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Financing sustainability: Sustainable institutional investors and bank loan access☆

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ABSTRACT

This study examines the role of sustainable institutional investors in enhancing portfolio firms' access to bank loans. Utilising the Principles for Responsible Investment (PRI) signatory status as a marker of commitment to responsible investing, we find that being held by these responsible investors not only enables firms to borrow more but also at a lower cost. Further analysis shows that the advantages in loan market access are due to the presence of sustainable institutional investors serving as a signal of the credibility of firms' ESG profiles, which aligns long-term growth goals and reduces shareholder–creditor conflicts. Being held by sustainable institutional investors also allows firms to avoid green and sustainability-linked loans that, whilst supporting their ESG development, require stricter monitoring than conventional loans. Additionally, we document that the negative relationship between sustainable investors and carbon emissions is more pronounced for firms that have obtained loans compared than those that have not. Overall, this study highlights the importance of financing support for sustainable institutional investors in fulfilling sustainability commitments and highlights the synergy between different financial markets in curbing carbon emissions.

1. Introduction

As climate issues gain rising importance in financial markets and amongst regulatory authorities, a new business agenda has emerged, emphasising that long-term growth should be aligned with delivering profit with responsible practices. An increasing number of institutional investors are committed to addressing these challenges through socially responsible investing, which has led to a rapid accumulation of socially responsible capital in recent years.[1] Intuitively, divestment and engagement are two influential tools for sustainable institutional investors to enhance sustainability and reduce externality. These investors are particularly well-equipped with the knowledge and expertise to engage firms in improving their sustainability performance or to divest from irresponsible firms,

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[1] According to the Global Sustainable Investment Review 2022 by Global Sustainable Investment Alliance, assets under management with sustainable investment strategies have reached $21.9 trillion in Europe, Canada, Japan, Australia, and New Zealand, reflecting a 20% growth over the past two years. The report is available at https://www.gsi-alliance.org/wp-content/uploads/2023/12/GSIA-Report-2022.pdf.

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thereby increasing their cost of capital. Although theoretical works predict promising outcomes (e.g., Heinkel et al., 2001; Pástor et al., 2021; Oehmke and Opp, 2024), significant empirical conflicts persist regarding the effectiveness of socially responsible investing (SRI) in addressing these externalities (e.g., Gibson et al., 2022; Raghunandan and Rajgopal, 2022; Kim and Yoon, 2023), particularly in relation to engagement activities aimed at correcting unsustainable behaviours in portfolio firms (Heath et al., 2023; Heeb et al., 2023; Michaely et al., 2024).

One perspective in the literature suggests that corrective actions for irresponsible behaviour typically involve substantial financial resources (e.g., Cohn and Deryugina, 2018; Edmans et al., 2022; Xu and Kim, 2022), which aligns with the concept of "it pays to be green" (e.g., Walley and Whitehead, 1994; Hart, 1995; Hart and Ahuja, 1996). Numerous anecdotal examples confirm the concept. For instance, in 2012, the New York City Comptroller's Office, representing pensions for over half a million beneficiaries and employees, compelled Apple and Intel to address environmental and human rights issues in their supply chains. This initiative led Intel to invest hundreds of millions of dollars in water conservation and green energy and prompted Apple to share the costs of improving suppliers' working conditions.[2,3]

Despite the significant financial resources required to promote firms' responsible activities, it remains unclear if firms held by socially conscious investors have financing advantages to achieve these outcomes. Specifically, this study aims to bridge this gap by exploring whether sustainable institutional ownership enhances portfolio firms' loan financing ability and their sustainability profile after obtaining bank loans. We focus on firms' ability to raise bank loans because banks are increasingly committed to responsible investment and incorporate firms' environmental, social, and governance (ESG) performance into their lending decisions (e.g., Jung et al., 2018; Bolton and Kacperczyk, 2021; Ivanov et al., 2024).[4]

From the demand perspective, we argue that firms need more loans to meet the commitment of their sustainable institutional investors. Firms must "pay to be green". Sustainable investments compete for financial resources with productive investments. Engagement strategies, like corrective actions to improve sustainability, are costly for portfolio firms, especially when transitioning from a polluting firm to a socially responsible one. As a result, firms with sustainable institutional investors demand more loans to support their sustainability investments.

From the supply perspective, we propose two mechanisms through which sustainable institutional investors facilitate firms' access to loan markets: the *ESG credibility channel* and the *interest alignment channel*. Concerns about greenwashing may deter banks from incorporating a firm's sustainability profile into their lending decisions, as banks typically do not participate directly in firms' decision-making as shareholders do, and previous lending relationships may not reliably indicate a firm's post-lending ESG practices. If banks view institutional investors with an explicit commitment to responsible investing as capable of enhancing or maintaining a high level of sustainability, then the ESG credibility channel suggests that being held by sustainable institutional investors could serve as a credible signal of borrowers' ESG profile. Consequently, the perception of the credible ESG profile may provide firms with better access to favourable loan terms in the loan market.

The limited liability framework creates different pay-off structures between shareholders and creditors, reducing banks' incentives to lend. Adhering to responsible investment principles implies that investors may not evaluate a firm purely based on risk-return characteristics, which ensures the firm's long-term sustainable growth and diminishes the pressure to generate short-term returns. Therefore, the interest alignment channel posits that the commitment of institutional investors to responsible investment strategies alleviates banks' concerns about shareholder–creditor conflicts, thereby enhancing firms' borrowing ability.

We identify institutional investors who are signatories of the Principles for Responsible Investment (PRI) as shareholders with an explicit commitment to responsible investing and analyse portfolio firms' bank debts in the US from 2006 to 2023. We discover a positive relationship between the holdings by sustainable institutional shareholders and the amount of loans received. The results from the Difference-in-Differences (DID) framework, which utilises signatory events, further confirm a positive causal effect. Additionally, by examining loan-level data, we find that these firms not only secure more loans but also benefit from lower loan spreads.

Our mechanism analysis also supports both the demand-side and supply-side channels. Our results show that the impact of sustainable institutional ownership on secured loans is more profound for firms with higher costs of sustainable investments, aligning with the explanation of "pay to be green". Similarly, consistent with the ESG credibility channel, we find that the impact on loan costs is stronger if banks have a greater awareness of sustainability. In line with the interest alignment channel, the impact is stronger if firms face high shareholder–creditor conflicts.

In our additional tests, we broaden our understanding to investigate how bank loans influence real sustainable outcomes and types of loans. By estimating the carbon emissions of portfolio firms, we find that, on average, the presence of sustainable institutional shareholders is not associated with significantly lower carbon emissions. However, the negative relationship between socially conscious investors and carbon emissions is more pronounced for firms obtaining loans compared to those without loans. In addition, they also allow firms to avoid green and sustainability-linked loans that, whilst supporting their ESG development, require stricter monitoring than conventional loans. Taken together, this study provides new evidence of the significant role played by sustainable

[2] https://www.csrwire.com/press_releases/34358-shareholder-resolutions-spur-u-s-companies-to-act-on-sustainability-during-2012-proxy-season.

[3] https://venturebeat.com/business/apple-foxconn-to-split-costs-of-improving-factory-working-condition.

[4] According to a report published by the United Nations Environment Programme Finance Initiative in 2023, the Net-Zero Banking Alliance, launched in April 2021 with 43 banks, quickly grew to 136 banks by the end of September 2023. Banks join this alliance by committing to the principles of responsible banking, demonstrating more than a threefold increase in membership in just two and a half years. The report is available at https://www.unepfi.org/industries/banking/net-zero-banking-alliance-2023-progress-update.

institutional investors in loan markets, highlighting the need for both financial resources and active engagement to achieve sustainable objectives.

This study contributes to the literature on the role of financial markets in promoting the transition to a low-carbon economy in several ways. First, this study complements the ongoing debate in the literature on whether sustainable institutional investors "walk the talk" by creating real sustainable outcomes (e.g., Gibson et al., 2022; Raghunandan and Rajgopal, 2022; Kim and Yoon, 2023). We provide novel evidence that they lower carbon emissions if portfolio firms receive sufficient financial support. Our findings highlight the "it pays to be green" perspective in the promise of socially conscious investors to effectively promote firms' responsible decisions (e.g., Walley and Whitehead, 1994; Hart, 1995; Hart and Ahuja, 1996).

Second, this study adds to the literature on banks' lending decisions in support of sustainability. Whilst prior literature demonstrates that banks incorporate ESG performance into their lending decisions (e.g., Jung et al., 2018; Bolton and Kacperczyk, 2021; Ivanov et al., 2024), this study extends the knowledge by showing that the credibility of an ESG profile is a significant consideration in loan decisions. Our results suggest that adequately addressing banks' concerns about greenwashing could more effectively promote their role in supporting a low-carbon economy. Additionally, we contribute to the literature on shareholder–creditor conflicts in the loan market (e.g., Guedes and Opler, 1996; Chava and Roberts, 2008; Chava et al., 2019). By demonstrating that large shareholders' commitments to SRI alleviate banks' concerns about shareholder–creditor conflicts in lending decisions, this study offers new evidence of the benefits of SRI in enhancing firms' financing capabilities.

Finally, this study broadly contributes to the literature on financial market interdependence (e.g., Schenone, 2010; Ivashina and Sun, 2011; Saunders and Steffen, 2011), with a specific focus on its implications for addressing climate issues. The effective functioning of the financial system relies on information flows that facilitate capital allocation. Under the sustainable finance framework, these information flows become particularly crucial, especially given widespread concerns about greenwashing (e.g., Kim and Lyon, 2015; Marquis et al., 2016; Cohen et al., 2023). We provide evidence on the informational role of SRI, highlighting how it is transmitted from the stock market to the loan market and shedding light on the synergy between different financial markets in curbing carbon emissions. Our study provides novel implications for policymakers on leveraging the function of financial markets to tackle the challenge of global warming.

The remaining sections are organised as follows. We review the literature and develop our hypotheses in Section 2. We describe the data and methodology in Section 3, followed by Section 4 where we discuss the empirical results. Section 5 concludes the paper.

2. Literature review and hypothesis development

2.1. Sustainable institutional investors

Responsible institutional investors commit to integrating ESG factors into their investment decisions to promote long-term financial returns and positive social outcomes. Divestment and engagement are prevalent strategies to mitigate externalities. Theoretical evidence suggests that investor demand for ESG can impose profound effects on financial markets and corporate behaviour, potentially creating positive social impacts (Heinkel et al., 2001; Landier and Lovo, 2020; Pástor et al., 2021; Broccardo et al., 2022; Goldstein et al., 2022; Oehmke and Opp, 2024).

Specifically, on the one hand, sustainable institutional investors' demand for green assets influences the cost of capital, accelerating the growth of green firms whilst decelerating that of brown firms. On the other hand, their commitments incentivise brown firms to improve their ESG practices in order to attract capital. Supporting this argument, Gantchev et al. (2022) document that firms experiencing negative environmental and social (E&S) incidents suffer divestment from responsible investors. Dasgupta et al. (2023) find that the Environmental Protection Agency's enforcement actions significantly reduce the toxic emissions of plants for firms held by socially responsible mutual funds. Berg et al. (2022a) show that ESG funds react to a firm's downward adjustment in ESG ratings by reducing their holdings and to an upward adjustment by increasing their holdings. Humphrey and Li (2021) and Pástor et al. (2023) document that institutional investors tend to tilt their portfolios to a greener level after signing the PRI. Therefore, institutional investors have the potential to create a significant social impact on the real economy through responsible investment.

Despite the promise of sustainable investing, the motivation behind institutional investors' socially responsible strategies may stem from attracting fund inflows rather than genuinely delivering on their promises of social responsibility (Hartzmark and Sussman, 2019). Theoretically, if sustainable investors lack a mandate that violates fiduciary duty on financial returns, they tend to invest only in firms with low negative externality, and such strategies may not generate meaningful sustainable impacts (Oehmke and Opp, 2024). Responsible institutional investors may not always "walk the talk" and are subject to suspicions of "greenwashing" (Gibson et al., 2022; Liang et al., 2022; Raghunandan and Rajgopal, 2022; Kim and Yoon, 2023; Michaely et al., 2024). Another strand of studies finds evidence for the "impact washing", suggesting that these investors rely more on ESG scores than on conducting their own due diligence regarding firms' environmental and social practices (Atta-Darkua et al., 2023; Heath et al., 2023; Heeb et al., 2023).

Poor performance in the ESG records of portfolio firms does not necessarily indicate greenwashing suspicion, as sustainable institutional investors may adopt engaging strategies and take corrective actions to mitigate firms' negative externalities. These actions can be carried out individually or collaboratively, such as through private communications with management teams during meetings and earnings calls, or by voting on shareholder proposals.

Literature shows that the engaging approach is more effective in tackling major societal challenges than divestment, offering significant advantages (Landier and Lovo, 2020; Berk and Van Binsbergen, 2025; Naaraayanan et al., 2021; Broccardo et al., 2022; Edmans et al., 2022). Engagement serves as a significant catalyst for promoting investor-driven sustainability in capital markets, providing advantages over traditional regulatory methods.

2.2. Demand side on bank lending: Pay to be green

Engagement is the key component of PRI.[5] Moreover, effectively applying ESG principles involves balancing the diverse demands of stakeholders and weighing the explicit and implicit costs and benefits to firms. The PRI initiatives provide signatories with the necessary knowledge, tools, and expertise to better engage and enhance firms' ESG performance (Humphrey and Li, 2021). Consistent with the above argument, Dimson et al. (2015) find that socially responsible investors conduct ESG engagements by informing and warning firms about ESG issues and requesting specific changes in response to unsatisfactory ESG performance. Dimson et al. (2021) discover that PRI-signatory investors who lead the group engage more actively in environmental and social issues through collaborations. Dyck et al. (2019) provide international evidence that institutional investors with a PRI signatory use private engagement, rather than exit and selection strategies, to enhance firms' E&S performance. Krueger et al. (2020) provide survey evidence confirming that ESG-oriented institutional investors consider risk management and engagement – rather than divestment – more effective in addressing climate risks. Recognising the importance of engagement, it has become the primary method employed by signatories.[6]

Nevertheless, banks' financing support could be crucial for sustainable institutional investors seeking to enhance their portfolio firms' sustainability profiles. Engagement strategies, like corrective actions to improve sustainability, are costly for portfolio firms. These investors may lack the substantial financial resources required (Cohn and Deryugina, 2018; Edmans et al., 2022; Xu and Kim, 2022), especially when transitioning a polluting firm to a socially responsible one. This argument aligns with the perspective of "it pays to be green" in the management literature (Walley and Whitehead, 1994; Hart, 1995; Hart and Ahuja, 1996; Kim and Lyon, 2015). ESG investments could compete for financial resources with productive investments, and the return on firms' ESG investments may not cover the initial costs in the short term. Given the substantial capital requirements for sustainable transformation and the competition for capital with conventional investment opportunities, firms may need additional financial resources to achieve sustainable performance (Christmann, 2000; Hong et al., 2012). Therefore, the demand-side perspective suggests that sustainable institutional investors could incentivise firms to secure more loans to improve or maintain sustainability performance.

2.3. Supply side on bank lending: ESG credibility

From the supply-side perspective, creditors also have an incentive to incorporate ESG commitments into their lending decisions. Previous studies provide ample evidence that a better profile in terms of sustainability allows borrowers to gain lower borrowing costs and more favourable contract conditions (Goss and Roberts, 2011; Chava, 2014; Jung et al., 2018; Zerbib, 2019; Huynh and Xia, 2021, 2023; Ivanov et al., 2024). This incentive is driven by the pro-social preference to support a low-carbon transition (e.g., Chang et al., 2021; Green and Vallee, 2022; Houston and Shan, 2022) and mitigate ESG-related risks (e.g., Correa et al., 2022; Hoepner et al., 2024; Ivanov et al., 2024).

A good sustainability profile could demonstrate borrowers' long-term financial stability, the creditworthiness of firms (Attig et al., 2013; Jiraporn et al., 2014), and resilience during the economic downturn (Lins et al., 2017; Flammer, 2021). As a result, borrowers with better sustainability profile convey a high repayment ability to lenders. Firms with high ESG profiles tend to have higher profitability and a larger customer base (Giese et al., 2019; Derrien et al., 2022), increased labour productivity, and sales growth (Flammer, 2015). For instance, climate change represents a significant source of risk (Krueger et al., 2020; Ilhan et al., 2021), which motivates creditors to mitigate this risk (Bolton and Kacperczyk, 2021; Giglio et al., 2021; Ilhan et al., 2021; Pástor et al., 2021; Correa et al., 2022; Houston and Shan, 2022; Ivanov et al., 2024; Zhang et al., 2024). In anticipation of stricter environmental regulation, creditors may expect increased regulatory constraints that favour environmental protection, potentially disadvantaging less responsible firms (Krueger et al., 2020; Ramelli et al., 2021; Kim et al., 2022; Acharya et al., 2023; Haushalter et al., 2023). Good ESG practices can reduce climate-related and other downside risks stemming from poor sustainability practices, especially in the context of high ESG uncertainty (Albuquerque et al., 2019; Ilhan et al., 2021; Ramelli et al., 2021; Avramov et al., 2022; Hoepner et al., 2024).

However, banks may lack the ability to guarantee borrowers' future sustainability activities, weakening their pro-social preferences and making them reluctant to support borrowers' loan financing. Financial market participants typically lack sufficient information to evaluate firms' commitment to environmental sustainability (Lyon and Maxwell, 2011; Lyon and Montgomery, 2015; Berrone et al., 2017). This informational gap necessitates a credible mechanism to distinguish between companies that are genuinely committed to environmental sustainability and those that are not. Firstly, although banks may acquire proprietary information through past lending experiences, this does not guarantee an accurate assessment of firms' ESG practices post-lending. Secondly, unlike shareholders, banks do not directly participate in management and decision-making processes, which limits their capacity to enforce firms' ESG commitments effectively. Finally, despite borrowers' ESG ratings provided by third-party agents being indicative of their current ESG profile, they are subject to limited reliability for borrowers' future sustainable performance (Hoepner et al., 2016; Bams and van der Kroft, 2023). Thses ratings may also involve significant disagreement due to variations in data sources and methodologies used (Berg et al., 2022b; Christensen et al., 2022; Serafeim and Yoon, 2022).

If banks perceive that those sustainable institutional investors genuinely "walk the talk" by responsibly divesting from their

[5] Principles for Responsible Investment (2018). ESG Monitoring, Reporting and Dialogue in Private Equity. Available at https://www.unpri.org/download?ac=4839.

[6] Global Sustainable Investment Alliance (2023) reports that negative screening, ESG integration and engagement are the top three prevalent methods in investment strategies, which account for over 80% in assets. In the US, engagement accounts for 62%, and divestment strategy has the least proportion. The report is available at https://www.gsi-alliance.org/wp-content/uploads/2023/12/GSIA-Report-2022.pdf.

portfolios and actively engaging with portfolio firms to enhance ESG performance, they may consider sustainable institutional ownership as a signal that the borrowers' ESG profile is highly credible. As a result, banks may be more willing to offer loans on better terms, such as more approvals and/or lower interest rates, to these firms. We refer to this as the *ESG credibility channel*.

2.4. Supply side on bank lending: Interest alignment

Another explanation is that being held by sustainable institutional investors could alleviate creditors' concerns about shareholder–creditor conflicts. The limited liability framework creates distinct cash flow entitlements for shareholders and creditors. Shareholders have a convex pay-off structure between risk and return. This pay-off structure incentivises shareholders to prefer higher risks in exchange for potentially greater rewards. Theoretically, shareholder–creditor conflicts can induce moral hazard problems in firms' decisions (Galai and Masulis, 1976; Jensen and Meckling, 1976; Myers, 1977; Smith and Warner, 1979; John, 1987; Leland, 1994; Parrino and Weisbach, 1999), leading to risk-shifting activities (Andrade and Kaplan, 1998; Parrino and Weisbach, 1999; Eisdorfer, 2008; Gilje, 2016). Recent studies also find that alleviated shareholder–creditor conflicts significantly influence risk-taking decisions, including innovation (Yang, 2021), tax avoidance (Francis et al., 2022), dividend payouts (Chu, 2018), and merger and acquisition decisions (Hilscher and Şişli-Ciamarra, 2013; Bodnaruk and Rossi, 2016).

Banks could be reluctant to lend or may require a higher return to compensate for the risk if they perceive significant shareholder–creditor conflicts. Consistent with the argument, previous studies find that high shareholder–creditor conflicts lead to restrictions on long-term debt capacity (Guedes and Opler, 1996), tighter loan contracts (Garleanu and Zwiebel, 2009; Demiroglu and James, 2010), and more investment restrictions under contract violations (Chava and Roberts, 2008; Chava et al., 2019). Another strand of the literature shows that banks acting as shareholders can mitigate concerns about these conflicts (Kroszner and Strahan, 2001), leading to easier access to bank loans and lower loan costs (Lin et al., 2009; Jiang et al., 2010; Ferreira and Matos, 2012).

Socially responsible investing acts as a signal of institutional investors' commitment, as it shows that these investors may not evaluate firms solely based on risk-return characteristics. Investment adhering to SRI principles is more likely to be motivated by social preferences or signals rather than by pecuniary motives (Riedl and Smeets, 2017; Barber et al., 2021; Bauer et al., 2021). Therefore, responsible investors are more inclined to support firms' long-term sustainable growth and are less motivated to exert pressure for short-term performance. For instance, institutional investors' demand for ESG assets is more resilient during market turbulence and economic downturns. Bollen (2007) and Renneboog et al. (2011) show that responsible fund flows are less sensitive to past negative returns. Cao et al. (2023) find that responsible institutional investors tend to focus more on ESG performance and less on traditional quantitative value signals. Döttling and Kim (2024) reveal that institutional investors do not significantly reduce their holdings in high ESG funds in response to the COVID-19 shock.

As the pressure for short-term performance could encourage firms to take excessive risks, investors pursuing sustainability could reduce shareholder–creditor conflicts (Freeman, 2010). As a result, the presence of socially conscious investors may alleviate creditors' concerns about conflicts of interest, leading to improved access to the debt market for firms. We refer to this alleviation of conflicts of interest, induced by sustainable institutional holdings, as the *interest alignment channel*.

Overall, the *ESG credibility channel* and the *interest alignment channel* suggest that sustainable institutional ownership enables borrowers to benefit from the loan market, which forms our first hypothesis.

***H1**: Firms held by sustainable institutional investors obtain more bank loans and benefit from lower loan cost.*

A natural question that arises is whether firms held by sustainable institutional investors achieve real outcomes for transitioning to a low-carbon economy after obtaining loans. The literature presents ambiguous evidence regarding the actual impacts of banks' lending decisions. From a positive perspective, Chang et al. (2021) provide theoretical evidence within a framework where lenders cannot use contracts to restrict borrowing firms' greenwashing decisions. In equilibrium, ESG-friendly lenders increase the overall borrowing cost for brown firms, which in turn incentivises these firms to enhance their environmental practices. Green and Vallee (2022) find that banks' coal divestment strategies significantly limit coal companies' ability to obtain loans, which leads to the earlier retirement of coal power plants by these companies. Houston and Shan (2022) observe that banks with high ESG profiles positively influence the ESG practices of underperforming ESG borrowers through lending relationships. Conversely, Oehmke and Opp (2022) theoretically demonstrate that policies intervening in banks' asset allocation stimulate banks to address climate-related financial risks without meaningfully reducing emissions. Haushalter et al. (2023) report that, following the implementation of stricter mining policies, banks under weak public monitoring do not reduce coal extraction by restricting loans to irresponsible firms.

By providing financial resources, banks enable firms to shift their practices towards more sustainable operations. Oehmke and Opp (2024) theoretically propose that socially responsible investors can promote clean technologies by issuing a green bond that stipulates these technologies. Therefore, it is justifiable for banks to expand their lending or reduce borrowing costs as a long-term strategy to improve firms' environmental performance.

We focus on greenhouse gas emissions to evaluate sustainable outcomes. The potential harm from emissions is widespread, whilst the polluters may only face minimal repercussions (Shive and Forster, 2020). Additionally, the cost of reducing emissions is higher compared to other sustainability initiatives (Fowlie, 2010), making it difficult to increase profits in the short term. Therefore, we believe that greenhouse gas emissions provide a robust measure for assessing firms' prosocial practices. Our second hypothesis is as follows.

***H2**: Firms held by sustainable institutional investors reduce emissions after achieving loans.*

3. Data and methodology

Our sample is constructed using several databases. We collected financial information from the Compustat and Capital IQ databases, ESG scores from the Refinitiv ESG database (formerly ASSET4), carbon emission data from the S&P Trucost database, loan-level data from the Refinitiv DealScan database, and institutional ownership data from the Thomson Reuters Institutional Holdings (13F) database.

To identify sustainable institutional investors, we rely on financial institutions' declarations of commitment to responsible investment, indicated by their signing of the UN-sponsored Principles for Responsible Investment. The PRI Collaboration Platform, established after the founding of PRI in 2006, serves as the world's largest forum for collaborative shareholder engagements. This platform aids signatories in coordinating ESG issues by facilitating the identification of actionable issues within companies or sectors and enabling collaboration to address these concerns. Whilst it is feasible to identify an institutional investor's commitment to responsible investing by assessing the average ESG performance of their portfolio firms, this method may not accurately reflect their commitment. This is because institutional investors lacking an explicit ESG policy may still pursue ESG factors for financial benefits, and those with explicit commitments do not necessarily restrict their investments to high ESG firms, particularly if they focus on engagement and corrective strategies to fulfil their commitments. Therefore, we use the status of a PRI signatory as the criterion for estimating responsible commitment rather than relying solely on portfolio firms' ESG performance.

We match the PRI signatory directory data[7] with institutional investors' names in the 13F database. The sample period begins in 2006, coinciding with the formation year of PRI, and ends in 2023, covering a set of institutions and listed firms in the US. We exclude financial firms and regulated industries (SIC codes in the range of 4900–4999 and 6000–6999), since these firms are subject to different regulations. We also exclude observations with missing variables in our baseline estimations. After completing the data-cleaning steps, our dataset comprises 13,153 observations.

We construct two proxy variables to measure the holdings of sustainable institutional investors. The first proxy, *Sustainable Indicator*, is a dummy variable that equals one if a firm is held by an institutional investor with PRI signatory in a given year and zero otherwise. The second proxy, *Sustainable IO*, is calculated as the percentage of outstanding shares held by sustainable institutional investors. We focus on scenarios where sustainable institutional investors are also blockholders. Large ownership stakes held by blockholders enable them to exert a greater impact on management teams, and achieving sustainable goals requires sustainable investors to hold financial claims large enough to counterbalance the profit motives of non-sustainable investors (Chowdhry et al., 2019). Fig. 1 presents the sustainable institutional ownership by year. The graph shows a noticeable increasing trend over the past decade. This trend is consistent with the findings reported by the Global Sustainable Investment Review (2022) and PRI Annual Report (2021),[8] suggesting a rapid accumulation of socially responsible capital.

We begin our analysis by estimating the role of sustainable institutional investors in firms' bank financing. Specifically, we estimate the following equation:

$$Bank\ Debt_{i,t} = \beta_0 + \beta_1 Sustainable\ Investors_{i,t-1} + \beta_2 X_{i,t-1} + \gamma_i + \gamma_t + \epsilon_{i,t}$$

where i and t represent firm and year, respectively. *Bank Debt* is calculated as the natural logarithm of the sum of one plus total bank loans. *Sustainable Investors* represent the proxies for sustainable institutional investor ownership, including *Sustainable Indicator* and *Sustainable IO*. X denotes a set of control variables, which include book leverage ratio (*Leverage*), calculated as the sum of long-term and short-term debt scaled by total assets; Tobin's Q (*TQ*), the ratio of market to book value of assets; firm size (*Size*), the natural logarithm of book assets; profitability (*ROA*), earnings before interest and tax scaled by total assets; tangibility (*PPE*), property, plant, and equipment scaled by total assets; interest coverage (*IC*), the ratio of earnings before interest and tax to interest expenses; earnings volatility (*EV*), defined as the standard deviation of operating income before depreciation over a five-year rolling window; and total institutional ownership (*IO*), the aggregate share ownership held by institutional investors.

We also include ESG scores (*ESG*) to ensure that our results are not driven by the possibility that sustainable institutional investors hold stocks with higher ESG ratings, whilst banks offer better loan conditions to companies with higher ESG scores. By controlling for the effects of ESG scores, we aim to rule out the potential that the observed effects on bank loans are attributable to the ESG performance of firms rather than the influence of sustainable institutional investors. We account for year-specific economic fluctuations and time-invariant firm characteristics by including year and firm fixed effects. Table 1 provides the summary statistics for the variables used in this study. Detailed variable constructions are presented in Appendix A.

4. Empirical results

4.1. Baseline results

In this section, we present our main findings regarding the role of sustainable institutional investors in bank loans. We start by examining bank debt at the firm level. Table 2 reports the results from estimating Equation (1). In column 1, the coefficient on *Sustainable Indicator* is 0.187 and is significant at the 5% level. This indicates that the presence of sustainable institutional investors is

[7] The data are available at https://www.unpri.org/signatories/signatory-resources/signatory-directory.

[8] The report is available at: https://www.unpri.org/annual-report-2021/how-we-work/building-our-effectiveness/enhance-our-global-footprint.

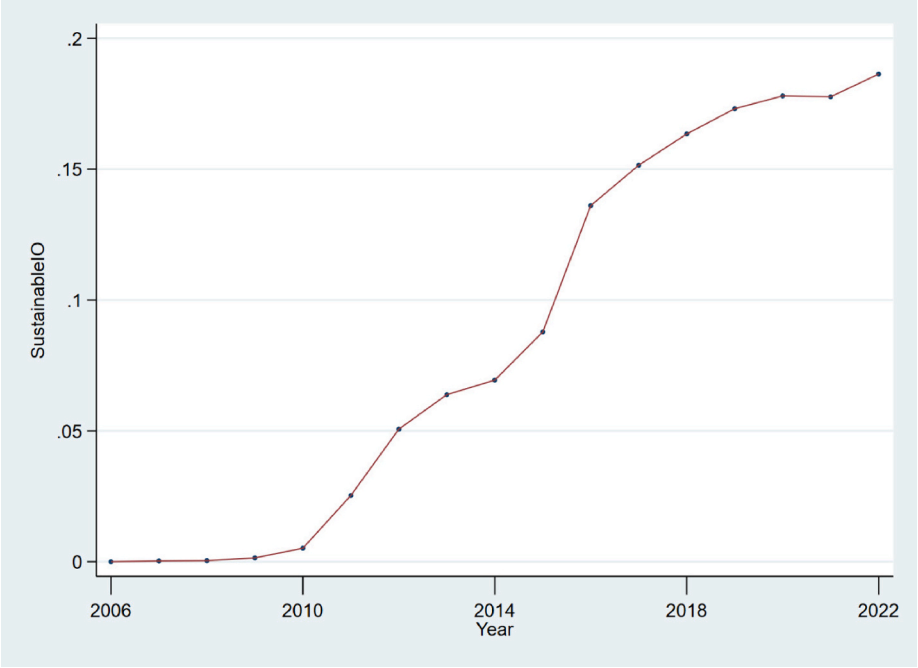

Fig. 1. The trend of sustainable institutional ownership. Note: This graph shows the average sustainable institutional ownership (Sustainable IO) over years. The X-axis represents the years from 2006 to 2022. The Y-axis represents the average percentage of outstanding shares held by sustainable institutional investors in a given year.

significantly and positively associated with firms' bank debt. In column 2, we use the alternative proxy for institutional investors by replacing the indicator with the ownership proxy, *Sustainable IO*. The coefficient on *Sustainable IO* remains positive at 0.982, albeit marginally significant. Moreover, the economic magnitude of this effect is significant. Specifically, firms with sustainable institutional investors tend to have bank debt that is 5 per cent higher relative to the sample mean compared to firms without such investors. Additionally, firms with a one-standard-deviation increase in sustainable institutional ownership are associated with a 3 per cent increase in bank debt relative to the sample mean. Overall, the results in Table 2 support our *H1*, confirming the positive impact of sustainable institutional investors on bank loans.

We also check the validity with a series of robustness tests, including employing an alternative measure of bank debt and an entropy balancing technique and conducting a test for reverse causality. Specifically, we construct an industry-adjusted bank loans measure, calculated by subtracting the industry-year median loans from actual loans, as the dependent variable. For the reverse causality test, following Schopohl et al. (2024), we estimate our baseline regression with all independent variables lagged by two or three years. To conduct an entropy balancing test, we create a treatment group of firms with sustainable institutional ownership above the median and a control group below the median for a given year. We then reweigh each firm-year observation in the control group to align the distribution of their means with those of the treatment group (Hainmueller, 2012). We report the corresponding results in Appendix B. The results generally support the baseline findings.

4.2. Difference-in-differences estimation on the PRI signatory

To explore the causal effect of sustainable institutional investors on firm loans, we employ a difference-in-differences framework to verify the robustness of our findings. In the spirit of the identification strategy employed by Kacperczyk and Peydró (2022), we utilise the date of the PRI signatory as an event that makes the responsible commitments of institutional investors publicly available.

The signatory events span multiple periods, and the literature has highlighted the bias in comparisons between newly treated units and previously treated units in a multi-period DID setting (Cengiz et al., 2019; Goodman-Bacon, 2021; Baker et al., 2022). To address this issue, we perform a stacked DID analysis, which compares the bank debt of affected firms before and after the signatory date with that of firms never treated, thereby ensuring "clean" control groups. Specifically, we first identify treated firms as those experiencing the signatory of at least one institutional blockholder. To minimize the confounding effects of multiple events, we require that treated firms have not experienced other signatory events within two years prior to the treatment. Next, we create cohorts by (1) selecting only firms in the control groups that have never experienced the signatory of institutional blockholders in the control groups, and (2) retaining only those treated and control firms with complete data for all relevant variables for three years, both before and after the event in each cohort. Finally, we stack observations from each cohort into a single dataset and conduct the DID estimation using the following equation:

Table 1
Descriptive statistics.

Variable	(1) Observations	(2) Mean	(3) S.D.	(4) Median
Bank Debt	13,153	3.968	2.756	4.735
Sustainable Indicator	13,153	0.749	0.434	1.000
Sustainable IO	13,153	0.128	0.105	0.127
Leverage	13,153	0.316	0.229	0.288
TQ	13,153	2.245	1.834	1.719
Size	13,153	8.045	1.566	8.074
ROA	13,153	0.106	0.167	0.122
PPE	13,153	0.269	0.230	0.189
IC	13,153	0.175	0.892	0.063
EV	13,153	0.043	0.082	0.026
IO	13,153	0.265	0.150	0.256
ESG	13,153	0.400	0.180	0.379
Amount	8546	6.147	1.442	6.215
AISD	7463	1.911	1.326	1.500
Maturity	8546	48.921	33.410	60.867
Secured	8546	0.373	0.484	0.000
Covenant	8546	0.458	0.498	0.000
Concentration	8546	3.549	2.844	3.000
NonBank	8546	0.077	0.266	0.000
Relationship	8546	0.569	0.495	1.000
Size_L	7859	13.621	0.424	13.857
ROA_L	7859	0.008	0.004	0.008
NII_L	7859	0.492	0.068	0.495
CR_L	7827	11.949	2.078	12.487
Board Size	12,143	2.330	0.203	2.303
Gender Ratio	12,143	0.794	0.114	0.818
Ind_director	12,143	0.768	0.119	0.778
CEO Gender	12,143	0.051	0.219	0.000
CEO Tenure	12,143	5.011	4.996	3.500
Responsible_L	8546	0.440	0.496	0.000
Dedicated IO	8546	0.317	0.466	0.000
Dual holding	8546	0.317	0.466	0.000
LnScope1	14,099	0.984	3.000	0.164
LnScope2	14,099	0.346	0.428	0.211
LnScope3	14,099	1.745	1.665	1.139
IntScope1	14,099	10.632	2.590	10.609
IntScope2	14,099	10.751	2.223	10.815
IntScope3	14,099	12.491	2.246	12.715
Borrow	14,099	0.197	0.398	0.000
Green and sustainability-linked loans	3768	0.017	0.131	0.000

Notes: This table shows the descriptive statistics for the variables used in this study. Columns 1 to 4 report the number of observations, the mean, the standard deviation, and the median for each variable, respectively. All continuous variables are winsorized at their 1st and 99th percentiles. Detailed variable definitions are in Appendix A.

$$Bank\ Debt_{i,t} = \beta_0 + \beta_1 Signatory_{i,t-1} + \beta_2 Post_{i,t-1} + \beta_2 X_{i,t-1} + \gamma_{i,c} + \gamma_t + \epsilon_{i,t}$$

where *i*, *t*, and *c* refer to firm, year, and cohort, respectively. The *Signatory* is the DID estimator that equals one if a treated firm has experienced a signatory event and zero otherwise. *Post* is a dummy variable that equals one for the post-event period in each cohort and zero otherwise. *X* represents control variables, which are identical to those in Eq. (1). We include the firm-cohort fixed effect to absorb time-invariant variation between treat and control groups within each cohort.

Table 3 reports the estimation results from estimating Eq. (2). In column 1, the coefficient on the DID estimator is positive and significant, with a value of 0.241. The result indicates that firms increase their bank loans following the signatory event of institutional shareholders, which is consistent with our baseline results. In columns 2 to 4, we perform a variety of robustness checks using different settings on fixed effects and methods for clustering standard errors. The results remain qualitatively unchanged.

A crucial assumption for a valid DID estimation is that the bank debt of treated and control groups must share similar time trends prior to the events. If the level of bank debt in the treatment and control groups already exhibits diverging trends before the events, the DID estimator will fail to capture the causal effect of the events on firms' bank loans. To verify the validity of our DID estimation, we conduct a pre-trend analysis to test the parallel trend assumption. Specifically, we create variables indicating the year relative to the year of institutional shareholders' signatory, including *Signatory (−2)*, *Signatory (−1)*, *Signatory (0)*, *Signatory (+1)*, and *Signatory (+2)*. For example, *Signatory (−2)* is set to one if a firm will experience the signatory of institutional shareholders two or more years later. *Signatory (+1)* is set to one if a firm experienced the signatory in the previous year. We then include all these trend indicators in Eq. (2) and redo the estimation.

Table 4 reports the corresponding results. In column 1, we observe that the coefficients on *Signatory (−2)* and *Signatory (−1)* are insignificant. Similarly, columns 2 to 4 show that none of the coefficients on the pre-trend indicators are significant. The insignificance

Table 2
Results of baseline regression analysing the impact of sustainable institutional investors on bank debt.

Variable	(1) *Bank Debt*	(2) *Bank Debt*
Sustainable Indicator	0.187**	
	(0.078)	
Sustainable IO		0.982*
		(0.568)
Leverage	1.701***	1.728***
	(0.251)	(0.251)
TQ	−0.005	0.002
	(0.026)	(0.025)
Size	0.372***	0.393***
	(0.106)	(0.105)
ROA	−0.330	−0.331
	(0.300)	(0.300)
PPE	−0.077	−0.076
	(0.577)	(0.575)
IC	0.023	0.023
	(0.034)	(0.034)
EV	−2.380***	−2.399***
	(0.707)	(0.700)
IO	−0.440	−0.610**
	(0.273)	(0.307)
ESG	0.725***	0.678***
	(0.257)	(0.258)
Fixed effects	Year and firm	Year and firm
Adjusted R^2	0.611	0.611
Observations	13,153	13,153

Notes: This table presents the baseline results from the estimation of Equation 1. The dependent variable, *Bank Debt*, is defined as the natural logarithm of the sum of one plus total bank loans. *Sustainable Indicator* is a dummy variable that equals one if a firm is held by an institutional investor who is a PRI signatory in a given year, and zero otherwise. *Sustainable IO* is the percentage of outstanding shares held by sustainable institutional investors. *Leverage* is calculated as the total debt over the total assets. *Size* is the natural logarithm of the book value of assets. *TQ* is the ratio of the market value of assets to the book value of assets. *ROA* is earnings before interest and tax, scaled by total assets. *PPE* is the ratio of property, plant, and equipment to total assets. *IC* is the ratio of earnings before interest and tax to interest expenses. *EV* is the standard deviation of operating income before depreciation, calculated over a five-year rolling window. *IO* is the percentage of outstanding shares held by institutional investors. *ESG* is the ESG score from the Refinitiv ESG database. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

of these coefficients suggests that there is no evidence of violation of the parallel trend assumption. In addition, we find that the post-trend indicators remain significantly positive, except for *Signatory (+1)*. Overall, our pre-trend analysis confirms the validity of our DID estimations.

One concern in the DID setting is that the heterogeneous characteristics between treatment and control groups may drive our findings. For instance, investors who commit to the PRI may have strong pro-social preferences and, thus, are more likely to hold firms already with strong ESG performance prior to the signatory, potentially leading to a spurious relationship between bank debt and the presence of sustainable institutional investors. To mitigate concerns that our results are influenced by underlying heterogeneity between treated and control groups, we employ a propensity score matching (PSM) approach, detailed as follows.

First, we generate a treatment dummy variable for firms that experience the signatory events in a given year. Next, using this treatment dummy as the dependent variable, we estimate a logit model to calculate the propensity score that a firm will experience the events, including all control variables from Equation (1) measured in the year preceding the event. Finally, for each treated firm within each cohort, we select one firm from the control group with the closest propensity score, allowing for matching with replacement. Our final sample comprises 517 treated firms and 149 matched firms. We then perform a balance test, presented in Appendix C, to evaluate the matching outcomes for the year prior to the events. The results reveal no significant differences in matching observables between the treated and control firms, except for a slightly higher average institutional ownership amongst the treated firms (p-value = 0.073). Overall, our matching process has effectively eliminated most observed differences between the treatment and control groups.

Table 5 presents the results of the stacked DID analysis using the matched sample. The significant and positive coefficients on the DID estimator across all columns confirm the robustness of our findings across various settings. In addition to the PSM method, we also repeat the test using quarterly data and reports, with results reported in Appendix D. The conclusion from interpreting the quarterly-level results remains qualitatively the same. Overall, our DID analysis indicates that firms with sustainable institutional investors obtain more bank debt, thereby providing supportive evidence for our *H1*.

Table 3
Results of the difference-in-differences analysis for the PRI signatory.

Variable	(1) *Bank Debt*	(2) *Bank Debt*	(3) *Bank Debt*	(4) *Bank Debt*
Signatory	0.241**	0.203*	0.241**	0.203**
	(0.122)	(0.118)	(0.098)	(0.101)
Post	−0.065	−0.063	−0.065	−0.063
	(0.041)	(0.041)	(0.050)	(0.052)
Leverage	0.876***	1.087***	0.876***	1.087***
	(0.281)	(0.341)	(0.175)	(0.191)
TQ	−0.024	−0.015	−0.024	−0.015
	(0.029)	(0.032)	(0.018)	(0.020)
Size	0.534***	0.470***	0.534***	0.470***
	(0.126)	(0.132)	(0.076)	(0.078)
ROA	−0.418	−0.189	−0.418*	−0.189
	(0.371)	(0.407)	(0.226)	(0.246)
PPE	0.749	0.447	0.749**	0.447
	(0.511)	(0.619)	(0.330)	(0.387)
IC	−0.017	−0.036	−0.017	−0.036
	(0.042)	(0.049)	(0.025)	(0.027)
EV	−1.492	−1.344	−1.492***	−1.344**
	(0.908)	(0.919)	(0.569)	(0.601)
IO	−0.048	−0.121	−0.048	−0.121
	(0.349)	(0.343)	(0.183)	(0.183)
ESG	−0.129	−0.113	−0.129	−0.113
	(0.320)	(0.386)	(0.210)	(0.224)
Fixed effects	Year and firm-cohort	Year, firm, and cohort	Year and firm-cohort	Year, firm, and cohort
Cluster	Firm	Firm	Firm-cohort	Firm-cohort
Adjusted R^2	0.712	0.713	0.712	0.713
Observations	14,320	14,320	14,320	14,320

Notes: This table reports the results of the difference-in-differences analysis using the PRI signatory as an event that makes the responsible commitments of institutional investors publicly available. The dependent variable is *Bank Debt* in all the estimations. *Signatory* is the DID estimator that equals one if a treated firm has experienced a signatory event, and zero otherwise. *Post* is a dummy variable that equals one for the post-event period in each cohort, and zero otherwise. Columns 1 and 3 include year and firm-cohort fixed effects, and columns 2 and 4 include year, firm, and cohort fixed effects. Standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level in columns 1 and 2, and at the firm-cohort level in columns 3 and 4. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

Table 4
Results of dynamic analysis for the PRI signatory.

Variable	(1) *Bank Debt*	(2) *Bank Debt*	(3) *Bank Debt*	(4) *Bank Debt*
Signatory (−2)	0.150	0.137	0.150	0.137
	(0.116)	(0.114)	(0.097)	(0.092)
Signatory (−1)	0.110	0.127	0.110	0.127
	(0.158)	(0.159)	(0.124)	(0.119)
Signatory (0)	0.186*	0.202*	0.186*	0.202**
	(0.112)	(0.109)	(0.106)	(0.100)
Signatory (+1)	0.209	0.210	0.209	0.210
	(0.194)	(0.199)	(0.149)	(0.143)
Signatory (+2)	0.451**	0.436*	0.451***	0.436***
	(0.213)	(0.224)	(0.160)	(0.157)
Fixed effects	Year and firm-cohort	Year, firm, and cohort	Year and firm-cohort	Year, firm, and cohort
Cluster	Firm	Firm	Firm-cohort	Firm-cohort
Adjusted R^2	0.712	0.711	0.712	0.711
Observations	14,320	14,320	14,320	14,320

Notes: This table reports the dynamic analysis for the PRI signatory. The dependent variable is *Bank Debt* in all the estimations. *Signatory* is the DID estimator that equals one if a treated firm has experienced a signatory event, and zero otherwise. *Signatory (−2)* is a dummy variable that equals one if a firm will experience the signatory of institutional shareholders two or more years later. *Signatory(−1)* equals one if a firm will experience the signatory of institutional shareholders one year later. *Signatory (0)* equals one if a firm is experiencing the signatory of institutional shareholders. *Signatory (+1)* equals one if a firm experienced the signatory of institutional shareholders one year before. *Signatory (+2)* equals one if a firm experienced the signatory of institutional shareholders two or more years before. Columns 1 and 3 include year and firm-cohort fixed effects, and columns 2 and 4 include year, firm, and cohort fixed effects. Standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level in columns 1 and 2, and at the firm-cohort level in columns 3 and 4. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10 %, 5 %, and 1 % level, respectively. Detailed variable definitions are in Appendix A.

Table 5
Results of difference-in-differences with propensity score matching.

Variable	(1) *Bank Debt*	(2) *Bank Debt*	(3) *Bank Debt*	(4) *Bank Debt*
Signatory	0.358**	0.334*	0.358**	0.334**
	(0.172)	(0.170)	(0.151)	(0.162)
Post	−0.353**	−0.346**	−0.353**	−0.346**
	(0.170)	(0.169)	(0.149)	(0.160)
Leverage	1.568***	1.786***	1.568***	1.786***
	(0.430)	(0.448)	(0.423)	(0.459)
TQ	−0.016	0.049	−0.016	0.049
	(0.079)	(0.089)	(0.078)	(0.092)
Size	0.435**	0.423**	0.435***	0.423**
	(0.172)	(0.183)	(0.168)	(0.180)
ROA	0.071	0.219	0.071	0.219
	(0.649)	(0.678)	(0.630)	(0.696)
PPE	1.879**	1.383	1.879**	1.383
	(0.920)	(0.958)	(0.900)	(0.949)
IC	0.003	−0.013	0.003	−0.013
	(0.090)	(0.099)	(0.079)	(0.089)
EV	−3.134**	−3.119**	−3.134**	−3.119**
	(1.295)	(1.294)	(1.271)	(1.315)
IO	0.212	0.182	0.212	0.182
	(0.404)	(0.429)	(0.395)	(0.435)
ESG	0.396	0.589	0.396	0.589
	(0.375)	(0.394)	(0.366)	(0.398)
Fixed effects	Year and firm-cohort	Year, firm, and cohort	Year and firm-cohort	Year, firm, and cohort
Cluster	Firm	Firm	Firm-cohort	Firm-cohort
Adjusted R^2	0.670	0.658	0.670	0.658
Observations	4640	4640	4640	4640

Notes: This table presents the results for the difference-in-difference with the propensity score matching approach. The dependent variable is *Bank Debt* in all the estimations. Columns 1 and 3 include year and firm-cohort fixed effects, and columns 2 and 4 include year, firm, and cohort fixed effects. Standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level in columns 1 and 2, and at the firm-cohort level in columns 3 and 4. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

4.3. Loan-level evidence

So far, our results confirm the positive relationship between bank debt and sustainable institutional ownership. Next, we examine the role of sustainable institutional ownership in bank lending at the loan-level.

We construct a sample of syndicated loans by linking the GVKEY identifier in the Compustat database with the COMPANY ID in the DealScan database for both borrowers and lenders.[9] We begin our analysis by estimating the impact of sustainable institutional ownership on the amount of loans. Specifically, we estimate the following equation.

$$Amount_f = \beta_0 + \beta_1 Sustainable\ Investors_{b,t-1} + \beta_2 X\_B_{b,t-1} + \beta_3 X\_L_{l,t-1} + \beta_4 X\_F_f + \gamma_b + \gamma_l + \gamma_t + \epsilon_{i,t} \quad (3)$$

where *f*, *b*, *l*, and *t* represent facility, borrower, lender, and year, respectively. The dependent variable is the loan amount at the facility level. *X_B* is a vector of control variables for borrower characteristics, which are identical to those in Equation (1). *X_L* refers to control variables representing the average characteristics of lead arrangers,[10] including bank size (*Size_L*), ROA (*ROA_L*), Net Interest Income (*NII_L*), and financial strength (*CR_L*). For each loan, we take the average for the lead arrangers' characteristics. Following previous studies (Ivashina, 2009; Lim et al., 2014; Berg et al., 2016; Schwert, 2018; Keil and Müller, 2020), we also include loan characteristics in *X_F*, which include loan maturity (*Maturity*), whether the loan is secured (*Secured*), covenant (*Covenant*), syndicate concentration (*Concentration*), non-bank lead arranger participation (*NonBank*), and relationship lending (*Relationship*). In all the estimations, we include fixed effects for loan types and purposes.

Table 6 presents the estimation results of Equation (3). Column 1 shows that sustainable institutional investor ownership is significantly and positively associated with loan amount at the facility level. In column 2, we include the lender fixed effect to account for unobserved time-invariant bank characteristics. In column 3, we include time-variant bank characteristics. The results show qualitatively similar. In columns 4 to 6, we re-estimate the impact of the percentage of holdings and find that the coefficients remain significant and positive. Overall, our results support the baseline finding that firms with sustainable institutional investors borrow more from banks.

Next, we turn to the cost of loans to explore whether sustainable institutional investors help portfolio firms secure lower borrowing

[9] The link tables for borrowers and lenders are provided by Chava and Roberts (2008) and Schwert (2018), respectively.
[10] A syndicated loan involves multiple lead arrangers. We calculate the lenders' characteristics by taking the average for all lead arrangers.

Table 6
Results of loan-level analysis – loan amount.

Variable	(1) *Amount* Leader–arranger level	(2) *Amount* Leader–arranger level	(3) *Amount* Facility level	(4) *Amount* Leader–arranger level	(5) *Amount* Leader–arranger level	(6) Amount Facility level
Sustainable Indicator	0.183**	0.220***	0.150**			
	(0.081)	(0.079)	(0.076)			
Sustainable IO				0.972*	1.150**	0.977**
				(0.535)	(0.500)	(0.496)
Leverage	−0.115	−0.197	−0.058	−0.168	−0.217	−0.099
	(0.169)	(0.159)	(0.153)	(0.177)	(0.162)	(0.154)
TQ	0.048*	0.067**	0.053**	0.055*	0.072***	0.055**
	(0.028)	(0.026)	(0.024)	(0.029)	(0.026)	(0.024)
Size	0.318***	0.272***	0.234***	0.307***	0.269***	0.230***
	(0.062)	(0.051)	(0.060)	(0.064)	(0.050)	(0.061)
ROA	0.162	0.212	0.149	0.193	0.233	0.189
	(0.218)	(0.207)	(0.200)	(0.223)	(0.209)	(0.208)
EV	−0.081	−0.039	−0.149**	−0.091	−0.060	−0.155**
	(0.074)	(0.073)	(0.066)	(0.075)	(0.073)	(0.071)
PPE	−0.387	−0.076	−0.374	−0.440	−0.103	−0.337
	(0.404)	(0.395)	(0.407)	(0.405)	(0.395)	(0.409)
IC	0.000	−0.000	−0.000	0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IO	−0.437*	−0.401**	−0.358*	−0.427*	−0.392*	−0.432*
	(0.226)	(0.199)	(0.201)	(0.254)	(0.223)	(0.223)
ESG	0.078	0.044	−0.069	0.025	−0.014	−0.152
	(0.193)	(0.183)	(0.190)	(0.202)	(0.190)	(0.194)
Maturity	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Secured	−0.255***	−0.223***	−0.172**	−0.256***	−0.207***	−0.165**
	(0.086)	(0.077)	(0.084)	(0.085)	(0.076)	(0.083)
Covenant	0.393***	0.288***	0.332***	0.389***	0.284***	0.326***
	(0.050)	(0.043)	(0.048)	(0.050)	(0.043)	(0.049)
Concentration	0.091***	0.136	0.088***	0.087***	0.017	0.088***
	(0.012)	(0.382)	(0.012)	(0.013)	(0.357)	(0.012)
NonBank	−0.317***	0.080	−0.096	−0.337***	0.083	−0.072
	(0.097)	(0.082)	(0.094)	(0.096)	(0.082)	(0.095)
Relationship	0.203***	0.166***	0.174***	0.209***	0.173***	0.180***
	(0.037)	(0.033)	(0.034)	(0.036)	(0.032)	(0.034)
Size_L			0.584***			0.591***
			(0.103)			(0.104)
ROA_L			−1.868			−0.875
			(10.843)			(11.061)
NII_L			−0.579			−0.556
			(0.598)			(0.596)
CR_L			−0.003			0.004
			(0.021)			(0.022)
Fixed effects	Year, type, purpose, and borrower	Year, type, purpose, borrower, and lender	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, borrower, and lender	Year, type, purpose, and borrower
Adjusted R^2	0.495	0.552	0.516	0.495	0.553	0.515
Observations	8546	8546	7827	8546	8546	7827

Notes: This table presents the estimation results on loan amount. The dependent variable, *Amount*, is defined as the natural logarithm of the loan amount in each facility. *Maturity* is the maturity of a facility in months. *Secured* is a dummy variable that equals 1 if a facility is secured. *Covenant* is a dummy variable that equals 1 if a loan facility has any type of covenant attached. *Concentration* is the number of lead arrangers in the loan syndicate. *NonBank* is a dummy variable that equals 1 if at least one of the lead arrangers does not belong to commercial and investment banks. *Relationship* is a dummy variable that equals 1 if a borrower has received a loan from at least one of the lead banks in the past five years. *Size_L* is the natural logarithm of total assets for a lead arranger. *ROA_L* is the net income to total assets for a lead arranger. *NII_L* is the net interest income to operating revenues for a lead arranger. *CR_L* is the Tier 1 capital to risk-weighted assets. In columns 3 and 6, we take the average of the control variables of lead arrangers in each facility. *Type* is a vector of dummy variables for the different loan types. *Purpose* is a vector of dummy variables for different primary loan purposes. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

costs. We replace our dependent variable with the all-in-spread-drawn (*AISD*) of the loan facility and include all the control variables from Equation (3) and the loan amount.

Table 7 reports the results for the cost of loans. In column 1, we find that the presence of sustainable institutional investors is significantly and negatively related to the cost of loans for portfolio firms. Results in columns 2 and 3 further confirm the negative

impact under different settings. The results in columns 4 to 6 also indicate qualitatively similar results using the proxy of sustainable institutional ownership. Overall, Table 7 provides evidence that conditional loans, being held by sustainable institutional investors, benefit firms by reducing loan costs. Combined with the results from the previous sections, sustainable institutional investors not only enhance portfolio firms' access to the loan market but also contribute to achieving lower costs.

4.4. Additional robustness tests

In addition to the DID analysis and loan-level analysis, we conducted a variety of robustness tests to validate our findings. These tests include modelling with additional control variables, high-dimensional fixed effects, alternative proxy variables for bank loans, and estimations addressing reverse causality and using entropy balancing. The results are presented in the appendix, which, overall, support our findings.

Firstly, we consider the role of the board and managerial characteristics that may influence financing decisions and firm risks (Faccio et al., 2016; Li and Zeng, 2019; Schopohl et al., 2021). We redo the estimations, incorporating control variables such as board size (*Board Size*), the proportion of female directors (*Gender Ratio*), the proportion of independent directors (*Ind_director*), CEO gender (*CEO Gender*), and CEO tenure (*CEO Tenure*). We report the results in Appendix E.

Secondly, it is possible that the supply of loans and firms held by sustainable institutional investors might be subject to time-varying heterogeneity across industries, such as specific climate regulatory policies affecting certain industries. Following Gormley and Matsa (2014), we mitigate the heterogeneity by including high-dimensional fixed effects for firms and interacted industry-year fixed effects. The results are presented in Appendix F.

Thirdly, the signing of PRI does not guarantee sustainable investing. It is possible that institutional investors are signatories yet still invest in unsustainable firms. To alleviate this concern, we reconstruct the proxy variables for sustainable institutional investors by excluding insurance companies. According to the ERM Sustainability Institute report (2023),[11] the top 16 US insurance companies collectively held approximately 50 per cent of the sector's fossil fuel-related assets, valued at over $500 billion. This reflects that insurance companies may prioritise financial stability over sustainable investing that affects the ability to meet their obligations to beneficiaries. In Appendix G, we re-perform the tests using the new proxy variables which exclude insurance companies in the construction process. The robustness tests show qualitatively unchanged results, which validate our findings.

4.5. Demand-side mechanism – pay to be green

We then explore the demand-side mechanism to answer the question of why firms held by sustainable institutional investors demand more bank loans. To fulfil their commitment to sustainable investing, sustainable institutional investors engage with portfolio firms to invest in sustainable projects. Sustainable investments require substantial financing to support because such investments compete for financial resources with productive investment opportunities. Therefore, to meet sustainable institutional investors' requirements on sustainability performance, firms with high investment opportunities could require more bank loans to support sustainable investment. To test this prediction, we construct a dummy variable of high investment opportunities (*High TQ*) based on the median value of Tobin's Q in a given year and then regress the loan amount on the interaction between the proxies for sustainable institutional investors and the dummy variable.

In addition, portfolio firms require significant financing support if the engagement involves corrective actions for transitioning from a polluting firm to a socially responsible one. Therefore, we expect that firms with high transition costs to become sustainable companies may seek more loan support. To test this prediction, we follow Ilhan et al. (2021) and Huynh and Xia (2021) to classify top-polluting industries and construct a dummy variable indicating these industries.[12] Firms operating in top-polluting industries face high transition costs and require more loans to support the process. We then include an interaction between the proxies for sustainable institutional investors and a dummy variable indicating top polluting industries (*High TC*).

Table 8 reports the estimation results. In columns 1 and 2, the significant and positive coefficients on the interaction terms between sustainable institutional proxies and high investment opportunities suggest that firms held by sustainable institutional investors obtain more loans if they have more investment opportunities. The results are consistent with our expectation that improving or maintaining a high sustainability profile to meet the commitment of sustainable institutional investors competes with investment opportunities, which in turn increases firms' demand for bank loans. In the same vein, the coefficients on the interaction terms between sustainable institutional proxies and high transition costs are positive and significant in columns 3 and 4, supporting that firms facing high transition costs demand more loans to meet sustainable institutional investors' sustainability requirements. Overall, our evidence is supportive of the "pay to be green" theory. To satisfy sustainable institutional investors' sustainability requirements, firms demand more bank loans to maintain or improve their sustainability profile.

[11] The report is available at: https://www.sustainability.com/globalassets/sai-changing-climate-for-insurance_final.pdf.

[12] The top polluting industries include petroleum and coal products; primary metal industries; electric, gas, and sanitary services; air transportation; trucking and warehousing; water transportation; oil and gas extraction; railroad transportation; stone, clay, and glass products; paper and allied products; metal mining; non-classifiable establishments; chemical and allied products; general merchandise stores; and textile mill products.

Table 7
Results of loan-level analysis – loan spreads.

Variable	(1) *AISD* Leader–arranger level	(2) *AISD* Leader–arranger level	(3) *AISD* Facility level	(4) *AISD* Leader–arranger level	(5) *AISD* Leader–arranger level	(6) *AISD* Facility level
Sustainable Indicator	−0.183***	−0.121**	−0.119*			
	(0.063)	(0.057)	(0.061)			
Sustainable IO				−0.957**	−1.101**	−1.100**
				(0.412)	(0.496)	(0.441)
Leverage	0.415***	0.446***	0.443***	0.495***	0.421***	0.494***
	(0.150)	(0.128)	(0.144)	(0.131)	(0.157)	(0.146)
TQ	−0.069***	−0.084***	−0.064***	−0.093***	−0.073***	−0.075***
	(0.025)	(0.023)	(0.024)	(0.023)	(0.026)	(0.022)
Size	−0.110**	−0.108**	−0.079	−0.100**	−0.117**	−0.082*
	(0.056)	(0.050)	(0.051)	(0.047)	(0.056)	(0.048)
ROA	−0.753***	−0.753***	−0.670**	−0.675***	−0.671***	−0.609**
	(0.277)	(0.261)	(0.268)	(0.232)	(0.251)	(0.237)
EV	0.065	0.087	0.058	0.083	0.063	0.054
	(0.059)	(0.063)	(0.058)	(0.062)	(0.058)	(0.056)
PPE	−0.166	−0.399	−0.414	−0.402	−0.261	−0.443
	(0.320)	(0.293)	(0.299)	(0.291)	(0.332)	(0.300)
IC	−0.000	0.000	−0.000	0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
IO	0.054	0.104	0.208	0.077	0.124	0.203
	(0.177)	(0.154)	(0.159)	(0.167)	(0.184)	(0.159)
ESG	−0.033	−0.044	0.001	−0.083	−0.040	−0.018
	(0.150)	(0.145)	(0.147)	(0.139)	(0.151)	(0.144)
Amount	−0.163***	−0.141***	−0.123***	−0.140***	−0.162***	−0.121***
	(0.020)	(0.020)	(0.021)	(0.019)	(0.020)	(0.020)
Maturity	0.001	0.001	−0.000	0.001	0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Secured	0.468***	0.382***	0.400***	0.380***	0.492***	0.408***
	(0.071)	(0.064)	(0.068)	(0.062)	(0.071)	(0.067)
Covenant	−0.156***	−0.141***	−0.117***	−0.148***	−0.171***	−0.126***
	(0.038)	(0.036)	(0.037)	(0.036)	(0.039)	(0.037)
Concentration	−0.021**	−0.066	−0.012	−0.065	−0.021**	−0.013
	(0.009)	(0.172)	(0.010)	(0.174)	(0.009)	(0.010)
NonBank	0.520***	0.102	0.184*	0.066	0.519***	0.153
	(0.120)	(0.076)	(0.098)	(0.071)	(0.119)	(0.097)
Relationship	−0.021	−0.018	−0.038	−0.016	−0.012	−0.036
	(0.025)	(0.024)	(0.024)	(0.024)	(0.025)	(0.024)
Size_L			−0.111*			−0.082
			(0.059)			(0.063)
ROA_L			−4.166			−0.211
			(7.045)			(7.658)
NII_L			−0.152			−0.196
			(0.366)			(0.354)
CR_L			−0.026			−0.027
			(0.037)			(0.038)
Fixed effect	Year, type, purpose, and borrower	Year, type, purpose, borrower, and lender	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, borrower, and lender	Year, type, purpose, and borrower
Adjusted R^2	0.687	0.718	0.686	0.724	0.688	0.694
Observations	7463	7463	6903	7463	7463	6903

Notes: This table presents the estimation results on loan spreads. The dependent variable is *AISD*, which is the loan spread in each facility, calculated as the interest rate spread over LIBOR in basis points. In columns 3 and 6, we take the average of the control variables of lead arrangers in each facility. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

4.6. Supply-side mechanisms – ESG credibility and interest alignment

Next, we explore the underlying mechanisms from the supply side. The ESG credibility channel suggests that sustainable institutional investors enhance the credibility of a firm's ESG profile, which leads to lower borrowing costs. The interest alignment channel posits that the responsible commitments of sustainable institutional investors decrease shareholder–creditor conflicts, reducing borrowing costs. To test the ESG credibility channel, we investigate the moderating roles of ESG scores, the presence of responsible banks, and attention to climate issues in the impact of sustainable institutional shareholders on the cost of loans.

We include an interaction between the proxies for sustainable institutional investors and a dummy variable indicating high ESG scores (*High ESG*) which are defined based on the median value of a given year. A significant and negative coefficient on this interaction

Table 8
Results of demand-side mechanism analysis – pay to be green.

Variable	(1) *Amount*	(2) *Amount*	(3) *Amount*	(4) *Amount*
Sustainable Indicator	0.060		0.089	
	(0.095)		(0.085)	
Sustainable Indicator × *High TQ*	0.248***			
	(0.083)			
Sustainable IO		0.624		0.731
		(0.603)		(0.549)
Sustainable IO × *High TQ*		0.844*		
		(0.488)		
High TQ	−0.077	0.004		
	(0.078)	(0.071)		
Sustainable Indicator × *High TC*			0.197**	
			(0.100)	
Sustainable IO × *High TC*				0.984*
				(0.582)
Control variables	Yes	Yes	Yes	Yes
Fixed effects	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, and borrower
Adjusted R^2	0.496	0.495	0.504	0.499
Observations	8546	8546	8546	8546

Notes: This table presents the results of the roles of investment opportunities and transition costs in the relationship between sustainable institutional ownership and the loan amount. The dependent variable, *Amount*, is defined as the natural logarithm of the loan amount in each facility. *High TQ* is a dummy variable that equals one if a borrower's Tobin's Q is above the median value in a given year. *High TC* is a dummy variable that equals one if a borrower belongs to high-polluting industries. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

term suggests that sustainable institutional investors increase the credibility of firms' ESG profiles, leading to lower borrowing costs. On the contrary, a positive coefficient could imply that banks expect firms with less responsible sustainable institutional investors to improve their ESG performance in the future.

We next identify responsible banks as those that are signatories of the United Nations Principles for Responsible Banking[13]. Banks with high ESG commitments value ESG performance and incorporate ESG-related information into their lending decisions. For instance, responsible banks indirectly pressure their borrowers to improve their ESG performance through first-time lending decisions, the renewal process, and the threat to exit (Houston and Shan, 2022; Kacperczyk and Peydró, 2022). We include an interaction between the proxies for sustainable institutional investors and a dummy variable indicating responsible lead arrangers (*Responsible_L*). If sustainable institutional investor ownership reduces borrowing costs by enhancing firms' ESG credibility, we expect responsible banks to strengthen the negative relationship between sustainable institutional investors and the cost of loans.

In the same vein, we expect that an increase in climate risk awareness will strengthen the relationship between sustainable institutional investors and the cost of loans. Increased attention to climate issues can intensify financial institutions' awareness of these issues, leading them to incorporate ESG factors into their decisions. Supporting this, Correa et al. (2022) find that attention to climate change amplifies the impact of climate change-related disasters on the cost of loans for firms with high exposure. Similarly, Bolton and Kacperczyk (2021) discover that investors care more about carbon risk following the Paris Agreement. Hence, we utilise the Paris Agreement in 2015 as an exogenous shock to financial institutions' awareness of climate issues and examine whether the relationship between sustainable institutional investors and the cost of loans becomes more pronounced in the post-Paris Agreement period.

To test the interest alignment channel, we include two interaction terms. The first interaction term is between the proxy for sustainable institutional investors and a dummy variable (*Low Dedicated IO*) that indicates a low proportion of dedicated institutional ownership based on the median value for a given year. Dedicated institutional investors, who focus on long-term performance, help mitigate managerial myopia, thereby reducing shareholders–creditors conflicts (e.g., Edmans and Manso, 2011; An and Zhang, 2013; Appel et al., 2016; Harford et al., 2018; Nguyen et al., 2020). In contrast, institutional investors with a short-term focus tend to prioritise immediate returns, which may drive managers to pursue short-term gains at the expense of long-term stability (e.g., Stein, 1989; Bushee, 1998, 2001; Bolton et al., 2006). This short-termism can increase a firm's bankruptcy risk and impair its collateral value, consequently raising debt cost and reducing debt capacity (e.g., Huang and Petkevich, 2016; Garel and Petit-Romec, 2017; Cline et al., 2020; Pathan et al., 2021). If sustainable institutional investors lead to lower borrowing costs by reducing shareholder–creditor conflicts, we should observe a negative coefficient on the interaction term in our model.

The second term is defined as an interaction with a dummy variable indicating the presence of dual holders. Previous studies show that dual holdings can alleviate shareholder–creditor conflicts, significantly influencing managers' risk-taking decisions (e.g., Chu,

[13] The membership of signatory banks is available at https://www.unepfi.org/members.

2018; Francis et al., 2022; Yang, 2021). Therefore, if sustainable institutional investors lead to lower borrowing costs by reducing the conflicts, we expect their impact on loan costs to be less significant when a borrower has an investor who simultaneously holds both the firm's debt and equity.

Table 9 presents the corresponding estimation results using *Sustainable IO* as the proxy for sustainable institutional ownership. The coefficients on the interaction term in columns 1 to 3 are all significant and negative. These results align with our prediction on the ESG credibility channel, suggesting that the influence of sustainable institutional investors on loan costs is more pronounced for firms with high ESG profiles, the participation of responsible banks, and periods of strengthened climate issue awareness. Furthermore, the negative coefficient on the interaction term with low dedicated institutional ownership in column 4 and the positive coefficient with dual holdings in column 5 corroborate the interest alignment channel. In Appendix H, we re-perform the estimation using the other proxy (i.e., *Sustainable Indicator*) for sustainable institutional ownership under different model settings. We find that the results remain qualitatively unchanged. Overall, our findings support both ESG credibility and interest alignment channels.

4.7. Real outcome – carbon emissions

We test for the environmental outcomes of firm activities. Following the model setting and methodology in Bolton and Kacperczyk (2021), we employ both the absolute value and the intensity of carbon emissions. The absolute carbon emissions, *LnScope1*, *LnScope2,* and *LnScope3*, are calculated as the natural logarithm of Scope 1, Scope 2, and upstream Scope 3 emissions, respectively. The carbon emission intensity, *IntScope1*, *IntScope2,* and *InScope3*, are calculated as the emissions in three scopes scaled by the firm's revenue, as reported in the S&P Global Trucost database. The absolute proxy is a more relevant measure for Net Zero objectives, whilst the intensity proxy accounts for the differences in firm size and profitability. Scope 1 encompasses direct emissions from production activities, and Scope 2 accounts for indirect emissions from the consumption of purchased electricity, heat, or steam. Scope 3 can be upstream and downstream, representing emissions caused in the upstream and downstream supply chain, respectively; and due to the data availability, we focus on the upstream of Scope 3 in our estimations.

Table 9
Results of supply-side mechanism analysis – ESG credibility and interest alignment.

Variable	(1) *AISD*	(2) *AISD*	(3) *AISD*	(4) *AISD*	(5) *AISD*
Sustainable IO	−0.045	−0.064	0.690	0.368	−0.698
	(0.548)	(0.533)	(0.671)	(0.489)	(0.556)
Sustainable IO × High ESG	−0.949**				
	(0.404)				
High ESG	0.156**				
	(0.064)				
Sustainable IO × Responsible_L		−0.637*			
		(0.370)			
Responsible_L		0.062			
		(0.053)			
Sustainable IO × PA			−1.649**		
			(0.830)		
Sustainable IO × Low Dedicated IO				−1.281*	
				(0.662)	
Low Dedicated IO				0.062	
				(0.047)	
Sustainable IO × Dual holding					0.751**
					(0.373)
Dual holding					−0.023
					(0.044)
Control variables	Yes	Yes	Yes	Yes	Yes
Fixed effects	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, and borrower
Adjusted R^2	0.685	0.681	0.669	0.688	0.676
Observations	7463	7463	7463	7463	7463

Notes: This table reports the results of the roles of ESG, responsible banks, the Paris Agreement, and dedicated institutional ownership in the relationship between sustainable institutional ownership and the cost of loans. The dependent variable is *AISD* in all the estimations. *High ESG* is a dummy variable that equals one if a borrower's ESG scores are above the median value in a given year. *Responsible_L* is a dummy variable that equals one if a lead arranger has signed the Principles for Responsible Banking. *PA* is a dummy variable that equals one for years after 2015. *Low Dedicated IO* is a dummy variable that equals one if a borrower has dedicated institutional ownership lower than the median value in a given year. *Dual holding* is a dummy variable that equals one if a borrower is held by a shareholder who is also a lender in a given year. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

We start our estimation by regressing the proxy for sustainable institutional investors on carbon emissions, the results of which are reported in Panel A of Table 10. The coefficients on *Sustainable Indicator* are insignificant, except for the intensity of Scope 2. This finding aligns with previous research (Gibson et al., 2022; Liang et al., 2022; Kim and Yoon, 2023), which suggests that signatory institutional shareholders have a limited impact on firms' responsible activities.

Next, we explore the role of bank loans in the relationship between sustainable institutional investors and carbon emissions. In Panel B of Table 10, we examine the interaction between the *Sustainable Indicator* and a dummy variable indicating whether a firm has received loans from banks in a given year. We find that the coefficients on the interaction term are significant and negative across all carbon emission measures, except the intensity of Scope 2. In Panel C, we re-conduct the estimation using *Sustainable IO*, and the results remain qualitatively unchanged. Overall, the results support our *H2*, suggesting that financial support from loans enables sustainable institutional investors to more effectively reduce externality.

4.8. Do sustainable institutional investors help acquire green and sustainability-linked loans?

In the final section of our empirical analysis, we extend the scope of our study to examine whether sustainable institutional investors facilitate firms' access to sustainability-related loans versus conventional loans. Following the identification by Kim et al. (2022), we construct a dummy variable indicating whether a loan is a green loan or a sustainability-linked loan. We then regress this variable on the proxy variables for sustainable institutional investors whilst controlling a vector of firm characteristics. Given that sustainability-linked loans first emerged in 2016 (Kim et al., 2022), we limit our sample to the period beginning from 2016. Table 11 presents the corresponding results.

Table 10
Results of analysing real impact – carbon emissions.

Variable	(1) *LnScope1*	(2) *LnScope2*	(3) *LnScope3*	(4) *IntScope1*	(5) *IntScope2*	(6) *IntScope3*
Panel A						
Sustainable Indicator	−0.058	−0.047***	−0.104	0.080	0.012	0.060
	(0.120)	(0.017)	(0.064)	(0.064)	(0.045)	(0.044)
Leverage	0.436***	0.030	0.122	0.498***	0.292***	0.288***
	(0.134)	(0.024)	(0.107)	(0.104)	(0.080)	(0.084)
TQ	−0.058***	−0.016***	−0.059***	−0.041***	−0.016*	0.002
	(0.013)	(0.002)	(0.009)	(0.012)	(0.008)	(0.008)
Size	0.061	0.013**	0.035	0.842***	0.912***	0.939***
	(0.042)	(0.006)	(0.024)	(0.025)	(0.018)	(0.016)
ROA	0.230	0.048	0.730***	2.069***	1.647***	2.069***
	(0.209)	(0.031)	(0.126)	(0.203)	(0.167)	(0.187)
IO	−0.088	−0.086*	−0.172	−0.366**	−0.552***	−0.530***
	(0.225)	(0.047)	(0.186)	(0.164)	(0.137)	(0.122)
ESG	0.261	0.126**	−0.167	−0.003	0.526***	0.428***
	(0.365)	(0.057)	(0.202)	(0.192)	(0.130)	(0.110)
Fixed effects	Year and industry	Year and industry	Year and industry	Year and industry	Year and industry	Year and industry
Adjusted R^2	0.467	0.395	0.563	0.763	0.818	0.855
Observations	14,099	14,099	14,099	14,099	14,099	14,099
Panel B						
Sustainable Indicator	−0.011	−0.045***	−0.064	0.115*	0.030	0.086*
	(0.121)	(0.017)	(0.054)	(0.065)	(0.047)	(0.046)
Sustainable Indicator × *Borrow*	−0.245*	−0.012	−0.144**	−0.184***	−0.095**	−0.138***
	(0.145)	(0.020)	(0.057)	(0.062)	(0.047)	(0.040)
Borrow	0.051	0.002	0.121***	0.218***	0.120***	0.140***
	(0.087)	(0.014)	(0.044)	(0.047)	(0.040)	(0.033)
Adjusted R^2	0.467	0.395	0.620	0.763	0.818	0.855
Observations	14,099	14,099	14,099	14,099	14,099	14,099
Panel C						
Sustainable IO	−0.368	−0.053	0.234	1.637***	1.200***	1.243***
	(0.657)	(0.091)	(0.334)	(0.350)	(0.262)	(0.251)
Sustainable IO × *Borrow*	−1.442*	−0.121	−1.126***	−1.604***	−1.013***	−1.113***
	(0.801)	(0.128)	(0.391)	(0.438)	(0.337)	(0.286)
Borrow	0.001	0.002	0.107***	0.212***	0.127***	0.131***
Adjusted R^2	0.467	0.394	0.620	0.764	0.819	0.856
Observations	14,099	14,099	14,099	14,099	14,099	14,099

Notes: Panel A reports the estimations on the impact of sustainable institutional investors on carbon emissions, and Panels B and C report the results for the moderating role of bank loans. The dependent variables are the absolute measure of emissions in columns 1 to 3, and the intensity measure in columns 4 to 6. *LnScope1*, *LnScope2*, and *LnScope3* are the natural logarithms of the absolute values of emissions for Scope 1, 2, and 3, respectively. *IntScope1*, *IntScope2*, and *IntScope3* are the emissions of Scope 1, 2, and 3 scaled by revenues. Borrow is a dummy variable that equals one if a firm has acquired loans in a given year. Panels B and C include all control variables, industry, and year fixed effects. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

Table 11
Results of examining green and sustainability-linked loans.

Variable	(1) *Green and sustainability-linked loans*	(2) *Green and sustainability-linked loans*	(3) *Green and sustainability-linked loans*	(4) *Green and sustainability-linked loans*
Sustainable Indicator	−0.055**	−0.004		
	(0.028)	(0.004)		
Sustainable IO			−0.106*	−0.187*
			(0.055)	(0.112)
Leverage	−0.009	−0.004	−0.010	0.003
	(0.013)	(0.007)	(0.013)	(0.010)
TQ	−0.002	0.001	−0.004*	−0.001
	(0.002)	(0.001)	(0.002)	(0.002)
Size	−0.005	0.001	−0.008	0.013
	(0.005)	(0.010)	(0.006)	(0.013)
ROA	−0.014	−0.011	−0.016	−0.008
	(0.025)	(0.015)	(0.026)	(0.018)
EV	0.012	0.006	0.009	0.003
	(0.009)	(0.006)	(0.009)	(0.008)
PPE	0.006	−0.046	0.010	−0.094
	(0.019)	(0.079)	(0.019)	(0.104)
IC	−0.000	0.000	−0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
IO	−0.011	0.026**	−0.035	0.091
	(0.019)	(0.013)	(0.031)	(0.058)
ESG	0.096*	0.003	0.092*	−0.000
	(0.052)	(0.007)	(0.051)	(0.008)
Fixed effects	Year and industry	Year and firm	Year and industry	Year and firm
Adjusted R^2	0.595	0.876	0.589	0.836
Observations	3768	3759	3768	3768

Notes: This table reports the results of the impact of sustainable institutional investors on the choice of green and sustainability-linked loans. The dependent variable is *Green and sustainability-linked loans*, which is a dummy variable that equals one if a loan belongs to sustainability-related loans. The sample starts from 2016. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. Detailed variable definitions are in Appendix A.

Columns 1 and 3 of Table 11 report that the coefficients on both proxy variables for sustainable institutional investors are significant and negative when estimated with year and industry fixed effects. In columns 2 and 4, we replace industry fixed effects with firm fixed effects. The coefficients remain negative, although they are insignificant when sustainable investors are measured using the *Sustainable Indicator*.

Overall, our findings suggest that being held by sustainable investors decreases the likelihood of acquired loans by firms being green or sustainability-linked loans. Kim et al. (2022) document that borrowers self-select into ESG loan contracts to signal their ESG commitments and are tightly monitored by lenders through green or sustainability-linked loans. They also show that these loans are not less expensive than non-ESG loans. Therefore, our results further support the *H1*, suggesting that sustainable institutional investors may enhance the credibility of portfolio firms' ESG commitments, allowing them to avoid the strictly monitored loan types that support their ESG development. For these firms, conventional loans could be more suitable for financing ESG improvements compared to sustainability-related loans.

5. Conclusion

This study explores the impacts of sustainable institutional investor holdings on portfolio firms' access to bank loans in the US. We hypothesise that socially conscious investors facilitate firms' access to the loan market. To meet sustainable institutional investors' expectations for their sustainability profile, firms require more loans to support their sustainability investments. We also argue that sustainable institutional ownership allows firms to achieve lower loan costs, as it signals the credibility of firms' ESG profiles and reduces shareholder–creditor conflicts.

Considering the PRI signatory as a commitment by financial institutions to responsible investment, we find that holdings by sustainable institutional shareholders is positively associated with loan amount. The results of the DID analysis, which uses signatory events, also confirm the positive causal effect. Using loan-level data, we observe that these firms have not only obtained more loans but also benefited from lower loan spreads.

Further mechanism analysis supports the "pay to be green", ESG credibility, and interest alignment explanations. Our results show that firms with significant sustainable institutional ownership tend to secure more loans if firms face higher costs of sustainable investments, which is consistent with the demand-side hypothesis of "it pays to be green". Consistent with the ESG credibility hypothesis, we observe that the benefits of lower loan costs, driven by sustainable institutional holdings, are most pronounced for firms with high ESG scores, loans involving responsible banks, and during periods around heightened awareness of climate issues. Aligning with the

interest alignment hypothesis, these effects are stronger amongst firms with a low proportion of dedicated institutional investors and are diminished in the presence of dual holders.

We deepen our study to explore the role of bank loans in influencing the real outcomes of firms' responsible activities. By estimating the carbon emissions of portfolio firms, we find that socially conscious investors have a meaningful impact on carbon emissions only for firms that have obtained loans from banks. Furthermore, they allow firms to avoid the types of loans that, whilst supporting their ESG development, suffer strict monitoring (i.e., green loans).

Overall, this study provides novel evidence of the importance of sustainable institutional investors in the loan market and highlights the critical role of both sustainable institutional investor engagement and financial resources in achieving sustainability goals.

CRediT authorship contribution statement

Suyang Li: Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Lu Qiao:** Writing – original draft, Validation, Supervision, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Boru Ren:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Zilong Wang:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Investigation, Formal analysis, Conceptualization.

Appendix A. Variable definitions

Sustainable Indicator: A dummy variable that equals one if a firm is held by an institutional investor who is a signatory of PRI, and zero otherwise (sources: Thomson Reuters Institutional Holdings (13F) and Principles for Responsible Investment).

Sustainable IO: The percentage of outstanding shares held by institutional investors who are signatories of the PRI (sources: Thomson Reuters Institutional Holdings (13F) and Principles for Responsible Investment).

Bank Debt: The natural logarithm of the sum of one plus total bank loans (source: Capital IQ).

Leverage: The total debt over total assets (source: Compustat).

Size: The natural logarithm of the book value of assets (source: Compustat).

TQ: The ratio of the market value of assets to the book value of assets (source: Compustat).

ROA: Earnings before interest and tax, scaled by total assets (source: Compustat).

PPE: Property, plant, and equipment to total assets (source: Compustat).

IC: The ratio of earnings before interest and tax to interest expenses (source: Compustat).

EV: The standard deviation of operating income before depreciation, calculated over a five-year rolling window (source: Compustat).

IO: The percentage of outstanding shares held by institutional investors (source: Thomson Reuters Institutional Holdings (13F)).

ESG: ESG scores provided in the Refinitiv ESG database (source: Refinitiv ESG).

Amount: The natural logarithm of the loan amount in each facility (source: DealScan).

AISD: The loan spread in each facility, calculated as the interest rate spread over LIBOR in basis points (source: DealScan).

Maturity: The maturity of a facility in months (source: DealScan).

Secured: A dummy variable that equals one if a facility is secured, and zero otherwise (source: DealScan).

Covenant: A dummy variable that equals one if a loan facility has any type of covenant attached, and zero otherwise (source: DealScan).

Concentration: The number of lead arrangers in the loan syndicate (source: DealScan).

NonBank: A dummy variable that equals one if at least one of the lead arrangers does not belong to commercial and investment banks, and zero otherwise (source: DealScan).

Relationship: A dummy variable that equals one if a borrower has received a loan from at least one of the lead banks in the past five years, and zero otherwise (source: DealScan).

Types: A vector of dummy variables for the three loan types, including credit lines, term loans, and other loan types (source: DealScan).

Purpose: A vector of dummy variables for the different loan purposes in the DealScan (source: DealScan).

Size_L: The natural logarithm of total assets for a lead arranger (source: Compustat).

ROA_L: The net income to total assets for a lead arranger (source: Compustat).

NII_L: The net interest income to operating revenues for a lead arranger (source: Compustat).

CR_L: The tier 1 capital to risk-weighted assets (source: Compustat).

Board Size: The logarithm of the number of board members in a company (source: BoardEx).

Gender Ratio: The proportion of female directors on a board (source: BoardEx).

Ind_director: The proportion of independent directors on a board (source: BoardEx).

CEO Gender: A dummy variable that equals one if a firm's CEO is female (source: BoardEx).

CEO Tenure: The number of years a CEO served on a board (source: BoardEx).

High TQ: A dummy variable that equals one if a borrower's Tobin's Q is above the median value in a given year (source: Authors' calculation).

High TC: A dummy variable that equals one if a borrower belongs to high-polluting industries (source: Authors' calculation).

High ESG: A dummy variable that equals one if a borrower's ESG scores are above the median value in a given year, and zero

otherwise (source: Refinitiv ESG and authors' calculation).

Responsible_L: A dummy variable that equals one if a lead arranger has signed the Principles for Responsible Banking, and zero otherwise (source: United Nations Environment Programme Finance Initiative).

PA: A dummy variable that equals one for years after 2015, and zero otherwise (source: Authors' calculation).

Low Dedicated IO: A dummy variable that equals one if a borrower has dedicated institutional ownership lower than the median value in a given year, and zero otherwise (sources: Bushee (2001) and authors' calculation).

Dual holding: A dummy variable that equals one if a borrower is held by a shareholder who is also a lender in a given year, and zero otherwise (source: DealScan and authors' calculation).

LnScope1: The natural logarithm of absolute values of emissions for Scope 1 (source: S&P Trucost).

LnScope2: The natural logarithm of absolute values of emissions for Scope 2 (source: S&P Trucost).

LnScope3: The natural logarithm of absolute values of emissions for upstream Scope 3 (source: S&P Trucost).

IntScope1: The emissions of Scope 1 scaled by total revenues (source: S&P Trucost).

IntScope2: The emissions of Scope 2 scaled by total revenues (source: S&P Trucost).

IntScope3: The emissions of upstream Scope 3 scaled by total revenues (source: S&P Trucost).

Borrow: A dummy variable that equals one if a firm acquires loans in a given year, and zero otherwise (source: DealScan).

Green and sustainability-linked loans: A dummy variable that equals one if a loan's market segment flag is identified as a green loan or sustainability-linked loan in DealScan (source: DealScan).

Appendix B. Results of estimations using alternative proxy or entropy balance and reverse causality tests

Variable	(1) Alternative proxy	(2) Alternative proxy	(3) Entropy balancing	(4) Entropy balancing	(5) Reverse causality (lag 2)	(6) Reverse causality (lag 2)	(7) Reverse causality (lag 2)	(8) Reverse causality (lag 2)
Sustainable Indicator	0.186**		0.149*					
	(0.078)		(0.080)					
Sustainable IO		0.937*		0.914				
		(0.569)		(0.564)				
Sustainable Indicator_lag2					0.074			
					(0.093)			
Sustainable IO_lag2						1.590**		
						(0.652)		
Sustainable Indicator_lag3							0.171*	
							(0.098)	
Sustainable IO_lag3								1.637**
								(0.812)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Year and firm	Year and firm	Year and firm	Year and firm	Year and firm	Year and firm	Year and firm	Year and firm
Adjusted R^2	0.594	0.594	0.638	0.641	0.616	0.615	0.626	0.625
Observations	13,153	13,153	13,153	13,153	10,859	10,859	8915	8915

Notes: This table presents the results of robustness tests for the baseline regression. In columns 1 and 2, the dependent variable is the industry-adjusted bank debt, which is calculated as the difference between *Bank Debt* and industry median in a given year. Columns 3 and 4 report the results using the entropy balancing technique. Columns 5 and 6 report the results with estimations using two-year lagged proxies for sustainable institutional investors, whilst columns 7 and 8 report the estimations using three-year lagged proxies. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10 %, 5 %, and 1 % level, respectively. Detailed variable definitions are in Appendix A.

Appendix C. Results of balance test

Variable	(1) Treated	(2) Control	(3) Difference-in-means	(4) P-value
Leverage	0.312	0.317	−0.006	0.728
TQ	2.141	2.245	−0.105	0.344
Size	8.595	8.404	0.190	0.144
ROA	0.132	0.116	0.016	0.111
PPE	0.260	0.262	−0.002	0.927
IC	0.173	0.256	−0.082	0.189
EV	0.032	0.034	−0.002	0.454
IO	0.282	0.262	0.020	0.073
ESG	0.426	0.421	0.006	0.680

Notes: This table reports the results of the balance test. Columns 1 and 2 report the mean value of each variable for treated and control

groups, respectively. Column 3 reports the difference in means for each variable between treated and control groups. Column 4 reports the P-value for the difference-in-mean. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10 %, 5 %, and 1 % level, respectively. Detailed variable definitions are in Appendix A.

Appendix D. Results of difference-in-differences analysis using quarterly data

Variable	(1) *Bank Debt*	(2) *Bank Debt*	(3) *Bank Debt*	(4) *Bank Debt*	(5) *Bank Debt*	(6) *Bank Debt*	(7) *Bank Debt*	(8) *Bank Debt*
Signatory	0.086*	0.120**	0.086**	0.120***				
	(0.046)	(0.052)	(0.039)	(0.040)				
Signatory (−2)					−0.006	−0.004	−0.006	−0.004
					(0.036)	(0.043)	(0.024)	(0.047)
Signatory (−1)					0.012	0.004	0.012	0.004
					(0.046)	(0.046)	(0.026)	(0.028)
Signatory (0)					0.079**	0.104**	0.079***	0.104**
					(0.034)	(0.045)	(0.025)	(0.050)
Signatory (+1)					0.096**	0.132**	0.096**	0.132**
					(0.044)	(0.055)	(0.044)	(0.065)
Fixed effects	Year-quarter and firm-cohort	Year-quarter, firm, and cohort	Year-quarter and firm-cohort	Year-quarter, firm, and cohort	Year-quarter and firm-cohort	Year-quarter, firm, and cohort	Year-quarter and firm-cohort	Year-quarter, firm, and cohort
Cluster	Firm	Firm	Firm-cohort	Firm-cohort	Firm	Firm	Firm-cohort	Firm-cohort
Adjusted R^2	0.857	0.792	0.857	0.792	0.857	0.792	0.857	0.792
N	92,277	92,277	92,277	92,277	92,277	92,277	92,277	92,277

Notes: This table reports the results of the difference-in-differences analysis using the quarterly data. The dependent variable is *Bank debt* in all the estimations. Signatory is the DID estimator that equals one if a treated firm has experienced a signatory event, and zero otherwise. *Signatory (−2)* is a dummy variable that equals one if a firm will experience the signatory of institutional shareholders two or more quarters later. *Signatory(−1)* equals one if a firm will experience the signatory of institutional shareholders one quarter later. *Signatory (0)* equals one if a firm is experiencing the signatory of institutional shareholders. *Signatory (+1)* equals one if a firm experienced the signatory of institutional shareholders one quarter before. *Signatory (+2)* equals one if a firm experienced the signatory of institutional shareholders two or more quarters before. Columns 1, 3, 5, and 7 include year-quarter and firm-cohort fixed effects, and columns 2, 4, 6, and 8 include year-quarter, firm and cohort fixed effects. Standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level in columns 1, 2, 5, and 6, and at firm-cohort level in columns 3, 4, 7, and 8. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10 %, 5 %, and 1 % level, respectively. Detailed variable definitions are in Appendix A.

Appendix E. Results of estimations with board and CEO characteristics

Variable	(1) *Bank Debt*	(2) *Amount*	(3) *AISD*	(4) *Bank Debt*	(5) *Amount*	(6) *AISD*
Sustainable Indicator	0.181**	0.186**	−0.129**			
	(0.083)	(0.088)	(0.065)			
Sustainable IO				1.057*	0.935*	−0.721
				(0.579)	(0.552)	(0.552)
Board Size	−0.063	0.030	−0.341**	−0.035	0.074	−0.354**
	(0.305)	(0.195)	(0.173)	(0.308)	(0.197)	(0.177)
Gender Ratio	0.182	−0.527	−0.248	0.152	−0.442	−0.162
	(0.437)	(0.352)	(0.246)	(0.438)	(0.351)	(0.244)
Ind_director	0.665	−0.157	0.472*	0.627	−0.209	0.477*
	(0.493)	(0.323)	(0.265)	(0.502)	(0.329)	(0.286)
CEO Gender	0.089	0.124	−0.049	0.059	0.159	−0.015
	(0.196)	(0.121)	(0.107)	(0.193)	(0.124)	(0.109)
CEO Tenure	−0.007	0.002	−0.005	−0.008	0.001	−0.008*
	(0.007)	(0.005)	(0.004)	(0.007)	(0.005)	(0.004)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Year and firm	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year and firm	Year, type, purpose, and borrower	Year, type, purpose, and borrower
Adjusted R^2	0.603	0.502	0.687	0.605	0.503	0.690
Observations	12,143	7869	6851	12,143	7869	6851

Notes: This table presents the results of robustness tests with control variables of board and CEO characteristics. The dependent

variables are *Bank Debt* in columns 1 and 4, *Amount* in columns 2 and 5, and *AISD* in columns 3 and 6. *Board Size* is the logarithm of the number of board members in a company. *Gender Ratio* is the proportion of female directors on a board. *Ind_director* is the proportion of independent directors on a board. *CEO Gender* is a dummy variable that equals one if a firm's CEO is female. *CEO Tenure* is the number of years a CEO served on a board. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10 %, 5 %, and 1 % level, respectively. Detailed variable definitions are in Appendix A.

Appendix F. Results of estimations with high dimensional fixed effects

Variable	(1) *Bank Debt*	(2) *Amount*	(3) *AISD*	(4) *Bank Debt*	(5) *Amount*	(6) *AISD*
Sustainable Indicator	0.164**	0.160*	−0.197***			
	(0.078)	(0.085)	(0.061)			
Sustainable IO				1.107**	0.711	−1.229**
				(0.564)	(0.555)	(0.499)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Year-industry and firm	Year-industry, type, purpose, and borrower	Year-industry, type, purpose, and borrower	Year-industry and firm	Year-industry, type, purpose, and borrower	Year-industry, type, purpose, and borrower
Adjusted R^2	0.617	0.493	0.690	0.617	0.495	0.692
Observations	13,153	8546	7463	13,153	8546	7463

Notes: This table presents the results of robustness tests with high-dimensional fixed effects. The dependent variables are *Bank Debt* in columns 1 and 4, *Amount* in columns 2 and 5, and *AISD* in columns 3 and 6. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10 %, 5 %, and 1 % level, respectively. Detailed variable definitions are in Appendix A.

Appendix G. Results of robustness tests excluding insurance companies

Variable	(1) *Bank Debt*	(2) *Amount*	(3) *AISD*	(4) *Bank Debt*	(5) *Amount*	(6) *AISD*
Sustainable Indicator	0.164**	0.112	−0.128**			
	(0.079)	(0.083)	(0.053)			
Sustainable IO				0.766*	0.930**	−0.778**
				(0.426)	(0.437)	(0.385)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Year-industry and firm	Year-industry, type, purpose, and borrower	Year-industry, type, purpose, and borrower	Year-industry and firm	Year-industry, type, purpose, and borrower	Year-industry, type, purpose, and borrower
Adjusted R^2	0.611	0.490	0.687	0.612	0.497	0.693
Observations	13,153	8546	7463	13,153	8546	7463

Notes: This table presents the results of robustness tests using proxies for sustainable institutional investors that exclude insurance companies. The dependent variables are *Bank Debt* in columns 1 and 4, *Amount* in columns 2 and 5, and *AISD* in columns 3 and 6. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10 %, 5 %, and 1 % level, respectively. Detailed variable definitions are in Appendix A.

Appendix H. Results of mechanism analysis using the other main proxy – ESG credibility and interest alignment

Variable	(1) *AISD*	(2) *AISD*	(3) *AISD*	(4) *AISD*	(5) *AISD*
Sustainable Indicator	0.006	−0.018	0.034	0.035	−0.137*
	(0.076)	(0.074)	(0.077)	(0.078)	(0.078)
Sustainable Indicator × *High ESG*	−0.231***				
	(0.073)				
High ESG	0.214***				
	(0.070)				
Sustainable Indicator × *Responsible_L*		−0.116*			
		(0.066)			
Responsible_L		0.093*			
		(0.052)			

(*continued on next page*)

(*continued*)

Variable	(1) *AISD*	(2) *AISD*	(3) *AISD*	(4) *AISD*	(5) *AISD*
Sustainable Indicator × *PA*			−0.552***		
			(0.188)		
Sustainable Indicator × *Low Dedicated IO*				−0.173**	
				(0.071)	
Low Dedicated IO				0.092*	
				(0.051)	
Sustainable Indicator × *Dual holding*					0.115*
					(0.063)
Dual holding					−0.015
					(0.046)
Control variables	Yes	Yes	Yes	Yes	Yes
Fixed effect	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type, purpose, and borrower	Year, type,purpose, and borrower
Adjusted R^2	0.686	0.681	0.670	0.688	0.685
Observations	7463	7463	7463	7463	7463

Notes: This table reports the results for the roles of ESG, responsible banks, Paris agreement, and dedicated institutional ownership in the relationship between sustainable institutional indicator and the cost of loans. The dependent variable is *AISD* in all the estimations. All standard errors in parentheses are adjusted for heteroscedasticity and clustered at the firm level. All continuous variables are winsorized at the 1st and 99th percentiles. *, **, and *** indicate significance at the 10 %, 5 %, and 1 % level, respectively. Detailed variable definitions are in Appendix A.

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