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## Impact of Sustainable Finance Regulations on Banks' Lending to Carbon-Intensive versus Green Sectors

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### Abstract

**Purpose:** This paper empirically investigates whether the introduction of sustainable finance regulations—specifically the EU Taxonomy Regulation and mandatory climate disclosure requirements—has reallocated bank lending capital away from carbon-intensive industries toward green sectors.

**Design/methodology/approach:** Using a difference-in-differences (DiD) framework, we analyze a panel of syndicated loans from 25 major European banks extended to 850 non-financial firms between 2017 and 2024. The sample is split into "Brown" (carbon-intensive) and "Green" (taxonomy-aligned) sectors, with the 2020 enactment of the EU Taxonomy serving as the exogenous policy shock.

**Findings:** The results indicate a statistically significant "regulatory reallocation effect." Post-regulation, lending volumes to carbon-intensive sectors decreased by approximately 14.2% relative to green sectors. Furthermore, the interest rate spread charged to brown borrowers increased by 18.5 basis points, suggesting that banks are pricing in transition risks more aggressively in response to regulatory pressure.

**Originality/value:** This study provides direct evidence of the "real effects" of sustainable finance regulation, demonstrating that disclosure mandates and taxonomy classifications are not merely compliance exercises but are actively reshaping capital allocation in the banking sector.

**Keywords:** Brown, carbon-intensive, paper empirically, EU Taxonomy, taxonomy-aligned

### Introduction

The role of the banking sector in facilitating the low-carbon transition has moved to the forefront of global financial regulation. Policymakers argue that for the goals of the Paris Agreement to be met, capital must be redirected from "brown" activities (e.g., fossil fuels, heavy manufacturing) to "green" activities (e.g., renewable energy, clean transport). To achieve this, jurisdictions like the European Union have introduced comprehensive frameworks, most notably the EU Taxonomy Regulation (2020) and the Sustainable Finance Disclosure Regulation (SFDR).

While the theoretical intent of these regulations is clear—to reduce information asymmetry and penalize carbon-intensive lending through higher capital costs or reputational risk—the empirical evidence on their effectiveness remains nascent. Are banks actually reducing their exposure to brown sectors, or are they merely reclassifying existing loans ("greenwashing")?

### This paper addresses two central questions

1. Has the implementation of sustainable finance regulations led to a tangible reduction in lending volumes to carbon-intensive firms relative to green firms?
2. Have these regulations altered the cost of debt (loan spreads) for brown borrowers compared to green borrowers?

We exploit the introduction of the EU Taxonomy in 2020 as a quasi-natural experiment. Using syndicated loan data from 2017 to 2024, we employ a difference-in-differences (DiD) strategy to compare lending behaviors before and after the regulation. Our findings suggest that regulation is effective: we document a significant "capital flight" from brown sectors and a rising "carbon risk premium" in loan pricing.

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## Literature Review

**Banking and Climate Risk:** Traditional banking theory suggests that banks price loans based on credit risk. Climate risk introduces new dimensions: physical risks (damage to assets) and transition risks (policy/technology changes stranding assets). Carney (2015)<sup>[3]</sup> famously categorized these risks, arguing they impact financial stability. Campiglio *et al.* (2018)<sup>[2]</sup> argue that without intervention, market failure prevents banks from fully internalizing these risks due to short time horizons.

**The "Greenium" vs. Carbon Penalties:** A growing body of literature examines whether green borrowers enjoy lower costs of capital (a "greenium"). Fatica *et al.* (2021)<sup>[6]</sup> find that green bonds command a premium, but evidence in the loan market is mixed. Delis *et al.* (2019) find that banks began pricing climate policy risk in syndicated loans only after the Paris Agreement, and even then, the effect was limited to banks holding significant fossil fuel assets.

**Regulatory Impact:** Recent studies focus on specific policies. Müller & Saphir (2022)<sup>[7]</sup> suggest that mandatory ESG disclosure leads banks to sever ties with the worst polluters to protect their reputation. Alessi *et al.* (2023)<sup>[1]</sup> find that the "green asset ratio" (GAR) requirements incentivize banks to "green" their balance sheets. Our paper contributes by quantifying the *magnitude* of this shift specifically around the 2020 EU Taxonomy shock.

## Data and Methodology

**Data Sources:** We construct a matched dataset combining loan-level information with firm-level environmental and financial data.

- Loan Data:** DealScan (Thomson Reuters). We focus on syndicated loans to ensure coverage of large corporate financing.
- Firm Data:** Refinitiv Eikon (Financials) and MSCI ESG Ratings (Carbon emissions/Sector classification).
- Sample Period:** 2017-2024. The sample covers the pre-regulation period (2017-2019) and post-regulation period (2021-2024), treating 2020 as the transition year.
- Geography:** EU-27 banking institutions and borrowers, ensuring the regulatory shock is applicable.

## Variable Definitions

### Dependent Variables

- $\ln(\text{Amount})_{i,b,t}$ : Natural log of the loan facility size (Volume).
- $\text{AISD}_{i,b,t}$ : The All-in-Spread-Drawn, defined as the interest rate spread over LIBOR/EURIBOR in basis points (Price).

### Independent Variables

- $\text{Post}_t$ : Dummy variable equal to 1 for years  $\geq 2021$ , 0 otherwise.
- $\text{Brown}_i$ : Dummy variable equal to 1 if the borrower operates in High-Climate-Impact sectors (NACE codes: Mining, Energy, Manufacturing, Transport) and has high emission intensity ( $>90^{\text{th}}$  percentile).
- $\text{Green}_i$ : Dummy variable equal to 1 if the borrower's activities are Taxonomy-aligned (Renewables, Clean Tech).
- Controls:** Firm size ( $\ln(\text{Assets})$ ), leverage (Debt/Assets), profitability (ROA), and loan maturity.

**Econometric Model:** We estimate the following Difference-in-Differences (DiD) regression specification:

$$Y_{i,b,t} = \alpha + \beta_1(\text{Brown}_i \times \text{Post}_t) + \beta_2 \text{Brown}_i + \beta_3 \text{Post}_t + \gamma X_{i,t} + \delta_b + \theta_t + \epsilon_{i,b,t}$$

Where:  $Y_{i,b,t}$  represents the outcome variable (Volume or Spread). The coefficient of interest is  $\beta_1$ , which captures the causal impact of the regulation on brown firms relative to the control group (green/neutral firms). Bank fixed effects ( $\delta_b$ ) and Time fixed effects ( $\theta_t$ ) control for unobserved heterogeneity.

## Results

### Descriptive Statistics

**Table 1:** Summary Statistics (2017-2024)

Variable	Mean (Green)	Mean (Brown)	Diff (t-stat)
Loan Amount (€ millions)	420.5	680.2	8.4***
Spread (AISD, bps)	145.2	185.6	12.1***
Leverage (Debt/Assets)	0.45	0.52	5.2***
Carbon Intensity (tCO2/Rev)	25.4	410.8	35.6***
Total Observations	1,240	1,850	

**Source:** Author's calculation based on DealScan & Refinitiv data.

Note: \*\*\* indicates statistical significance at the 1% level.

### Impact on Lending Volumes (Quantity Effect)

**Table 2:** Impact of Regulation on Loan Volumes

Variable	Dependent Var: $\ln(\text{Amount})$
Brown $\times$ Post (DiD)	-0.142* (0.041)
Brown Dummy	0.210*** (0.035)
Post Dummy	0.055 (0.040)
Firm Controls	Yes
Bank FE	Yes
Time FE	Yes
Adj. R-squared	0.62

Note: Standard errors clustered at the bank level. \*\*\* p<0.01.

**Interpretation:** The coefficient of -0.142 indicates that, after the introduction of the EU Taxonomy, loan volumes to carbon-intensive firms decreased by approximately 14.2% compared to the control group. This confirms a significant "capital reallocation" effect away from brown sectors.

### Impact on Cost of Debt (Pricing Effect)

**Table 3:** Impact of Regulation on Loan Spreads

Variable	Dependent Var: Spread (bps)
Brown $\times$ Post (DiD)	18.45* (4.20)
Brown Dummy	25.30*** (3.80)
Post Dummy	5.10 (3.10)
Firm Controls	Yes
Adj. R-squared	0.58

Note: \*\*\* p<0.01.

**Interpretation:** The interaction term is positive and significant (18.45). This implies that post-regulation, the "carbon premium" charged to brown borrowers increased by roughly 18.5 basis points relative to green borrowers, holding risk factors constant.

**Robustness Checks:** To ensure validity, we tested the Parallel Trends Assumption by interacting the *Brown* dummy with individual year dummies. We found no significant difference in lending trends between green and brown sectors in the pre-2020 period, validating the DiD approach. Additionally, results remain robust when excluding the energy sector, suggesting the effect is not driven solely by oil and gas firms.

## Discussion

The empirical results provide strong evidence that sustainable finance regulations are not merely administrative burdens but are actively reshaping the European credit market.

- The "Stranded Asset" Fear:** The ~14% reduction in lending volume to brown sectors (Table 2) suggests banks are proactively limiting exposure to assets that might become "stranded" under strict climate policies. The EU Taxonomy has made "greenwashing" harder, forcing banks to justify high-carbon lending, which carries higher capital requirements and reputational risks.
- Pricing the Transition:** The ~18 bps increase in spreads for brown firms (Table 3) indicates that banks are transferring the cost of regulatory compliance and transition risk to the borrower. This makes capital more expensive for polluters, theoretically incentivizing them to decarbonize.
- The "Green Asset Ratio" (GAR) Effect:** Banks are under competitive pressure to improve their GAR (the proportion of green assets in their portfolio). This creates a "race for green assets," increasing supply of credit to renewable projects while constraining credit to fossil fuel projects.

## Conclusion

This paper investigates the impact of sustainable finance regulations (specifically the EU Taxonomy) on bank lending. Using a Difference-in-Differences approach on syndicated loan data (2017-2024), we find robust evidence of regulatory effectiveness.

## Key Findings

- Quantity:** Lending to carbon-intensive sectors fell by ~14% relative to green sectors post-regulation.
- Price:** The cost of borrowing for carbon-intensive firms rose by ~18.5 basis points relative to green peers.

## Implications

- For Policymakers:** Disclosure mandates and taxonomies are effective tools for redirecting capital. However, care must be taken to ensure "transition finance" is not choked off entirely, as brown firms need capital to decarbonize operations.
- For Banks:** Early movers in decarbonizing loan books may avoid future credit losses from stranded assets, but they face short-term revenue tradeoffs from exiting profitable heavy-industry relationships.

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