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Corporate Net Zero Transition and Financing Cost: Evidence of Impact from the Global Energy and Utilities Sectors

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Abstract
We study whether the net zero transition (NZT) affects loan pricing in the energy and utilities sectors of the loan market. We find that firms with higher levels of overall NZT disclosure experience a lower cost of debt in the loan market, controlling for loan-specific and firm financial characteristics. This effect is economically and statistically significant in Europe, but not in North America or emerging markets, and becomes more pronounced after the 2015 Paris Agreement. We also identify relevant NZT actions contributing to such a relation. Firms disclosing clear emission reduction targets aligned with the Paris Agreement enjoy lower loan spreads. Additionally, environmental R&D expenditure and improved energy efficiency policies are associated with lower loan spreads. Moreover, effective governance actions, such as environmental management training and ESG-linked executive compensation, help mitigate climate risks and lower loan spreads.

Keywords Net zero transition · Financing cost · Cost of debt · Bank loan

1 Introduction

Achieving global net zero transition (NZT) requires sufficient investment in upgrading existing energy assets and facilities, scaling renewable technologies, and developing carbon capture and storage. According to the International Energy Agency (IEA, 2023), global annual clean energy investment must rise from $2 trillion to $5 trillion by 2030 to around $4.5 trillion by 2050 to reach net zero emissions by 2050.

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Investors increasingly incorporate climate factors into their investment strategies and decision-making for two reasons (van Benthem et al. 2022). First, growing societal and regulatory pressures compel investors to integrate environmental and social impacts alongside financial returns. Second, climate transition risks, such as regulatory shifts, litigation, and stranded asset risks, have emerged as material concerns that influence project valuations, future cash flows, and the cost of capital.

Empirical research shows that transition risks already affect asset prices across multiple financial markets, including loans (Jung et al. 2018; Zhou et al. 2021, 2023a, b), equities (Pástor et al. 2021; X. Y. Zhou et al. 2023a, b), and bonds (Huynh and Xia 2021; Painter 2020). Furthermore, this body of literature suggests that the absence of technological and financial strategies for reducing carbon emissions likely exposes investors to the risk of economic losses. As a result, carbon-intensive corporations are under mounting pressure from investors and regulators to disclose net zero transition plans. In response, a growing number of firms have disclosure net zero transition schemes and policies to align with the Paris Agreement (Krabbe et al. 2015; Rekker et al. 2022, 2023), particularly for sectors with high emissions, such as energy and power.

Beyond emissions-based measures, banks and financial institutions have also begun to integrate NZT valuation frameworks into their credit risk assessments. Initiatives such as the Task Force on Climate-related Financial Disclosures (TCFD)[1] and the Net-Zero Banking Alliance (NZBA)[2] provide guidance for incorporating transition risk metrics—covering emissions reduction targets, governance structures, and capital allocation strategies—into lending practices. These frameworks enable banks to incorporate transition performance directly into internal risk management and credit pricing models. For example, HSBC's transition banking strategy highlights how financed emissions targets and sectoral decarbonisation pathways inform client engagement and risk-pricing decisions.[3] Complementing these institutional shifts, empirical evidence shows that emissions and transition risk metrics are increasingly influencing loan terms. Ehlers et al. (2022) document that borrowers with higher CO_2 emission intensity face significantly higher risk premia in syndicated loan markets, while Ben-Nasr et al. (2025) find that firms with elevated climate risk are charged wider loan spreads. These findings suggest that components of NZT performance, especially credible emission targets and disclosure, are already being used by lenders in pricing corporate debt.

From an economic perspective, the relationship between corporate NZT performance and financing costs operates through three complementary mechanisms. First, a risk mitigation channel: firms that develop credible transition strategies are better positioned to manage climate-related risks—such as regulatory tightening, carbon pricing, and stranded asset exposure—thereby reducing expected default risk and the risk premium required by lenders (Delis et al. 2024; Palea and Drogo 2020). Second, an information and signalling channel: NZT disclosures, including emission reduction targets, investment in low-carbon technologies, and governance commitments, provide forward-looking and verifiable information about firms' transition readiness, reducing information asymmetry and enhancing investor confidence (Chang and Lo 2022; Jung et al. 2018). Third, a credit allocation (supply-side)

[1] https://www.fsb-tcfd.org/about/.

[2] https://www.unepfi.org/net-zero-banking/.

[3] HSBC, Net Zero Transition Plan 2024, https://www.hsbc.com/who-we-are/our-climate-strategy/our-net-zero-transition-plan.

channel: as banks increasingly integrate climate considerations into their risk management and lending frameworks, firms with stronger NZT performance are more likely to be viewed as aligned with lenders' strategic and regulatory objectives, improving their access to credit and borrowing conditions (Kacperczyk and Peydró 2024; Sastry et al. 2024). These mechanisms suggest that credible NZT performance should be associated with more favourable financing terms, particularly in institutional environments where climate policies and sustainable finance practices are more developed.

However, the effectiveness of these mechanisms critically depends on the credibility of corporate net-zero commitments. Van Benthem et al. (2022) highlight that many corporate emissions reduction plans are non-binding and sometimes misaligned with scientific benchmarks. Furthermore, a firm's compliance with emissions targets at a specific point in time offers only a partial view of its transition trajectory. Other critical dimensions, such as governance structures, financial strategies, and policy actions, must be assessed comprehensively, given that the path to net zero is dynamic and requires forward-looking enforcement mechanisms. Understanding these factors is essential for evaluating investment risks and making climate-resilient financial decisions (Rekker et al. 2022).

Despite the increasing disclosure of net zero commitments, a key research gap remains: do firms that take credible, proactive steps to mitigate climate transition risks benefit from financial markets? Specifically, does a company's commitment to a net zero strategy impact its cost of capital? Addressing this gap, our study examines how the credibility of corporate net zero transition plans influences loan financing, with a focus on the cost of debt in the energy and utilities sectors. In addition, we examine whether the relationship between corporate NZT performance and loan spreads varies across regions and over time. Climate transition risks vary: they are strongly shaped by policy regimes, regulatory environments, and disclosure practices, which differ across jurisdictions and evolve with major policy events such as the 2015 Paris Agreement (Carney 2015; Palea and Drogo 2020; Ehlers et al. 2022; Delis et al. 2024; Christensen et al. 2021; Kling et al. 2021). By conducting subsample analyses across regions and pre- and post- the 2015 Paris Agreement, we provide new evidence on how institutional context and policy salience condition the extent to which banks incorporate NZT progress into loan pricing. Moreover, we identify which aspects of NZT are most material for investment decision-making in the energy and utilities sectors.

We concentrate on the energy and utilities sectors because they are pivotal to the global low-carbon transition and thus most relevant for examining the relationship between net zero transition performance and financing costs. Both renewable energy and fossil fuel investments are particularly exposed to transition dynamics. Renewable energy firms may face significant capital expenditures in novel or evolving technologies (Egli 2020), while fossil fuel firms are increasingly vulnerable to legal risks, regulatory constraints on carbon emissions, and intensifying competition from clean energy alternatives (Caldecott 2017). Decarbonising these sectors is critical for meeting the 2015 Paris Agreement targets (Papadis and Tsatsaronis 2020), as the power sector represents the single largest source of greenhouse gas emissions, accounting for about 36% of global energy-related CO2 emissions (IEA 2021). Moreover, clean electricity generation underpins the decarbonisation of transportation, buildings, and industry, since effective electrification of these sectors depends on low-carbon power (IPCC, 2022). Given this centrality, investors perceive the energy and utilities sectors as both highly exposed to systemic transition risks and critical to capital reallocation toward net-zero objectives (van Benthem et al. 2022).

Using a global sample of 40,449 loan facilities issued between 2002 and 2022 to borrowers in 47 countries within the energy and electric utilities sectors, we assess NZT performance through four key dimensions: (1) targets and strategy, (2) financial actions, (3) emissions reduction policies, and (4) governance. Our analysis finds that banks incorporate NZT progress into loan pricing, with significant variations across regions and time periods—particularly after the 2015 Paris Agreement. Firms with higher NZT scores, developed based on publicly disclosed decarbonisation actions, benefit from lower loan spreads. This effect is strongest in Europe, where a one standard deviation increase in NZT scores leads to a 17.9 bps reduction in loan spreads. However, we find no significant relationship in North America or emerging markets, suggesting that NZT performance has a limited impact on loan costs in these regions.

Our findings align with previous research that lenders factor in transition and emissions risks when pricing debt. For instance, Ehlers et al. (2022) and Palea and Drogo (2020) have documented a "carbon premium" in syndicated loans, while Jung et al. (2018) have shown that disclosure and risk awareness can offset higher borrowing costs. We build on this research by demonstrating that a composite NZT score, which encompasses disclosure, targets, governance, and decarbonisation strategy, provides a more comprehensive and credible signal that lenders incorporate into credit pricing. Notably, we find that this effect varies: it is strongest in Europe and becomes more pronounced after the 2015 Paris Agreement, when policy salience and investor attention increased. In contrast, we observe no significant association in North America or emerging markets, mirroring studies that have found mixed ESG–spread relationships (e.g., Amiraslani et al., 2023) and suggesting that NZT progress is less pronounced in these regions than in Europe. Overall, our findings reinforce the notion that NZT credibility operates as both a risk-mitigation and signalling mechanism, but its impact on loan pricing depends on regulatory context, disclosure regimes, and regional market dynamics. Furthermore, our study explores which NZT actions drive lower debt costs. We find that companies disclosing clear, Paris-aligned emission reduction targets benefit from lower loan spreads. Investment in environmental R&D is also associated with reduced borrowing costs, whereas general environmental expenditure is not statistically significant. Additionally, strong corporate policies, especially those targeting energy efficiency, correlate with lower loan spreads. Effective governance mechanisms, such as environmental management training and ESG-linked executive compensation, further contribute to reduced financing costs.

In addition to our baseline regression, we employ a difference-in-difference model to eliminate the endogeneity issue. We estimate the differential impact of the Paris Agreement on the relation between NZT performance and loan spreads over a two-sided 7-year window around 2015. We find that the Paris Agreement significantly impacted loan spreads for firms with high NZT scores. Post-agreement, firms with higher NZT scores experienced a notable decrease in loan spreads. This result confirms the robustness of our findings and suggests that credible climate transition strategies create tangible financial benefits.

Our research makes several key contributions. First, while much prior research proxies transition risk with emissions metrics, policy exposure, or geography-based climate risk, our study provides novel evidence that firm-level NZT execution is itself priced by lenders. This broader, credibility-focused measure of NZT is significantly and negatively associated with loan spreads, particularly in the energy and utilities sectors where transition risk is most material. We highlight that this contribution extends the literature by moving beyond nar-

row emissions-based proxies and providing a more comprehensive view of how transition credibility operates as a risk-mitigation and signalling mechanism in debt markets. Second, by identifying the specific NZT actions that matter most for investment decisions, our study offers a framework for assessing and managing transition risks. This can help both firms and investors mitigate the financial consequences of climate change. Third, we highlight the importance of transparency in NZT disclosures—not only regarding long-term commitments but also governance and financial strategies that ensure credibility and enforceability. Finally, our findings contribute to the policy debate on mandatory climate risk disclosures. We provide empirical evidence that firms aligning with key recommendations[4] of the Task Force on Climate-related Financial Disclosures (TCFD) enjoy lower borrowing costs. This supports the argument that corporate climate risk disclosure legislation, at least in developed markets, can benefit firms, investors, and the broader economy(Griffin and Jaffe 2022).

The remainder of this paper is organised as follows. Section 2 reviews the literature on climate transition risks and the cost of capital. Section 3 presents the data research method. Section 4 presents the results and conducts endogeneity tests. The result discussion and conclusion are provided in Sects. 5 and 6.

2 Literature Review

2.1 Corporate Net Zero Transition (NZT) and the Cost of Capital

The global shift towards a low-carbon economy has brought growing academic interest in how corporate net-zero transition strategies affect financing conditions and the cost of capital. Climate transition risk refers to the financial and operational challenges firms face as economies shift toward low-carbon models (Bank of England, 2015). These risks arise from regulatory and policy changes, technological advancements, and evolving consumer preferences (Carney 2015). Addressing these risks requires firms to realign strategies, adapt operations, revise capital expenditures, and adjust governance structures (TCFD 2017). The extent of these changes reflects a firm's NZT performance, which measures its progress toward decarbonisation goals.

From a theoretical perspective, the NZT process alters the firm's risk–return profile in capital markets. According to asset pricing theory, investors demand compensation for bearing additional risks that are not fully diversifiable (Sharpe 1964). Transition risks fall into this category, as they create uncertainty about firms' future cash flows, asset valuations, and long-term viability, particularly in carbon-intensive industries (De Haas et al. 2023; Greig et al. 2023). Consequently, investors and creditors incorporate these risks into required returns, credit ratings, and financing costs (van Benthem et al. 2022). Higher perceived transition risk leads to increased capital costs (Wen et al. 2021; Zhou et al. 2023a, b).

Empirical evidence supports this mechanism. Firms located in climate-vulnerable regions or those exposed to regulatory uncertainty pay higher loan spreads and face restricted access to finance (Javadi & Al Masum, 2021; Kling et al., 2021), while those with larger carbon footprints tend to be penalised with lower credit ratings and higher bond spreads, particu-

[4] TCFD climate risks-related disclosure recommendations include four thematic areas: governance, strategy, risk management, and metrics and targets.
https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf.

larly in stricter regulatory contexts (Seltzer et al. 2022). Similarly, Ehlers et al. (2022) finds a "carbon premium" in syndicated loans, where borrowers with higher CO_2 emission intensity face significantly higher loan risk premia, even after controlling for sector effects. Recent studies add further nuance: Ben-Nasr et al. (2025) show that scope 1 and 2 emissions are negatively associated with bank debt ratio, indicating that high emitter firms are less able to secure bank debt. These findings suggest lenders are adjusting credit behaviour in response to emissions exposure and confirm that banks are increasingly embedding emissions and transition risk into loan pricing. The above-discussed theoretical and empirical evidence suggests that corporate NZT performance affects financing costs through a risk mitigation channel, whereby stronger transition performance reduces perceived default risk and lowers the risk premium required by lenders.

However, credible and transparent net-zero strategies can mitigate such financing penalties. Firms that adopt science-based targets, commit to renewable energy, and align governance with climate objectives signal adaptability and long-term resilience. This reduces investor uncertainty and leads to more favourable financing terms. Prior research shows that corporate environmental responsibility and sustainability disclosure are associated with lower costs of equity (El Ghoul et al. 2018; Gupta 2018) and reduced cost of debt (Vitolla et al. 2020). These findings suggest that markets reward firms that credibly embed transition strategies into their business models, while laggards face higher borrowing costs. In debt markets, Jung et al. (2018) demonstrate that firms with high carbon emissions are penalised with higher borrowing costs, but this effect is neutralised when firms exhibit carbon risk awareness through disclosure or cleaner technology investment. This evidence suggests that corporate NZT performance affects financing costs through an information and signalling channel, whereby NZT disclosures—such as emission reduction targets, financial commitments, and governance arrangements—provide forward-looking and verifiable information about firms' transition readiness, reducing information asymmetry and enhancing investor confidence.

Beyond risk and signalling channels, lender behaviour suggests the presence of a credit allocation (supply-side) channel. Kacperczyk and Peydró (2024) show that banks committed to decarbonisation reduce credit to high-emission firms, indicating that climate considerations influence lending decisions and portfolio allocation. Firms with stronger NZT performance are therefore more likely to align with lenders' strategic and regulatory objectives, improving their access to credit and borrowing conditions.

The extent to which the global transition to a low-carbon economy affects firms depends on their exposure to transition risks, their risk management strategies, and the speed of their adjustment processes (De Haas et al. 2023; Haas 2022). Climate transition risks are conceptually complex and pervasive, as they involve interconnected factors such as policy shifts, technological advancements, consumer behaviour changes, and broader macroeconomic trends (Gözlügöl and Ringe 2022; Reboredo and Ugolini 2022; Sastry et al. 2024). This complexity makes it challenging to assess and quantify transition risks with the same precision as traditional financial risks.

The literature indicates that transition risks are increasingly material to capital markets. Corporate NZT captures the breadth of a firm's response to decarbonisation imperatives, covering from emission reduction targets, renewable energy adoption, governance and financial alignment actions, to strategic repositioning. Firms that lag in this transition signal greater exposure to stranded assets (Delis et al. 2024; van der Ploeg and Rezai 2020)

and regulatory penalties (Fard et al. 2020; Palea and Drogo 2020), which creditors interpret as higher default risk. Consequently, lenders demand a higher risk premium, resulting in elevated loan spreads. Conversely, firms that demonstrate credible and proactive NZT strategies provide forward-looking signals that reduce informational asymmetry and reassure investors about long-term resilience. Transparent disclosure, credible target-setting, and alignment with international initiatives such as SBTi or RE100 reduce investor uncertainty by distinguishing committed firms from potential greenwashers (Chang and Lo 2022; Krabbe et al. 2015). Legitimacy theory also explains that firms aligning with societal and stakeholder expectations are more likely to maintain investor trust and access to capital (Suchman, 1995; Haque and Ntim 2020).

In summary, the previous literature implies that corporate NZT performance reduces perceived climate transition risks and, consequently, lowers the cost of debt financing. Loan spreads provide a direct and observable measure of this effect, as they reflect creditors' risk assessments in debt pricing. Thus, we hypothesise that corporate net zero transition performance is negatively correlated with the cost of debt, measured by loan spreads.

2.2 Net Zero Transition, Environmental Performance and Debt Financing

Carbon emissions and disclosure practices, as components of the broader net zero transition, have been extensively studied in relation to financial performance (Aswani et al. 2023; Bolton and Kacperczyk 2021; Wen et al. 2021). While carbon emissions metrics are central to understanding transition risks, they represent only one dimension of corporate adaptation. A firm's net zero transition performance is multidimensional—spanning emissions outcomes, disclosure quality, governance and target-setting, investment plans, and stakeholder engagement. Legitimacy theory suggests that firms use disclosure and governance strategies to maintain social approval and stakeholder trust (Suchman, 1995; Haque and Ntim 2020). By aligning with societal expectations, firms that engage in sustainability, a widely recognised legitimisation tool, tend to be rewarded by investors, as it signals their commitment to environmental responsibility and transparency (Haque and Ntim 2020; Kim and Lyon 2011).

Empirical evidence indicates that lenders price transition and environmental risk. Using Eurozone data (2010–2018), Palea and Drogo (2020) demonstrate that higher carbon emissions are linked to increased borrowing costs, and that lenders' sensitivity grew after the Paris Agreement. Interestingly, while they find that improved climate-related disclosure decreases carbon risk in loan pricing, external verification, and declared emission reduction targets have weaker effects, emphasising that disclosure credibility is a vital factor in influencing financing costs.

In syndicated loan markets, Ehlers et al. (2022) document a significant "carbon premium" in loan spreads related to Scope-1 emissions intensity, broadly across industries rather than only in fossil fuels. At the borrower level, Jung et al. (2018) find that firms with high historical emissions pay higher borrowing costs, but that carbon risk awareness—proxied by CDP responsiveness—neutralises the penalty, highlighting a salient signalling mechanism. Related bond evidence reinforces that long-horizon climate risk is priced. Huynh and Xia (2021) show bonds with higher climate-news beta deliver lower subsequent returns (investors pay up for climate hedges), and Painter (2020) find climate-exposed counties face

higher issuance costs on long-term municipal bonds, consistent with risk being priced over longer horizons via ratings and investor attention.

Banks' portfolio-level conditioning further supports a debt structure channel. (Delis et al. 2024) show banks price climate-policy exposure more strongly post-2015, especially for longer maturities, and "green" banks charge higher rates to fossil-fuel firms with stranded asset risk. Kacperczyk and Peydró (2024) identify a credit-supply effect: when banks commit to decarbonisation, they reduce credit to high-emission (Scope-1) borrowers, shifting debt structures via reallocation rather than financing abatement. Complementing this, Ben-Nasr et al. (2025) find carbon risk lowers the bank-debt share of total debt—consistent with both supply-side screening (reputational and regulatory sensitivity) and borrower demand-side adjustments (avoiding scrutiny), with effects stronger where financial development and environmental regulation are tighter. Evidence from China's green-credit tightening shows policy can transmit through pricing and quantities. Fan et al. (2021) document higher rates, smaller loans, and tighter access for non-compliant firms after regulation is reinforced. Du et al. (2017) show that better environmental performance reduces interest rates for Chinese private firms. Umar et al. (2021) find that carbon-neutral lending is associated with lower bank credit risk and default risk in the Eurozone.

Overall, these studies suggest that lenders and investors evaluate NZT comprehensively: not only emissions levels but also how credible and forward-looking a company's transition plan is. A credible NZT signal decreases perceived risks of default, stranded assets, regulation, and reputation, resulting in better loan conditions and sometimes altering debt structure (e.g., maturity, collateral, proportion of bank debt). Conversely, high emissions and weak or unclear disclosure raise borrowing costs and restrict credit access. This wider perspective supports our use of a composite NZT measure—covering emissions, disclosure, governance, and strategy—as the economically relevant indicator for creditors and investors when assessing climate transition risks.

3 Data and Method

3.1 Data

Our sample combines two main datasets: (1) Refinitiv's DealScan dataset on syndicated loans and (2) Refinitiv's Worldscope dataset on firms' net zero transition disclosures and financial characteristics. We first merge corporate financial data with net zero transition disclosure data from Worldscope. Then, we merge it with syndicated loan data from WRDS using tickers and corporate names. We exclude observations with missing information on the syndicated loan variables or firm characteristics used in the analysis. The final sample consists of 40,449 loan facilities between 2002 and 2022, with borrowers from 47 countries.

We obtained syndicated loan data from Refinitiv Dealscan, which contains information on loan contract terms (e.g., spreads, loan amounts, and maturities) issued to global public firms in the power and energy sectors from 2001 to 2022. Each loan is identified as a distinct observation at the lender-facility level. For each facility[5], we use the all-in-drawn spread

[5] In Refinitiv's DealScan database, a loan facility is a component of a larger loan deal, representing a specific credit line or term loan within that deal, each with its own terms and conditions. A facility agreement includes the loan amount, interest rates, repayment schedule, and any fees.

variable (the total annual spread paid over the London Interbank Offered Rate (LIBOR)) to measure the cost of bank loans. Energy and electric utilities have been selected as the sample for this study due to their significant exposure to transition risks and their essential role in systematic decarbonisation efforts.

The net zero transition measures how effectively companies are advancing towards their commitments to achieve net-zero greenhouse gas emissions. It encompasses a range of strategies and actions that organisations disclose and implement to reduce their greenhouse gas (GHG) emissions to net zero. Drawing on the IEA net zero transition roadmap and the UK's Transition Plan Taskforce disclosure framework, we considered the essential alignment actions for the net zero transition outlined in Table 1 as guiding principles for selecting quantifiable indicators. Key measures for the net zero transition encompass targets and planning, financial actions to facilitate business planning for renewables, policy implementations for decarbonisation, and governance actions to bolster renewables.

To enable our assessment, we have selected multiple disclosure variables from Eikon to proxy the key action items in this four-dimensional framework for corporate net zero transition. To begin, we selected four indicator variables for NZT targets and planning, including (1) Emission reduction target year, (2) Emission reduction target percentage, (3) GHG Emissions Scope 1,2,3 Paris Agreement Aligned, and (4) GHG Emissions Intensity Scope 1,2,3 Paris Agreement Aligned. Two NZT financial actions are environmental R&D expenditure and environmental investment initiatives. The two NZT policy indicator variables consist of energy efficiency and environmental supply chain policies. NZT governance variables include the environmental management team, environmental management training, remuneration arrangements incorporating climate change, and executive compensation related to ESG performance. The definitions for these 12 NZT disclosure indicators are outlined in

Table 1 Key elements of net zero transition plan

Disclosure framework	Alignment actions
NZT target and planning	• Whether the company has set short-term (2023–2030), medium-term (2030–2040), and long-term (2040–2050) GHG reduction targets clearly defined in terms of the scope of emissions • Whether the carbon emissions are aligned with the Paris Agreement
Financial actions to support NZT business planning for renewables	• Whether the company disclose the amount of capital expenditure and environmental investments that will be used to expand renewables • Whether the company disclose its R&D investments in innovative technologies
Policy implementations to support NZT business planning for renewables	• Whether the company has policies to reduce emissions • Whether the company has policies to reduce climate change's impact on the supply chain?
Governance actions to support NZT business planning for renewables	• Whether the company's board is explicitly responsible for oversight on matters related to climate change • Whether the company's executive remuneration scheme is linked to climate performance • Whether the board or a dedicated committee possesses the necessary experts, skills and competencies to manage risks and opportunities related to climate change

Table 2. Each NZT indicator variable is a dummy variable, set to 1 if the company implements a corresponding action or policy in year *t*, and 0 otherwise. The overall NZT score is obtained by summing all indicators. The score for each of the four NZT dimensions—(1) targets and planning, (2) financial actions, (3) policy implementation, and (4) governance mechanisms—is determined by summing the indicators within that specific dimension.

The Climate Action (CA) 100+and Assessing Low-Carbon Transition (ACT) initiatives have published detailed methodologies and benchmark assessments covering multiple aspects of energy companies' transition plans. However, both initiatives suffer from limited historical data, with scores and assessments available only for two years (2021–2023). Furthermore, relying on a single metric, such as ACT, to proxy the 'credibility' of the net zero transition is biased. For example, the weighting ratio assigned to different indicators may not accurately reflect their significance in facilitating the energy transition. Changes in these weights could lead to different performance ratings. Thus, we compose the net zero transition score by incorporating the relevant indicators or actions as discussed above.

We include a set of control variables in the regression to ensure that the estimated relationship between net-zero transition (NZT) performance and loan spreads is not confounded by other factors that are known to influence loan pricing. Prior literature on syndicated loan markets highlights that both loan-specific features and borrower characteristics sys-

Table 2 Indicator variables of net zero transition

Key dimensions of the NZT plan	Variables components in Eikon	Variable description
NZT target and planning	Emission reduction target year	Indicator equal to 1 if the firm discloses a specific target year for achieving emissions reduction; 0 otherwise.
	Emission reduction target percentage	Indicator equal to 1 if the firm discloses a quantified emissions reduction target (percentage); 0 otherwise.
	GHG Emissions Scope 1,2,3 Paris Agreement Aligned	Indicator equal to 1 if the firm reports that its Scope 1, 2, and 3 emissions reduction targets are aligned with the Paris Agreement; 0 otherwise.
	GHG Emissions Intensity Scope 1,2,3 Paris Agreement Aligned	Indicator equal to 1 if the firm reports that its emissions intensity targets are aligned with the Paris Agreement; 0 otherwise.
NZT Financial actions	Env R&D expenditure	Indicator equal to 1 if the firm reports investment in environmental or low-carbon research and development activities; 0 otherwise.
	Env investments initiatives	Indicator equal to 1 if the firm discloses capital expenditures or investments aimed at environmental improvement or low-carbon transition; 0 otherwise.
NZT policy	Energy efficiency policy	Indicator equal to 1 if the firm has formal policies aimed at improving energy efficiency; 0 otherwise.
	Env supply chain policy	Indicator equal to 1 if the firm has policies to manage or reduce environmental impact within its supply chain; 0 otherwise.
NZT governance	Env management team	Indicator equal to 1 if the firm has a dedicated team or personnel responsible for environmental management; 0 otherwise.
	Env management training	Indicator equal to 1 if the firm provides training to employees on environmental or sustainability issues; 0 otherwise.
	Remuneration climate	Indicator equal to 1 if executive remuneration is linked to climate or environmental performance; 0 otherwise.
	ESG-linked executive compensation	Indicator equal to 1 if executive compensation is explicitly tied to ESG or sustainability performance metrics; 0 otherwise.

tematically affect spreads. First, loan facility attributes capture interest rates. Loan size may affect spreads negatively, because larger syndicated loans attract more lenders and benefit from enhanced monitoring and risk-sharing (Dennis and Mullineaux 2000; Ivashina 2010). Maturity is generally associated with higher spreads as longer-term contracts expose lenders to greater uncertainty (Ivashina, 2010). The number of lenders in a syndicate influences spreads through risk-sharing and information production, with more lenders often lowering financing costs (Sufi 2007). We also control for loan type (secured, sponsored, and project loans), as these reflect different contractual structures and risk-sharing arrangements. For example, secured loans frequently carry higher spreads because collateralization is more common among riskier borrowers (Goss and Roberts 2011). Second, firm-level financial characteristics are included to capture borrower risk profiles. Credit rating is a central determinant of loan pricing, with lower-rated firms facing significantly higher spreads (Sufi, 2007). Profitability proxies for a firm's ability to service debt, where more profitable firms typically enjoy lower spreads (Degryse et al. 2019). Leverage measures financial risk, with more highly leveraged firms generally paying higher loan premia (Graham and Harvey 2001). These controls are consistent with established determinants of loan spreads in the syndicated loan literature and ensure that our estimates of the impact of NZT progress are not biased by omitted-variable effects.

3.2 Empirical Design

To test the impact of NZT on the cost of debt (i.e., loan spreads), we estimate the baseline regression model incorporating the NZT score to capture overall corporate NZT performance. Our baseline regression is a unbalanced panel OLS estimation with fixed effects.[6] The model is specified below:

$$LoanSpread_{i,j,t} = \alpha_0 + \beta_1 NZT_{j,t} + X'_{i,j,t}\theta + \gamma_t + \delta_c + \sigma_s + \lambda_l + \epsilon_{i,j,t} \quad (1)$$

where *i* indexes loan facility, *j* indexes the borrowing firm, *t* indexes year. $LoanSpread_{i,j,t}$ is the interest rate spread on loan facility *i* for borrowing firm *j* in year *t*. $X'_{i,j,t}$ is the vector of control variables, including loan-specific and firm-level characteristics. $NZT_{j,t}$ represents borrower *j*'s net zero transition score at year *t*. We include year (γ_t), country δ_c, sector (σ_s), and loan type (λ_l) fixed effects in the regression to account for unknown factors in the market. $\epsilon_{i,j,t}$ is the error term.

This model assesses the overall NZT impact on LoanSpread. It measures the overall risk associated with a loan investment. The NZT score is the sum of indicator variables that represent a borrower's net zero transition performance. It contains four key dimensions of the NZT plan: target and planning, financial support, policy implementation, and governance. Each key dimension contains several indicator variables, as outlined in Table 2. We first test the overall NZT score effect using the sum of all NZT indicators in our sample. We then conduct subsample analyses across regions and time periods because climate transition risks

[6] We performed a Breusch–Pagan LM test and rejected the null hypothesis that variance across panels is zero, confirming that pooled OLS is inappropriate. This supports the use of panel models. To justify our choice of fixed effects, a Hausman specification test comparing fixed-effects and random-effects models yields $\chi^2(46) = 81.43$ ($p = 0.001$). We reject the null that random effects are consistent, confirming that unobserved heterogeneity is correlated with the regressors. Accordingly, we adopt a fixed-effects specification in our baseline regressions, implemented via reghdfe to absorb multiple high-dimensional fixed effects.

are strongly shaped by policy regimes, regulatory environments, and disclosure practices, which differ across jurisdictions and evolve over time (Carney 2015; Palea and Drogo 2020; Ehlers et al. 2022; Delis et al. 2024; Christensen et al., 2021; Kling et al., 2021). In particular, the 2015 Paris Agreement represents a turning point that heightened policy salience and investor attention, while regional variation in regulatory enforcement and disclosure standards (e.g., Europe vs. North America vs. emerging markets) creates distinct contexts for how lenders incorporate net-zero transition (NZT) progress into loan pricing. Next, we delve deeper into the nuanced effects of disclosure within the key NZT dimension. We test the above four key dimensions and their component indicators of a firm's NZTP effects on loan spread to identify which elements are material in the pricing of transition risk. Appendix Table 1 reports variable definitions and sources.

To mitigate endogeneity issues due to unobserved heterogeneity, omitted variables, or simultaneity in a regression analysis, we apply a difference-in-difference approach to examine how financial institutions respond to corporate net zero transition performance (Fard et al. 2020; Imbens and Wooldridge 2009; Reghezza et al. 2022). Using the introduction of the Paris Agreement as a natural experiment, we employ this model to evaluate how the Paris Agreement can explain the corporate NZT impacts on the cost of loan in the energy and power sectors. The Paris Agreement serves as a critical catalyst for the global transition to net-zero emissions. It sets a clear goal for global emission reductions and provides a comprehensive international framework for climate action. Countries are required to submit their Nationally Determined Contributions (NDCs), which outline their plans and targets for reducing greenhouse gas emissions. Such ambitious targets and commitments stimulate innovation and investment in green technologies and sustainable practices.

We examine the impact of the Paris Agreement on the relationship between corporate net zero transition (NZT) performance and loan spreads using a difference-in-differences (DiD) framework. The Paris Agreement serves as a natural experiment because it represents a major global policy intervention that increased regulatory attention to climate transition risks and accelerated the incorporation of climate-related considerations into financial decision-making. The model specification is as follows.

$$\begin{aligned} LoanSpread_{i,j,t} = \alpha_0 + \beta_1(NZT\_high_j \times Post_t) \\ +X'_{i,j,t}\theta + \gamma_t + \delta_c + \sigma_s + \lambda_l + \varepsilon_{i,j,t} \end{aligned} \tag{2}$$

Where $LoanSpread_{i,j,t}$ is the interest rate spread on loan facility *i* issue to borrower *j* in year *t*. *NZT_high* is an indicator identifying firms with relatively high NZT disclosure score. *Post* equals one for observations after the introduction of the Paris Agreement and zero otherwise. This choice is consistent with prior literature showing that the Paris Agreement marked a turning point for lenders' recognition and pricing of climate-policy risk (Palea and Drogo 2020; Ehlers et al. 2022; Delis et al. 2024). $X'_{i,j,t}$ is a vector of control variables, including loan-specific and firm-level characteristics. We include year (γ_t), country (δ_c), sector (σ_s) and loan type (λ_l) fixed effects. The coefficient of interest is β_1, which reflects the differential effect of net zero transition disclosure on loan spreads between treated and control groups following the Paris Agreement.

To define firms with relatively high NZT score, we employ three alternative treatment classifications. First, firms with NZT scores above the annual sample mean are classified as the treatment group, allowing the benchmark to evolve with changes in transition practices

over time. Second, we use a fixed threshold of four, corresponding to the midpoint of the annual NZT score distribution (0–8) shown in Fig. 1. Because the NZT score is constructed as the sum of binary transition indicators, a one-unit increase reflects the implementation of an additional transition action, giving the threshold a clear economic interpretation. Third, we conduct an additional analysis by redefining the treatment and control groups using the empirical distribution of NZT scores. Specifically, firms in the top 40% of the distribution are classified as the treatment group, firms in the bottom 40% form the control group, and firms in the middle 20% are excluded from the estimation to increase the separation between treatment and control groups. Consistent results across these alternative classifications indicate that our findings are not sensitive to the choice of treatment threshold.

4 Results and Discussions

4.1 Summary Statistics

The purpose of this study is to explore the connection between corporate net zero transition performance and loan spreads in the energy and utilities sectors. To mitigate the influence of extreme observations, all continuous variables are winsorised at the 1st and 99th percentiles. We begin by reporting summary statistics for all samples. Next, we present the impact of overall net zero transition performance for the entire sample and by regions, followed by the individual impacts of four key NZT aspects: NZT targets and planning, financial actions to implement NZT business planning for renewables, climate change policies to support NZT business planning for renewables, and governance actions to facilitate NZT business planning for renewables. In the subsequent discussion, we highlight NZT disclosure indicators that prove effective in influencing the cost of debt. We also relate our findings to existing literature.

Table 3 displays summary statistics at the syndicated loan tranche level. It shows the number of observations, mean, standard deviation, and the distribution of each variable at the minimum, median, and maximum values for the whole sample. The NZT variables show an average overall score of 2.32, a median of 1, and a maximum of 11. The maxi-

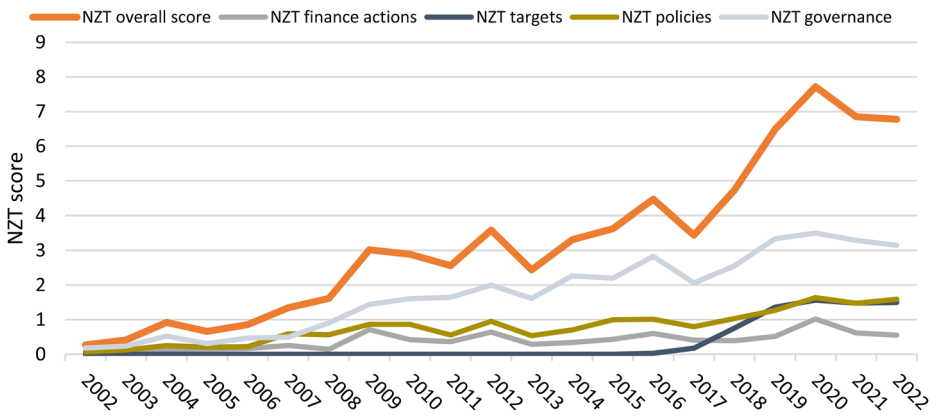

Fig. 1 The changes in the mean value of the net zero transition score

mum observed NZT score is 11, reflecting that no firm simultaneously discloses all indicators in the sample. Among all NZT indicators, firms tend to implement and disclose NZT governance-related actions such as environmental management training, environmental management teams, and executive compensation linked to ESG performance. However, these governance-related disclosures vary across firms. In contrast, the least disclosed items include whether the firms' Scope 1, 2, and 3 emissions align with the Paris Agreement and whether the firms' emission reduction targets percentage and year. The mean and standard deviation of loan spreads are 148.22 and 98.88, with a median of 125.

Figure 1 illustrates the changes in the mean of aggregated NZT score and key dimensions of NZT performance from 2002 to 2022. It reveals that while the overall NZT score has been steadily rising throughout the sample period, there was a significant increase from 2017 to 2020, one financial year after the launch of the Paris Agreement in late 2015, jumping from 4 disclosure items to 8. A closer examination of the four key dimensions of the net zero transition shows a noticeable variation after 2008. Disclosure of NZT governance has gradually increased, whereas the growth of NZT policy and financial item disclosures has remained relatively low. As anticipated, the disclosure of NZT targets and strategies began to rise following the Paris Agreement.

Table 3 Summary statistics

Variables	# Obs.	Mean	Std. Dev	Min	Median	Max
NZT overall score	40,451	2.32	2.69	0	1	11
NZT target score	40,451	0.12	0.50	0	0	3
Reduction target year	40,451	0.04	0.20	0	0	1
Reduction target %	40,451	0.05	0.23	0	0	1
Paris Agreement aligned (emission)	40,451	0.01	0.11	0	0	1
Paris Agreement aligned (emission intensity)	40,451	0.02	0.15	0	0	1
NZT finance score	40,451	0.32	0.52	0	0	2
Env R&D expenditure	40,451	0.04	0.19	0	0	1
Env investments initiatives	40,451	0.28	0.45	0	0	1
NZT policy score	40,451	0.60	0.79	0	0	2
Energy efficiency policy	40,451	0.38	0.48	0	0	1
Env supply chain policy	40,451	0.22	0.41	0	0	1
NZT governance score	40,451	1.28	1.47	0	1	5
Env management team	40,451	0.35	0.48	0	0	1
Env management training	40,451	0.40	0.49	0	0	1
Remuneration climate	40,451	0.05	0.22	0	0	1
ESG linked Executive Compensation	40,451	0.39	0.49	0	0	1
Loan spreads	40,451	148.22	98.88	19	125	550
Profit	40,451	0.38	0.20	-0.01	0.39	1.00
leverage(debt/asset)	40,451	0.34	0.14	0.01	0.33	0.77
S&P rating	40,451	10.66	2.92	1	11	17
Time to maturity	40,451	5.57	3.88	1	5	19.25
# of lead arrangers	40,451	4.91	4.78	1	3	23
Log loan amounts	40,451	6.58	1.08	3.69	6.62	8.99
Sponsored loan	40,451	0.02	0.15	0	0	1
Secured loan	40,451	0.24	0.42	0	0	1
Project finance	40,451	0.02	0.15	0	0	1

4.2 Baseline Results: Aggregated Net Zero Transition and the Cost of Debt

Table 4 presents the impact of the overall net zero transition on the cost of debt for the whole sample. In each regression, the dependent variable is the loan spread. Column (1) reports the coefficients with firm-level controls, and Column (2) shows the results after controlling for firm and project characteristics. All regressions include controls for year, country, sector and loan type fixed effects to account for unknown factors in the market.

We find that the coefficient of the overall net zero transition score is negative and highly statistically significant after accounting for country, year, and sector and loan type fixed effects in all regressions. The estimate indicates that banks charge lower spreads to firms with higher net zero transition scores. Focusing on Column (2), we observe that the overall NZT coefficient is -0.985. This implies that a one standard deviation increase in the net zero transition score reduces the cost of a bank loan by 2.65 bps, or 2%, relative to the sample mean (148.22 bps). The association is economically modest but consistent with prior estimates of climate-related risk premia. The magnitude of this effect is smaller than the carbon premia documented in prior studies (e.g., Ehlers et al. 2022), but is consistent with the interpretation that broader transition credibility is priced incrementally alongside emissions-based risk measures.

Table 4 The net zero transition and syndicated loan spreads

Dependent Variable	Loan Spread	
	(1)	(2)
NZT overall score	-1.758***	-0.985***
	(-5.52)	(-3.35)
Profit	-28.606***	-6.277*
	(-8.37)	(-1.95)
leverage(debt/asset)	94.822***	87.782***
	(16.07)	(15.95)
S&P rating	-8.383***	-5.280***
	(-27.42)	(-18.79)
Time to maturity		-0.473***
		(-2.83)
# of lead arrangers		1.265***
		(6.31)
Log loan amounts		-7.165***
		(-9.36)
Sponsored loan		-4.527
		(-1.05)
Secured loan		61.153***
		(25.41)
Project finance		0.634
		(0.14)
Loan type Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Country Fixed Effects	Yes	Yes
Sector Fixed Effects	Yes	Yes
SE Cluster	Lender	Lender
# Obs.	40,449	40,449
Adj. R2	0.465	0.515

Notes: This table reports regressions at the loan-facility level relating net zero transition performance (*Overall NZT score)* to syndicated loan spreads (Loan Spread). Column (1) displays results controlling for firm-level characteristics, and Column (2) shows results accounting for both firm and loan facility-level characteristics. Variable definitions are included in Appendix Table 1. The total number of observations decreased from 40,451 to 40,449 due to the removal of 2 singleton observations in fixed effect regressions. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively

This result aligns with theoretical expectations that credible transition strategies reduce perceived transition risks. Our findings also support prior evidence. Gupta (2018) shows that stronger corporate environmental responsibility lowers equity financing costs, while Vitolla et al. (2020) find that high-quality integrated reporting reduces the cost of equity capital. In debt markets, Seltzer et al. (2022) document that poor environmental performance increases bond spreads, and Ben-Nasr et al. (2025) show that firms with higher Scope 1 and 2 emissions face wider loan spreads or reduced access to bank debt. Extending this literature, our study shows that not only carbon emission metrics but also a broader measure of net-zero transition performance significantly influence loan pricing. We therefore confirm that corporate net-zero transition performance is a key determinant of debt financing conditions: firms that credibly commit to and develop their transition strategies enhance their resilience to climate risks and are rewarded with lower borrowing costs.

The coefficients of the control variables in all models are in the expected direction and are consistent with the prior literature (e.g.,Ben-Nasr et al. 2025; Jung et al. 2018). At the firm level, profitable and higher-credit-rating firms have lower spreads, as reflected by the negative and statistically significant coefficient on these variables. The positive and statistically significant coefficient on leverage shows that the cost of a bank loan rises as the amount of debt in a firm's capital structure increases. Among the loan-specific features, we observe negative and significant coefficients for the number of lenders and sponsored loans, suggesting that more lenders and sponsored loans are associated with lower loan spreads. Notably, the coefficient on secured loans is 61.163, at the 1% significance level, indicating that all else being equal, collateralised loans carry higher spreads than unsecured loans. This finding aligns with syndicated loan literature (e.g., Goss and Roberts 2011), which shows that collateral requirements often signal higher borrower risk.

We then examine the impact of the net zero transition on the cost of loans by region, following Zhou et al. (2021) who observed that the loan spreads for energy and utilities loans have varied greatly across regions over the past 20 years. Loan spreads in emerging markets remain higher than in developed markets for oil & gas. In Europe, low-carbon electric utilities have a lower cost of capital than their high-carbon peers. In North America, the cost of capital for low-carbon electric utilities is not lower than that of high-carbon peers.

Table 5 Panel (A) reports the effects of the aggregated net zero transition on loan spreads in the energy and utilities sector by region. Panel A Columns (1) to (3) report the estimated coefficients for Europe, North America and emerging markets, respectively. We present regression specifications with year, country, sector and loan type fixed effects. The coefficient of the aggregated NZT score is negative and statistically significant in Europe (Column (1), indicating that progress in the corporate net zero transition is associated with loan spreads. An increase of one standard deviation in the fitted value of the NZT score translates into a decrease in the loan spread of 17.9 bps in Europe.[7] The relationship is economically and statistically significant. This result suggests that banks tend to charge a significantly lower spread for European firms that implement and disclose thorough key net zero transition measures, from setting net zero transition targets and planning to taking government and financial efforts and actions to reduce carbon emissions to net zero. We then look at the influence of the net zero transition performance on loan pricing for North American borrow-

[7] The standard deviation of the overall NZT score in Europe is 2.745 and the coefficient of NZT is -6.510, thus one standard deviation increase in NZT score is associated with a decrease in loan spread of 17.9 bps (2.745*-6.510) in Europe.

Table 5 The net zero transition and syndicated loan spreads by region

Dependent Variable	**Loan Spread**		
Panel A: Regional analysis: 2002–2022			
	(1)	(2)	(3)
	Europe	North America	Emerging markets
Overall NZT score	-6.510***	-0.314	-5.020
	(-4.54)	(-1.16)	(-1.42)
Controls	Yes	Yes	Yes
Loan type Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes
SE Cluster	Lender	Lender	Lender
# Obs.	3336	34,218	1839
Adj. R2	0.808	0.497	0.923
Panel B : Europe analysis: 2002–2015 vs. 2015–2022			
	(1)		(2)
	2002–2015		2015–2022
Overall NZT score	-1.570		-30.945***
	(-0.81)		(-5.87)
Controls	Yes		Yes
Loan type Fixed Effects	Yes		Yes
Year Fixed Effects	Yes		Yes
Country Fixed Effects	Yes		Yes
Sector Fixed Effects	Yes		Yes
SE Cluster	Lender		Lender
# Obs.	2880		456
Adj. R2	0.827		0.997

Notes: This table reports regressions at the loan-facility level relating net zero transition performance (*Overall NZT score)* to syndicated loan spreads (Loan Spread) by region. Panel A Columns (1) to (3) report the estimated coefficients for Europe, North America and emerging markets, respectively. Panel (B) Columns (1) and (2) report the estimated coefficient of NZT score pre and post the Paris Agreement in 2015 in Europe. Variable definitions are reported in Appendix Table 1. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively

ers in Column (2). While the estimate of NZT is negative, it is insignificant, indicating that North American banks are just beginning to be aware of the transition risks. This negative but insignificant effect of NZT disclosure also applies to emerging markets.

Accordingly, we look at the NZT performance effect in Europe for different periods as national and international measures and efforts have been introduced and implemented gradually over the past 20 years. The results are presented in Table 5, Panel (B). Columns (1) and (2) report the estimated coefficients of the NZT score pre and post-2015. In Column (1), we observe that the negative but insignificant effect of NZT on loan spreads prior 2015. However, the coefficient of the NZT score in Column (2) is negative and statistically significant. One standard deviation increase in the overall NZT score is associated with a reduction of 99.6 bps[8] after 2015. We provide evidence that the progress of NZT is priced by financial institutions, suggesting that firms with advanced NZT performance are associated with lower risk for European borrowers after 2015. This could be explained by a notable surge in net-zero pledges from nations and corporations worldwide after the Paris Agreement (Net

[8] The standard deviation of the overall NZT score in Europe post 2015 is 3.220 and the coefficient of NZT is -30.945, thus one standard deviation increase in NZT score is associated with a decrease in loan spread of 99.6 bps.

Zero Tracker, 2023; Won & Hidano, 2023). This result is consistent with evidence that the Paris Agreement was a turning point in the financial materiality of transition risks. Palea and Drogo (2020) find that Eurozone banks became more sensitive to firm-level carbon emissions after Paris, particularly for less-polluting sectors. Similarly, Ehlers et al. (2022) document the emergence of a significant "carbon premium" in syndicated loan markets only after Paris, highlighting the role of regulatory salience in reshaping lender behaviour.

Overall, these regional and time variations of the NZT impacts could be explained by the environmental policies stringency variations across regions (Bonsall et al. 2021). Zhou et al. (2025) find that climate change policy is an important transition risk that determines the cost of the loan. Higher levels of climate and environmental policy stringency can reduce uncertainties associated with loan investments in the energy and utilities sectors. In addition, Stroebel and Wurgler (2021) conduct a survey among 861 finance academics, professionals, and public sector regulators and policy economists about climate finance topics, identifying regulatory risk as the most significant climate risk to businesses and investors.

4.3 Baseline Results: Net Zero Transition Indicators and the Cost of Debt

Next, we investigate the four key dimensions of NZT and its components' effects and identify which action items are more effective in affecting the cost of debt, as evidence shows that different aspects of NZT measures and components might not be of an equivalent degree of credibility, and some actions are more reliable and credible in achieving emission reduction to net zero.

Table 6 reports the results of the NZT planning and its action items' impacts. The regression specification is similar to that employed in previous Tables. Column (1) reports the estimated coefficients for the overall NZT target and planning. Columns (2) to (5) show the estimates for specific NZT target actions: Emission reduction target year, Emission reduction target percentage, GHG Emissions Scope 1,2,3 Paris Agreement Aligned, and GHG Emissions Intensity Scope 1,2,3 Paris Agreement Aligned, respectively. The coefficient on the overall NZT target and planning disclosure is negative and significant (Column (1)). A one standard deviation increase in NZT score is associated with an approximately 2 bps decline in all-in-drawn loan spreads. Looking at the indicator of the NZT target and planning, the Paris Agreement aligned total emission (Column (4)) and emission intensity (Column (2)) are also negatively related to loan spreads (Column (5)). A one standard deviation increase in the disclosure of the Paris Agreement aligned total emission and emission intensity is associated with a 1.6 bps and 1.4 bps decline in loan spreads, respectively.

It is worth noting that the effects of the emission reduction year and reduction percentage are negative but insignificant. We then use the actual value of the emission reduction percentage as an alternative measure to test the credibility of the NZT emission reduction effect. We find that a higher percentage of the reduction target is associated with lower financing costs. The results are reported in Column (1) of Appendix Table 3. The results imply that the cost of debt for firms that disclose emission reduction percentages and align with the Paris Agreement is generally lower than for firms with no NZT target or plan. Emission reduction percentage, Paris Agreement aligned GHG total emissions and emission intensity are all relevant components that are priced by banks.

Table 7 demonstrates the estimated coefficients on the NZT financial action items. Column (1) reports the estimated coefficients for the NZT finance score. Columns (2) and (3)

Table 6 Net zero transition target and planning and syndicated loan spreads

Dependent Variable	Loan Spread				
	(1)	(2)	(3)	(4)	(5)
NZT_target	-3.452***				
	(-2.71)				
Reduction target year		-1.936			
		(-0.65)			
Reduction target %			-5.637		
			(-1.55)		
Paris Agreement aligned (emission)				-15.317***	
				(-2.66)	
Paris Agreement aligned (emission intensity)					-9.069***
					(-3.40)
Profit	-6.738**	-6.767**	-6.593**	-7.037**	-7.034**
	(-2.21)	(-2.22)	(-2.16)	(-2.31)	(-2.31)
leverage(debt/asset)	85.215***	85.148***	85.225***	85.509***	85.135***
	(14.94)	(14.93)	(14.94)	(15.01)	(14.94)
S&P rating	-5.552***	-5.550***	-5.548***	-5.552***	-5.546***
	(-19.36)	(-19.36)	(-19.33)	(-19.35)	(-19.31)
Time to maturity	0.149	0.161	0.154	0.150	0.154
	(0.86)	(0.93)	(0.89)	(0.87)	(0.89)
# of lead arrangers	0.925***	0.950***	0.939***	0.944***	0.944***
	(4.63)	(4.77)	(4.73)	(4.79)	(4.77)
Log loan amounts	-7.667***	-7.718***	-7.691***	-7.675***	-7.679***
	(-10.38)	(-10.51)	(-10.43)	(-10.43)	(-10.44)
Sponsored loan	-7.823*	-7.650*	-7.780*	-7.737*	-7.713*
	(-1.73)	(-1.70)	(-1.72)	(-1.72)	(-1.71)
Secured loan	62.612***	62.739***	62.643***	62.634***	62.592***
	(24.81)	(24.79)	(24.88)	(24.80)	(24.66)
Project finance	-2.504	-2.723	-2.322	-2.716	-2.451
	(-0.52)	(-0.56)	(-0.48)	(-0.56)	(-0.51)
Loan type Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
SE Cluster	Lender	Lender	Lender	Lender	Lender
# Obs.	40,449	40,449	40,449	40,449	40,449
Adj. R2	0.504	0.504	0.504	0.505	0.504

Notes: This table reports regressions at the loan facility level relating to net zero transition target and planning disclosure and its component actions to syndicated loan spreads (Loan Spread). Column (1) reports the estimated coefficients for the overall NZT target and planning disclosure. Columns (2) to (5) show the estimates for specific NZT target and planning actions: Emission reduction target year, Emission reduction target percentage, GHG Emissions Scope 1,2,3 Paris Agreement Aligned, and GHG Emissions Intensity Scope 1,2,3 Paris Agreement Aligned, respectively. Variable definitions are reported in Appendix Table 1. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively

show the estimates for environmental R&D expenditure and environmental investment initiatives. Among the component indicators within NZT financial actions, the coefficient on environment R&D expenditure is negative, at the 10% significance level. This suggests that banks integrate environmental R&D expenditure to assess the risk of an investment opportunity and charge a lower spread on loans issued to borrowers with higher environmental R&D costs. A one standard deviation increase in R&D expenditure is associated with a 1bps drop in loan spreads. In addition, we use the actual value of the R&D expenditure to measure its effect on loan spreads. We find that a higher value of R&D expenditure is related to loan spreads, at a 1% significance value (Column (2) Appendix Table 3). This finding is in line with the findings of Töbelmann and Wendler (2020) and suggests that investors concur that technological innovation is the key factor in addressing climate change and reducing carbon emissions. However, the coefficient of environmental expenditure is not statistically significant, indicating that the disclosure of environmental expenditures has a negligible effect on loan spreads.

Table 7 Net zero transition financial actions and loan spreads

Dependent Variable	Loan Spread		
	(1)	(2)	(3)
NZT_finance	0.194		
	(0.16)		
Env R&D expenditure		-4.718*	
		(-1.81)	
Env investments initiatives			1.277
			(0.92)
Profit	-6.805**	-6.629**	-6.729**
	(-2.23)	(-2.18)	(-2.20)
leverage(debt/asset)	85.236***	85.338***	85.608***
	(15.02)	(14.96)	(15.09)
S&P rating	-5.554***	-5.548***	-5.593***
	(-18.73)	(-19.27)	(-18.72)
Time to maturity	0.163	0.162	0.170
	(0.94)	(0.94)	(0.98)
# of lead arrangers	0.957***	0.977***	0.960***
	(4.88)	(4.93)	(4.86)
Log loan amounts	-7.732***	-7.694***	-7.777***
	(-10.48)	(-10.48)	(-10.56)
Sponsored loan	-7.602*	-7.817*	-7.521*
	(-1.68)	(-1.73)	(-1.67)
Secured loan	62.717***	62.819***	62.651***
	(24.40)	(24.73)	(24.42)
Project finance	-2.627	-2.995	-2.553
	(-0.54)	(-0.62)	(-0.52)
Loan type Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes
SE Cluster	Lender	Lender	Lender
# Obs.	40,449	40,449	40,449
Adj. R2	0.504	0.504	0.504

Notes: This table reports regressions at the loan facility level relating net zero transition financial disclosure and its action items to syndicated loan spreads (Loan Spread). Column (1) reports the estimated coefficients for the NZT finance disclosure. Columns (2) and (3) show the estimates for environmental R&D expenditure and environmental investment initiatives. Variable definitions are reported in Appendix Table 1. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively

Table 8 reports the results of the NZT policy and its action items' impact on loan spreads. Column (1) reports the estimated coefficients for the overall NZT policy score. Columns (2) and (3) show the estimates for specific NZT policy disclosure items: energy efficiency and environmental supply chain policies. The coefficient on NZT policy in Column (1) shows that there is a significant negative relationship between the stringency level of NZT policies and loan spread for energy and utility firms. The coefficient in Column (2) suggests that a one standard deviation increase in the energy efficacy policy is associated with a 2.6 bps drop in loan spreads. This finding is consistent with Popp (2010) that "improved energy efficiency plays a large role in determining the overall cost of combating climate change". As such, banks incorporate energy efficiency policies into investment analysis and decision-making processes and charge a 2.6 bps lower spread to loan issuers that make such disclosures.

The results of NZT governance and its component actions are reported in Table 9. Column (1) reports the estimated coefficients for the NZT governance score. Columns (2) to

Table 8 Net zero transition policy and loan spreads

Dependent Variable	Loan Spread		
	(1)	(2)	(3)
NZT policy	-1.958**		
	(-2.19)		
Energy efficiency policy		-5.362***	
		(-3.95)	
Env supply chain policy			0.873
			(0.59)
Profit	-6.336**	-6.232**	-6.927**
	(-2.07)	(-2.02)	(-2.27)
leverage(debt/asset)	83.812***	82.999***	85.431***
	(14.82)	(14.70)	(14.99)
S&P rating	-5.447***	-5.367***	-5.563***
	(-18.46)	(-18.30)	(-19.13)
Time to maturity	0.178	0.198	0.161
	(1.03)	(1.15)	(0.93)
# of lead arrangers	0.965***	0.973***	0.956***
	(4.93)	(4.99)	(4.88)
Log loan amounts	-7.637***	-7.523***	-7.729***
	(-10.26)	(-10.03)	(-10.54)
Sponsored loan	-8.074*	-8.369*	-7.547*
	(-1.81)	(-1.87)	(-1.69)
Secured loan	62.677***	62.697***	62.753***
	(24.81)	(24.78)	(24.85)
Project finance	-3.006	-3.196	-2.589
	(-0.62)	(-0.66)	(-0.53)
Loan type Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes
SE Cluster	Lender	Lender	Lender
# Obs.	40,449	40,449	40,449
Adj. R2	0.504	0.505	0.504

Notes: This table reports regressions at the loan facility level relating to net zero transition policy and its action items to syndicated loan spreads (Loan Spread). Column (1) reports the estimated coefficients for the overall NZT policy disclosure. Columns (2) and (3) show the estimates for specific NZT policy disclosure items: energy efficiency policy and environmental supply chain policy. Variable definitions are reported in Appendix Table 1. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively

(5) show the estimates for specific NZT governance actions: the environmental management team, environmental management training, remuneration arrangements incorporating climate change, and executive compensation related to ESG performance, respectively. The coefficient on the NZT governance score, environmental management training and executive compensation related to ESG are all negative and significant at the 1% level. A one standard deviation increase in environmental management training and ESG-linked compensation is associated with a 3.6 bps and 1.8 bps decline in loan spreads, respectively. In line with the overall NZT performance reported in Table 4, the governance actions to facilitate emission reductions are integrated into risk assessments. Among NZT governance factors, environmental management training and executive compensation tied to ESG performance could reduce uncertainties associated with loan investments during the net zero transition.

4.4 Endogeneity – Difference in Difference (DiD) Analysis

We apply a difference-in-difference approach to examine how the Paris Agreement changes the corporate NZT impacts on the cost of loan in the energy and utilities sectors. The results are displayed in Table 10. Panel A displays loan-level DiD regression results obtained by splitting the treatment and control samples according to the mean NZT value each year. Panel B shows the coefficients estimated by separating the treatment and control groups at an annual NZT midpoint value of 4. Panel C reports the DiD estimates using an alternative treatment definition based on the empirical distribution of NZT scores. Columns (1) and (3) report the coefficients estimated for the whole sample period (2002–2022) for global firms and European firms, respectively. Columns (2) and (4) report the results obtained over a two-sided 7-year window (2008–2022) for global firms and European firms, respectively.

In Column (1) Panel A, the coefficient on the interaction term (NZT_high × Post) is negative and statistically significant, suggesting that after the Paris Agreement, firms with a higher level of net zero transition planning had a lower loan spread than their peers with a lower NZT score. The interaction term in Column (2) is also negative and highly significant, indicating that the result is consistent for the 7-year window (2008–2022). This finding also applies to European borrowers, but the size of the negative effect is much more pronounced. We obtain similar results using a different threshold NZT value of 4 to define high and low firm-level NZT performance. The results in Panel C remain qualitatively unchanged. The interaction term between the treatment indicator and the post-Paris Agreement period remains negative and statistically significant across all specifications, confirming that our findings are not sensitive to the particular cutoff used to define high and low NZT firms. This result not only supports our previous findings from the fixed effect models but also alleviates endogeneity concerns, improves identification of the Paris Agreement effect, and enables a more causal interpretation of our results.

4.5 Robustness Checks

We performed several robustness checks to verify the stability of our results. Firstly, we control for the TRBC subsector fixed effect and use the Moody credit rating instead of the S&P rating in the baseline regression. The regressions displayed consistent results. In addition, we include two more corporate control variables, return on equity and capital expenditure, in the regressions and find that the sign and significance levels of the results for all

Table 9 Net zero transition governance support and loan spreads

Dependent Variable	Loan Spread				
	(1)	(2)	(3)	(4)	(5)
NZT governance	-2.143***				
	(-4.01)				
Env management team		-2.293			
		(-1.56)			
Env management training			-8.939***		
			(-6.92)		
Remuneration for climate				-1.837	
				(-0.88)	
ESG linked Executive Compensation					-4.649***
					(-3.42)
Profit	-5.659*	-6.348**	-4.608	-6.833**	-6.395**
	(-1.87)	(-2.09)	(-1.53)	(-2.24)	(-2.10)
leverage(debt/asset)	83.447***	84.834***	84.147***	84.996***	83.718***
	(14.72)	(15.00)	(14.86)	(14.80)	(14.73)
S&P rating	-5.420***	-5.523***	-5.248***	-5.548***	-5.470***
	(-18.27)	(-18.95)	(-17.49)	(-19.33)	(-18.82)
Time to maturity	0.108	0.149	0.092	0.165	0.110
	(0.62)	(0.85)	(0.53)	(0.95)	(0.64)
# of lead arrangers	0.986***	0.952***	1.022***	0.953***	1.012***
	(5.03)	(4.81)	(5.17)	(4.83)	(5.22)
Log loan amounts	-7.479***	-7.616***	-7.533***	-7.708***	-7.592***
	(-10.06)	(-10.23)	(-10.25)	(-10.52)	(-10.24)
Sponsored loan	-8.782*	-7.966*	-8.928**	-7.638*	-8.747*
	(-1.96)	(-1.77)	(-2.00)	(-1.70)	(-1.96)
Secured loan	62.386***	62.581***	62.070***	62.765***	62.610***
	(24.70)	(24.93)	(24.45)	(24.77)	(24.70)
Project finance	-1.970	-2.441	-1.455	-2.747	-1.879
	(-0.41)	(-0.51)	(-0.30)	(-0.57)	(-0.39)
Loan type Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes	Yes
SE Cluster	Lender	Lender	Lender	Lender	Lender
# Obs.	40,449	40,449	40,449	40,449	40,449
Adj. R2	0.504	0.504	0.505	0.504	0.504

Notes: This table reports regressions at the loan facility level relating net zero governance disclosure and its action items to syndicated loan spreads (Loan Spread). Column (1) reports the estimated coefficients for the overall NZT governance disclosure. Columns (2) to (5) show the estimates for specific NZT governance actions: the environmental management team, environmental management training, remuneration arrangements incorporating climate change, and executive compensation related to ESG performance, respectively. Variable definitions are reported in Appendix Table 1. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively

Table 10 Net zero transition and loan spreads: role of the paris agreement

Dependent Variable	Loan Spread			
Panel A: NZT_high generated by the mean value				
	Global		Europe	
	2002–2022	2008–2022	2002–2022	2008–2022
	(1)	(2)	(3)	(4)
*NZT_high*Post2015*	-10.026***	-5.270**	-93.329***	-81.655***
	(-4.24)	(-2.38)	(-7.25)	(-6.62)
Controls	Yes	Yes	Yes	Yes
Loan type Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes
SE Cluster	Lender	Lender	Lender	Lender
# Obs.	40,449	22,236	3336	1795
Adj. R2	0.504	0.452	0.810	0.848
Panel B: NZT_high generated by the value of 4				
	Global		Europe	
	2002–2022	2008–2022	2002–2022	2008–2022
	(1)	(2)	(3)	(4)
*NZT_high*Post2015*	-12.942***	-13.297***	-65.412***	-71.084***
	(-4.21)	(-4.81)	(-3.29)	(-3.62)
Controls	Yes	Yes	Yes	Yes
Loan type Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes
SE Cluster	Lender	Lender	Lender	Lender
# Obs.	40,449	22,236	3336	1795
Adj. R2	0.515	0.473	0.807	0.845
Panel C: NZT_high generated by top 40% and the bottom 40% of NZT distribution				
	Global		Europe	
	2002–2022	2008–2022	2002–2022	2008–2022
	(1)	(2)	(3)	(4)
*NZT_high*Post2015*	-20.928***	-26.697***	-94.348***	-101.764***
	(-6.44)	(-8.70)	(-5.70)	(-6.05)
Controls	Yes	Yes	Yes	Yes
Loan type Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Sector Fixed Effects	Yes	Yes	Yes	Yes
Cluster	Lender	Lender	Lender	Lender

Table 10 (continued)

Dependent Variable	Loan Spread			
# Obs.	31,244	18,311	2761	1600
Adj. R2	0.512	0.510	0.819	0.843

Note: This table reports the results of regressions at the loan-facility level relating net zero transition score to syndicated loan spreads before and after the introduction of the Paris Agreement. The dependent variable in all models is loan spreads. Panel A displays loan-level DiD regression results obtained by splitting the treatment and control samples according to the mean NZT value. NZT_high equals one if the firm's NZT score is above the mean of all sample net zero transition scores and zero otherwise. Panel B shows the coefficients estimated by separating the treatment and control groups according to the NZT value of 4. NZT_high equals one if the firm's NZT score is equal to or above 4 and zero otherwise. Panel C reports the DiD estimates using an alternative treatment definition based on the empirical distribution of NZT scores. Firms in the top 40% of the NZT distribution are classified as the treatment group, firms in the bottom 40% constitute the control group, and firms in the middle 20% are excluded from the estimation to increase the separation between treatment and control groups. The Post equals 1 if the loan observations are after the Paris Agreement in 2015 and 0 otherwise. NZT_high*Post are the interaction terms showing the impacts of the Paris Agreement on the cost of loans for firms with higher levels of NZT score compared to firms with lower levels of NZT score. We control for other loan and firm characteristics as in Table 2. Variable definitions are reported in Appendix Table 1. Standard errors, reported in parentheses, are clustered at the lender level. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively

samples are consistent with those reported in Table 4. All results are reported in Appendix Table 2. Moreover, to confirm the effect of NZT disclosure on the cost of debt, we use the actual disclosure value/scale as an alternative measure of NZT actions. Among the variable indicators, firms disclose values for the percentage of net zero reduction, environmental R&D expenditure, and energy efficiency rate. We find negative and significant effects of these values on loan spreads, such as a higher percentage of the reduction target, increased environmental R&D expenditure, and a higher energy efficiency, which are associated with lower financing costs. The results are reported in Appendix Table 3. Lastly, we verify that the results remain qualitatively unchanged when excluding observations of loan spreads beyond ±3 standard deviations, confirming that our findings are not driven by extreme values.

5 Discussion

The empirical results provide consistent evidence that corporate net zero transition (NZT) performance is incorporated into loan pricing, although the magnitude of the effect varies across contexts. In the full sample, a one-standard-deviation increase in NZT performance is associated with a reduction in loan spreads of approximately 2–3 basis points. While this magnitude appears economically modest, it is broadly consistent with the literature on climate-related risk pricing. For example, Ehlers et al. (2022) document a carbon risk premium of around 3–4 basis points on average in syndicated loan markets, increasing to approximately 7 basis points for high emitters. Compared with these estimates, our findings suggest that NZT performance—capturing broader and forward-looking transition credibility rather than emissions exposure alone—is priced incrementally as a complementary risk factor. This interpretation is also consistent with Jung et al. (2018), who show that forward-looking carbon risk awareness can reduce borrowing costs, highlighting the importance of credible disclosure beyond historical emissions.

A key insight from the analysis is that the average effect masks substantial heterogeneity across regions and over time. In particular, the NZT effect is economically large and statisti-

cally significant in Europe, where a one-standard-deviation increase in NZT scores reduces loan spreads by approximately 18 basis points, and becomes markedly stronger after the 2015 Paris Agreement. These findings align with evidence that climate policy shocks alter both the pricing and allocation of credit. For example, Reghezza et al. (2022) show that European banks reduced lending to more polluting firms following the Paris Agreement, while Palea and Drogo (2020) find that lenders became more sensitive to carbon emissions after this policy shift. Similarly, Ehlers et al. (2022) document that the carbon premium in loan markets emerges primarily after the Paris Agreement, highlighting the role of regulatory salience. From a credit supply perspective, Kacperczyk and Peydró (2024) further show that banks actively reallocate credit away from high-emission firms when they commit to decarbonisation, suggesting that transition risks are transmitted not only through pricing but also through credit availability. In contrast, the absence of a significant NZT effect in North America and emerging markets indicates that the financial materiality of transition risk remains conditional on institutional context, particularly policy stringency and disclosure frameworks. This heterogeneity supports the interpretation that NZT affects financing costs through risk mitigation and signalling channels, but that these channels operate more strongly when supported by credible policy frameworks and disclosure regimes.

At the level of individual NZT dimensions, the results provide further insight into the mechanisms through which transition performance affects financing costs. We find that concrete and verifiable actions, such as Paris-aligned emission targets, environmental R&D investment, and energy efficiency policies, are consistently associated with lower loan spreads, whereas less specific measures, such as general environmental expenditures, are not statistically significant. This pattern supports the information and signalling channel identified in the literature (Jung et al. 2018; Chang and Lo 2022), whereby credible and forward-looking disclosures reduce information asymmetry and enhance lender confidence. It also aligns with evidence that disclosure quality, rather than disclosure per se, is critical for reducing financing costs (Vitolla et al., 2020). More broadly, our findings are consistent with the loan contracting literature, which emphasises that lenders rely on observable and verifiable firm characteristics when assessing borrower risk and pricing debt. For example, evidence on corporate social responsibility shows that lenders penalise firms with higher ESG concerns through higher loan spreads, reflecting perceived risk and uncertainty in borrower behaviour (Goss and Roberts 2011). In contrast, credible and well-aligned transition actions—such as those captured by our NZT indicators—function as positive signals of risk management and strategic commitment, thereby improving borrowing conditions.

Finally, the relatively large coefficients observed for traditional loan characteristics, such as secured loans, reflect established credit risk premia in syndicated loan markets (Booth and Booth 2006; Goss and Roberts 2011). Prior research shows that collateral is closely tied to borrower risk and loan contracting decisions, with secured lending more prevalent among riskier borrowers (Booth and Booth 2006). Importantly, all continuous variables are winsorised, and the results are robust to excluding extreme observations, suggesting that these differences are not driven by outliers or non-linearities. Overall, the findings indicate that NZT performance is increasingly incorporated into credit risk assessment, but primarily through specific, credible actions and in institutional environments where climate risks are actively priced.

6 Conclusions

This study examines whether corporate net zero transition (NZT) performance affects the cost of debt in the syndicated loan market, focusing on the energy and utilities sectors where transition risks are particularly salient. Using a global sample of loan facilities, we provide evidence that NZT performance is incorporated into credit pricing, with the strength of this relationship varying across institutional environments and over time.

Our results highlight that the financial relevance of NZT is not uniform. While the aggregate effect is modest, it becomes economically meaningful in settings where climate policy is more credible and binding, particularly in Europe and in the period following the 2015 Paris Agreement. This suggests that the pricing of transition risk depends critically on policy salience, regulatory enforcement, and the maturity of sustainable finance frameworks. More broadly, the findings indicate that lenders increasingly incorporate forward-looking transition information—beyond traditional emissions-based metrics—into credit risk assessments.

The analysis also provides insight into which aspects of NZT matter most for financial markets. Rather than all disclosures being equally valued, lenders appear to respond primarily to concrete and verifiable transition actions, such as Paris-aligned targets, environmental innovation, and governance mechanisms. This distinction underscores the importance of credibility and implementation in shaping the financial consequences of climate strategies.

These findings have several implications. Our results suggest that credible transition strategies can translate into tangible financing benefits, particularly in jurisdictions where climate risks are actively priced. Firms that align with key recommendations from the Task Force on Climate-related Financial Disclosures (TCFD) enjoy lower borrowing costs, supporting the argument that mandatory climate risk disclosure can benefit both firms and investors. For financial institutions, NZT disclosures provide useful signals for assessing long-term risk exposure and improving capital allocation decisions. For policymakers, the results support the role of disclosure frameworks and climate policy in enhancing the financial materiality of transition risks.

At the same time, several limitations remain. Our NZT measure is based on publicly disclosed information and may be subject to reporting biases and cross-country inconsistencies. In addition, the empirical framework focuses on average linear effects and may not fully capture potential non-linearities or threshold effects in how transition risks are priced. Future research could extend this analysis by exploring sectoral differences, alternative measures of transition credibility, and the interaction between climate policy dynamics and financial market responses.

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Data Availability This paper analyses data downloaded from Refinitiv's DealScan and Refinitiv's Worldscope datasets. ALL data reported in this paper will be shared by the lead contact upon request. This paper

does not report original code. The code for the analysis was written in Stata and is available from the lead contact upon request.

Declarations

Conflict of Interest The authors declare that there are no conflicts of interest related to this research, authorship, or publication of this paper.

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