013; Tyukavina et al., 2022). To capture changes in vegetation greenness, we use the NASA MODIS Normalized Difference Vegetation Index (NDVI). Information on ecosystem dependencies of production processes is sourced from the ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure) tool, maintained and regularly updated by the United Nations. Customer–supplier relationships for U.S. firms are retrieved from Compustat Segment. Climate risk indices are obtained from Li et al. (2024). Corporate disclosures related to deforestation are collected via Refinitiv Advanced Filings Search (AdvFil). Data on plant divestitures are drawn from the EPA's Toxics Release Inventory (TRI) Program and the SDC M&A database. Syndicated loan information is sourced from DealScan, while firm and bank financials are compiled from Compustat Global, Compustat North America, and Refinitiv. We exclude financial firms, regulated utilities, and public administration firms.

We match the new LoanConnector DealScan data with the legacy DealScan dataset using the WRDS mapping utility. To obtain ISIN codes, the old DealScan data are linked to Worldscope via the DealScan–Worldscope Link Table (Beyhaghi et al., 2021). For borrower financial data, we use the link table provided by Schwert (2018) to merge DealScan with Compustat. Lender information is matched using the link table developed by Chava and Roberts (2008). To link Compustat company records with customer identifiers from Compustat Segment, we rely on the mapping tables contributed by Cohen and Frazzini (2008) and Cen (2017).

The combined dataset, used for testing our main hypotheses, is structured at the loan level[7], and contains 42,590 observations across 6,329 unique borrowers. Of these, 2,866 firms (45%) are headquartered in the US, 829 (13%) in the EU, and 4,766 (75%) in OECD member countries. This sample also includes 1,298 unique lenders, with 328 (25%) in the US, 226 (17%) in the EU, and 782 (60%) in OECD countries.

2.1 Measuring forest loss surrounding firm using geospatial data

We measure firm-level forest loss using two geospatial datasets from the University of Maryland. The Global Forest Change dataset (Hansen et al. 2013) provides annual 30-meter resolution data on gross forest cover loss from 2000 to 2023, with forest loss defined as a stand-replacement disturbance (from a forest to non-forest state). Tyukavina et al. (2022) disaggregate this into fire-induced and other causes. Fire-induced loss includes only full canopy fires, excluding mechanical burnings for agriculture. We define firm-level fire-induced

[7] We follow Chakraborty et al. (2018) to rank and select the lead arrangers with significant share in a deal. The final data for analysis is at the lead arranger-deal-earliest tranche (origination date) level.

and human-induced forest loss accordingly, with the latter primarily linked to commodity and agricultural drivers according to the classification of Curtis et al. (2018).[8]

Next, we measure the forest loss, both fire and human-induced, surrounding the headquarters of firms in our sample. Firm headquarters data (from Compustat and Refinitiv) are geocoded using a multi-step Google Maps algorithm to minimize location errors. We then calculate forest loss within a 10-kilometer radius of each headquarter via Google Earth Engine, recording fire- and human-induced loss in square kilometers.

Before merging with loan-level data, we match forest loss to the DealScan firm-year panel to analyze its distribution and create lagged measures. Figure 1 maps firm locations and 2023 forest loss intensity for the matched sample. Table 1 ranks average losses by country: Greece, Portugal, and Russia lead in fire-induced loss (U.S. ranks seventh), while Malaysia ranks highest in human-induced loss. This reflects Malaysia's globally leading deforestation rate from commercial agriculture and land use change.[9] Panel A and Panel B of Table 2 show forest loss exposure by SIC division (excluding financials, utilities, and public administration). All industries are exposed to some degree of forest loss, though variation is greater for fire-induced loss; wholesale trade is most exposed to fire-induced loss, whereas mining firms are most exposed to human-induced loss.

[Figure 1] [Table 1 and Table 2]

Table 3 presents summary statistics for fire-induced and human-induced forest loss lagged by one year in the DealScan loan-level sample. On average, firms experience 0.008 km^2

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[8] Curtis et al. (2018) attribute about 77% of global forest loss to commodity and agricultural drivers, 23% to wildfires, and less than 1% to urbanization.

[9] For instance: (1) Malaysia has the world's highest deforestation rate, as revealed by Google's forest map. https://news.mongabay.com/2013/11/malaysia-has-the-worlds-highest-deforestation-rate-reveals-google-forest-map/; (2) Causes of rainforest deforestation in Malaysia. https://www.internetgeography.net/topics/causes-of-rainforest-deforestation-in-malaysia/.

of fire-induced forest loss with a standard deviation of 0.123, and 0.170 km^2 of human-induced loss with a standard deviation of 0.419.

[Table 3]

2.2 Measuring firms' production forest-dependency

We use ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure), a tool developed in 2018 by Global Canopy, UNEP FI, and UNEP-WCMC, to assess firms' reliance on forest-based ecosystem services. ENCORE includes two pathways: dependency (direct reliance) and impact (pressure on ecosystems). We use dependency to capture forest risk. In our sample, 80% of above-median dependency firms also show above-median impacts, underscoring the dual role firms play as both reliant on and contributors to forest risk.

ENCORE rates 271 production activities across 25 ecosystem services using a six-level materiality scale (from very low to very high), based on literature reviews and expert validation.[10] For each activity, it provides: (1) a materiality rating on the production process dependency on various ecosystem services[11], (2) the natural capital assets required for each ecosystem service and the associated benefits, and (3) the natural or human-induced pressures (e.g., forest loss drivers) affecting these assets' ability to provide goods and services.

In our analysis, we begin by identifying ecosystem services provided by forest-related natural capital assets (referred to as "*forest services*" afterwards for simplicity). For instance, the ecosystem service "climate regulation" depends on the proper functioning of habitats, soils, water, and wetlands. These natural capital assets are classified as forest-related because they are affected by deforestation drivers such as habitat modification and overharvesting. In this case, "climate regulation" will be identified as *forest services*. After selecting only *forest*

[10] Where no links are identified, the activity-service pair is marked as N/A (Not Applicable) or ND (No Data).
[11] For example, the production of large-scale rainfed arable crops depends on 18 ecosystem services. It is highly dependent on animal-based energy due to low resilience to disruption, but shows minimal reliance on water quality, which does not critically affect operations.

services, we then aggregate the six-level materiality ratings (we re-assign values from 0-5) of the production process dependency on the *forest services* into the production process level. This approach specifically focuses on highly forest-related ecosystem services to assess production process-level risks, rather than broadly aggregating all ecosystem service dependency ratings.

Finally, we aggregate the production process-level dependency scores into the GICS industry level, which is the original classification used by ENCORE. We then use the industry crosswalk tables provided by ENCORE, and the ISIC-USSIC link table, to match the data with our sample at the 2-digit SIC level. After excluding financial firms, regulated utilities, and public administration, we ended up with 64 unique industry groups. We normalize the continuous dependency score into 0-5 scale, to be comparable to the ENCORE six-level materiality rating at the production process level.

Table 2 Panel C shows the summary statistics of the dependency score for each high-level SIC division at the firm level. The top three high-level SIC divisions with the highest average forest dependency scores are agriculture, forestry, and fishing (2.52), mining (2.31), and manufacturing (1.04). At the 2-digit SIC level, top five industries with the highest dependency score are forestry (5.0), food and kindred products (3.15), coal mining (2.79), agricultural production crops (2.71), and agriculture production livestock and animal specialties (2.71). Table 3 shows that the average dependency measure *Dependency* is 0.91 for the loan-level sample.

3 Empirical design

We begin by examining whether banks price in physical and transition risks from forest loss in loans. Firms more reliant on forest-based inputs face greater risk when nearby loss occurs, with the risk type depending on its cause. Specifically, fire-induced forest loss represents a realization of *physical risk*, as it can abruptly disrupt firms that rely on forests by unexpectedly removing raw materials essential to their production processes. Wildfires may also produce secondary effects—such as smoke damage or destruction of physical assets—that can impact a broader range of firms. However, these effects are typically shorter-lived and less directly tied to production activities. In contrast, human-induced forest loss may similarly reduce the availability of forest-based inputs, but it often stems from the firm's own actions, such as supply chain expansion or land-use change. Consequently, it exposes forest-dependent firms to *transition risks*, as the loss signals involvement in deforestation and environmental degradation. This increases the likelihood of regulatory scrutiny under current or anticipated deforestation-related policies. Thus, we estimate the following model specification at the loan level:

$$\text{Yield spread}_{\text{b,f,l,t}} = \beta_1 \text{Dependency}_{\text{i}} + \beta_2 \text{Loss}_{\text{f,t}-1} + \beta_3 \text{Dependency}_{\text{i}} \times \text{Loss}_{\text{f,t}-1} + \theta_1 (\text{Loan ctrls})_{\text{b,f,l,t}} + \theta_2 (\text{Bank ctrls})_{\text{b,t}-1} + \theta_3 (\text{Firm ctrls})_{\text{f,t}-1} + \text{FE} + \epsilon_{\text{b,f,l,t}}. \quad (1)$$

The dependent variable $Yield\ spread_{b,f,l,t}$ is "all-in-spread drawn" (AISD) divided by 100. $Dependency_i$ is the proxy for the levels of an industry's forest dependency, aggregated at the 2-digit SIC level. Alternatively, we also construct a country-weighted forest dependency measure, where industry dependency is weighted by country-year-level total forest loss, to account for heterogeneity in deforestation exposure across countries.[12] $Loss_{f,t-1}$ captures the total forest loss—both fire-induced and human-induced—within a 10-kilometer radius of a firm's headquarter in the previous year.[13] The coefficient β_3 captures the differential change in

[12] We calculate the country-weighted dependency score as $Dependency \times (1 + forest\ loss_{c,t})$, where both components are normalized between 0 and 1. This ensures that in years with minimal forest loss, the original industry dependency remains unchanged, while in years with high country-level forest loss, the weighted score can rise to a maximum of 2, effectively doubling the base dependency to reflect elevated risk.

[13] While using headquarters locations may introduce measurement error when production occurs elsewhere, prior studies employing this proxy argue that a substantial portion of firms' operations, business activities and employees are concentrated near their headquarters (e.g., Chaney et al. 2012, Korniotis and Kumar 2013, Barrot and Sauvagnat 2016, Tuzel and Zhang 2017, Huynh and Xia 2021). At the time of drafting, we are unable to

loan yield spreads for high forest-dependent firms relative to low forest-dependent firms in response to forest loss, enabling us to assess whether banks price risk based on firms' reliance on forest-related inputs.

The vector, FE, represents a set of fixed effects to account for unobserved heterogeneity. In our baseline specification, we include year fixed effects to control for time-varying macroeconomic conditions. We further incorporate high-level industry fixed effects (SIC division) to examine within-sector variation in loan pricing. To account for cross-border lending heterogeneity, we also include bank×firm country fixed effects, which control for differences in lending practices that may arise from country-level interactions between lenders and borrowers—such as variations in regulatory regimes, deforestation exposure, or credit market conditions. Loan-level controls include a set of dummy variables: *If secured loan*, *If base prime*, *If refinance*, *Repeated lending*, *Loan purpose*, *Log loan amount*, and *Log maturity*. Borrower-level controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating,* all lagged by one year. Lender-level controls include *Bank size*, also lagged by one year. The summary statistics for the variables are reported in Table 3. All variables are defined in Appendix Table A.1. $\epsilon_{b,f,l,t}$ is the error terms, clustered at the 2-digit SIC industry and year level to account for correlated shocks within industries over time.

Next, we examine whether banks increase lending rates in response to the rising transition risks from deforestation, using the introduction of the EUDR as a policy shock that amplifies such risks. A key regulatory distinction is the source of forest loss: natural events like wildfires are beyond firm control and unlikely to trigger penalties, while human-induced loss, such as from business expansion or land-use change, represents a local environmental exploitation and is more likely to attract exposure to regulatory scrutiny, especially for forest-

conduct plant-level robustness check using U.S. plant-level data from the Census of Manufactures or Annual Survey of Manufactures, as access is suspended under federal data restrictions.

dependent firms. Unlike voluntary initiatives, the EUDR imposes legally binding due diligence, requiring firms to ensure their products are deforestation-free. It applies not only to EU firms but also to those trading with the EU, with strict traceability rules linking products to their geographic origin.

To capture rising transition risk, we define the period following July 2019, when the EUDR legislative framework was proposed, as the beginning of heightened regulatory pressure on deforestation. This timing reflects the forward-looking nature of market responses to anticipated compliance obligations. Accordingly, we estimate the following loan-level model:

$$\begin{aligned}\text{Yield spread}_{b,f,l,t} = {} & \beta_1 \text{Dependency}_i + \beta_2 \text{Loss}_{f,t-1} + \beta_3 \text{Post EUDR}_t + \\ & \beta_4 \text{Dependency}_i \times \text{Loss}_{f,t-1} + \beta_5 \text{Dependency}_i \times \text{Post EUDR}_t + \beta_6 \text{Loss}_{f,t-1} \times \\ & \text{Post EUDR}_t + \beta_7 \text{Dependency}_i \times \text{Loss}_{f,t-1} \times \text{Post EUDR}_t + \theta_1 (\text{Loan ctrls})_{b,f,l,t} + \\ & \theta_2 (\text{Bank ctrls})_{b,t-1} + \theta_3 (\text{Firm ctrls})_{f,t-1} + \text{FE} + \epsilon_{b,f,l,t}. \qquad (2)\end{aligned}$$

$Post\ EUDR_t$ is a time indicator equal to one after July 2019, and zero otherwise. A significantly positive β_7 would suggest that banks adjust loan pricing in response to heightened transition risk from human-induced loss under stricter regulatory scrutiny.

4 Empirical results and discussions

4.1 Baseline results: forest loss and loan spreads

We estimate equation (1) to test whether banks increase loan spreads for forest-dependent firms following nearby forest loss. Table 4 presents the results for both measures of *Fire loss* and *Anthropogenic loss*. Column (1) shows that at the sample mean of *Dependency* (0.91), one additional square kilometer of fire loss corresponds to a 15 basis point increase in spreads. In contrast, column (2) shows the interaction of *Dependency* and *Anthropogenic loss* is small and not significant. Column (3) confirms the observations with both loss types included.

These results suggest that banks distinguish between the two forest loss types and primarily price unanticipated physical risks from fire-induced loss.

[Table 4]

A potential concern is that the observed effects may be driven by a few high-dependency industries. Table 2 Panel C shows the average dependency score in agriculture, forestry, and fishing is significantly higher than in mining (difference = 0.167, SE = 0.0168) and manufacturing (difference = 1.418, SE = 0.0298). However, there is meaningful variation within industries. In agriculture, forestry, and fishing, dependency scores range from 1.622 to 5, with a standard deviation of 0.932, higher than the mean for construction, the fourth-highest division. To address this, column (4) includes fixed effects for the eight major SIC divisions. The interaction coefficient remains significant, decreasing only slightly from 0.424 to 0.415, indicating that banks continue to price fire-induced loss risk beyond industry-level variation.

Another possibility is whether banks condition loan pricing on borrowers' country-level deforestation risk. To address this, column (5) employs a country-weighted dependency measure, assigning greater weight to firms in high-risk countries. The interaction coefficient rises from 0.424 to 0.527, indicating banks are more responsive to physical risk in vulnerable geographies. Column (6), which includes bank×firm country fixed effects, yields a similar coefficient (0.586), suggesting pricing is driven by within-country variation rather than cross-country differences. That is, banks respond to localized fire-induced loss rather than uniformly penalizing firms in fire-prone countries. Together, these results imply banks incorporate both systemic country-level risk and idiosyncratic local shocks in loan pricing.

Another potential concern is that loan pricing reflects general climate risk rather than forest-specific exposure. Table B.1 addresses this by controlling for firm-level acute, chronic, and transition risks (Li et al. 2024) in a sample of U.S. listed firms. The *Dependency* and *Fire loss* interaction remains stable (0.587 to 0.584) and significant at the 1% level, indicating the effect is not confounded by broader climate risk but reflects the unique pricing of forest-related physical shocks.

4.2 Robustness

The severity of fire-induced forest loss likely shapes banks' risk assessments. While small fires may be inconsequential, extreme events can disrupt operations significantly for forest-dependent firms. If banks perceive such tail risks as disproportionately costly, loan pricing should exhibit nonlinearity. For robustness, Table B.2 re-estimates equation (1) by interacting *High dependency* (firms above the median forest dependency) with discrete fire loss indicators defined by percentile thresholds, with *Yield spread* as the dependent variable.

Column (1) shows that a one-standard-deviation increase in fire-induced loss raises spreads by 2.4 bps for high-dependency firms (interaction = 0.194). This likely understates tail risk due to right-skewed fire loss distribution. Column (2) uses a binary indicator for any fire loss; the interaction rises to 0.145, implying a 14.5 bps spread difference when any fire loss occurs. Columns (3)-(6) apply increasingly severe percentile cutoffs, with interaction effects strengthening as fire magnitude intensifies. The top panel of Figure 2 further confirms a nonlinear pricing pattern: interaction coefficients between *High dependency* and fire loss indicators rise steadily across percentile thresholds (50^{th} to 99^{th}), with a sharp increase beyond the 95^{th} of fire loss. Across specifications, coefficients range from 0.12 to 0.65, implying that forest-dependent firms face 12-65 bps higher spreads following fire events, depending on severity.

[Figure 2]

4.3 Policy shock: the introduction of the EUDR

To assess whether banks adjust pricing in response to deforestation-related transition risk, we estimate equation (2) using the global sample first, focusing on the post-EUDR period (August 2019 to December 2024). Column (1) of Table 5 shows that the *Dependency* and *Fire loss* interaction remains positive and significant, while the triple interaction with *Post EUDR* is not, suggesting no change in pricing of fire-induced loss after the regulation. Column (2), using *Weighted dependency*, yields similar non-significance, consistent with fire-induced loss being exogenous and thus not triggering transition risk concerns.

[Table 5]

In comparison, columns (3) and (4) of Table 5 examine *Anthropogenic loss*. The triple interaction with *Dependency* and *Post EUDR* is 0.261 in column (3), implying an 8.1 bps spread increase for a one-standard-deviation rise in both dependency and human-induced loss. Using *Weighted dependency* in column (4), the coefficient rises to 0.416, suggesting banks impose larger penalties on forest-dependent firms in high-risk countries post-EUDR. Figure B.1 presents year-by-year estimates of equation (1) using rolling five-year windows. The top panel shows that the pricing effect of fire-induced loss is generally positive, with a small dip and increasing variation after 2014. In contrast, the bottom panel shows that pricing effects for human-induced loss decline after 2008, rise steadily post-2016 around the Paris Agreement, and become significantly positive from 2020 onward, coinciding with the EUDR proposal timeline.

4.3.1 Country heterogeneity

To further assess whether EUDR-driven pricing effects are stronger within the EU, Table 6 compares EU lender-borrower pairs with other lending situations. Column (1), which focuses on EU bank-EU firm loan subsample, shows a triple interaction coefficient of 1.766 between *Dependency*, *Anthropogenic loss* and *Post EUDR*, indicating that EU banks impose higher spreads on forest-dependent EU firms exposed to human-induced loss post-EUDR. This effect is significantly larger than the 0.238 coefficient for non-EU pairs (column 2). In economic terms, the post-EUDR pricing gap between high- and low-dependency firms (relative to the sample median) ranges from approximately 40 to 200 bps depending on the level of human-induced loss, as shown in the bottom panel of Figure 2.

[Table 6]

We also test for spillovers to non-EU OECD countries. Column (3) shows a triple interaction of 0.420 for OECD lending pairs that exclude any EU lender or borrower, roughly one-fourth the EU effect in column (1). This is significantly larger than the 0.122 coefficient for non-OECD pairs (column 4). While weaker than within-EU pricing, the results indicate OECD lenders are responsive to EU deforestation policy signals.

To isolate the compliance role of EU banks, we then focus on EU operators: firms either headquartered in the EU or with major EU customers (identified via Compustat Segment). This ensures direct exposure to EUDR. Table B.3 re-tests on this subsample and shows that EU banks significantly raise spreads for forest-dependent firms facing anthropogenic loss post-EUDR (column 1), while non-EU banks show no response (column 2). Results hold with *Weighted dependency* (columns 3 and 4), confirming EU banks' stronger regulatory sensitivity.

Given the multiple phases of EUDR implementation, we next examine whether changes in regulatory certainty affect loan pricing. From the framework proposal in July 2019 to enforcement in June 2023, firms faced elevated but uncertain transition risk. Once the regulation took effect, compliance terms became clearer, but pressure intensified as deadlines approached. Table B.4 uses two post indicators and presents how banks adjust loan spreads across these phases. We define post indicator *Post EUDR (phase 1)* as August 2019 to June 2023, and *Post EUDR (phase 2)* as the period following enforcement. Column (1) of Table B.4 shows that for EU bank-firm pairs, the triple interaction of *Dependency*, *Anthropogenic loss* and *Post EUDR* rises from 2.3 in phase 1 to 4.6 in phase 2. These correspond to yield spread increases of 43.5 and 46.9 bps, respectively, for a one-standard-deviation rise in both dependency and human-induced loss during phases 1 and 2. These results suggest that the differential pricing strengthens as the regulation moves from proposal to enforcement. Column (2) finds no meaningful response for loans involving non-EU parties. Columns (3) and (4), using *Weighted dependency*, show even larger effects for EU pairs in both phases, further supporting the stronger compliance role of EU banks.

4.3.2 Credit supply side: compliance role of committed banks

From credit supply side, a natural question is whether banks that publicly commit to addressing deforestation play a more active role in pricing transition risk. Table 7 presents the results by re-estimating the interaction between *Dependency* and *Anthropogenic loss* across four subsamples: committed and non-committed banks, before and after the EUDR. Committed banks are identified as those who ever mentioned "deforestation" in their public disclosures, including ESG reports, annual reports, and SEC filings retrieved from Refinitiv AdvFil.

[Table 7]

In the post-EUDR period, only committed banks exhibit a significant positive interaction coefficient of 0.196, implying that these banks charge higher spreads to forest-dependent firms following human-induced forest loss. The effect corresponds to an estimated 17.6 basis point increase at the sample mean of Dependency (0.9) for a 1 km^2 loss. No significant pricing response is observed for non-committed banks or in the pre-EUDR period. These findings suggest that committed banks internalize regulatory transition risks more actively in loan pricing, highlighting a compliance-oriented channel on the credit supply side.

4.3.3 Firm heterogeneity: firm commitments on deforestation

We next examine whether this pricing effect is mitigated when firms actively engage with deforestation issues in their public disclosures. Similarly, Table 8 presents the results by re-estimating the *Dependency* and *Anthropogenic loss* interaction across firm commitment status and pre- versus post-EUDR subsamples. Committed firms are defined as those who mention "deforestation" in public filings (via Refinitiv AdvFil again) during the previous year, capturing time-series variation in deforestation exposure and engagement. The proxy rests on two assumptions. First, "deforestation" is a specific term rarely used outside environmental contexts, unlike broader terms such as "ecosystem". Second, firms referencing "deforestation" in formal disclosures typically signal recognition or mitigation efforts, rather than admitting involvement.

[Table 8]

Columns (1) and (2) report results for committed firms before and after the EUDR, and columns (3) and (4) show results for non-committed firms. Only non-committed firms in the post-EUDR period exhibit a significant positive interaction between forest dependency and human-induced loss, implying that lenders impose higher borrowing costs on uncommitted firms when deforestation risk is salient. At the sample mean of *Dependency* (0.91), the estimate implies a 23 bps increase in yield spread for each km^2 of human-induced loss. The absence of such pricing for committed firms suggests that disclosure serves as a mitigating signal of transition risk.[14]

5 Mechanisms and ex-post outcomes

5.1 Mechanism: forest loss and firm operation

To assess whether loan pricing reflects realized operational disruption, we estimate dynamic difference-in-differences regressions where the outcome is operating cash flow divided by tangible assets of the prior year. Firms are classified using *Top dependency*, equal to one for the top 30 percent of forest reliance and zero for the bottom 30 percent. *Post large fire loss* and *Post large anthropogenic loss* are event-time indicators spanning from two years before to four years after the loss. Large loss events are defined as those in the top 20 percent of the annual distribution, measured consistently across all distance bands from 10 to 80 kilometers around the firm, to ensure the event is both nearby and severe. We exclude cases with overlapping events to avoid contamination. Figure 3 plots the dynamic interaction

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[14] As a robustness check, we replicate the analysis using firms' E pillar scores from Refinitiv ESG rating as an alternative measure of environmental engagement and obtain similar results.

between *Top dependency* and each forest loss type. Following large fire-induced loss, high-dependency firms experience a sharp decline in operating cash flow that drops below minus 20 percent relative to low-dependency peers. The negative effect persists for two years before gradually recovering by year four. In contrast, human-induced loss generates no immediate impact. Instead, cash flows among high-dependency firms begin to rise over time, with relative performance gains becoming evident by the fourth post-event years, suggesting business expansion-driven gains.

[Figure 3]

5.2 Ex-post outcome in production

After receiving syndicated loans, firms may adjust their sourcing or reforestation activities, offering insight into whether lending supports green transitions or sustains deforestation-intensive practices. If high-risk firms reduce deforestation exposure post-loan, this suggests lender engagement in promoting sustainability. Conversely, continued deforestation implies that lending may enable environmentally harmful operations. We begin by examining changes in forest-related supply.

Table 9 reports firm-level results on how receiving loans after forest loss affects a firm's supply chain. We use two outcome variables to capture different types of supply chain transitions: (1) *Supply dependency* measures the share of a firm's inputs sourced from forest-dependent suppliers, calculated as the sum of each supplier's *Dependency* weighted by its share of the firm's total purchases. A decline in this measure indicates a shift away from forest-based inputs, reflecting an overall transition in production sourcing. (2) *Country-adj supply* measures the share of inputs from forest-dependent suppliers located in high-deforestation-risk countries, calculated as the sum of each supplier's *Weighted dependency* (accounting for both forest dependency and country-level deforestation risk) multiplied by its share of the firm's total purchases. A decrease in this variable reflects a shift toward responsible sourcing, where the firm continues to use forest inputs but increasingly sources them from countries with lower deforestation risk. In both Panel A and Panel B, columns (1) and (3) report average outcomes over three years forward, while columns (2) and (4) report four-year averages. Firms are classified using *If get loan*, a dummy equal to one if a firm obtains a syndicated loan in the same year or within one year following a large forest loss, and zero otherwise.

[Table 9]

Panel A examines firm responses to large human-induced forest loss. *Post large anthropogenic loss* equals one for the three years after the event and zero for the three years before. In columns (1) and (2), the interaction between *If get loan* and the time indicator is negative and weakly significant, suggesting limited reduction in overall reliance on forest-based inputs. Columns (3) and (4) show stronger effects: the interaction terms are negative and significant, indicating that firms shift toward sourcing from lower-risk countries rather than reducing total forest input use. This implies that loans are associated with more responsible sourcing under heightened transition risk. Panel B evaluates responses to large fire-induced loss using the same specification. *Post large fire loss* is defined over the same three-year window. Across all columns, the interaction terms are negative but not significant, suggesting no material adjustment in supply chains among firms receiving loans. This lack of response reflects the more exogenous nature of wildfire shocks, which do not intensify transition risks in the same way as human-driven deforestation.

5.3 Ex-post outcome in reforestation

We next assess whether firms receiving syndicated loans after large human-induced forest loss engage in reforestation. Unlike supply chain shifts, reforestation requires active restoration, as the environmental damage is long-lasting and cannot be reversed through sourcing changes alone. To measure reforestation, we use the *Normalized Difference Vegetation Index* (NDVI), a satellite-based indicator of vegetation greenness from NASA

MODIS. Table 10 reports results from a firm-year panel. The time indicator *Post large anthropogenic loss* equals one for the three years after the event and zero for the three years before. *If get loan* equals one if a firm receives a syndicated loan in the same year or within one year of the loss event.

[Table 10]

Panel A of Table 10 reports the results for the full sample. The interaction between *If get loan* and *Post large anthropogenic loss* is positive and significant across all windows, with coefficients from 1.174 (one-year forward outcome) to 1.215 (two-year forward outcome). This indicates greater reforestation following loan receipt. Panel B restricts the sample to firms above the median in forest dependency. Coefficients are ranging from 1.555 to 1.595, implying that forest-dependent firms respond more through reforestation. To test whether this response is specific to human-driven loss, Table B.5 repeats the analysis for fire-induced events. No significant relationship is found between loan receipt and NDVI, consistent with wildfires being external shocks. This supports the interpretation that reforestation is more likely when deforestation is anthropogenic and linked to transition risk.

5.4 Ex-post outcome in pollutive plant divestiture

Firms may also respond to deforestation-related transition risk by adjusting their asset portfolios. One channel is divesting pollutive plants, particularly if syndicated loans provide the capital to support such restructuring. If loans facilitate this transition, we would expect a higher likelihood of divestiture. Table 11 tests this by examining whether firms receiving loans are more likely to divest pollutive forest-linked plants after large human-induced forest loss. The sample includes U.S. public firms with at least one TRI-listed plant. Divestiture data come from the SDC M&A database. We limit the sample to transactions where the buyer acquires over 50 percent ownership and exclude financial firms as acquirers or targets. Pollutive plants are restricted to only forest-dependent ones. The divestiture indicator is multiplied by 100, so coefficients represent percentage-point changes in divestiture likelihood. The outcome is measured forward from one to four years across columns.

[Table 11]

The results show that firms receiving loans after human-induced forest loss are more likely to divest pollutive forest-dependent plants. Starting from the forward two-year outcome (column 2), the triple interaction of *Dependency*, *Anthropogenic loss*, and *If get loan* is positive and significant, with coefficients rising from 1.095 to 1.215 as the outcome window extends from t+2 to 4. Column (3) implies that a one-standard-deviation increase in both forest dependency and loss raises divestiture probability by 0.38 percentage points for loan-receiving firms relative to others.

5.5 Further discussions: selection into loan receipt and alternative measures

A potential concern is that firms receiving loans differ systematically from non-recipients, potentially biasing post-loan outcomes. To assess this, the t-test in Table B.6 shows that loan receipt is associated with higher book debt, confirming expanded debt capacity. Table B.7 estimates a probit model of loan receipt. Column (3) shows that neither *Anthropogenic loss* nor *Dependency* significantly predicts loan access, indicating that deforestation exposure does not drive selection. To further address selection, Table B.8 includes the Inverse Mills Ratio in the analysis of production outcomes, with no change in results. Similar robustness holds for reforestation (Table B.9) and divestiture outcomes (Table B.10).

Another concern is that NDVI may not directly capture firm-level reforestation, especially if projects occur off-site, such as through carbon offsets. To address this, we construct an alternative outcome based on self-reported reforestation. Using a keyword dictionary derived from voluntary "Forestry and Land Use" carbon offset classifications, we flag firm disclosures from Refinitiv sources when they mention reforestation.[15] The variable *Reforest* equals 100 if such activity is reported within the post-loan estimation window.

Table B.11 tests this alternative outcome and confirms prior findings. Forest-dependent firms receiving loans after human-induced loss are more likely to report reforestation, with the triple interaction of *Dependency*, *Anthropogenic loss*, and *If get loan* positive and significant across all models. Coefficients range from 0.560 to 0.756. Column (2) implies a one-standard-deviation increase in both variables raises reforestation disclosure likelihood by 0.24 percentage points. Results remain robust to selection controls, as shown in Table B.12.

6 Conclusion

This paper examines how banks price syndicated loans for firms exposed to deforestation risks, distinguishing between fire-induced and human-induced forest loss. We find that banks increase loan spreads for forest-dependent firms affected by fire-induced forest loss, charging a premium of 12-65 basis points. Regulatory frameworks, such as EUDR, have a profound influence on financial institutions' risk assessment and capital allocation. EU banks impose higher loan spreads on forest-dependent firms affected by human-induced loss compared to non-EU banks, with a stronger effect on firms operating within high-deforestation-risk countries. The regulatory impact extends to OECD countries, though with a lower intensity. Over different phases of EUDR implementation, loan pricing became more sensitive to transition risks from the policy framework proposal in July 2019 until the regulation's entry into force in June 2023, with a further rise afterwards.

[15] The dictionary is based on the categories of voluntary "Forestry & Land Use" projects documented in the Voluntary Registry Offsets Database (Haya et al. 2025). The dictionary includes terms related to key project types: afforestation, reforestation, (improved) forest management, (avoided) forest conversion, forest restoration, forest projects, (improved) grassland management, (avoided) grassland conversion, grassland restoration, (improved) wetland management, (avoided) wetland conversion, wetland restoration, and REDD+.

We further find that firms also respond to the rising costs of capital and evolving regulations. Those that actively disclose deforestation-related risks experience reduced loan pricing penalties, demonstrating the role of transparency in mitigating financial burdens. In response to transition risks associated with human-induced forest loss, firms shift sourcing toward countries with lower deforestation risk, engage in reforestation efforts, and divest pollutive forest-dependent plants.

This study contributes to the literature by uncovering how banks integrate climate risks into loan pricing, highlighting the role of regulations in influencing capital markets, and providing firm-level evidence of regulatory-driven operational shifts.

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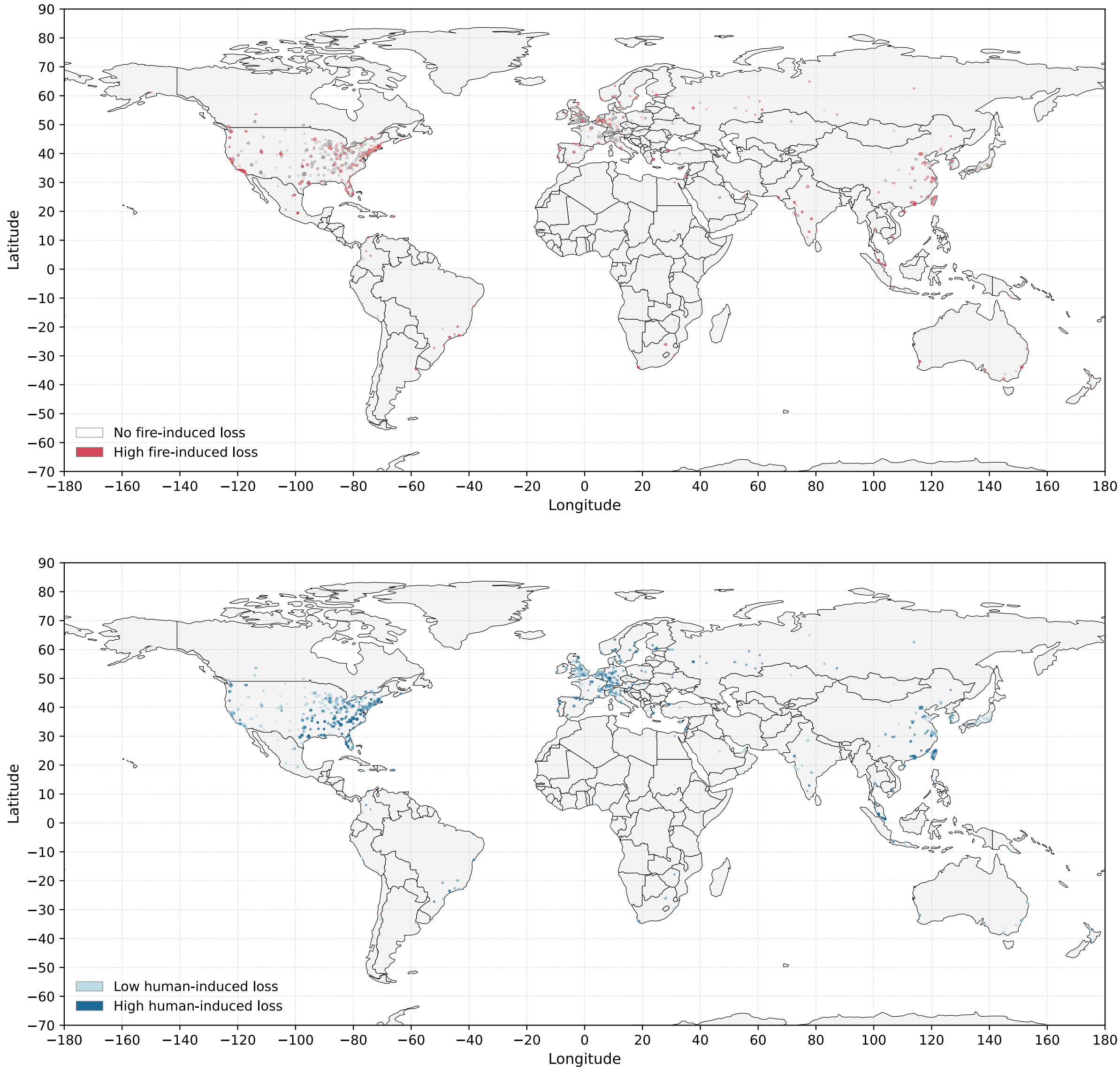


Figure 1. Forest loss of the sample firms in 2023

The plots illustrate the geographic distribution of our sample firms and the forest loss around them in 2023. The first figure depicts fire-induced forest loss, where gray circles indicate firms with no fire-induced loss, and increasing shades of red represent greater fire-induced loss. The second figure focuses on human-induced forest loss, with light blue circles indicating minimal forest loss and darker shades indicating more severe loss. The forest loss is measured within a 10km radius around each firm. The circles on the maps are visually enlarged to clearly display firms' locations, and do not represent the actual geographical areas of the forest loss.

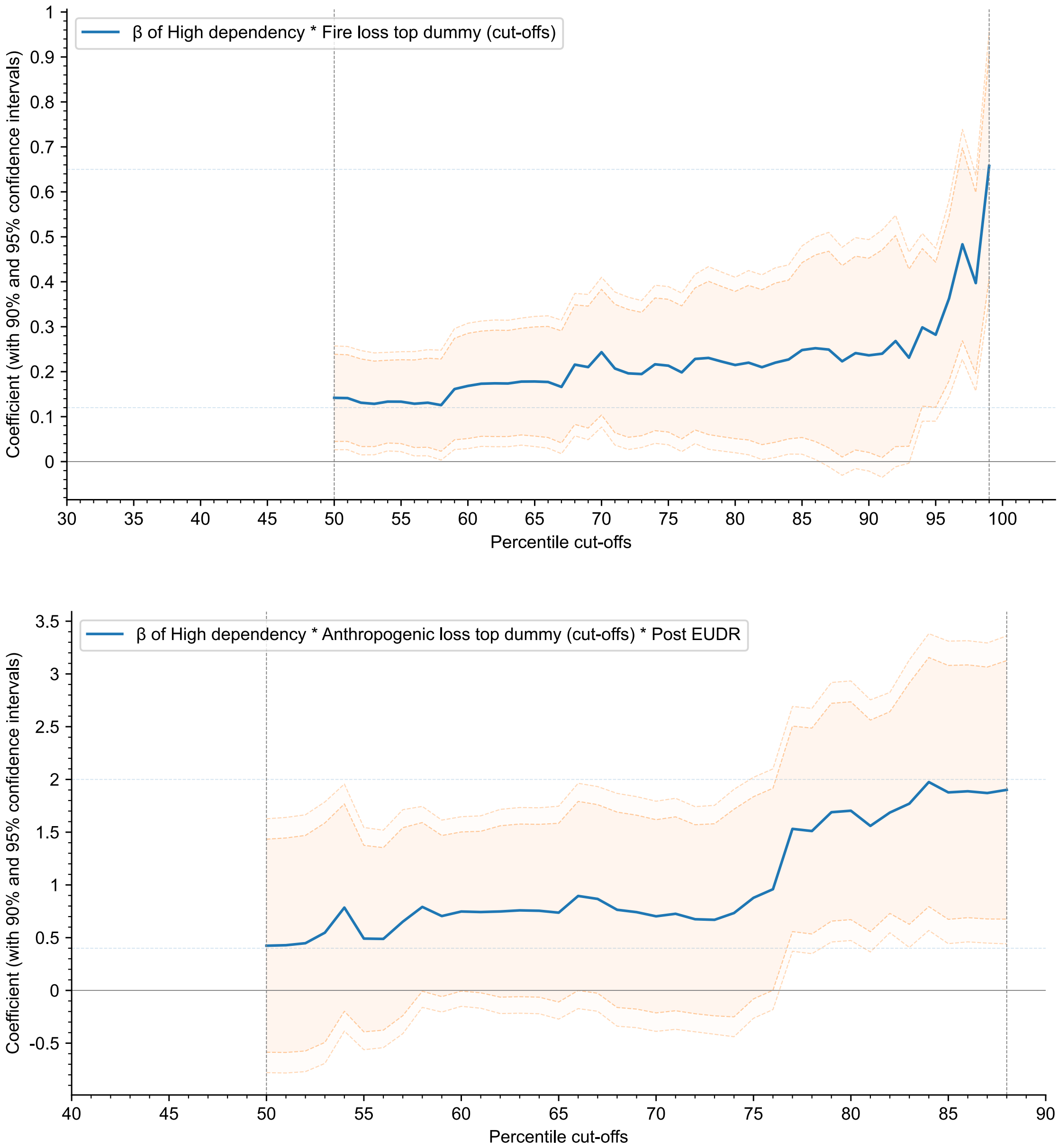


Figure 2. Forest loss thresholds and differential pricing effects

This figure plots estimated coefficients from interaction terms involving *High Dependency* and deforestation loss percentile cut-off dummies, with *Yield spread* as the dependent variable. The top panel shows the interaction with fire-induced loss; the bottom panel plots the triple interaction with human-induced loss and *Post EUDR*, using EU bank-firm lending pairs. *High Dependency* equals one if the firm's forest dependency score is above the median. Loss dummies equal one if exposure exceeds a given percentile threshold. Blue lines show coefficient paths; shaded areas indicate statistical significance (light orange for 5%, dark orange for 10%).

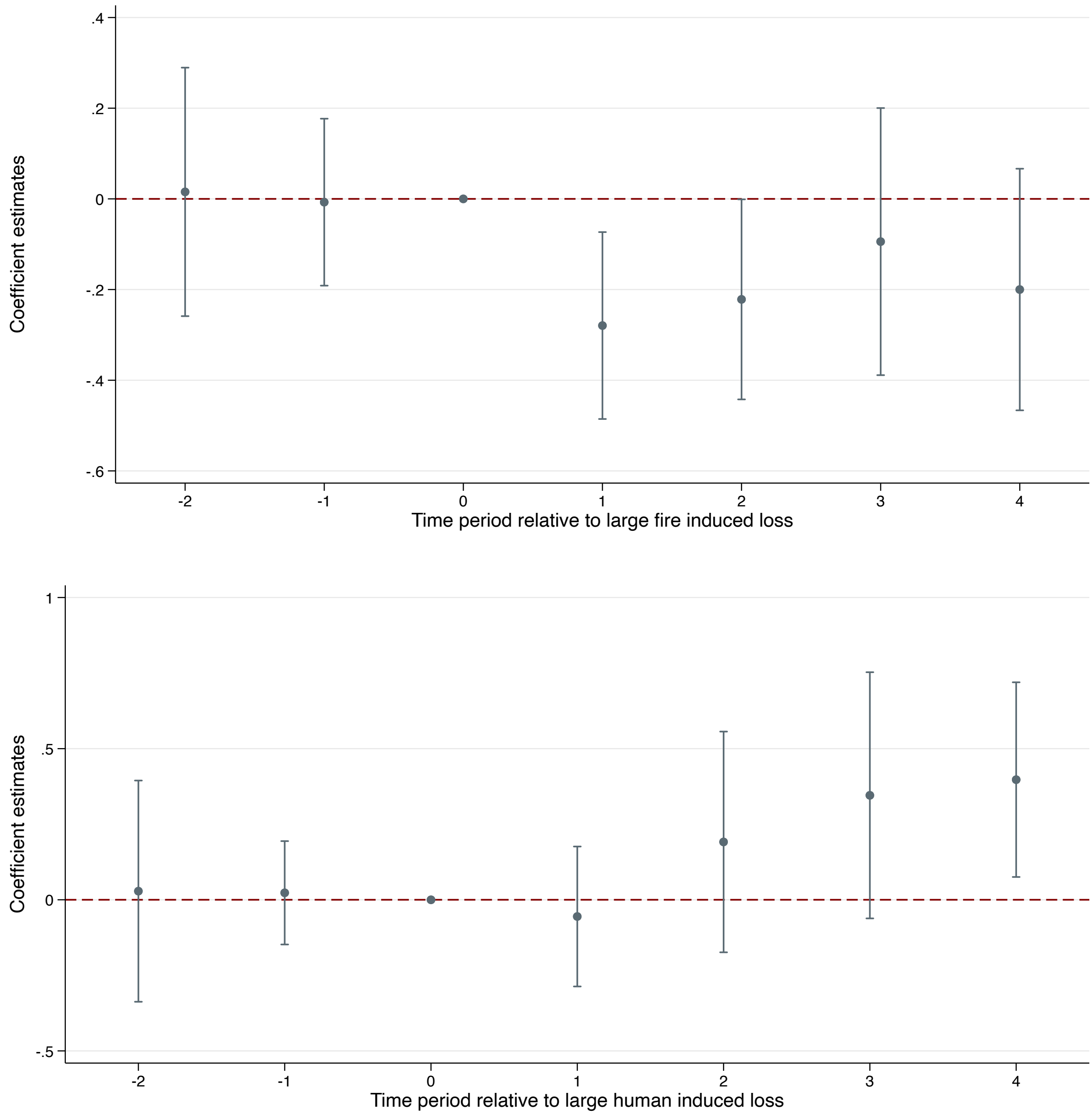


Figure 3. Dynamic effects of large forest loss on firm cash flow

This figure plots the time trend of the treatment effect estimates of firms' high forest-dependency on cash flow around large forest loss events. The top figure shows fire-induced forest loss, while the bottom figure shows human-induced forest loss. Cash flow is measured by dividing operating cash flow by the previous year tangible assets. Firms' dependency on forest is measured by *Top dependency*, a dummy variable equals one if the firm's forest-dependency score is within top 30% of the sample, and zero if within bottom 30%. For each period, we plot the point estimate (the solid circle) and the 90% confidence interval (the vertical lines intersecting the solid circles). Time indicators are defined for each year around a large forest loss event. For instance, Time (0) denotes the year of the large forest loss; Time (-1) denotes the year before the large forest loss, and so forth.

Table 1. Forest loss rankings across countries

This table reports the cross-country statistics of fire-induced forest loss (*Fire loss*) and human-induced forest loss (*Anthropogenic loss*) in square kilometers (km^2), in the firm-year panel sample. Panel A lists the top ten countries with the highest average fire-induced forest loss. Panel B lists the top ten countries with the highest average human-induced forest loss. The selection condition requires that each country has more than 100 firms in the sample.

Panel A. Top ten countries (>100 firms) with the highest average forest loss from fire

Fire loss	**Obs.**	**Mean**	**STD**	**Min**	**Median**	**Max**
Greece	428	0.3249	1.4402	0	0.00283	24.2641
Portugal	165	0.1275	0.5805	0	0.00631	5.1818
Russia	811	0.07622	1.1142	0	0.00713	31.4377
South Africa	343	0.06176	0.3540	0	0.00545	5.7976
Australia	2,682	0.04276	0.0868	0	0.01562	1.7574
Colombia	151	0.04008	0.09676	0	0.00779	0.7654
United States	40,255	0.02335	0.7545	0	0.00075	96.6292
Italy	882	0.01755	0.2124	0	0	4.1066
Brazil	803	0.01571	0.08534	0	0.00248	2.0665
Mexico	895	0.01562	0.02622	0	0.00422	0.1647

Panel B. Top ten countries (>100 firms) with the highest average human-induced forest loss

Anthropogenic loss	**Obs.**	**Mean**	**STD**	**Min**	**Median**	**Max**
Malaysia	502	1.3599	1.3103	0.03571	0.9703	11.4485
Portugal	165	0.7898	1.1001	0.0049	0.2370	5.2686
Finland	540	0.5442	0.6275	0.01819	0.3229	4.1991
Spain	1,369	0.4701	1.1811	0	0.08622	9.9872
Norway	670	0.4691	0.5331	0	0.3549	3.6835
Singapore	999	0.4597	0.5784	0.00626	0.2681	5.3275
Sweden	1,002	0.3886	0.7078	0	0.2161	6.2322
Poland	128	0.3885	0.5769	0	0.1543	3.1312
Turkey	370	0.3588	0.5463	0	0.1488	4.3528
Vietnam	157	0.3437	1.1123	0	0.02197	7.0750

Table 2. Industry rankings for forest loss and dependency

This table reports the descriptive statistics and the high-level SIC division rankings for fire-induced forest loss (*Fire loss*), human-induced forest loss (*Anthropogenic loss*), and forest dependency score (*Dependency*) in the firm-year level panel sample. Panel A provides details on *Fire loss*, Panel B focuses on *Anthropogenic loss*, and Panel C on *Dependency*.

Panel A. Industry rankings of the forest loss from fire

Fire loss	**Obs.**	**Mean**	**STD**	**Min**	**Median**	**Max**
Wholesale Trade	4,430	0.05306	2.0547	0	0.00067	96.6292
Construction	3,385	0.03250	0.4782	0	0.00034	20.1115
Services	18,031	0.01665	0.2528	0	0.0007	16.8422
Retail Trade	6,485	0.01534	0.2957	0	0.00071	16.8789
Agriculture, Forestry, Fishing	560	0.01428	0.0940	0	0.00071	1.5693
Transp. & Comm., Electric, Gas	12,675	0.01392	0.2484	0	0.00055	24.2641
Mining	8,631	0.01341	0.0974	0	0.00073	3.6712
Manufacturing	46,464	0.01067	0.2572	0	0.00059	31.4377

Panel B. Industry rankings of human-induced forest loss

Anthropogenic loss	**Obs.**	**Mean**	**STD**	**Min**	**Median**	**Max**
Mining	8,631	0.2151	0.6158	0	0.04281	7.0488
Construction	3,385	0.2057	0.5824	0	0.0433	9.1428
Retail Trade	6,485	0.1984	0.4884	0	0.04472	7.7134
Wholesale Trade	4,430	0.1980	0.4576	0	0.04742	6.8372
Agriculture, Forestry, Fishing	560	0.1974	0.5211	0	0.04088	4.6086
Manufacturing	46,464	0.191	0.4959	0	0.04687	18.2719
Services	18,031	0.1788	0.4794	0	0.04317	20.0675
Transp. & Comm., Electric, Gas	12,675	0.1673	0.4404	0	0.03463	6.8476

Panel C. Firm-level summary of industry rankings of the dependency score

Dependency	**# of firms**	**Mean**	**STD**	**Min**	**Median**	**Max**
Agriculture, Forestry, Fishing	34	2.5188	0.9322	1.6228	2.693	5
Mining	560	2.3089	0.3264	1.7654	2.4649	2.7719
Manufacturing	2,730	1.039	0.7062	0.2281	0.8421	3.1316
Construction	203	0.8503	0.0726	0.5614	0.8684	0.8684
Services	1,265	0.5636	0.3199	0.114	0.7735	1.8041
Retail Trade	430	0.5548	0.1823	0.3596	0.5044	0.9561
Transp. & Comm., Electric, Gas	785	0.4999	0.5584	0	0.152	1.5298
Wholesale Trade	274	0.3395	0.0022	0.3377	0.3377	0.3421

Table 3. Summary statistics

This table reports the summary statistics of our main analysis sample at the loan level. The definition of variables is detailed in Appendix Table A.1.

Variable	Obs.	Mean	STD	Min	Median	Max
All in spread drawn bps	42,590	191.666	146.5982	15	150	825
Yield spread	42,590	1.9167	1.466	0.15	1.5	8.25
Dependency	42,590	0.9108	0.7472	0	0.7735	5
Weighted dependency	42,590	0.5852	0.5268	0	0.4517	3.8872
Fire loss (km^2)	42,590	0.0077	0.1228	0	0.0007	11.8811
Anthropogenic loss (km^2)	42,590	0.1696	0.4197	0	0.0461	10.2686
Loan amount (m$)	42,590	645.9761	1,021.1591	2.5	250	5,000
Log loan amount	42,590	5.4331	1.5737	0.9163	5.5215	8.5172
Maturity (month)	42,590	54.6548	25.7748	3	60	222
Log maturity	42,590	3.8587	0.6031	1.0986	4.0943	5.4027
If secured loan	42,590	0.3731	0.4836	0	0	1
If base prime	42,590	0.0069	0.0827	0	0	1
If refinance	42,590	0.1719	0.3773	0	0	1
Repeated lending	42,590	0.395	0.4889	0	0	1
Loan purpose	42,590	0.2276	0.4193	0	0	1
Bank total assets (m$)	42,590	111,081.01	219,229.38	0.4038	3,578.467	2,608,333.8
Bank size	42,590	9.1003	2.976	0.3392	8.183	14.7742
Total assets (m$)	42,590	114,271.17	363,745.55	0.246	6,889.5908	1,846,191.1
Firm size	42,590	8.9617	2.3658	0.2199	8.8379	14.4286
Leverage	42,590	0.6131	0.2286	0.0276	0.6046	3.0809
ROA	42,590	0.0459	0.1119	-3.2236	0.0451	0.252
Liquidity	42,590	0.0886	0.088	0	0.0618	0.8015
Credit rating	42,590	5.6283	18.7277	0	0	98
Log credit rating	42,590	0.6205	1.2075	0	0	4.5951

Table 4. Forest loss and loan spreads

This table reports the baseline results of loan-level tests examining how forest loss affects yield spreads differently for firms based on their forest dependency. The dependent variable is *Yield spread*, measured by AISD divided by 100. Columns (1) to (4) use *Dependency* to measure forest dependency at the 2-digit SIC level, and columns (5) to (6) use *Weighted dependency*, which adjusts for risks associated with country-year-level forest loss and is rescaled to a range of 0 to 5. *Fire loss* refers to firm-level forest loss from fire in the previous year, and *Anthropogenic loss* refers to firm-level forest loss from human activities in the previous year. Column (4) includes high-level industry fixed effects at the high-level SIC division level, and column (6) includes bank×firm country-level fixed effects. Definitions for all variables are provided in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC level and year level, with values reported in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

Dependent variable: Yield spread						
Dependency measures	*Dependency*				*Weighted dependency*	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependency measure	-0.00745	-0.00484	-0.00721	0.0000886	0.0703	-0.0359
	(0.0740)	(0.0761)	(0.0758)	(0.0476)	(0.103)	(0.0605)
Fire loss	-0.235*		-0.238*	-0.246*	-0.238	-0.327*
	(0.134)		(0.136)	(0.129)	(0.143)	(0.165)
Anthropogenic loss		0.0349	0.0373	0.0570	0.0574	0.0265
		(0.0439)	(0.0432)	(0.0355)	(0.0480)	(0.0295)
Dependency measure×	0.425**		0.424**	0.415**	0.527**	0.586**
Fire loss	(0.176)		(0.183)	(0.177)	(0.230)	(0.261)
Dependency measure×		0.00219	-0.00143	-0.0115	-0.0330	-0.0140
Anthropogenic loss		(0.0279)	(0.0288)	(0.0278)	(0.0377)	(0.0290)
If secured loan	0.683***	0.682***	0.682***	0.665***	0.680***	0.683***
	(0.0764)	(0.0766)	(0.0767)	(0.0714)	(0.0764)	(0.0560)
If base prime	1.038***	1.035***	1.036***	1.013***	1.026***	1.266***
	(0.207)	(0.209)	(0.209)	(0.226)	(0.204)	(0.277)
If refinance	-0.137*	-0.136*	-0.137*	-0.132*	-0.135*	-0.0896
	(0.0784)	(0.0782)	(0.0786)	(0.0746)	(0.0785)	(0.0555)
Repeated lending	-0.261***	-0.262***	-0.262***	-0.247***	-0.261***	-0.0888***
	(0.0468)	(0.0467)	(0.0469)	(0.0455)	(0.0466)	(0.0232)
Log loan amount	-0.0500	-0.0500	-0.0498	-0.0764**	-0.0519	-0.166***
	(0.0366)	(0.0367)	(0.0366)	(0.0323)	(0.0362)	(0.0148)
Log maturity	0.129**	0.130**	0.129**	0.129***	0.135***	0.127***
	(0.0479)	(0.0478)	(0.0478)	(0.0453)	(0.0474)	(0.0343)
Loan purpose	0.659***	0.660***	0.660***	0.665***	0.664***	0.523***
	(0.0741)	(0.0740)	(0.0740)	(0.0721)	(0.0747)	(0.0478)
Firm size	-0.155***	-0.155***	-0.154***	-0.145***	-0.154***	-0.0956***
	(0.0217)	(0.0217)	(0.0217)	(0.0183)	(0.0212)	(0.0137)
Leverage	0.950***	0.949***	0.950***	0.933***	0.965***	0.709***
	(0.163)	(0.163)	(0.163)	(0.155)	(0.164)	(0.104)
ROA	-1.138***	-1.142***	-1.141***	-1.060***	-1.135***	-1.241***
	(0.224)	(0.224)	(0.224)	(0.213)	(0.229)	(0.219)
Liquidity	-0.635***	-0.632***	-0.631***	-0.478***	-0.604**	-0.424*
	(0.217)	(0.216)	(0.217)	(0.151)	(0.220)	(0.230)
Log credit rating	0.0401***	0.0400***	0.0396***	0.0414**	0.0380**	0.00920
	(0.0141)	(0.0139)	(0.0139)	(0.0150)	(0.0136)	(0.0168)

Bank size	0.00918	0.00872	0.00876	0.00758	0.00781	-0.00479
	(0.0104)	(0.0105)	(0.0105)	(0.0102)	(0.0104)	(0.0133)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
High-level industry FE	No	No	No	Yes	No	No
Bank×firm country FE	No	No	No	No	No	Yes
Observations	42,590	42,590	42,590	42,590	42,590	42,590
Adjusted R-squared	0.342	0.341	0.342	0.357	0.342	0.515

Table 5. Transition risks from EU deforestation regulation change

This table presents loan-level regression results examining how the development of EUDR affects yield spreads for forest-dependent firms versus other firms when forest loss occurs. The dependent variable is *Yield spread*. All columns use *Dependency* to measure forest dependency at the 2-digit SIC level. Columns (1) and (2) use *Fire loss* as the loss measure, which is the firm-level forest loss from fire in the previous year. Columns (3) and (4) use *Anthropogenic loss*, which is the firm-level forest loss from human activities in the previous year. *Post EUDR* is a time indicator, defined as one after the deforestation framework stage (July 2019), and zero otherwise. Loan controls include *If secured loan, If base prime, If refinance, Repeated lending, Loan purpose, Log loan amount, and Log maturity*. Borrower controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. Lender controls include *Bank size*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Yield spread				
Loss measure	*Fire loss*		*Anthropogenic loss*	
	(1)	(2)	(3)	(4)
Dependency	-0.0257		-0.0194	
	(0.0721)		(0.0756)	
Weighted dependency		0.0469		0.0599
		(0.0980)		(0.104)
Loss measure	-0.249	-0.241	0.0622	0.0818
	(0.147)	(0.150)	(0.0508)	(0.0532)
Post EUDR	0.0115	0.0558	0.0946	0.148
	(0.110)	(0.110)	(0.140)	(0.143)
Dependency×Loss measure	0.455**		-0.0184	
	(0.202)		(0.0374)	
Weighted dependency×Loss measure		0.551**		-0.0519
		(0.248)		(0.0427)
Dependency×*Post EUDR*	0.186**		0.148	
	(0.0839)		(0.0929)	
Weighted dependency×*Post EUDR*		0.224		0.156
		(0.132)		(0.157)
Loss measure×*Post EUDR*	0.285	0.704	-0.415**	-0.424**
	(1.607)	(1.711)	(0.159)	(0.154)
Dependency×Loss measure×*Post EUDR*	-0.588		0.261*	
	(2.136)		(0.126)	
Weighted dependency×Loss measure×*Post EUDR*		-1.554		0.416**
		(3.066)		(0.185)
Constant	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Borrower Controls	Yes	Yes	Yes	Yes
Lender Controls	Yes	Yes	Yes	Yes
Observations	42,590	42,590	42,590	42,590
Adjusted R-squared	0.342	0.343	0.343	0.343

Table 6. Country heterogeneity of EUDR's effect on yield spreads

This table reports the loan-level results examining the country heterogeneity of the effect of the introduction of EUDR on yield spread differently for forest-dependent firms and other firms when human-induced loss occurred. The dependent variable is *Yield spread*. All columns use *Dependency* to measure forest dependency at the 2-digit SIC level, and use *Anthropogenic loss*, which is the firm-level forest loss from human activities in the previous year. *Post EUDR* is a time indicator, defined as one after the deforestation framework stage (July 2019), and zero otherwise. Columns (1) and (2) compare pairs of EU banks with EU firms versus other lending situations. Columns (3) and (4) compare pairs of OECD (excluding EU) banks and firms versus other situations. Loan controls include *If secured loan, If base prime, If refinance, Repeated lending, Loan purpose, Log loan amount, and Log maturity*. Borrower controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. Lender controls include *Bank size*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Yield spread				
Bank country – Firm country pair	*EU*	*Non-EU*	*OECD*	*Non-OECD*
	(1)	(2)	(3)	(4)
Dependency	-0.125**	-0.00149	-0.023	-0.013
	(0.0553)	(0.0786)	(0.052)	(0.081)
Anthropogenic loss	0.129	0.0502	0.034	0.092
	(0.204)	(0.0439)	(0.025)	(0.225)
Post EUDR	0.469***	0.0770	0.349***	-0.298***
	(0.154)	(0.140)	(0.101)	(0.101)
Dependency×Anthropogenic loss	-0.0239	-0.0224	-0.007	-0.105
	(0.184)	(0.0315)	(0.020)	(0.157)
Dependency×*Post EUDR*	0.0324	0.141	0.067	0.203
	(0.128)	(0.0973)	(0.112)	(0.183)
Anthropogenic loss×*Post EUDR*	-1.751*	-0.376**	-0.611**	-0.133
	(0.846)	(0.171)	(0.236)	(0.371)
Dependency×Anthropogenic loss×*Post EUDR*	1.766**	0.238*	0.420***	0.122
	(0.712)	(0.134)	(0.137)	(0.234)
Chi-square test	*(1) = (2)*	10.114***	*(3) = (4)*	5.315**
P-value		0.0015		0.021
Constant	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Borrower Controls	Yes	Yes	Yes	Yes
Lender Controls	Yes	Yes	Yes	Yes
Observations	5,518	37,072	17,464	12,418
Adjusted R-squared	0.477	0.337	0.417	0.202

Table 7. Loan pricing and bank commitment to deforestation

This table presents loan-level regression results testing whether banks' public commitments to deforestation influence the pricing of forest risk. The dependent variable is *Yield spread*. The sample is split by bank commitment status and regulatory period. *Committed banks* are defined as those that have ever mentioned "deforestation" in public disclosures, such as ESG reports, annual reports, and SEC filings retrieved from Refinitiv AdvFil. Columns (1) and (2) present the results for committed bank subsample, and columns (3) and (4) show the non-committed bank subsample. The pre-EUDR period includes loans from January 2014 to July 2019, and the post-EUDR period includes loans from August 2019 to December 2024. Loan controls include *If secured loan, If base prime, If refinance, Repeated lending, Loan purpose, Log loan amount, and Log maturity*. Borrower controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. Lender controls include *Bank size*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Yield spread				
Bank subsample	*Committed banks*		*Non-committed banks*	
Subsample period	*Pre-EUDR*	*Post-EUDR*	*Pre-EUDR*	*Post-EUDR*
	(1)	(2)	(3)	(4)
Dependency	-0.0181	0.143	0.0400	0.164
	(0.0666)	(0.112)	(0.0887)	(0.104)
Anthropogenic loss	0.151	-0.282	0.200	-0.227
	(0.132)	(0.173)	(0.141)	(0.279)
Dependency×Anthropogenic loss	-0.0375	0.196***	-0.0607	0.214
	(0.100)	(0.0727)	(0.0615)	(0.188)
Chi-square test	*(1) = (2)*	3.797*	*(3) = (4)*	2.134
P-value		0.0513		0.144
Constant	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Borrower Controls	Yes	Yes	Yes	Yes
Lender Controls	Yes	Yes	Yes	Yes
Observations	3,094	2,932	6,626	2,385
Adjusted R-squared	0.381	0.435	0.278	0.395

Table 8. Firm commitments on deforestation

This table presents loan-level regression results examining how firm commitments on deforestation affect yield spreads for forest-dependent firms versus other firms when human-induced forest loss occurs. The dependent variable is *Yield spread*. *Committed firms* are defined as those that mention "deforestation" in the previous year in public disclosures, such as ESG reports, annual reports, and SEC filings retrieved from Refinitiv AdvFil. Columns (1) and (2) present the results for committed firm subsample, and columns (3) and (4) show the non-committed firm subsample. The pre-EUDR period includes loans from January 2014 to July 2019, and the post-EUDR period includes loans from August 2019 to December 2024. Loan controls include *If secured loan, If base prime, If refinance, Repeated lending, Loan purpose, Log loan amount, and Log maturity*. Borrower controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. Lender controls include *Bank size*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Yield spread				
Firm subsample	*Committed firms*		*Non-committed firms*	
Subsample period	*Pre-EUDR*	*Post-EUDR*	*Pre-EUDR*	*Post-EUDR*
	(1)	(2)	(3)	(4)
Dependency	-0.197	0.0686	0.0268	0.163
	(0.185)	(0.149)	(0.0845)	(0.106)
Anthropogenic loss	-0.333	0.00833	0.165	-0.374*
	(0.445)	(0.815)	(0.121)	(0.195)
Dependency×Anthropogenic loss	0.931	0.0956	-0.0322	0.252***
	(0.811)	(0.875)	(0.0697)	(0.0940)
Chi-square test	*(1) = (2)*	0.151	*(3) = (4)*	6.445**
P-value		0.698		0.011
Constant	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Borrower Controls	Yes	Yes	Yes	Yes
Lender Controls	Yes	Yes	Yes	Yes
Observations	270	291	9,450	5,026
Adjusted R-squared	0.700	0.562	0.294	0.413

Table 9. Ex-post outcome in production

This table reports the firm-level results examining the effect of receiving loans after forest loss on the firm's supply chain. In both Panel A and Panel B, the dependent variable for columns (1) and (2) is *Supply dependency*, measuring the proportion of inputs that comes from forest-dependent suppliers for each firm, calculated as the sum of sales-weighted supplier's *Dependency* for a firm. The dependent variable for columns (3) and (4) is *Country-adj supply*, measuring the proportion of inputs that comes from forest-dependent suppliers of high-deforestation-risk countries for each firm, calculated as the sum of sales-weighted supplier's *Weighted dependency* for a firm. *If get loan* is defined as one if the firm gets syndicate loan in the same year or within one year following the forest loss. Panel A uses *Post large anthropogenic loss* as the time indicator, which equals one if three years after a large human-induced forest loss, and zero if three years before. Panel B uses *Post large fire loss* as the time indicator, which equals one if three years after a large fire-induced forest loss, and zero if three years before. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Transition in supply chain after large human-induced loss

Dependent variable	*Supply dependency*		*Country-adj supply*	
Outcome window (forward)	*+3 years*	*+4 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	0.0593**	0.0634**	0.111**	0.115**
	(0.0273)	(0.0295)	(0.0417)	(0.0440)
Post large anthropogenic loss	0.0423*	0.0396	0.0613	0.0577
	(0.0235)	(0.0243)	(0.0387)	(0.0402)
If get loan×*Post large anthropogenic loss*	-0.0426*	-0.0437	-0.0703**	-0.0711**
	(0.0225)	(0.0277)	(0.0250)	(0.0321)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	523	523	523	523
Adjusted R-squared	0.330	0.345	0.349	0.365

Panel B. Transition in supply chain after large forest loss from fire

Dependent variable	*Supply dependency*		*Country-adj supply*	
Outcome window (forward)	*+3 years*	*+4 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	0.0559**	0.0549**	0.0802*	0.0769*
	(0.0254)	(0.0258)	(0.0440)	(0.0432)
Post large fire loss	-0.00661	-0.00748	-0.0197	-0.0210
	(0.0201)	(0.0195)	(0.0395)	(0.0378)
If get loan×*Post large fire loss*	-0.0262	-0.0244	-0.0369	-0.0334
	(0.0215)	(0.0222)	(0.0384)	(0.0381)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	615	615	615	615
Adjusted R-squared	0.156	0.165	0.168	0.177

Table 10. Ex-post outcome in reforestation

This table reports the firm-level results examining the effect of receiving loans after human-induced loss on the reforestation around a firm. In both Panel A and Panel B, the dependent variable is *NDVI*, measuring the greenness of vegetation of the land surface around a firm on a scale from 0 to 100. The time indicator is *Post large anthropogenic loss*, which equals one if three years after a large human-induced forest loss, and zero if three years before. *If get loan* is defined as one if the firm gets syndicate loan in the same year or within one year following the forest loss. Panel A report the tests using full sample, and Panel B report the subsample of firms with forest dependency score above median. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Outcome in reforestation: Full sample

Dependent variable: NDVI				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	-0.224	-0.184	-0.150	-0.0940
	(0.710)	(0.701)	(0.697)	(0.696)
Post large anthropogenic loss	-2.271*	-2.059	-1.918	-1.781
	(1.314)	(1.360)	(1.395)	(1.393)
If get loan×*Post large anthropogenic loss*	1.174***	1.215***	1.200***	1.126***
	(0.334)	(0.359)	(0.359)	(0.359)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	4,322	4,322	4,322	4,322
Adjusted R-squared	0.178	0.176	0.170	0.163

Panel B. Outcome in reforestation: High forest dependency subsample

Dependent variable: NDVI				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	0.727	0.796	0.858	0.928
	(1.053)	(1.045)	(1.044)	(1.053)
Post large anthropogenic loss	-2.230	-1.944	-1.869	-1.745
	(1.662)	(1.690)	(1.708)	(1.684)
If get loan×*Post large anthropogenic loss*	1.555**	1.575**	1.595**	1.525**
	(0.593)	(0.620)	(0.632)	(0.646)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	2,303	2,303	2,303	2,303
Adjusted R-squared	0.193	0.189	0.183	0.177

Table 11. Ex-post outcome in divesting pollutive plants

This table reports the firm-level results examining the effect of receiving loans after human-induced loss on divesting pollutive plants. The dependent variable is *Divestiture*, an indicator that equals 100 if the firm divests a forest-dependent pollutive plant in the following estimation window. *Anthropogenic loss* refers to firm-level forest loss from human activities in the previous year. *If get loan* is an indicator defined as one if the firm gets syndicate loan in a year, and zero otherwise. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Divestiture				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
Dependency	-0.0748	-0.403	-0.726	-0.966
	(0.316)	(0.291)	(0.450)	(0.609)
Anthropogenic loss	-0.0663	-0.0493	-0.154	-0.322
	(0.0932)	(0.121)	(0.146)	(0.187)
If get loan	0.206	0.575	0.868**	0.819
	(0.297)	(0.360)	(0.391)	(0.493)
Dependency×Anthropogenic loss	0.377	0.623	1.123*	1.526*
	(0.300)	(0.371)	(0.569)	(0.753)
Dependency× *If get loan*	-0.617**	-0.992**	-1.032**	-1.273**
	(0.233)	(0.423)	(0.454)	(0.520)
Anthropogenic loss× *If get loan*	0.174	-0.413*	-0.531**	-0.477**
	(0.182)	(0.201)	(0.192)	(0.218)
Dependency×Anthropogenic loss× *If get loan*	0.248	1.095***	1.118***	1.215***
	(0.202)	(0.282)	(0.304)	(0.390)
Constant	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	7,313	7,313	7,313	7,313
Adjusted R-squared	0.003	0.013	0.020	0.023

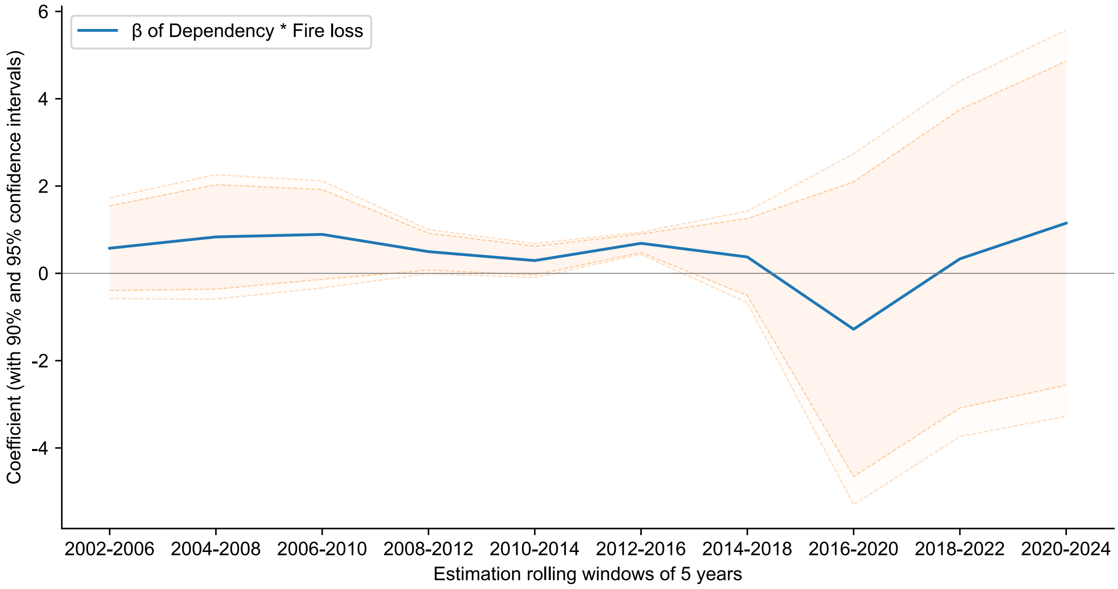
Appendix

Table A.1. Variable definition

Variable	Definition	Source
Acute physical risk	The frequency of mentions of the unigrams or bigrams related to the acute climate discussion in the proximity of risk synonyms in the previous year earnings call transcript, divided by the total length of the transcript and standardized.	Li et al. (2024), StreetEvents
Anthropogenic loss	The size of forest loss from human activities within 10km around a firm's headquarter in the previous year in km².	Hansen et al. (2013), Tyukavina et al. (2022)
Bank size	The log value of total assets (million USD) of a bank in year t-1.	Compustat, Refinitiv, BankFocus
Book value of debt	The sum of long-term debt, notes payable, and the current portion of long-term debt.	Compustat, Refinitiv,
Cash flow	Operating cash flow divided by previous year tangible assets of a firm in year t-1.	Compustat, Refinitiv
Chronic physical risk	The frequency of mentions of the unigrams or bigrams related to the chronic climate discussion in the proximity of risk synonyms in the previous year earnings call transcript, divided by the total length of the transcript and standardized.	Li et al. (2024), StreetEvents
Country-adj supply	The proportion of inputs that comes from forest-dependent suppliers of high-deforestation-risk countries for each firm, calculated as the sum of sales-weighted supplier's *Weighted dependency* for a firm.	Compustat Segment
Dependency	Level of production processes' dependency on forest of a firm at the 2-digit SIC level on a 0-5 scale.	ENCORE
Divestiture	An indicator that equals 100 if the firm divests a forest-dependent pollutive plant in the following estimation window.	TRI EPA, SDC M&A
Fire loss	The area of forest loss from fire within 10km around a firm's headquarter in the previous year in km².	Tyukavina et al. (2022)
Firm commit	The total number of firm disclosures that mentioned "deforestation" in the previous year. Corporate filings include: ESG reports, annual reports; SEC filings, etc.	Refinitiv AdvFil
Firm size	The log value of total assets (million USD) of a firm in year t-1.	Compustat, Refinitiv
High dependency	An indicator that equals one if the firm's dependent score *Dependency* is above the sample median, and zero otherwise.	ENCORE
If base prime	An indicator that equals one if the base rate for a loan is the prime rate rather than LIBOR, and zero otherwise.	DealScan
If fire	An indicator that equals one if a firm has non-zero fire-induced loss in the previous year, and zero otherwise.	Tyukavina et al. (2022)
If get loan	An indicator that equals one if the firm gets syndicate loan in the same year or within one year following the forest loss, and zero otherwise.	DealScan, Hansen et al. (2013), Tyukavina et al. (2022)
If refinance	An indicator that equals one if the loan refinances a previous loan, and zero otherwise.	DealScan
If secured loan	An indicator that equals one if the loan tranche (facility) is secured, and zero otherwise.	DealScan
Leverage	Total liabilities divided by total assets of a firm in year t-1.	Compustat, Refinitiv
Liquidity	Cash divided by total assets of a firm in year t-1.	Compustat, Refinitiv
Loan purpose	An indicator that equals one if the loan tranche (facility) purpose is M&A, and zero otherwise.	DealScan
Log amount	The log value of loan amount (million USD).	DealScan
Log credit rating	Moody's short-term issuer rating of a firm in year t-1.	Refinitiv
Log maturity	The log value of loan maturity (month).	DealScan

NDVI	MODIS normalized difference vegetation index (NDVI) within 10km around the firm's headquarter, measuring how "green" a vegetation area is from -1 to 1. The measure is normalized to 0-100 scale in the regressions.	MODIS NDVI
Post large anthropogenic loss	A time indicator that equals one if the period within estimation window is after a large human-induced forest loss, and zero if before.	Hansen et al. (2013), Tyukavina et al. (2022)
Post large fire loss	A time indicator that equals one if the period within estimation window is after a large fire-induced forest loss, and zero if before.	Tyukavina et al. (2022)
Post EUDR	A time indicator defined as one after the first deforestation framework stage (July 2019), and zero otherwise.	European Commission
Post EUDR (phase 1)	A time indicator defined as one for the period between the first deforestation policy framework and the regulation's entry into force (June 2023), and zero otherwise.	European Commission
Post EUDR (phase 2)	A time indicator defined as one for the period after the EUDR goes into force (June 2023), and zero otherwise.	European Commission
Reforest	An indicator that equals 100 if the firm claims to engage in reforestation activities in their disclosures in the following estimation window.	Refinitiv AdvFil
Repeated lending	An indicator that equals 1 if there is a past relationship with any of the lead banks in the last five years before the present loan and 0 otherwise.	DealScan
ROA	Net profit divided by total assets in year t-1.	Refinitiv, Compustat
Supply dependency	The proportion of inputs that comes from forest-dependent suppliers for each firm, calculated as the sum of sales-weighted supplier's *Dependency* for a firm.	Compustat Segment
Top dependency	An indicator that equals one if the firm's dependent score *Dependency* is above the top 30% of the sample, and zero if below bottom 30%.	ENCORE
Transition risk	The frequency of mentions of the unigrams or bigrams related to the transition climate discussion in the proximity of risk synonyms in the previous year earnings call transcript, divided by the total length of the transcript and standardized.	Li et al. (2024), StreetEvents
Weighted dependency	Country-year-level forest loss-weighted dependency score in year t-1, rescaled to a range of 0 to 5. The measure is calculated as $Dependency \times (1 + forest\ loss_{c,t})$, where $forest\ loss_{c,t}$ is the country-year total area of forest loss. Both *Dependency* and $forest\ loss_{c,t}$ are normalized to 0-1 during the calculation.	ENCORE, GLAD
Yield spread	All-in-spread drawn (AISD) divided by 100.	DealScan

Online Appendix



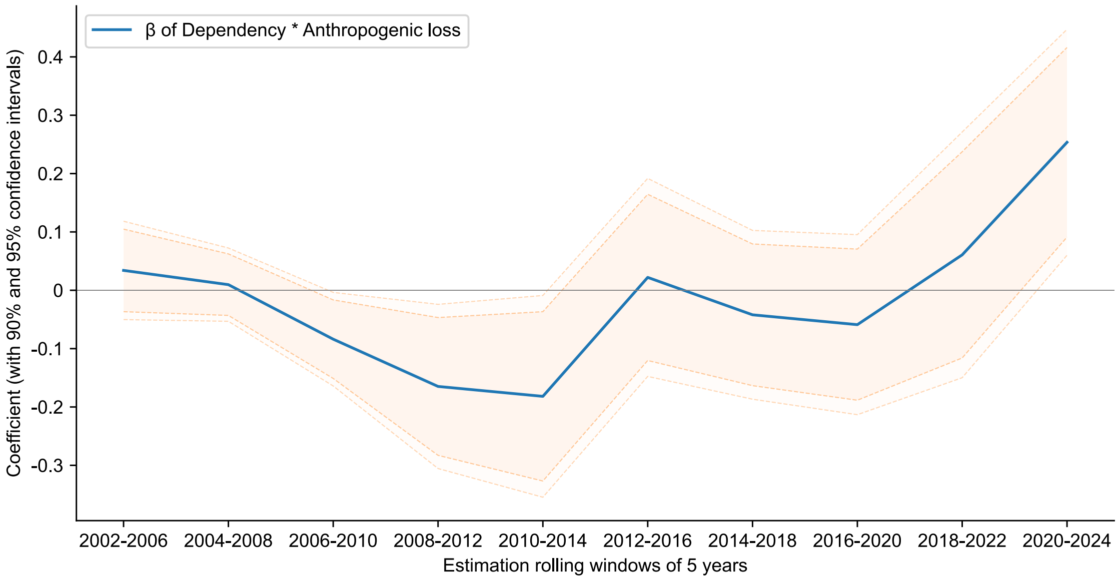


Figure B.1. Year-by-year regression: Effect of forest loss on yield spread

This figure shows estimated interaction coefficients between *Dependency* and forest loss in year-by-year loan-level regressions where *Yield spread* is the dependent variable. Each regression is run on a five-year subsample, rolling in two-year intervals from 2002-2006 to 2020-2024. The top panel plots coefficients using fire-induced forest loss, and the bottom panel uses human-induced forest loss. The blue line shows coefficient estimates. Dark orange shading indicates statistical significance at the 10% level, and light orange at the 5% level.

Table B.1. Forest loss and loan spreads controlling for climate risk index

This table reports the robustness results controlling the climate risk index of Li et al. (2024) for the tests examining how forest loss impacts yield spreads differently for firms based on their forest dependency. The regression sample is the US listed firms with call transcripts in a year. The dependent variable is *Yield spread*, measured by AISD divided by 100. Columns (1) and (2) use *Dependency* to measure forest dependency at the 2-digit SIC level, and columns (3) to (4) use *Weighted dependency*, which adjusts for risks associated with country-year-level forest loss and is rescaled to a range of 0 to 5. *Fire loss* refers to firm-level forest loss from fire in the previous year, and *Anthropogenic loss* refers to firm-level forest loss from human activities in the previous year. *Acute physical risk*, *Chronic physical ri*sk, and *Transition risk* are three climate risk proxies calculated by the frequency of mentions of the unigrams or bigrams related to the acute, chronic, and transition climate discussion, respectively, in the previous year earnings call transcript, divided by the total length of the transcript and standardized (Li et al. 2024). Definitions for all variables are provided in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC level and year level, with values reported in parentheses. Statistical significance is denoted by ***, **, and * at the 1%, 5%, and 10% levels, respectively.

Dependent variable: Yield spread				
Dependency measures	*Dependency*		*Weighted dependency*	
	(1)	(2)	(3)	(4)
Dependency measure	0.0109	0.0146	-0.000578	0.00345
	(0.0657)	(0.0672)	(0.0719)	(0.0737)
Fire loss	-0.223	-0.241	-0.275	-0.294
	(0.270)	(0.272)	(0.281)	(0.284)
Anthropogenic loss	0.131	0.130*	0.115	0.115
	(0.0783)	(0.0748)	(0.0824)	(0.0786)
Dependency measure × *Fire loss*	0.587***	0.584***	0.781***	0.776***
	(0.123)	(0.125)	(0.166)	(0.166)
Dependency measure × *Anthropogenic loss*	-0.0862	-0.0873	-0.0727	-0.0747
	(0.0652)	(0.0642)	(0.0723)	(0.0708)
Acute physical risk		0.0225		0.0228
		(0.0586)		(0.0593)
Chronic physical risk		0.00593		0.00603
		(0.0365)		(0.0366)
Transition risk		-0.0712***		-0.0709***
		(0.0199)		(0.0197)
Constant	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Borrower Controls	Yes	Yes	Yes	Yes
Lender Controls	Yes	Yes	Yes	Yes
Observations	4,277	4,277	4,277	4,277
Adjusted R-squared	0.368	0.369	0.368	0.369

Table B.2. Forest loss and loan spreads: Fire cut-offs

This table reports the loan-level results with the interaction between the equally distributed forest dependency groups and fire-induced loss measures, to further examine the loan pricing effects between high versus low forest-dependency groups following fire-induced forest loss. The dependent variable is *Yield spread*, measured by AISD divided by 100. Forest dependency group is separated by *High dependency*, defined as one if the firm's dependent score is above the sample median and zero otherwise. Column (1) uses *Fire loss* as the loss measure, which is the firm-level forest loss from fire in the previous year in km². Column (2) uses *If fire*, which equals one if a firm has non-zero fire-induced loss in the previous year, and zero otherwise. Columns (3) to (6) defines the top fire loss indicators based on percentile cut-offs of top 40%, 25%, 5%, and 3%, respectively, to compare with situations of no fire loss. Loan controls include *If secured loan, If base prime, If refinance, Repeated lending, Loan purpose, Log loan amount, and Log maturity*. Borrower controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. Lender controls include *Bank size*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Yield spread						
Fire measure	*Fire loss*	*If fire*	*Top 40%*	*Top 25%*	*Top 5%*	*Top 3%*
	(1)	(2)	(3)	(4)	(5)	(6)
High dependency	-0.214**	-0.291**	-0.291**	-0.295**	-0.289**	-0.286**
	(0.0972)	(0.121)	(0.121)	(0.121)	(0.120)	(0.120)
Fire measure	-0.0422	-0.0417	-0.0304	-0.0252	0.0504	-0.0741
	(0.0484)	(0.0571)	(0.0698)	(0.0775)	(0.0402)	(0.0585)
High dependency×Fire measure	0.194**	0.145**	0.165**	0.211**	0.298***	0.499***
	(0.0924)	(0.0596)	(0.0718)	(0.0892)	(0.102)	(0.136)
Statistics: fire loss cut-off group						
Mean (km^2)		0.01113	0.02763	0.04315	0.18511	0.28869
Equivalent # of football pitches		2.08	5.16	8.07	34.60	53.96
Standard deviation		0.1955	0.3084	0.3893	0.8558	1.0917
# of firm-year loss cases		23,411	17,977	10,922	2,004	1,221
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Controls	Yes	Yes	Yes	Yes	Yes	Yes
Lender Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	42,590	42,590	37,136	30,065	21,125	20,342
Adjusted R-squared	0.346	0.347	0.344	0.345	0.335	0.331

Table B.3. Country heterogeneity of EUDR's effect: EU operators

This table presents the robustness results on how the EUDR introduction affects yield spreads for forest-dependent firms compared to other firms when human-induced loss occurred. The analysis examines how EU banks and non-EU banks respond differently to EU operators. The dependent variable is *Yield spread*. Columns (1) and (2) use *Dependency* to measure forest dependency, and columns (3) and (4) use *Weighted dependency* to account for country-year-level forest loss risk. *Post EUDR* is a time indicator, defined as one after the deforestation framework stage (July 2019), and zero otherwise. Columns (1) and (3) examine EU banks with EU operators, and Columns (2) and (4) examine non-EU banks with EU operators. Loan controls include *If secured loan, If base prime, If refinance, Repeated lending, Loan purpose, Log loan amount, and Log maturity*. Borrower controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. Lender controls include *Bank size*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Yield spread				
Dependency measure	*Dependency*		*Weighted dependency*	
Bank country	*EU bank*	*Non-EU*	*EU bank*	*Non-EU*
	(1)	(2)	(3)	(4)
Dependency measure	-0.126*	-0.135	-0.149	-0.144
	(0.0723)	(0.122)	(0.149)	(0.200)
Anthropogenic loss	0.0696	-0.0716	0.0833	-0.111
	(0.187)	(0.220)	(0.191)	(0.244)
Post EUDR	0.339**	-0.952**	0.365*	-0.891**
	(0.161)	(0.359)	(0.181)	(0.378)
Dependency measure×Anthropogenic loss	0.0412	0.0624	0.0426	0.158
	(0.176)	(0.236)	(0.298)	(0.415)
Dependency measure×*Post EUDR*	0.0662	0.671*	0.0723	0.994
	(0.122)	(0.359)	(0.280)	(0.616)
Anthropogenic loss×*Post EUDR*	-1.792**	0.533	-1.564	0.714
	(0.767)	(1.421)	(0.955)	(1.418)
Dependency measure×Anthropogenic loss×*Post EUDR*	1.686**	-0.423	2.568*	-1.016
	(0.643)	(1.698)	(1.382)	(2.796)
Chi-square test	*(1) = (2)*	3.0201*	*(3) = (4)*	2.7673*
P-value		0.0822		0.0962
Constant	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Borrower Controls	Yes	Yes	Yes	Yes
Lender Controls	Yes	Yes	Yes	Yes
Observations	6,171	5,671	6,171	5,671
Adjusted R-squared	0.471	0.441	0.469	0.440

Table B.4. EU deforestation regulation: Phase 1 and 2

This table reports the results examining the effects of different phases of EUDR on yield spread for forest-dependent firms and other firms when human-induced loss occurred. The dependent variable is *Yield spread*. Columns (1) and (2) use *Dependency* to measure forest dependency, and columns (3) and (4) use *Weighted dependency* to account for country-year-level forest loss risk. *Post EUDR (phase 1)* is the time indicator defined as one for the period between the deforestation policy framework and the regulation's entry into force (June 2023), and zero otherwise. *Post EUDR (phase 2)* is the time indicator defined as one after the EUDR goes into force, and zero otherwise. Columns (1) and (3) examine pairs of EU banks with EU firms, and Columns (2) and (4) examine other lending situations. Loan controls include *If secured loan, If base prime, If refinance, Repeated lending, Loan purpose, Log loan amount, and Log maturity*. Borrower controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. Lender controls include *Bank size*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Yield spread				
Dependency measure	*Dependency*		*Weighted dependency*	
Bank country – Firm country pair	*EU*	*Non-EU*	*EU*	*Non-EU*
	(1)	(2)	(3)	(4)
Dependency measure	-0.124**	-0.00149	-0.233**	0.0829
	(0.0581)	(0.0791)	(0.111)	(0.103)
Anthropogenic loss	0.133	0.0504	0.137	0.0672
	(0.206)	(0.0444)	(0.206)	(0.0495)
Post EUDR (phase 1)	0.606**	0.0663	0.596**	0.122
	(0.224)	(0.163)	(0.228)	(0.162)
Post EUDR (phase 2)	2.001***	0.552***	1.991***	0.580***
	(0.173)	(0.131)	(0.172)	(0.112)
Dependency measure×Anthropogenic loss	-0.0283	-0.0224	-0.0592	-0.0524
	(0.186)	(0.0321)	(0.350)	(0.0379)
Dependency measure×*Post EUDR (phase 1)*	-0.145	0.157	-0.250	0.169
	(0.302)	(0.116)	(0.582)	(0.192)
Dependency measure×*Post EUDR (phase 2)*	-0.261***	0.0454	-0.499***	0.0323
	(0.0820)	(0.119)	(0.154)	(0.165)
Anthropogenic loss×*Post EUDR (phase 1)*	-1.975***	-0.426*	-1.947***	-0.412*
	(0.681)	(0.248)	(0.675)	(0.216)
Anthropogenic loss×*Post EUDR (phase 2)*	-10.58***	-0.355	-10.53***	-0.360
	(1.791)	(0.286)	(1.813)	(0.319)
Dependency measure×Anthropogenic loss×	2.260***	0.288	4.201***	0.407
Post EUDR (phase1)	(0.642)	(0.195)	(1.205)	(0.255)
Dependency measure×Anthropogenic loss×	4.608***	0.186	8.662**	0.333
Post EUDR (phase 2)	(1.608)	(0.113)	(3.112)	(0.251)
Chi-square test (phase 1)	*(1) = (2)*	4.325**	*(3) = (4)*	4.525**
P-value		0.0376		0.0334
Chi-square test (phase 2)	*(1) = (2)*	15.896***	*(3) = (4)*	15.183***
P-value		0.0001		0.0001
Constant	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes	Yes
Borrower Controls	Yes	Yes	Yes	Yes
Lender Controls	Yes	Yes	Yes	Yes
Observations	5,518	37,072	5,518	37,072
Adjusted R-squared	0.481	0.338	0.481	0.338

Table B.5. Ex-post outcome in reforestation after fire-induced loss

This table reports the firm-level results examining the effect of receiving loans after fire-induced loss on the reforestation around a firm. In both Panel A and Panel B, the dependent variable is *NDVI*, measuring the greenness of vegetation of the land surface around a firm on a scale from 0 to 100. The time indicator is *Post large fire loss*, which equals one if three years after a large fire-induced forest loss, and zero if three years before. *If get loan* is defined as one if the firm gets syndicate loan in the same year or within one year following the forest loss. Panel A report the tests using full sample, and Panel B report the subsample of firms with forest dependency score above median. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Outcome in reforestation: Full sample

Dependent variable: NDVI				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	-0.0657	-0.112	-0.145	-0.177
	(0.839)	(0.840)	(0.837)	(0.835)
Post large fire loss	0.0504	0.535	0.836	0.870
	(2.412)	(2.471)	(2.508)	(2.512)
If get loan×*Post large fire loss*	-0.160	-0.0949	-0.0556	-0.0334
	(0.539)	(0.531)	(0.539)	(0.556)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	6,811	6,811	6,811	6,811
Adjusted R-squared	0.0722	0.0720	0.0717	0.0714

Panel B. Outcome in reforestation: High forest dependency subsample

Dependent variable: NDVI				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	0.719	0.662	0.632	0.613
	(0.966)	(0.972)	(0.968)	(0.966)
Post large fire loss	-0.908	-0.495	-0.226	-0.204
	(2.394)	(2.447)	(2.468)	(2.478)
If get loan×*Post large fire loss*	-0.346	-0.277	-0.247	-0.247
	(0.573)	(0.547)	(0.552)	(0.574)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	3,648	3,648	3,648	3,648
Adjusted R-squared	0.0928	0.0929	0.0926	0.0921

Table B.6. Loan receipt and differences in firms' book value of debt

This table compares the book value of debt between firms that receive bank syndicate loans in a year (*If get loan* = 1) and those that do not (*If get loan* = 0). The book value of debt is measured as the sum of long-term debt, notes payable, and the current portion of long-term debt.

	If get loan=1		If get loan=0		Diff: Yes - No
	Mean (std. dev.)	Obs	Mean (std. dev.)	Obs	Mean (std. err.)
Book value of debt (m$)	33,126.102 (94,882.800)	23,891	28,191.304 (86,935.547)	93,292	4,934.7978*** (642.5301)

Table B.7. Selection into granting loans

This table reports the first-stage probit model estimating the likelihood of a firm receiving a syndicated loan in a given year. The dependent variable *If get loan* is an indicator equal to one if the firm obtains a syndicated loan and zero otherwise. Firm-level controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. Columns (2) and (3) include *Anthropogenic loss* and *Dependency*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: If get loan			
	(1)	(2)	(3)
Firm size	0.00830**	0.00748*	0.00740*
	(0.00401)	(0.00390)	(0.00394)
Leverage	0.150***	0.155***	0.158***
	(0.0383)	(0.0404)	(0.0386)
ROA	0.299***	0.324***	0.326***
	(0.0465)	(0.0463)	(0.0473)
Liquidity	-0.715***	-0.725***	-0.720***
	(0.0604)	(0.0577)	(0.0542)
Log credit rating	0.0339***	0.0309***	0.0308***
	(0.00726)	(0.00755)	(0.00756)
Anthropogenic loss		0.00748*	0.0133
		(0.00390)	(0.0155)
Dependency			0.0110
			(0.0117)
Constant	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	104,166	99,198	99,198
Adjusted R-squared	0.00656	0.00643	0.00647

Table B.8. Robustness: Ex-post outcome in production

This table reports the robustness results examining the effect of receiving loans after forest loss on the firm's supply chain, controlling for selection bias using the Inverse Mills Ratio (IMR) from the first-stage probit model (Table B.7). In both Panel A and Panel B, the dependent variable in columns (1) and (2) is *Supply dependency*, measuring the proportion of inputs sourced from forest-dependent suppliers. Columns (3) and (4) use *Country-adj supply*, capturing inputs from forest-dependent suppliers in high-deforestation-risk countries. *If get loan* equals one if the firm secures a syndicated loan in the same year or within one year after forest loss. Panel A defines the post-event period based on large human-induced forest loss, while Panel B uses large fire-induced forest loss. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, *Log credit rating*, and the IMR term. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Transition in supply chain after large human-induced loss

Dependent variable	*Supply dependency*		*Country-adj supply*	
Outcome window (forward)	*+3 years*	*+4 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	0.0592**	0.0635**	0.112**	0.115**
	(0.0272)	(0.0293)	(0.0412)	(0.0436)
Post large anthropogenic loss	0.0293	0.0277	0.0471	0.0446
	(0.0247)	(0.0253)	(0.0409)	(0.0428)
If get loan×*Post large anthropogenic loss*	-0.0448**	-0.0459	-0.0736***	-0.0744**
	(0.0215)	(0.0267)	(0.0243)	(0.0311)
IMR (*If get loan*)	-3.643**	-3.358**	-4.083*	-3.785*
	(1.466)	(1.281)	(2.235)	(2.116)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	518	518	518	518
Adjusted R-squared	0.342	0.355	0.355	0.370

Panel B. Transition in supply chain after large forest loss from fire

Dependent variable	*Supply dependency*		*Country-adj supply*	
Outcome window (forward)	*+3 years*	*+4 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	0.0549**	0.0539**	0.0789*	0.0758*
	(0.0248)	(0.0254)	(0.0435)	(0.0430)
Post large fire loss	-0.00660	-0.00747	-0.0197	-0.0209
	(0.0198)	(0.0193)	(0.0392)	(0.0376)
If get loan×*Post large fire loss*	-0.0254	-0.0237	-0.0360	-0.0326
	(0.0219)	(0.0229)	(0.0394)	(0.0396)
IMR (*If get loan*)	2.582	2.464	3.070	3.001
	(4.255)	(4.175)	(6.584)	(6.476)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	614	614	614	614
Adjusted R-squared	0.158	0.167	0.168	0.177

Table B.9. Robustness: Ex-post outcome in reforestation

This table reports the robustness results examining the effect of receiving loans after human-induced forest loss on reforestation, controlling for selection bias using the Inverse Mills Ratio (IMR) from the first-stage probit model (Table B.7). In both Panel A and Panel B, the dependent variable is *NDVI*, which measures the greenness of vegetation around a firm on a scale from 0 to 100. *If get loan* equals one if the firm obtains a syndicated loan in the same year or within one year after forest loss. The time indicator is *Post large anthropogenic loss*, which equals one if three years after a large human-induced forest loss, and zero if three years before. Panel A report the tests using full sample, and Panel B report the subsample of firms with forest dependency score above median. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, *Log credit rating*, and the IMR term. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A. Outcome in reforestation: Full sample

Dependent variable: NDVI				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	-0.103	-0.0796	-0.0446	0.00227
	(0.696)	(0.690)	(0.687)	(0.688)
Post large anthropogenic loss	-2.901**	-2.692*	-2.584*	-2.454*
	(1.297)	(1.340)	(1.370)	(1.370)
If get loan×*Post large anthropogenic loss*	1.005**	1.063**	1.045**	0.979**
	(0.385)	(0.404)	(0.403)	(0.390)
IMR (*If get loan*)	-282.2***	-281.0***	-295.1***	-297.0***
	(82.76)	(80.66)	(82.31)	(83.92)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	4,288	4,288	4,288	4,288
Adjusted R-squared	0.191	0.189	0.183	0.177

Panel B. Outcome in reforestation: High forest dependency subsample

Dependent variable: NDVI				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
If get loan (t or t+1)	0.583	0.638	0.703	0.774
	(1.158)	(1.147)	(1.144)	(1.152)
Post large anthropogenic loss	-1.851	-1.558	-1.482	-1.355
	(1.749)	(1.774)	(1.788)	(1.756)
If get loan×*Post large anthropogenic loss*	1.666**	1.699**	1.715**	1.644**
	(0.627)	(0.654)	(0.667)	(0.684)
IMR (*If get loan*)	146.4	150.0	150.3	151.4
	(113.0)	(113.7)	(113.7)	(114.4)
Constant	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	2,286	2,286	2,286	2,286
Adjusted R-squared	0.201	0.199	0.193	0.188

Table B.10. Robustness: Ex-post outcome in divesting pollutive plants

This table reports the firm-level results examining the effect of receiving loans after human-induced forest loss on the divestiture of pollutive, forest-dependent plants, controlling for selection bias using the Inverse Mills Ratio (IMR) from the first-stage probit model (Table B.7). The dependent variable is *Divestiture*, an indicator that equals 100 if the firm divests a forest-dependent pollutive plant in the following estimation window. *Anthropogenic loss* refers to firm-level forest loss from human activities in the previous year. *If get loan* is an indicator defined as one if the firm gets syndicate loan in a year, and zero otherwise. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, *Log credit rating*, and the IMR term. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Divestiture				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
Dependency	-0.0466	-0.351	-0.643*	-0.889*
	(0.252)	(0.245)	(0.360)	(0.497)
Anthropogenic loss	-0.0515	-0.0222	-0.111	-0.282
	(0.0967)	(0.0921)	(0.106)	(0.176)
If get loan	0.219	0.597**	0.904***	0.852**
	(0.245)	(0.284)	(0.285)	(0.338)
Dependency×Anthropogenic loss	0.375	0.620*	1.119**	1.522**
	(0.246)	(0.333)	(0.519)	(0.678)
Dependency× *If get loan*	-0.630**	-1.015***	-1.070***	-1.308***
	(0.280)	(0.268)	(0.270)	(0.382)
Anthropogenic loss× *If get loan*	0.168	-0.424***	-0.549***	-0.493***
	(0.112)	(0.149)	(0.148)	(0.147)
Dependency×Anthropogenic loss× *If get loan*	0.257	1.111***	1.143***	1.238***
	(0.192)	(0.119)	(0.157)	(0.260)
IMR (*If get loan*)	1.618	3.012**	4.819*	4.471*
	(1.126)	(1.382)	(2.435)	(2.484)
Constant	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	7,313	7,313	7,313	7,313
Adjusted R-squared	0.003	0.013	0.021	0.024

Table B.11. Reforestation: Alternative measure using firm disclosures

This table reports the robustness results on the effect of receiving loans after human-induced loss on firms' reforestation engagement. The dependent variable is *Reforest*, an indicator that equals 100 if the firm claims to engage in reforestation activities in their disclosures in the following estimation window. *Anthropogenic loss* refers to firm-level forest loss from human activities in the previous year. *If get loan* is an indicator defined as one if the firm gets syndicate loan in a year, and zero otherwise. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, and *Log credit rating*. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Reforest				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
Dependency	0.268	0.184	0.0437	-0.0712
	(0.297)	(0.334)	(0.353)	(0.402)
Anthropogenic loss	0.893***	1.138***	1.228**	1.286**
	(0.293)	(0.378)	(0.436)	(0.471)
If get loan	1.024***	1.253***	1.492***	1.548***
	(0.301)	(0.335)	(0.336)	(0.359)
Dependency×Anthropogenic loss	-0.499**	-0.536**	-0.421*	-0.310
	(0.187)	(0.209)	(0.234)	(0.287)
Dependency× *If get loan*	-0.840***	-0.881**	-1.003***	-1.042**
	(0.269)	(0.361)	(0.337)	(0.403)
Anthropogenic loss× *If get loan*	0.0102	0.0488	0.0395	0.0946
	(0.117)	(0.197)	(0.161)	(0.228)
Dependency×Anthropogenic loss× *If get loan*	0.657***	0.756***	0.705***	0.560***
	(0.127)	(0.153)	(0.123)	(0.180)
Constant	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	95,595	95,595	95,595	95,595
Adjusted R-squared	0.0335	0.0389	0.0408	0.0415

Table B.12. Robustness: Selection-adjusted results for alternative reforestation measure

This table reports the robustness results examining the effect of receiving loans after human-induced forest loss on firms' reforestation engagement, controlling for selection bias using the Inverse Mills Ratio (IMR) from the first-stage probit model (Table B.7). The dependent variable is *Reforest*, an indicator that equals 100 if the firm claims to engage in reforestation activities in their disclosures in the following estimation window. *Anthropogenic loss* refers to firm-level forest loss from human activities in the previous year. *If get loan* is an indicator defined as one if the firm gets syndicate loan in a year, and zero otherwise. Firm controls include *Firm size*, *Leverage*, *ROA*, *Liquidity*, *Log credit rating*, and the IMR term. All variables are defined in Appendix Table A.1. Standard errors are clustered at the 2-digit SIC and year level and reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Reforest				
Outcome window (forward)	*+1 year*	*+2 years*	*+3 years*	*+4 years*
	(1)	(2)	(3)	(4)
Dependency	3.094***	3.678***	3.839***	3.969***
	(0.780)	(0.950)	(1.056)	(1.141)
Anthropogenic loss	3.219***	4.012***	4.350***	4.609***
	(0.776)	(0.911)	(1.002)	(1.060)
If get loan	1.021***	1.249***	1.487***	1.543***
	(0.303)	(0.339)	(0.342)	(0.366)
Dependency×Anthropogenic loss	-0.503**	-0.541**	-0.426*	-0.316
	(0.184)	(0.205)	(0.228)	(0.279)
Dependency× *If get loan*	-0.870***	-0.917**	-1.043***	-1.084**
	(0.272)	(0.369)	(0.347)	(0.412)
Anthropogenic loss× *If get loan*	-0.00173	0.0341	0.0234	0.0775
	(0.120)	(0.194)	(0.162)	(0.227)
Dependency×Anthropogenic loss× *If get loan*	0.654***	0.753***	0.701***	0.556***
	(0.126)	(0.151)	(0.138)	(0.187)
IMR (*If get loan*)	272.7***	337.1***	366.2***	389.8***
	(76.50)	(91.59)	(100.3)	(105.9)
Constant	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	95,595	95,595	95,595	95,595
Adjusted R-squared	0.0347	0.0403	0.0422	0.0429

References

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