

Corporate ESG Performance, Greenwashing, and Bank Loan Contracting: Evidence from Taiwan

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Abstract

This study examines the role of corporate environmental, social, and governance (ESG) performance in shaping bank loan terms, using Taiwan-listed companies from 2020 to 2024. Our results show that improvements in corporate ESG performance are associated with more favorable loan terms, and that borrowers' financial performance and banks' own ESG preferences moderate this relationship. We further decompose ESG performance into disclosure willingness and quantifiable performance, showing that substantive ESG performance is the key determinant of lower loan spreads. Using the gap between disclosure willingness and quantified ESG performance, we also find that Taiwanese banks are able to detect inconsistencies between firms' disclosure practices and their actual ESG conduct. Banks respond to such inconsistencies by imposing tougher loan terms, including higher loan spreads, smaller loan amounts, shorter loan maturities, and more stringent collateral requirements.

JEL Classification G21, G32, M14, Q56

1 Introduction

Taiwan's Financial Supervisory Commission (FSC) has positioned financial institutions as a central lever of the country's sustainability transition since 2017. Through a three-phase Green Finance Action Plan, the FSC directs financial institutions to mobilize capital in support of corporate transition toward net-zero emissions and to accelerate national progress toward the 2050 net-zero target. Green Finance Action Plan 1.0 launched in 2017 encourages financial institutions to provide capital in support of green energy industries; Green Finance Action Plan 2.0 launched in 2020 extends this support to corporate investments generating substantive environmental and social benefits; and Green Finance Action Plan 3.0 launched in 2022 integrates financial resources to support net-zero transition by incorporating corporate ESG and climate data into financial institutions' risk-response capacity.¹ Given Taiwan's pivotal role in the global semiconductor supply chain, such policies can have profound implications on the global economy.

Green and sustainability-linked lending in Taiwan has expanded substantially under these policy initiatives. According to statistics from the Joint Credit Information Center (JCIC), outstanding green loans and sustainability-linked loans amounted to NT\$574.6 billion and NT\$186.0 billion, respectively, as of June 2022.² By June 2025, following the FSC's implementation of the Green Finance Action Plan 3.0, these amounts had increased to NT\$1.86 trillion and NT\$1.67 trillion, representing increases of approximately 224% and 798%, respectively. The particularly pronounced growth in sustainability-linked lending highlights the increasing role of ESG considerations in credit allocation. This trend suggests that financial institutions in Taiwan are progressively integrating ESG considerations into their lending and investment decisions and directing capital toward low-carbon industries and sustainable development projects.

This study examines the role of corporate environmental, social, and governance (ESG) performance in shaping bank loan terms, using a sample of Taiwan-listed companies. From a corporate perspective, sustainability activities can constitute value-enhancing investments when they reduce the cost of capital or mitigate potential legal liabilities, otherwise the associated abatement costs may become an unproductive use of corporate resources. From a policy perspective, examining the lending consequences of ESG performance reveals the extent to which financial institutions have aligned their credit decisions with sustainable finance policy objectives.

Existing evidence on this issue, however, comes predominantly from public capital markets. Fiorillo et al. (2025) document that bonds issued by firms with better ESG performance carry yields that are, on average, 10 basis points lower than those issued by other firms in the global corporate bond market. Similarly, Lian et al. (2023) find a negative relationship between ESG performance and corporate bond credit spreads. Comparatively less attention has been paid to bank lending and, in particular, to the broader structure of loan contracts encompassing both pricing and non-pricing terms. Moreover, decomposing ESG performance into disclosure and quantifiable substantive performance provides further insight into how banks assess the credibility and economic relevance of borrowers' ESG activities.

This paper addresses the above issues by examining four questions: (1) how corporate ESG performance affects the pricing and non-pricing terms of bank loans; (2) how borrower characteristics and banks' ESG preferences moderate these effects; (3) whether ESG disclosure willingness and quantifiable substantive performance play distinct roles in loan contracting; and (4) whether banks detect and respond to inconsistencies between firms' ESG disclosures and their actual ESG conduct through loan terms. Our empirical setting draws on loan data for Taiwan-listed companies from 2020 to 2024, a period that coincides with a critical stage in the implementation of Taiwan's green finance policies and therefore provides a timely setting in which to observe how the lending market responds to these initiatives. We employ the TESG ratings compiled by the Taiwan Economic Journal (TEJ), which provide ESG assessments for all Taiwan-listed companies. The final sample covers ESG evaluations for 1,922 listed firms and detailed loan contract information, yielding 26,139 loan-level observations.

The empirical analysis yields four principal findings. First, stronger ESG performance is associated with more favorable loan terms after controlling for firm characteristics, macroeconomic conditions, and bank and industry fixed effects. ESG appears to serve as a risk-mitigation mechanism, thereby reducing the risk premium demanded by banks (Cheng et al., 2025). However, when lending to borrowers with low profitability but strong ESG performance, banks adopt a coherent yet selective contracting strategy. They lower loan spreads in response to the positive ESG signal while shortening loan maturities to preserve flexibility for dynamic monitoring and periodic reassessment (Qian et al., 2023; Goss and Roberts, 2011). Across the three ESG pillars, governance performance receives the most consistently favorable response from banks, whereas environmental and social performance elicit more heterogeneous lending responses.

Second, banks' own ESG preferences moderate the relationship between corporate ESG performance and loan spreads, with the strength of this moderating effect varying according to the alignment between a bank's preferred ESG pillar and a firm's pillar-specific performance (Hao and Wu, 2024). Governance-oriented banks exhibit the strongest willingness to reward firms with superior ESG performance, suggesting that these banks possess a greater capacity or willingness to incorporate ESG-related risks into loan pricing. In contrast, banks oriented toward other ESG pillars are less likely to reward strong performance in dimensions outside their primary areas of expertise. The effect of corporate ESG performance on loan spreads is therefore bank-specific, implying that banks' own ESG assessment capabilities play an important role in determining corporate financing terms (Alves and Meneses, 2024).

Third, after decomposing the TESG score into substantive ESG performance and ESG disclosure, we find that only substantive performance is reflected in loan spreads, while its effects on non-pricing loan terms are generally stronger than those of disclosure. These findings suggest that disclosure quality alone is not a panacea for improving loan terms. Its benefits depend on the extent to which disclosure is aligned with a firm's substantive ESG actions. This distinction motivates our examination of the gap between disclosure and substantive performance as a measure of greenwashing (Yu et al., 2020). Using this measure, we show that banks tighten loan terms when ESG disclosure outpaces substantive action.

Fourth, we exploit the FSC's expansion of mandatory ESG disclosure requirements to examine how ESG regulation affects firms' incentives to engage in greenwashing. The results show that firms tend to improve their disclosure performance first, as disclosure can be adjusted more rapidly than substantive ESG actions. Although strengthened disclosure requirements may enhance market transparency, they may also widen the gap between disclosure and substantive performance in the short run. These findings highlight a potentially unintended consequence of mandatory ESG disclosure regulation. Finally, we include time fixed effects and replace TESG scores with Sustainability Accounting Standards Board industry-based rankings to assess the sensitivity of our empirical results. These robustness tests confirm that our main findings are not driven by a particular empirical specification or ESG measurement approach.

This paper contributes to the literature on ESG and corporate financing in two ways. First, we extend the literature by showing that the effects of ESG performance on loan terms depend on firm characteristics, banks' ESG preferences, and firms' carbon-emission intensity. Recent evidence from China's A-share market shows that firms with higher ESG scores obtain larger loan amounts, face fewer collateral requirements, and pay lower loan spreads (Qian et al., 2023). We further show that banks oriented toward particular ESG pillars are less likely to reward strong corporate ESG performance in dimensions outside their primary areas of expertise. Because banks generally face less information asymmetry than investors in public debt markets, our findings complement the corporate bond literature by highlighting the role of creditor-specific ESG preferences in shaping the assessment and pricing of firms' ESG performance (Fiorillo et al., 2025; Lian et al., 2023).

Second, we employ a firm-level measure of the ESG disclosure–substance gap, the greenwashing score, to examine whether banks can identify and price inconsistencies between firms’ ESG disclosure and their substantive actions. ESG disclosure is generally viewed as providing a signaling benefit by reducing information asymmetry and enhancing corporate reputation, whereas substantive ESG performance serves a risk-mitigation function that can indirectly improve financial performance through channels such as stronger managerial incentives and more efficient resource allocation (Wang et al., 2025). We extend this literature by showing that banks consider not only the level of ESG disclosure or substantive performance individually, but also the consistency between the two. Our findings therefore identify the disclosure–substance gap itself as an important ESG factor in banks’ lending decisions.

Third, our findings offer important policy implications for the development of green finance. The fact that banks incorporate ESG indicators into their credit assessments suggests that Taiwan’s Green Finance Action Plan has been effective in encouraging financial institutions to integrate sustainability considerations into lending decisions. However, we also find that, in response to mandatory disclosure requirements, firms tend to improve their ESG disclosure more rapidly than their substantive ESG actions. As attention to ESG continues to increase, detecting and constraining potential greenwashing therefore becomes increasingly important. Our results underscore the value of integrating ESG information into standardized reporting frameworks and expanding third-party assurance to enhance the credibility and comparability of sustainability information. More broadly, consistent with the global development of sustainable finance, this study extends empirical evidence from the Asia-Pacific region and provides a useful basis for future cross-country comparisons.

The remainder of this paper proceeds as follows. Section 2 reviews the relevant literature, develops the theoretical framework, and presents the study’s hypotheses. Section 3 describes the research design, data sources, variable construction, and empirical models. Section 4 presents the empirical results, including the effects of ESG performance on loan pricing and non-pricing terms, as well as a series of additional analyses and robustness tests. Section 5 concludes the paper.

2 Literature review and hypothesis development

This section develops the theoretical foundation for the hypotheses. Section 2.1 draws on four theoretical perspectives (signaling theory, stakeholder theory, agency theory, and resource dependence theory) to explain the mechanisms through which ESG affects debt financing. Section 2.2 reviews the empirical literature on ESG, the cost of debt, and financing constraints, and studies how firm characteristics, the institutional environment, and the economic cycle shape the heterogeneity of ESG effects. Section 2.3 develops four research hypotheses on this basis.

2.1 ESG performance and debt financing

2.1.1 Signaling theory

Information asymmetry between firms and creditors is a defining feature of capital markets (Akerlof, 1970). Signaling theory (Spence, 1973) indicates that the informationally advantaged party can convey its creditworthiness and operating capability to the informationally disadvantaged party by sending costly, difficult-to-imitate signals. ESG practices fit this logic well: in debt financing, they can be viewed as a credible signal through which firms convey sound operating quality and robust debt-servicing capacity to creditors (Yu and Su, 2024).

Better ESG performance and disclosure serve this signaling function in two distinct ways. On the one hand, substantive ESG investment requires firms to commit substantial resources that only financially unconstrained firms can sustain, forming a costly-signaling screening mechanism (Cheng et al., 2025). On the other hand, transparent ESG disclosure lowers the information-search cost creditors incur in assessing firm risk, reducing the risk premium arising from information asymmetry (Qian et al., 2023). Together, these mechanisms predict that firms with superior ESG performance can obtain lower debt-financing costs and more favorable loan terms.

2.1.2 Stakeholder theory

Corporate value creation, in the view of stakeholder theory (Freeman, 1984), does not derive solely from shareholder wealth maximization but from a firm's capacity to build mutually beneficial relationships with a diverse set of stakeholders. Applied to debt financing, this perspective offers a distinct explanation for how ESG performance reduces firm risk through relationship-building.

Superior ESG performance reflects a firm's ability to manage relationships with stakeholders such as employees, customers, suppliers, communities, and government, building relational capital that can produce an insurance effect during periods of operational difficulty (Ding et al., 2024; Lian et al., 2023). Sound environmental management reduces the risk of environmental litigation and regulatory penalties; proactive social responsibility practices strengthen employee loyalty, customer stickiness, and social support; and robust corporate governance limits managerial opportunism and decision-making errors (He et al., 2023). Each of these risk-mitigation channels implies a lower probability of default from the creditor's perspective, making creditors more willing to offer favorable financing terms.

2.1.3 Agency theory

Another mechanism follows from agency theory, which addresses the conflicts of interest between shareholders and managers, and between shareholders and creditors, and their implications for firm value (Jensen and Meckling, 1976). In the shareholder-creditor relationship specifically, shareholders may harm creditors' interests through risk-shifting, asset substitution, or overinvestment (Myers, 1977).

The governance dimension of ESG (particularly board independence, information transparency, and internal control mechanisms) directly addresses this agency problem (Lian et al., 2023). A transparent governance structure raises both the observability of managerial opportunism and the cost of engaging in it, constraining self-interested behavior. Social responsibility can further serve as an informal governance mechanism that reduces managerial moral hazard (Yu and Su, 2024). For creditors, the

resulting reduction in agency costs lowers the probability that their claims will be impaired, making them more willing to accept a lower risk premium.

2.1.4 Resource dependence theory

Resource dependence theory holds that firm performance depends on a firm's ability to secure critical external resources (Pfeffer and Salancik, 1978). From this angle, ESG performance functions as a strategic tool through which firms build positive relationships with external resource providers.

Firms with high ESG ratings find it easier to secure government policy support, attract talented employees, establish stable supply-chain partnerships, and gain favor with institutional investors, which strengthen operational resilience and financial stability (Hao and Wu, 2024). This effect is observable in bank lending, because firms with superior ESG performance in emerging markets obtain significantly better outcomes in loan size, collateral probability, and interest rate terms (Qian et al., 2023). Similarly, corporate bond markets show that firms with better ESG exhibit significantly lower credit spreads, reflecting that capital markets have already priced in the resource stability ESG generates (Lian et al., 2023).

These four theoretical perspectives illuminate different facets of underlying channels. Signaling theory addresses the information mechanism; stakeholder theory and resource dependence theory address the relational mechanism; and agency theory addresses the governance mechanism. Jointly, they explain why firms with better ESG appear less risky to creditors and thereby gain an advantage in both the cost (e.g., interest rate) and capacity (e.g., loan amount) dimensions of debt financing. However, the weight of each mechanism may vary with firm characteristics, industry context, and institutional background, an issue taken up in the review below.

2.2 ESG performance and the cost of corporate financing

In addition to bank loan, ESG performance affects the cost of other financing tools. Fiorillo et al. (2025) find that bonds issued by firms with better ESG carry yields averaging 10 basis points lower than those of other firms in the global corporate bond market. Alves and Meneses (2024) and Kong (2023) confirm that ESG performance reduces financing costs in the United States, Europe, China, and Brazil. This benefit, however, is not universal. Goss and Roberts (2011), examining U.S. bank loans, find that firms with greater CSR face higher loan spreads, as U.S. banks facing borrowers of weaker financial quality tend to interpret CSR investment as a waste of resources rather than a risk-reducing signal. The financing benefit of ESG performance therefore appears conditional on firm financial quality rather than a uniform effect across all firms.

Beyond financing cost, ESG performance also shapes financing capacity. Hao and Wu (2024) and He et al. (2023) find that better ESG performance eases financing constraints. This benefit is more pronounced for privately owned firms than for state-owned enterprises across the Chinese market (Hao and Wu, 2024; Lian et al., 2023; Qian et al., 2023; Wang et al., 2025), consistent with the view that ESG serves privately owned firms as a mechanism for overcoming informational disadvantages that state-owned

firms already offset through implicit government credit backing. Kong (2023), focusing specifically on Chinese family businesses, extends this finding by showing that the debt-cost benefit of ESG persists across different life-cycle stages, from founding through succession.

The external institutional and market environment further moderates the strength of these effects. The ESG financing premium documented by Fiorillo et al. (2025) is more pronounced in countries with more developed financial markets and stronger bankruptcy-protection laws. Lian et al. (2023) and Cheng et al. (2025) similarly find that ESG's value signal is more effectively identified in regions with a higher degree of marketization. Alves and Meneses (2024) attribute a stronger debt-cost effect in bank-based financial systems to banks' capacity. Consistent with this insurance mechanism, the financing advantage of ESG performance becomes more salient during economic downturns (Lian et al., 2023; Cheng et al., 2025). Heightened post-pandemic attention to corporate sustainability and resilience also strengthens ESG's influence on financing terms (Qian et al., 2023).

The financing advantage associated with ESG performance rests, however, on an important precondition: disclosed ESG information must genuinely reflect substantive performance. When firms exaggerate or selectively disclose environmental information to embellish their image (i.e., engage in greenwashing) the benefits described above may be eroded or reversed. Yu, Van Luu, and Chen (2020), taking a cross-country test, find that greenwashing is more prevalent among firms with weaker corporate governance. Lee and Raschke (2023) interpret this behavior through the lens of stakeholder legitimacy, arguing that greenwashing represents a strategic choice to maintain legitimacy through symbolic action under social-accountability pressure, action that generates no substantive financial gain and may instead erode long-term reputation. Greenwashing, in this sense, reflects deeper institutional design deficiencies rather than mere marketing manipulation.

No unified standard yet exists for measuring greenwashing, though the field has converged on capturing the gap between a firm's ESG disclosure and its actual performance as the most promising approach. Bernini et al. (2024), in a systematic review of 127 empirical greenwashing studies, note that most existing measures rely on subjective survey-based scoring and lack objectivity, which identify greenwashing through the gap between disclosure and performance scores. For example, Yu et al. (2020) standardize and subtract Asset4 ESG performance scores from Bloomberg ESG disclosure scores to compute this gap.

Two aspects support the disclosure-substance gap as a legitimate and objective measure of greenwashing. Regarding the academic aspect, Walker and Wan (2012) define greenwashing as symbolic information originating within the organization without substantive action, whereas Lyon and Maxwell (2011) focus on firms' selective disclosure of positive environmental information alongside incomplete disclosure of negative information. In terms of the regulatory aspect, the European Supervisory Authorities define greenwashing as a practice in which sustainability-related statements, declarations, actions, or communications fail to clearly and fairly reflect the underlying sustainability profile of an entity, product, or service. In Taiwan, the FSC's Guidelines for Preventing Greenwashing by

Financial Institutions, issued in May 2024, define greenwashing as providing unclear or overstated information, selectively disclosing positive impacts, or making sustainability claims lacking supporting evidence (Tseng and Kuo, 2025).

What remains open, and practically consequential, is whether Taiwanese banks possess the capacity to detect this gap in credit decisions and adjust loan terms in response. If they do, then simply raising a firm's disclosure score would not confer a financing advantage and could instead trigger a higher risk premium, an outcome that would constitute an effective market disciplining mechanism.

2.3 Research hypotheses

Building on the above literature, ESG performance can affect bank loan terms through several channels. According to signaling theory, stronger ESG performance can serve as a credible signal of sound operating quality, effective management, and stronger debt capacity to creditors (Yu and Su, 2024). From a stakeholder-theory perspective, superior ESG performance also reflects a firm's ability to manage relationships with key stakeholders, thereby reducing operational and financial risks (Ding et al., 2024; Lian et al., 2023). Resource dependence theory further suggests that firms with higher ESG ratings may be better positioned to obtain government policy support, attract talented employees, establish stable supply-chain relationships, and gain support from institutional investors. Access to these critical resources can enhance firms' operational resilience and financial stability (Hao and Wu, 2024). Building on these arguments regarding ESG performance as an informative non-financial indicator of firm quality and risk, we propose the following hypothesis:

H1: Firms with better ESG performance obtain more favorable loan terms.

Banks assessing credit risk typically integrate both financial and non-financial information, but the marginal value of ESG as a non-financial signal is unlikely to be constant. When financial performance is already strong, comprehensive financial indicators largely suffice for a credit assessment, leaving little additional signaling value for ESG information. When financial performance is weak, by contrast, financial indicators convey comparatively little credit information, and ESG performance can serve as a more powerful positive signal that supplements this shortfall and reduces the risk premium banks would otherwise demand under uncertainty (Qian et al., 2023; Cheng et al., 2025). Therefore, ESG performance may confer a credit-enhancement effect where financial performance is weakest. This reasoning motivates:

H2: ESG performance moderates the relationship between corporate financial performance and loan terms.

A parallel asymmetry may arise on the supply side, since banks themselves hold ESG-related preferences that differ systematically in organizational structure and risk profile. Alves and Meneses (2024) show that banks acting as ESG promoters tend to build long-term partnerships with value-aligned firms, and a bank that has cultivated a sustainability-oriented image has a corresponding need to select and reward borrowers with better ESG performance to maintain that consistency. If banks accordingly

compete most aggressively for clients in the sustainability domains where they hold a comparative advantage, this implies:

H3: A bank's performance along a specific ESG dimension influences the relationship between corporate ESG performance and loan terms.

Although ESG performance provides non-financial information that complements financial performance, the credibility of ESG signals ultimately depends on whether firms' disclosures are substantiated by corresponding actions. Because an effective credit signal must be difficult to fabricate, a firm's substantive ESG actions convey a more persuasive risk-mitigation signal than disclosure alone, directly reflecting financing capacity (He et al., 2023; Hao and Wu, 2024). Disclosure unaccompanied by substantive improvement carries comparatively limited credibility. When disclosure significantly exceeds substantive action, this inconsistency exacerbates information asymmetry between bank and firm; and if banks can detect this gap, a high ESG disclosure–substance gap would not merely fail to improve financing terms but instead trigger more stringent loan restrictions (Qian et al., 2023). This leads to our final hypothesis:

H4: Firms with a larger ESG disclosure–substance gap face inferior loan terms.

3 Data and methodology

This chapter details the sample construction, variable measurement, and empirical models used to test our four hypotheses. Section 3.1 describes the data sources and sample selection; Section 3.2 defines the dependent, explanatory, and control variables; and Section 3.3 sets out regression models corresponding to Hypotheses 1 through 4.

3.1 Data sources

The sample combines TESG ratings compiled by the Taiwan Economic Journal (TEJ) with a corporate bank loan database, covering Taiwan-listed companies over the period 2020–2024. We excluded financial firms because that industry may be subject to other capital requirements. We also winsorized all accounting variables at the 1st and 99th percentiles to control for potential outliers. The resulting sample comprises ESG evaluation data for 1,922 listed companies and detailed loan contract data covering 1,086 firm-bank lending relationships, yielding 26,139 observations in total.

3.2 Variable definitions and measurement

3.2.1 Bank loan terms

Four variables jointly capture the price and non-price dimensions of bank credit decisions: loan spread, loan maturity, loan amount, and collateral requirement (Goss and Roberts, 2011). Loan spread (*Spread*) is the difference between a firm's loan interest rate and the benchmark rate for the corresponding year, with a lower spread indicating more favorable terms. Loan maturity (*Maturity*) captures a bank's

willingness to extend credit, with a longer maturity signaling greater confidence in the firm's credit risk. Loan amount (*Loanamt*) is the amount a firm draws down in a given year (as distinct from a credit limit), with a larger amount indicating greater bank support. Collateral requirement (*Secu*) is a dummy variable equal to 1 if the loan is secured and 0 otherwise, with a lower incidence reflecting greater bank confidence in the firm's credit quality.

3.2.2 TESG score

Two reasons motivate the choice of the TESG index as the primary ESG measure. First, TESG is designed specifically for Taiwanese firms and covers all listed, over-the-counter, emerging-market, and public disclosure companies in Taiwan, whereas international providers such as MSCI and Refinitiv rate only a subset, making TESG the more comparable measure of ESG engagement among Taiwanese firms. Second, TESG draws on the Sustainability Accounting Standards Board (SASB) materiality classifications by issue and industry, thereby balancing international compatibility with local applicability.

The index spans three pillars (environmental, social, and governance) across 16 categories, each scored from 0 to 100. Each category score combines a substantive score (weighted 75%, based on quantifiable performance variables) with a Global Reporting Initiative disclosure-level score (weighted 25%); industry-specific weights drawn from the SASB materiality map are then applied to produce an overall TESG score, also ranging from 0 to 100. This study uses the TESG score (*ESG*) together with the Environmental (*ENV*), Social (*SOC*), and Governance (*GOV*) pillar scores as the primary explanatory variables, all transformed using the natural logarithm to facilitate coefficient interpretation given the difference in scale between ESG and loan-term variables.³

3.2.3 Financial performance and bank ESG performance

Financial performance and ESG performance are expected to interact in credit assessment, since weaker financial condition typically signals higher default risk and may raise the marginal value of the non-financial information ESG conveys. This study measures financial performance using return on equity (*ROE*), with firms in the bottom 25% of *ROE* in a given year classified as low-profitability (*Low_ROE* = 1) and all others as *Low_ROE* = 0. This threshold identifies firms facing a significant financial disadvantage for the moderation test in Section 3.3.

Bank-side ESG performance is measured analogously, motivated by evidence that bank characteristics such as client-portfolio ESG scores, foreign ownership, and Equator Principles adoption shape credit terms. Banks with better ESG performance are expected, under a responsible-lending philosophy, to more readily incorporate borrowers' ESG performance into credit assessment. Banks are therefore ranked each year by their TESG score and by their environmental, social, and governance pillar scores, assigning a value of 1 to banks in the top 25% (and 0 otherwise) to capture this moderating effect over time.

3.2.4 Firm-level ESG disclosure-substance gap

A firm's ESG disclosure may outpace its substantive performance regardless of intent (whether through deliberate embellishment or disclosure that simply fails to track substantive action), and either scenario constitutes, from a bank's perspective, a detectable form of information inconsistency. This study terms this inconsistency the ESG disclosure-substance gap and constructs it by following the scoring framework of the TESG score. We follow Yu et al. (2020) and measure the ESG disclosure–substance gap (ESG_gw) as the industry-adjusted difference between the ESG standardized disclosure score and the ESG standardized substantive score.⁴ A larger value of ESG_gw indicates that a firm places greater emphasis on ESG disclosure relative to substantive action. The corresponding environmental (ENV_gw), social (SOC_gw), and governance (GOV_gw) scores are constructed in the same manner, allowing the analysis to test for differential effects across ESG pillars.

3.2.5 Control variables

Firm-level controls include the natural logarithm of total assets for firm size ($Size$); return on equity (ROE) and return on assets (ROA) for profitability and operating efficiency; the leverage ratio ($Leverage$) for indebtedness; total asset turnover ($Turnover$) for operating efficiency; the interest coverage ratio (ICR , EBIT divided by interest expense) for interest-servicing capacity; and the degree of financial leverage ($Fleverage$) and operating leverage ($Oleverage$) for financial structure and risk.

Loan-level controls address the interdependence among the four dependent variables. For example, a larger loan amount or longer maturity may allow a borrower to negotiate a lower spread, while collateral requirements are expected to correlate positively with spreads as a reflection of banks' demand for risk protection. Because loan spread, maturity, amount, and collateral requirements are jointly determined, we control for the other three loan terms when examining each loan term in our specifications.

Macroeconomic controls comprise the GDP growth rate ($GDPgr$), reflecting overall economic conditions under which default risk and bank credit willingness co-move, and the M2 money-supply growth rate ($M2gr$), reflecting market liquidity conditions that can place downward pressure on lending rates. Variable definitions and calculation methods appear in the Appendix A.

3.3 Empirical models

Following the empirical design of Leary (2009), we first focus on the firm-level TESG score to assess hypothesis 1 that better ESG performance leads to more favorable loan terms. We deploy the following ordinary least squares (OLS) regression model in this research to estimate the H1.

$$Y_{i,t}^k = \alpha_0 + \alpha_1 TESG_{i,t-1} + \alpha' X_{i,t-1} + \epsilon_{i,t}^k,$$

1

where $Y_{i,t}^k$ denotes alternatively measure k for loan terms such as loan spread ($Spread$), loan maturity ($Maturity$), loan amount ($Loanamt$), or collateral requirement ($Secu$) in year t . $TESG$ is TESG score, which covers three pillars (environmental, social, and governance). As our hypothesis that a firm having a

better ESG performance tends to have lower loan spread, longer maturity, larger loan amount, and less collateral requirement, we expect a positive coefficient β_1 when *Maturity* and *Loanamt* are used as dependent variable and a negative coefficient β_1 when *Spread* and *Secu* are used as dependent variable. $X_{i,t-1}$ is a vector of control variables, including firm characteristics, loan terms, and macroeconomic characteristics. Moreover, we include bank and industry fixed effects to absorb bank- and industry-specific differences in lending.

We next extend this baseline to examine hypothesis 2 by testing whether the ESG-loan-term relationship differs for financially weaker firms, using models as follows.

$$Y_{i,t}^k = \beta_0 + \beta_1 T ESG_{i,t-1} \times Low_ROE_{i,t-1} + \beta_2 T ESG_{i,t-1} + \beta_3 Low_ROE_{i,t-1} + \beta' X_{i,t-1} + \epsilon_{i,t}^k,$$

2

where *Low_ROE* identifies firms with worse financial performance firms. The interaction between *TESG* and *Low_ROE* tests the moderating effect, with controls and fixed effects unchanged from model (1). Because ESG performance tends to enhance loan terms especially for firms with worse financial performance, we expect a positive coefficient β_3 when *maturity* and *Loanamt* are used as dependent variable and a negative coefficient β_3 when *spread* and *Secu* are used as dependent variable.

Hypothesis 3

turns to the supply side, motivated by evidence that green banks price loans differently for green borrowers (Degryse et al., 2023). Building on model (2), we construct bank-level ESG dummy variables including *High_ESG*, *High_ENV*, *High_SOC*, and *High_GOV*, each equal to 1 for banks in the top 25% of the corresponding *t-1* ESG score. We further interact these variables with corporate ESG scores to test whether banks reward borrowers that perform well along the bank's own preferred pillar. We focus on only loan spread to save space and expect a negative coefficient of interaction term if hypothesis 3 holds, which predict that a bank's own strength in a given ESG pillar reinforces the ESG effect on that same pillar.

Finally, hypothesis 4 disentangles the substantive and disclosure components of the *TESG* score to identify which one drives banks' credit decisions. The ESG score and its environmental, social, and governance pillar scores are decomposed into an ESG substantive score and an ESG disclosure score and re-estimated using the baseline specification in model (1). Building on these estimates, the industry-adjusted difference between the ESG standardized disclosure score and the ESG standardized substantive score (greenwashing score) is then tested against all four loan terms, using the same empirical setting as the baseline model to ensure comparability of results.

4 Empirical Results

4.1 Descriptive Statistics

Table 1 reports descriptive statistics for all variables over the 2020–2024 sample period, comprising 26,139 observations. Sample firms exhibit relatively stable ESG performance, with a mean ESG score of 54.0. Decomposing the ESG score into its two components provides further insights. The mean ESG disclosure score (62.3) is substantially higher than the mean ESG substantive score (51.2), suggesting that firms generally perform better in ESG disclosure than in substantive ESG outcomes. This disclosure-substance gap is also reflected in the mean greenwashing score of 11.1.

Table 1
Descriptive statistics

	Mean	Q1	Median	Q3	Std.
Panel A: Corporate ESG scores					
<i>ESG</i>	53.979	47.840	54.530	61.820	12.133
<i>ESG_d</i>	62.299	58.570	59.820	69.620	11.020
<i>ESG_s</i>	51.203	43.980	51.960	59.750	13.214
<i>ESG_gw</i>	11.060	4.780	11.090	16.920	8.636
Panel B: Bank loan terms					
<i>Spread</i>	0.784	0.250	0.495	0.980	0.874
<i>Maturity</i>	2.378	0.420	1.000	3.500	2.837
<i>Loanamt</i>	11.291	10.309	11.406	12.422	1.662
<i>Secu</i>	0.403	0.000	0.000	1.000	0.491
Panel C: Borrower firm characteristics					
<i>Size</i>	16.041	14.962	15.838	16.890	1.498
<i>Leverage</i>	52.757	42.240	52.360	63.740	15.592
<i>Turnover</i>	0.666	0.350	0.590	0.880	0.455
<i>ICR</i>	22.143	1.990	8.590	20.870	52.962
<i>Fleverage</i>	1.021	0.910	1.050	1.160	1.036
<i>Oleverage</i>	3.303	1.000	1.770	3.550	10.858
<i>ROE</i>	7.187	1.190	7.260	14.390	13.660
<i>ROA</i>	3.521	0.490	3.060	6.540	6.132
<i>Salesgr</i>	12.000	-11.820	3.690	19.710	58.186
<i>Current</i>	179.316	125.410	156.010	205.570	93.538
<i>Quick</i>	105.035	58.240	89.735	131.780	73.821
<i>FCF</i>	12.820	11.675	12.769	13.930	1.846
Panel D: Macroeconomic indicators					
<i>GDPgr</i>	7.369	7.060	8.020	8.450	1.162
<i>M2gr</i>	3.669	2.680	3.420	6.720	2.030

	Mean	Q1	Median	Q3	Std.
Panel A: Corporate ESG scores					
Observations	26,139				

The dependent variables likewise exhibit substantial variation across the sample. The mean loan spread is 0.8 percentage points, with a standard deviation of 0.87, while the mean loan maturity is 2.4 years, with a standard deviation of 2.8 years. These statistics indicate considerable variation in loan terms among Taiwanese firms.

[Insert Table 1 here]

4.2 Corporate ESG performance and loan terms

Table 2 reports the results regarding hypothesis 1, showing that banks price ESG performance into loan spreads, but the mechanism operates differently across pillars. The T ESG score is significantly negatively associated with spread. A 1% increase in the T ESG score is associated with an approximately 0.14% decrease in loan spread, a finding that extends the information-asymmetry channel documented by Qian et al. (2023) to the Taiwanese bank lending context. The pillar-level results, however, diverge sharply. The social pillar contributes most to reducing loan spreads, while the environmental pillar’s effect fails to reach statistical significance, indicating that banks apply markedly different risk interpretations across ESG pillars instead of treating them as interchangeable. The overall pattern is broadly consistent with global evidence that firms with better ESG performance obtain a lower cost of debt (Fiorillo et al., 2025).

Table 2

Effect of corporate ESG performance on loan spread This table presents ordinary least squares estimates of Eq. (1). The dependent variable is loan spread (*Spread*). The explanatory variable of interest is the TESG score (*ESG*) and its environmental (*ENV*), social (*SOC*), and governance (*GOV*) pillar scores. All regressions include the firm-level and macroeconomic control variables described in Section 3.2.5, together with bank and industry fixed effects. Standard errors are clustered by bank, and *t*-statistics are reported in parentheses below each coefficient estimate. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Dependent variable	(1)	(2)	(3)	(4)
	<i>spread</i>	<i>spread</i>	<i>spread</i>	<i>spread</i>
<i>ESG</i>	-0.141*** (- 3.70)			
<i>ENV</i>		-0.020 (- 0.80)		
<i>SOC</i>			-0.209*** (- 7.74)	
<i>GOV</i>				0.054** (2.01)
<i>Loanamt</i>	-0.086*** (- 21.30)	-0.086*** (- 21.45)	-0.087*** (- 21.58)	-0.087*** (- 21.60)
<i>Maturity</i>	0.008*** (4.10)	0.008*** (3.88)	0.009*** (4.34)	0.007*** (3.78)
<i>Secu</i>	0.097*** (8.06)	0.101*** (8.39)	0.097*** (8.13)	0.104*** (8.63)
<i>Size</i>	0.049*** (9.28)	0.043*** (8.09)	0.060*** (11.08)	0.041*** (8.33)
<i>Leverage</i>	0.005*** (10.59)	0.005*** (10.92)	0.005*** (10.25)	0.005*** (11.08)
<i>Turnover</i>	0.292*** (21.29)	0.287*** (20.81)	0.296*** (21.69)	0.283*** (20.78)

Dependent variable	(1)	(2)	(3)	(4)
	<i>spread</i>	<i>spread</i>	<i>spread</i>	<i>spread</i>
<i>ICR</i>	-0.000 ^{***} (- 4.14)	-0.000 ^{***} (- 4.24)	-0.000 ^{***} (- 3.99)	-0.001 ^{***} (- 4.28)
<i>Fleverage</i>	-0.016 ^{***} (- 3.34)	-0.017 ^{***} (- 3.52)	-0.015 ^{***} (- 3.17)	-0.018 ^{***} (- 3.61)
<i>Oleverage</i>	-0.001 ^{***} (- 2.85)	-0.001 ^{***} (- 2.72)	-0.001 ^{***} (- 3.08)	-0.001 ^{***} (- 2.67)
<i>ROE</i>	-0.001 (- 1.10)	-0.001 (- 1.18)	-0.001 (- 1.24)	-0.001 (- 1.26)
<i>ROA</i>	-0.005 ^{**} (- 2.07)	-0.005 ^{**} (- 2.04)	-0.005 ^{**} (- 2.05)	-0.005 ^{**} (- 2.02)
<i>Salesgr</i>	0.000 (1.15)	0.000 (1.27)	0.000 (0.90)	0.000 (1.31)
<i>Current</i>	0.001 ^{***} (7.88)	0.001 ^{***} (7.83)	0.001 ^{***} (8.20)	0.001 ^{***} (7.89)
<i>Quick</i>	-0.002 ^{***} (- 10.81)	-0.002 ^{***} (- 10.86)	-0.002 ^{***} (- 10.98)	-0.002 ^{***} (- 10.95)
<i>FCF</i>	-0.001 ^{***} (- 3.55)	-0.001 ^{***} (- 3.60)	-0.001 ^{***} (- 3.48)	-0.001 ^{***} (- 3.63)
<i>GDPgr</i>	-0.056 ^{***} (- 9.32)	-0.056 ^{***} (- 9.31)	-0.055 ^{***} (- 9.12)	-0.056 ^{***} (- 9.23)
<i>M2gr</i>	0.016 ^{***} (4.69)	0.017 ^{***} (4.81)	0.016 ^{***} (4.64)	0.017 ^{***} (4.87)
<i>Constant</i>	1.416 ^{***} (10.04)	1.042 ^{***} (9.99)	1.523 ^{***} (14.25)	0.789 ^{***} (6.10)
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes

Dependent variable	(1)	(2)	(3)	(4)
	<i>spread</i>	<i>spread</i>	<i>spread</i>	<i>spread</i>
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.143	0.143	0.145	0.143

The governance pillar represents a notable exception, suggesting that stronger corporate governance does not necessarily reduce the cost of bank debt. This finding is consistent with the view that governance mechanisms designed primarily to protect shareholder interests may intensify shareholder–creditor conflicts by encouraging greater managerial risk-taking and increasing exposure to takeover pressure. Consistent with this argument, Chava et al. (2009) show that firms with stronger shareholder rights face higher bank loan spreads, while Liu and Wu (2023) find that shareholder-oriented governance reforms increase borrowing costs. Using international board reforms, Chiu et al. (2023) similarly document higher loan spreads following reforms that strengthen shareholder influence.

[Insert Table 2 here]

Table 3 reports the results regarding non-pricing loan terms. In Panel A, the TESG score reveals an expected effects on loan amount. A 1% increase in the ESG score corresponds to an approximately 0.45% increase in loan amount, reinforcing the resource-acquisition channel identified by Hao and Wu (2024) and He et al. (2023). However, the pillar composition differs from that of spread. Both the environmental and governance pillars contribute significantly and positively, with the governance pillar’s effect the most pronounced, presumably because sound governance structures directly reduce the agency costs creditors bear (Yu and Su, 2024), providing a more direct risk-mitigation signal when banks determine financing scale (Cheng et al., 2025).

Table 3

Effect of corporate ESG performance on non-pricing loan terms This table presents OLS estimates of Eq. (1). Panel A reports results for loan amount (*Loanamt*), Panel B for loan maturity (*Maturity*), and Panel C for collateral requirement (*Secu*). Within each panel, the explanatory variable of interest is the T ESG score and its environmental, social, and governance pillar scores. All regressions include firm-level and macroeconomic controls together with bank and industry fixed effects. Standard errors are clustered by bank, and *t*-statistics are reported in parentheses. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: Loan amount				
Dependent variable	<i>Loanamt</i>			
	(1)	(2)	(3)	(4)
<i>ESG</i>	0.449*** (7.77)			
<i>ENV</i>		0.294*** (7.57)		
<i>SOC</i>			-0.077* (- 1.86)	
<i>GOV</i>				0.488*** (11.94)
Control variables	Yes	Yes	Yes	Yes
Bank / Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.453	0.453	0.452	0.455
Panel B: Loan maturity				
Dependent variable	<i>Maturity</i>			
	(1)	(2)	(3)	(4)
<i>ESG</i>	1.187*** (9.96)			
<i>ENV</i>		0.001 (0.01)		
<i>SOC</i>			0.836***	

Panel A: Loan amount				
				(9.86)
GOV				0.706 ^{***} (8.35)
Control variables	Yes	Yes	Yes	Yes
Bank / Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.180	0.177	0.180	0.179
Panel C: Collateral requirement				
Dependent variable	Secu			
	(1)	(2)	(3)	(4)
ESG	-0.322 ^{***} (- 16.57)			
ENV		-0.181 ^{***} (- 13.82)		
SOC			-0.100 ^{***} (- 7.13)	
GOV				-0.197 ^{***} (- 14.23)
Control variables	Yes	Yes	Yes	Yes
Bank / Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.283	0.281	0.277	0.282

The social pillar, by contrast, exhibits a significant negative effect on loan amount, suggesting that banks may interpret social-responsibility performance differently when determining the scale of credit provision. This finding is related to Sautner et al. (2026), who examine the effects of the European Union Taxonomy on the syndicated loan market. They show that lenders extend smaller loans to borrowers with a high share of transitional revenue. Although transitional activities can contribute meaningfully to climate-change mitigation, banks appear less willing to expand lending to firms heavily engaged in such

activities. Our evidence from Taiwan is broadly consistent with this finding from the European Union, suggesting that sustainability-related activities may not uniformly translate into greater credit availability, particularly with respect to loan size.

Loan maturity is also strongly associated with ESG performance. A 1% increase in the TESG score is associated with an approximately 1.19% increase in loan maturity, suggesting that banks treat better ESG performance as evidence of greater long-term debt-servicing capacity and operational stability, in line with the view that a robust stakeholder network reduces the systematic risk a firm faces (Ding et al., 2024). Both the social and governance pillars contribute significantly to extending loan maturity, while the environmental pillar’s effect again fails to reach significance, indicating that banks weight social and governance performance more heavily than environmental performance when assessing long-term repayment capacity.

Collateral requirements exhibit the most consistent pattern among loan terms. The TESG score and all three pillar scores are significantly negatively associated with collateral, which evidence that banks treat ESG performance as a broad credit-quality signal when deciding whether to require security. This cross-pillar consistency stands in contrast to the divergent pillar-level effects observed for loan spread, amount, and maturity, a pattern implying that collateral decisions may be the dimension along which banks most comprehensively integrate ESG information.

Taken together, these results support hypothesis 1 that firms with better ESG performance obtain more favorable bank financing terms. The TESG score and its pillar scores are embedded in banks’ loan pricing mechanisms, which results corroborate the theoretical view of ESG as both a positive signal (Cheng et al., 2025) and a risk-mitigation tool (He et al., 2023), and are consistent with a reinforcing cycle in which better ESG performance helps firms build a perception of low risk, integrate key external resources (Hao and Wu, 2024).

[Insert Table 3 here]

4.3 Moderating effect: Supply side

4.3.1 Corporate profitability

Table 4 report the results regarding hypothesis 2 that better ESG performance helps firms with worse financial performance enhance their loan terms. The moderating role of ESG performance proves heterogeneous across loan terms. For loan spread, the increase in ESG performance helps firms with lower ROE lower the costs of bank loans. Such effects are evident across all three ESG pillars. Focusing on the TESG score, the interaction-term coefficient of -0.37 indicates that a 1% increase in ESG performance is associated with an additional 0.37% reduction in loan spreads for firms whose loan spreads are, on average, 1.54% higher. This pattern points to a risk-compensation mechanism. When default uncertainty is greater, banks appear to weight the ESG signal more heavily, using it to fill the

informational gap that financial indicators alone cannot bridge and thereby lowering the risk premium they would otherwise demand (Qian et al., 2023; Cheng et al., 2025).

Table 4

Moderating effect of corporate profitability This table presents OLS estimates of Eq. (2), which extend Eq. (1) by interacting the ESG score with a dummy for low corporate financial performance (*Low_ROE*), equal to 1 for firms in the bottom 25% of ROE). Panels A–D report results for loan spread, loan amount, loan maturity, and collateral requirement, respectively. From columns (1)–(4), *ESG performance* corresponds to the TESS score and its environmental, social, and governance pillar scores, respectively. All regressions include firm-level and macroeconomic controls together with bank and industry fixed effects. Standard errors are clustered by bank, and *t*-statistics are reported in parentheses. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: Loan spread				
Dependent variable	<i>Spread</i>			
	(1)	(2)	(3)	(4)
<i>ESG</i> × <i>Low_ROE</i>	-0.366*** (-5.12)			
<i>ENV</i> × <i>Low_ROE</i>		-0.148*** (-2.98)		
<i>SOC</i> × <i>Low_ROE</i>			-0.101* (-1.92)	
<i>GOV</i> × <i>Low_ROE</i>				-0.444*** (-8.08)
<i>ESG performance</i>	-0.041 (-0.97)	0.017 (0.61)	-0.179*** (-6.00)	0.201*** (6.27)
<i>Low_ROE</i>	1.538*** (5.41)	0.677*** (3.41)	0.485** (2.31)	1.839*** (8.47)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.145	0.144	0.146	0.146
Panel B: Loan amount				

Panel A: Loan spread				
Dependent variable	<i>Loanamt</i>			
	(1)	(2)	(3)	(4)
<i>ESG</i> × <i>Low_ROE</i>	0.212 [*] (1.95)			
<i>ENV</i> × <i>Low_ROE</i>		-0.275 ^{***} (-3.63)		
<i>SOC</i> × <i>Low_ROE</i>			0.106 (1.32)	
<i>GOV</i> × <i>Low_ROE</i>				0.343 ^{***} (4.10)
<i>ESG performance</i>	0.411 ^{***} (6.44)	0.362 ^{***} (8.45)	-0.095 ^{**} (-2.08)	0.388 ^{***} (7.96)
<i>Low_ROE</i>	-0.705 (-1.62)	1.224 ^{***} (4.05)	-0.293 (-0.91)	-1.212 ^{***} (-3.66)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.454	0.454	0.452	0.456

Table 4
Continued

Panel C: Loan maturity				
Dependent variable	<i>Maturity</i>			
	(1)	(2)	(3)	(4)
<i>ESG</i> × <i>Low_ROE</i>	-0.922 ^{***} (-4.10)			
<i>ENV</i> × <i>Low_ROE</i>		-0.655 ^{***} (-4.18)		
<i>SOC</i> × <i>Low_ROE</i>			-0.524 ^{***} (-3.16)	
<i>GOV</i> × <i>Low_ROE</i>				-0.547 ^{***} (-3.16)
<i>ESG performance</i>	1.415 ^{***} (10.76)	0.158 [*] (1.79)	0.964 ^{***} (10.26)	0.880 ^{***} (8.73)
<i>Low_ROE</i>	3.672 ^{***} (4.10)	2.591 ^{***} (4.15)	2.086 ^{***} (3.16)	2.162 ^{***} (3.16)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.180	0.177	0.180	0.179
Panel D: Collateral requirement				
Dependent variable	<i>Secu</i>			
	(1)	(2)	(3)	(4)
<i>ESG</i> × <i>Low_ROE</i>	-0.013 (-0.36)			
<i>ENV</i> × <i>Low_ROE</i>		0.031 (1.20)		

Panel C: Loan maturity				
<i>SOC</i> × <i>Low_ROE</i>			0.057**	
			(2.09)	
<i>GOV</i> × <i>Low_ROE</i>			-0.057**	
			(-2.02)	
<i>ESG performance</i>	-0.311*** (-14.50)	-0.187*** (-12.90)	-0.109*** (-7.08)	-0.173*** (-10.52)
<i>Low_ROE</i>	0.115 (0.78)	-0.055 (-0.54)	-0.158 (-1.46)	0.290*** (2.59)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.285	0.283	0.279	0.283

This finding runs counter to Goss and Roberts (2011), who find that U.S. banks penalize financially weaker firms' CSR investment as a waste of resources instead of rewarding it. The contrast is plausibly attributable to the institutional context rather than to a contradiction in the underlying theory. The present sample period coincides with the FSC's active promotion of the Green Finance Action Plan, during which Taiwanese banks have progressively institutionalized ESG within credit assessment. This policy environment, absent from Goss and Roberts (2011), gives banks a stronger incentive to reward ESG performance among financially weaker borrowers rather than uniformly tightening credit.

Loan amount tells a more divided story. The governance pillar exhibits a significant positive effect for firms with lower ROE, as sound governance structures directly reduce the agency costs creditors bear even when financial performance is weak (Yu and Su, 2024). The environmental pillar, by contrast, exhibits a significant negative effect, suggesting that banks read improved environmental performance at financially weaker firms as a source of capital-expenditure pressure, not a risk-reducing signal. The social pillar's effect fails to reach significance, indicating a comparatively limited marginal credit signal along this dimension for less profitable firms.

Loan maturity presents a different pattern. Banks tend to grant longer maturities to less profitable firms, whereas stronger ESG performance mitigates rather than reinforces this tendency. This finding does not imply that the ESG signal loses its credibility among less profitable firms. Instead, it reflects banks' joint determination of multiple loan-contract terms. Even when banks recognize the favorable ESG signal and

offer a reduction in loan spreads, they may simultaneously shorten loan maturity to preserve the flexibility for dynamic monitoring and periodic reassessment. Such a response can serve as a compensating risk-control mechanism against residual long-term default risk (Myers, 1977).

Collateral requirements exhibit a similarly pillar-dependent pattern to that observed for loan amount. The governance pillar remains significantly associated with lower collateral requirements even among less profitable firms, suggesting that the signal conveyed by strong governance and transparency remains credible across different financial conditions (Cheng et al., 2025). The social pillar, however, is associated with a higher likelihood of collateral requirements among less profitable firms. This finding is consistent with the overinvestment view of Goss and Roberts (2011), whereby banks may interpret social-responsibility expenditures by financially weaker borrowers as reflecting managerial self-interest rather than value creation and therefore demand greater collateral as a safeguard. Such concerns are likely to become more pronounced when profitability is low, as already-constrained resources make banks more sensitive to expenditures on activities perceived as peripheral to firms’ core operations.

The pattern across loan terms is better understood as a coordinated set of risk-control instruments banks allocate jointly in response to firms with weak profitability but strong ESG performance (Qian et al., 2023; Goss and Roberts, 2011). A lower spread that rewards the ESG signal, a shorter maturity that preserves monitoring flexibility, and selectively eased amount and collateral terms depending on which pillar drives the firm’s performance. Governance is most consistently rewarded, owing to its direct mitigation of agency costs, while environmental and social performance draw more divergent responses, reflecting banks’ concerns about resource consumption at financially constrained firms (Myers, 1977; Jensen and Meckling, 1976). The results accordingly offer partial support for hypothesis 2.

[Insert Table 4 here]

4.3.2 Corporate financing ability

We further examine why the environmental pillar score exhibits a weaker effect on loan spreads, as shown in Table 2. Table 5 reports the results, with a particular focus on firms’ financing ability and carbon-emission intensity. Regarding financing ability, the effect of bank screening may vary across different types of firms. On the one hand, firms with weaker financing ability may gain greater access to bank credit when banks receive liquidity support from the Federal Reserve (Leary, 2009). On the other hand, firms with stronger financing ability may obtain more favorable loan terms during periods of quantitative easing because they face a relatively flat marginal cost of financing investment (Ottonello and Winberry, 2020). We therefore examine the role of environmental performance in financing ability and use firm size and firm age as two proxies for financing ability. These two characteristics form the basis of the Hadlock–Pierce index for measuring financial constraints in the U.S. context (Hadlock and Pierce, 2010). Consistent with pecking-order and life-cycle theories, smaller and younger firms generally face greater difficulty accessing external financing than larger and more mature firms.⁵

Table 5

Moderating effect of financing ability and carbon-emission intensity This table presents OLS estimates extending Eq. (1) by interacting the ESG score with proxies for financing ability and carbon-emission intensity. Panels A–B report results for TESS score and its environmental pillar score. All regressions include firm-level and macroeconomic controls together with bank and industry fixed effects. Standard errors are clustered by bank, and *t*-statistics are reported in parentheses. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: ESG score				
Dependent variable	<i>Spread</i>			
	(1)	(2)	(3)	(4)
<i>ESG × Large</i>	0.856*** (8.611)			
<i>ESG × Mature</i>		0.041 (0.660)		
<i>ESG × Manufacturing</i>			-0.194*** (-2.617)	
<i>ESG × Low_carbonleakage</i>				-0.477*** (-6.999)
<i>ESG</i>	-0.275*** (-6.850)	-0.158*** (-3.427)	-0.093** (-2.271)	0.210*** (3.351)
<i>Financing ability</i>	0.025 (1.083)	0.009 (0.821)		
<i>Carbon-emission intensity</i>			0.047*** (2.945)	0.041*** (2.960)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,107	26,107	26,107	26,107
Adj. R ²	0.148	0.144	0.144	0.146
Panel B: Environmental pillar score				

Panel A: ESG score				
Dependent variable	<i>Spread</i>			
	(1)	(2)	(3)	(4)
<i>ENV × Large</i>	0.005 (0.083)			
<i>ENV × Mature</i>		0.114*** (2.671)		
<i>ENV × Manufacturing</i>			0.138*** (2.731)	
<i>ENV × Low_carbonleakage</i>				-0.186*** (-3.965)
<i>ENV</i>	-0.032 (-1.141)	-0.082** (-2.514)	-0.046 (-1.644)	0.112*** (2.622)
<i>Financing ability</i>	0.124*** (5.766)	0.009 (0.789)		
<i>Carbon-emission intensity</i>			0.059*** (3.663)	0.040*** (2.915)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,107	26,107	26,107	26,107
Adj. R ²	0.145	0.144	0.144	0.144

As shown in columns (1) and (2) of Table 5, financially constrained firms tend to benefit more from better environmental performance when seeking bank credit. In terms of overall ESG performance, a higher TESG score is associated with lower loan spreads on average. However, this benefit weakens, and may even be reversed, for firms with greater financing ability, as proxied by larger firm size. Focusing specifically on environmental performance, we likewise find that more mature firms do not enjoy the same reduction in loan spreads associated with stronger environmental performance. These results are consistent with the findings in Table 2, suggesting that better environmental performance does not necessarily translate into lower borrowing costs, particularly for firms that are relatively financially

unconstrained. In contrast, better environmental performance helps financially constrained firms signal positive information to creditors, thereby reducing their borrowing costs.

4.3.3 Carbon-emission intensity

We next examine the role of carbon-emission intensity. On the one hand, firms with higher carbon emissions may send a stronger positive signal to creditors when they simultaneously demonstrate better environmental performance. On the other hand, firms with lower carbon emissions may benefit more from strong environmental performance because they are exposed to lower transition risk. We test these competing arguments using two industry classifications. First, we distinguish between manufacturing and non-manufacturing firms to examine whether manufacturing firms derive greater financing benefits from better environmental performance. Second, we adopt the carbon-leakage industry classification issued by Taiwan's Ministry of Environment. Taiwan introduced a carbon fee in 2025 to encourage firms to reduce carbon emissions. To mitigate the immediate impact of the carbon fee on corporate profitability, the Ministry of Environment identifies industries with a high risk of carbon leakage and allows eligible firms to receive preferential fee rates if they submit and implement specific emission-reduction plans. We therefore use this classification as a more precise proxy for industries characterized by high carbon-emission intensity.

Columns (3) and (4) of Table 5 report the results regarding carbon-emission intensity. In Panel A, we find that non-manufacturing firms enjoy lower loan spreads when they have higher TESG scores. However, better environmental performance does not produce a similar reduction in loan spreads for non-manufacturing firms. These contrasting results suggest that the manufacturing versus non-manufacturing classification may not adequately capture differences in carbon-emission intensity. Turning to the carbon-leakage classification, the results reported in column (4) show that firms with lower carbon-leakage risk experience lower loan spreads when they exhibit better overall ESG or environmental performance. These findings support the view that firms with lower carbon emissions benefit more from strong environmental performance because they are exposed to lower transition risk.

In sum, two factors help explain why better environmental performance does not generally translate into lower loan spreads. First, environmental performance provides limited additional positive signals for financially unconstrained firms that already enjoy relatively low borrowing costs. Second, firms with higher carbon emissions may not benefit from stronger environmental performance because their greater exposure to transition risk offsets the favorable signal conveyed by such performance.

[Insert Table 5 here]

4.4 Moderating effect of bank ESG preferences

Table 6 examines the role of banks' ESG preferences by interacting the corporate TESG score with four indicators of bank ESG preference: *High_besg*, *High_benv*, *High_bsoc*, and *High_bgov*. The results show that all four dimensions of bank ESG preference such as ESG, environmental, social, and governance significantly strengthen the negative association between corporate ESG performance and loan spreads.

In other words, banks with stronger ESG performance tend to offer more favorable loan pricing to firms with better ESG performance. This broad pattern suggests that the risk-relevant signal conveyed by corporate ESG performance is recognized by banks across different ESG orientations, regardless of the particular dimension they emphasize (Qian et al., 2023). Among the four dimensions, governance-oriented banks exhibit the strongest moderating effect, followed by banks emphasizing social and environmental performance, respectively. This pattern suggests that governance-oriented banks are particularly sensitive to firms' sustainability performance when assessing credit risk and determining loan pricing.

Table 6

Moderating effect of bank ESG preferences This table presents OLS estimates examining the moderating effects of bank ESG preferences. The dependent variable is loan spread (*Spread*). Columns (1)–(4) interact the TESG score with a dummy equal to 1 for banks in the top 25% of ESG score (*High_BESG*), environmental pillar score (*High_BENV*), social pillar score (*High_BSOC*), and governance pillar score (*High_BGOV*), respectively. From columns (1)–(4), *Bank ESG performance* corresponds to bank's TESG score and its environmental, social, and governance pillar scores, respectively. All regressions include firm-level and macroeconomic controls together with bank and industry fixed effects. Standard errors are clustered by bank, and *t*-statistics are reported in parentheses. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Dependent variable	<i>Spread</i>			
	(1)	(2)	(3)	(4)
<i>ESG</i> × <i>High_besg</i>	-0.330*** (-4.22)			
<i>ESG</i> × <i>High_benv</i>		-0.181* (-1.88)		
<i>ESG</i> × <i>High_bsoc</i>			-0.248*** (-3.31)	
<i>ESG</i> × <i>High_bgov</i>				-0.447*** (-5.69)
<i>ESG</i>	-0.078* (-1.90)	-0.123*** (-3.11)	-0.088** (-2.14)	-0.056 (-1.37)
<i>Bank ESG performance</i>	1.370*** (4.35)	0.805** (2.08)	1.043*** (3.43)	1.854*** (5.87)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,044	26,044	26,044	26,044
Adj. R ²	0.144	0.144	0.144	0.145

The pattern narrows considerably, however, once corporate ESG performance is measured pillar by pillar as shown in Appendix B. When focusing on the environmental pillar, only governance-oriented banks exhibit a significant spread-reducing moderating effect, while the interaction terms for the other three bank types fail to reach significance. A similar but slightly broader pattern emerges for the social pillar. Banks emphasizing ESG, social, and governance performance all exert a significant moderating effect, while environmentally-oriented banks show none (Yu and Su, 2024). The insensitivity of environmentally-oriented banks to the social pillar is consistent with a preference matching pattern, in which banks find it more difficult to evaluate ESG performance outside their own core area of focus. The governance pillar produces the most consistent result. When examining the governance pillar, the interaction terms between firm governance performance and all measures of bank ESG performance are significantly negative. These moderating effects are sufficiently strong to reverse the positive association between firm governance performance and loan spreads documented in Table 2. These results highlight how much a bank’s own ESG identification capacity matters for corporate financing terms (Alves and Meneses, 2024).

These results broadly support Hypothesis 3 that bank ESG preferences moderate the ESG-loan spread relationship, with the strength of moderation varying by the combination of a bank’s preferred pillar and a firm’s pillar-level performance. The ESG–spread relationship is thus bank-specific that the financing benefits a firm derives from its ESG investment depends on the lending bank’s own ESG orientation. Governance-oriented banks exhibit the strongest spread-reducing moderating effect regardless of which pillar a firm’s performance is concentrated in, evidence that this group possesses the greatest overall capacity to integrate ESG risk into pricing decisions (Hao and Wu, 2024).

[Insert Table 6 here]

4.5 Corporate ESG substantive performance, disclosure performance, and the ESG disclosure-substance gap

Whether ESG affects loan terms primarily through substantive actions or disclosure is examined by decomposing the TESG score into its substantive and disclosure components, which are analyzed separately in Tables 7 and 8. We then examine whether banks penalize the gap between these two components, which may reflect potential greenwashing behavior.

Table 7

Effect of the ESG substantive score on loan terms This table presents OLS estimates of Eq. (1), replacing the TESS score and pillar scores with their substantive-score components. Panels A–D report results for loan spread, loan amount, loan maturity, and collateral requirement, respectively. All regressions include firm-level and macroeconomic controls together with bank and industry fixed effects. Standard errors are clustered by bank, and *t*-statistics are reported in parentheses. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: Loan spread				
Dependent variable	<i>Spread</i>			
	(1)	(2)	(3)	(4)
<i>ESG_s</i>	-0.120*** (- 4.18)			
<i>ENV_s</i>		-0.021 (- 1.17)		
<i>SOC_s</i>			-0.165*** (- 8.43)	
<i>GOV_s</i>				0.030* (1.66)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
N	26,139	26,139	26,139	26,139
Adj. R ²	0.144	0.143	0.145	0.143
Panel B: Loan amount				
Dependent variable	<i>Loanamt</i>			
	(1)	(2)	(3)	(4)
<i>ESG_s</i>	0.349*** (8.00)			
<i>ENV_s</i>		0.194*** (6.99)		

Panel A: Loan spread				
SOC_s			-0.067 ^{**} (- 2.24)	
GOV_s				0.336 ^{***} (12.17)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.453	0.453	0.452	0.455

Table 7
Continued

Panel C: Loan maturity				
Dependent variable	<i>Maturity</i>			
	(1)	(2)	(3)	(4)
<i>ESG_s</i>	0.926 ^{***} (10.32)			
<i>ENV_s</i>		-0.006 (- 0.11)		
<i>SOC_s</i>			0.638 ^{***} (10.36)	
<i>GOV_s</i>				0.451 ^{***} (7.89)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.180	0.177	0.180	0.179
Panel D: Collateral Requirement				
Dependent variable	<i>Secu</i>			
	(1)	(2)	(3)	(4)
<i>ESG_s</i>	-0.246 ^{***} (- 16.83)			
<i>ENV_s</i>		-0.122 ^{***} (- 13.06)		
<i>SOC_s</i>			-0.070 ^{***} (- 6.92)	
<i>GOV_s</i>				-0.132 ^{***} (- 14.19)

Panel C: Loan maturity				
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.284	0.281	0.277	0.281

Table 8

Effect of the ESG disclosure score on loan terms This table presents OLS estimates of Eq. (1), replacing the T ESG score and pillar scores with their disclosure -score components. Panels A–D report results for loan spread, loan amount, loan maturity, and collateral requirement, respectively. All regressions include firm-level and macroeconomic controls together with bank and industry fixed effects. Standard errors are clustered by bank, and *t*-statistics are reported in parentheses. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: Loan spread				
Dependent variable	<i>Spread</i>			
	(1)	(2)	(3)	(4)
<i>ESG_d</i>	0.097 (1.33)			
<i>ENV_d</i>		0.067 (0.94)		
<i>SOC_d</i>			0.127* (1.80)	
<i>GOV_d</i>				0.096 (1.32)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.143	0.143	0.143	0.143
Panel B: Loan amount				
Dependent variable	<i>Loanamt</i>			
	(1)	(2)	(3)	(4)
<i>ESG_d</i>	0.296*** (2.65)			
<i>ENV_d</i>		0.361*** (3.30)		

Panel A: Loan spread				
<i>SOC_d</i>			0.297 ^{***}	
			(2.75)	
<i>GOV_d</i>			0.168	
			(1.52)	
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.452	0.452	0.452	0.452

Table 8
Continued

Panel C: Loan maturity				
Dependent variable	<i>Maturity</i>			
	(1)	(2)	(3)	(4)
<i>ESG_d</i>	0.489** (2.12)			
<i>ENV_d</i>		0.658*** (2.91)		
<i>SOC_d</i>			0.263 (1.18)	
<i>GOV_d</i>				0.506** (2.22)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.177	0.177	0.177	0.177
Panel D: Collateral Requirement				
Dependent variable	<i>Secu</i>			
	(1)	(2)	(3)	(4)
<i>ESG_d</i>	-0.234*** (- 6.19)			
<i>ENV_d</i>		-0.312*** (- 8.42)		
<i>SOC_d</i>			-0.159*** (- 4.34)	
<i>GOV_d</i>				-0.187*** (- 4.99)

Panel C: Loan maturity				
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,139	26,139	26,139	26,139
Adj. R ²	0.277	0.278	0.276	0.277

Table 7 first examines the effects of substantive ESG performance and yields results broadly consistent with those based on the TESG score. Higher substantive ESG performance is associated with more favorable loan terms, including lower loan spreads, larger loan amounts, longer maturities, and less collateral requirements. At the pillar level, however, the substantive governance score again exhibits a positive association with loan spreads. Similarly, the results suggest that banks interpret substantive social performance as a credible signal of credit quality, while simultaneously reducing loan amounts for borrowers with stronger social performance. These findings suggest that, when structuring loan contracts, banks may view substantive social expenditures as a potential drain on corporate resources rather than purely as a mechanism for mitigating credit risk. Finally, substantive governance performance continues to elicit a distinct pricing response, a pattern broadly consistent with the predictions of signaling theory.

The ESG Disclosure Score, by contrast, tells a markedly different story. Table 8 shows that the disclosure score has insignificant effect on loan spreads, suggesting that banks price substantive ESG actions rather than disclosure itself. Disclosure alone therefore appears insufficient to constitute a credible risk-mitigation signal. Nevertheless, disclosure continues to affect other non-pricing loan terms. It is significantly positively associated with loan amount and maturity and significantly negatively associated with collateral requirements, suggesting that greater transparency leads banks to offer more favorable non-pricing terms without necessarily reducing borrowing costs. Taken together, Tables 7 and 8 reveal a clear asymmetry between substantive action and disclosure, particularly in loan pricing. Only substantive ESG performance is reflected in loan spreads, and its effects on loan terms are generally stronger than those of disclosure, according to the results based on the TESG score. Notably, the environmental pillar remains insignificant for loan spreads in both specifications, reinforcing the earlier finding that banks' valuation of environmental information depends critically on firm characteristics.

[Insert Tables 7 and 8 here]

The asymmetry found in Tables 7 and 8 motivates the test of gap between substantive action and disclosure, measures of greenwashing. This study constructs the firm-level greenwashing score (*ESG_gw*) as the industry-adjusted difference between the ESG standardized disclosure and substantive score. According to hypothesis 4, we predict that banks detect and penalize this disclosure–substance inconsistency.

Table 9 shows that the disclosure–substance gap is priced unfavorably across all four loan terms. The overall greenwashing score is positively associated with loan spreads and collateral requirements, and negatively associated with loan amounts and maturity. Firms exhibiting a larger gap between disclosure and substantive action therefore face higher risk premiums, smaller loan amounts, shorter maturities, and greater collateral requirements. Taken together, these findings indicate that Taiwanese banks recognize inconsistencies between what firms disclose and what they actually do and respond to such behavior through multiple dimensions of loan contracting.

Table 9

Effect of the ESG disclosure–substance gap (greenwashing score) on loan terms This table presents OLS estimates of Eq. (1), replacing the T ESG score and pillar scores with the greenwashing score, which is constructed by the industry-adjusted difference between the ESG standardized disclosure and substantive score. Panels A–D report results for loan spread, loan amount, loan maturity, and collateral requirement, respectively. All regressions include firm-level and macroeconomic controls together with bank and industry fixed effects. Standard errors are clustered by bank, and *t*-statistics are reported in parentheses. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: Loan spread				
Dependent variable	<i>Spread</i>			
	(1)	(2)	(3)	(4)
<i>ESG_gw</i>	0.039*** (5.49)			
<i>ENV_gw</i>		0.010* (1.67)		
<i>SOC_gw</i>			0.054*** (9.02)	
<i>GOV_gw</i>				-0.005 (-0.87)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,735	26,735	26,735	26,735
Adj. R ²	0.147	0.147	0.149	0.146
Panel B: Loan amount				
Dependent variable	<i>Loanamt</i>			
	(1)	(2)	(3)	(4)
<i>ESG_gw</i>	-0.075*** (-6.95)			
<i>ENV_gw</i>		-0.060***		

Panel A: Loan spread				
(-6.85)				
<i>SOC_gw</i>			0.023**	
			(2.51)	
<i>GOV_gw</i>			-0.088***	
			(-10.88)	
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,735	26,735	26,735	26,735
Adj. R ²	0.452	0.452	0.452	0.454

Table 9
Continued

Panel C: Loan maturity				
Dependent variable	<i>Maturity</i>			
	(1)	(2)	(3)	(4)
<i>ESG_gw</i>	-0.233*** (-10.35)			
<i>ENV_gw</i>		-0.014 (-0.77)		
<i>SOC_gw</i>			-0.202*** (-10.54)	
<i>GOV_gw</i>				-0.131*** (-7.77)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,735	26,735	26,735	26,735
Adj. R ²	0.180	0.177	0.181	0.179
Panel D: Collateral requirement				
Dependent variable	<i>Secu</i>			
	(1)	(2)	(3)	(4)
<i>ESG_gw</i>	0.050*** (13.71)			
<i>ENV_gw</i>		0.025*** (8.22)		
<i>SOC_gw</i>			0.016*** (5.22)	
<i>GOV_gw</i>				0.031*** (11.17)

Panel C: Loan maturity				
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	26,735	26,735	26,735	26,735
Adj. R ²	0.278	0.275	0.274	0.277

These results support Hypothesis 4. Taken together with the findings in Tables 7 and 8, they indicate that although strong ESG performance can secure more favorable financing terms, these benefits are driven primarily by substantive performance rather than disclosure quality. This finding is consistent with the theoretical view that ESG enhances firms' financing capacity through risk mitigation and resource integration (He et al., 2023; Hao and Wu, 2024). Disclosure alone, however, is not a panacea. When disclosure outpaces substantive action, banks not only withhold the financing benefits associated with strong ESG performance but also actively tighten multiple credit terms. These results provide evidence that Taiwanese banks incorporate potential greenwashing behavior into their credit-assessment mechanisms and penalize firms for inconsistencies between ESG disclosure and substantive action.

[Insert Table 9 here]

Because the implications of the disclosure–substance gap may depend on the relative levels of ESG disclosure and substantive performance, we further decompose the greenwashing measure into four quadrants. In Table 10, we partition the sample according to whether firms have above- or below-median standardized ESG disclosure and substantive scores. For firms in Quadrant 1, characterized by high disclosure and high substantive performance, a larger greenwashing score is associated with less favorable loan terms. In Quadrant 2, where firms exhibit low disclosure but high substantive performance, a larger greenwashing score is instead associated with lower loan spreads, suggesting that banks place greater weight on substantive actions than on disclosure. Firms in Quadrant 3, with low levels of both disclosure and substantive performance, face the strongest adverse effects on loan terms as the greenwashing score increases. Finally, for firms in Quadrant 4, which have high disclosure but low substantive performance, a larger greenwashing score is associated with more favorable non-price loan terms, although it does not reduce borrowing costs.

Table 10

Effect of the ESG disclosure–substance gap (greenwashing score) -

Quadrant This table presents OLS estimates showing the results regarding four types of greenwashing score, which is constructed by the industry-adjusted difference between the ESG standardized disclosure and substantive score. Columns (1) to (4) report results for loan spread, loan amount, loan maturity, and collateral requirement, respectively. All regressions include firm-level and macroeconomic controls together with bank and industry fixed effects. Standard errors are clustered by bank, and t-statistics are reported in parentheses.

Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Panel A: Quadrant 1 (High Disclosure, High Substance)				
Dependent variable	(1)	(2)	(3)	(4)
	<i>Spread</i>	<i>Loanamt</i>	<i>Maturity</i>	<i>Secu</i>
<i>ESG_gw</i>	0.053*** (2.97)	0.002 (0.08)	-0.177*** (-3.87)	0.037*** (4.78)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	10,019	10,019	10,019	10,019
Adj. R ²	0.135	0.462	0.231	0.293
Panel B: Quadrant 2 (Low Disclosure, High Substance)				
Dependent variable	(1)	(2)	(3)	(4)
	<i>Spread</i>	<i>Loanamt</i>	<i>Maturity</i>	<i>Secu</i>
<i>ESG_gw</i>	-0.067** (-2.02)	-0.331*** (-6.09)	-0.031 (-0.26)	0.094*** (4.98)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	3,776	3,776	3,776	3,776
Adj. R ²	0.186	0.484	0.297	0.320
Panel C: Quadrant 3 (Low Disclosure, Low Substance)				
Dependent variable	(1)	(2)	(3)	(4)

Panel A: Quadrant 1 (High Disclosure, High Substance)				
	<i>Spread</i>	<i>Loanamt</i>	<i>Maturity</i>	<i>Secu</i>
<i>ESG_gw</i>	0.060*** (5.03)	-0.078*** (-4.03)	-0.442*** (-10.11)	0.075*** (11.10)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	10,682	10,682	10,682	10,682
Adj. R ²	0.231	0.314	0.177	0.235
Panel D: Quadrant 4 (High Disclosure, Low Substance)				
Dependent variable	(1)	(2)	(3)	(4)
	<i>Spread</i>	<i>Loanamt</i>	<i>Maturity</i>	<i>Secu</i>
<i>ESG_gw</i>	0.094*** (2.84)	-0.415*** (-7.95)	0.598*** (6.06)	0.013 (0.69)
Control variables	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	2,240	2,240	2,240	2,240
Adj. R ²	0.154	0.401	0.226	0.313

Taken together, the findings in Tables 7 and 10 suggest that substantive ESG actions play the primary role in lowering firms' borrowing costs, whereas disclosure quality is more closely associated with favorable non-price loan terms. Importantly, disclosure that outpaces substantive performance does not reduce loan spreads and may instead increase borrowing costs. Moreover, firms that perform poorly in both ESG disclosure and substantive actions experience the most unfavorable loan terms, highlighting that banks consider both the level and the consistency of firms' ESG performance when making lending decisions.

[Insert Table 10 here]

4.6 Mandatory disclosure policy and greenwashing incentive

Finally, we exploit the FSC's expansion of mandatory ESG disclosure requirements as an exogenous policy shock to examine how ESG regulation affects firms' incentives to engage in greenwashing. To enhance the transparency of ESG performance, the FSC released mandatory sustainability-reporting requirements in 2022 to cover larger listed firms. This policy change provides a setting for implementing a difference-in-differences (DID) design around the 2022 regulatory threshold, with 2020–2021 defined as the pre-policy period and 2022–2024 as the post-policy period. The treatment group consists of listed firms with paid-in capital between NT\$2 billion and NT\$5 billion, which became newly subject to mandatory disclosure requirements, whereas the control group consists of firms with paid-in capital below NT\$2 billion that remained exempt throughout the sample period.

Relative to firms that are not required to disclose ESG information, treated firms may face stronger incentives to improve ESG transparency without making corresponding improvements in substantive ESG actions. Firms with a strong commitment to substantive ESG engagement might otherwise have voluntarily disclosed such information even in the absence of regulatory requirements. Mandatory disclosure may therefore widen the gap between disclosure and substantive action, thereby increasing firms' incentives for potential greenwashing. To test this conjecture, we use the industry-adjusted greenwashing score and its pillar-level counterparts as dependent variables. The DID model is specified as follows.

$$Y_{i,t}^k = \alpha_0 + \alpha_1 Treat_i \times Post_t + \alpha_2 Treat_i + \alpha_3 Post_t + \alpha' X_{i,t-1} + \epsilon_{i,t}^k,$$

3

where $Y_{i,t}^k$ denotes alternatively measure k for greenwashing score such as ESG (ESG_gw), environmental (ENV_gw), social (SOC_gw), and governance (GOV_gw) scores in year t . The dummy variable $Treat$ identifies treatment-group firms (those with paid-in capital between NT\$2 billion and NT\$5 billion), while $Post$ distinguishes the pre- and post-policy periods (equal to 1 from 2022 onward and 0 for 2020–2021). The coefficient of interest, α_1 , on the interaction term $Treat \times Post$ captures the incremental effect of the mandatory disclosure requirement on treatment firms' disclosure–substance gap relative to control firms. A positive α_1 would indicate that mandatory disclosure widens this gap, consistent with a mechanism whereby regulatory requirements induce firms to expand ESG disclosure more rapidly than substantive ESG actions. Such a divergence may arise because disclosure can be adjusted relatively quickly, whereas substantive improvements in ESG performance typically require greater time, resources, and organizational changes.

The evidence in Table 11 supports this prediction. The interaction term is positive for ESG_gw and all three pillar-level greenwashing scores. The effect is largest for the governance pillar, followed by the social pillar, while the environmental pillar exhibits the smallest effect. This pattern may reflect the greater quantifiability of environmental information and the corresponding difficulty of separating environmental disclosure from substantive environmental action. Because these results are identified using an exogenous policy shock rather than being driven solely by firm-specific characteristics, they

complement the evidence in Table 9 and highlight a potential policy trade-off. Although mandatory disclosure enhances market transparency, it may also widen the disclosure–substance gap in the short run. As a result, some newly regulated firms may experience a relative deterioration in financing terms, pointing to a potentially unintended consequence that warrants consideration in future ESG disclosure policy design and implementation.

Table 11

Mandatory disclosure policy and the ESG disclosure–substance gap

This table presents difference-in-differences estimates examining the effect of mandatory disclosure policy on greenwashing incentive. The dependent variables are the greenwashing score and its environmental, social, and governance pillar counterparts. The treatment group comprises listed companies with paid-in capital between NT\$2 billion and NT\$5 billion, newly subject to mandatory ESG disclosure in 2022; the control group comprises firms with paid-in capital below NT\$2 billion. Post equals 1 for 2022–2024 and 0 for 2020–2021. All regressions include firm-level and macroeconomic controls, together with firm and year fixed effects. *t*-statistics are reported in parentheses. Variable definitions are provided in the Appendix A. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

Dependent variable	<i>ESG_gw</i>	<i>ENV_gw</i>	<i>SOC_gw</i>	<i>GOV_gw</i>
	(1)	(2)	(3)	(4)
<i>Treat</i> × <i>Post</i>	0.348*** (14.85)	0.196*** (6.91)	0.334*** (12.30)	0.553*** (17.76)
<i>Treat</i>	0.012 (0.64)	-0.008 (-0.37)	-0.165*** (-7.61)	0.159*** (6.39)
<i>Post</i>	0.070*** (3.15)	0.038 (1.41)	0.109*** (4.26)	-0.091*** (-3.11)
<i>Size</i>	-0.045*** (-6.48)	-0.061*** (-7.31)	0.048*** (5.97)	0.122*** (13.31)
<i>Leverage</i>	-0.003*** (-6.26)	-0.009*** (-14.59)	-0.002*** (-3.52)	-0.004*** (-5.55)
<i>Turnover</i>	-0.174*** (-13.09)	-0.205*** (-12.71)	-0.103*** (-6.65)	-0.043** (-2.44)
<i>ICR</i>	-0.001*** (-10.42)	-0.001*** (-4.51)	-0.002*** (-13.03)	-0.001*** (-7.29)
<i>Fleverage</i>	-0.004 (-0.87)	0.021*** (3.63)	-0.015*** (-2.71)	0.006 (0.94)
<i>Oleverage</i>	0.000 (0.71)	-0.003*** (-5.34)	0.001** (2.33)	0.001* (1.75)

Dependent variable	<i>ESG_gw</i>	<i>ENV_gw</i>	<i>SOC_gw</i>	<i>GOV_gw</i>
	(1)	(2)	(3)	(4)
<i>ROE</i>	-0.009 ^{***} (-8.71)	-0.004 ^{***} (-3.38)	-0.009 ^{***} (-7.43)	-0.018 ^{***} (-12.75)
<i>ROA</i>	0.010 ^{***} (4.07)	0.002 (0.75)	0.014 ^{***} (4.99)	0.022 ^{***} (6.58)
<i>Salesgr</i>	0.000 (1.47)	0.000 (0.71)	0.000 ^{***} (3.75)	-0.000 (-0.03)
<i>Current</i>	0.000 ^{***} (4.74)	0.000 ^{***} (3.79)	0.000 ^{***} (3.98)	0.001 ^{***} (5.84)
<i>Quick</i>	-0.002 ^{***} (-13.30)	-0.002 ^{***} (-12.45)	-0.002 ^{***} (-9.70)	-0.002 ^{***} (-8.31)
<i>FCF</i>	-0.002 ^{***} (-4.92)	-0.002 ^{***} (-4.63)	-0.001 ^{**} (-2.30)	-0.001 ^{***} (-2.66)
<i>GDPgr</i>	-0.001 (-0.12)	-0.031 ^{***} (-3.03)	-0.008 (-0.78)	-0.004 (-0.38)
<i>M2gr</i>	0.018 ^{***} (5.01)	-0.002 (-0.40)	0.020 ^{***} (4.59)	0.012 ^{**} (2.45)
<i>Constant</i>	1.015 ^{***} (7.96)	1.920 ^{***} (12.46)	-0.438 ^{***} (-2.96)	-1.787 ^{***} (-10.55)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	21,238	21,238	21,238	21,238
Adj. R ²	0.098	0.069	0.058	0.120

[Insert Table 11 here]

4.7 Robustness Tests

Two robustness tests address the stability of specifications. First, we address the possibility that the effect of ESG performance may strengthen over time as market attention to ESG increases. We therefore include time fixed effects to absorb time-varying changes in ESG-related attention. Appendix C reports the results, showing that temporal trends in banks' attention to ESG do not alter our main findings. The ESG score and the social pillar remain significantly negatively associated with loan spreads, while the environmental pillar remains insignificant and the governance pillar retains its significantly positive coefficient, a pattern fully consistent with the baseline results in Table 2. All four ESG measures also remain significantly negatively associated with collateral requirements. Similarly, loan maturity is significantly and positively related to the overall ESG score and the social and governance pillars, while loan amount is significantly and positively related to the overall score and the environmental and governance pillars. The robustness of these findings further suggests that our baseline specifications already capture part of the underlying time trend through the inclusion of macroeconomic control variables.

Second, we replace the TESG scores with Sustainability Accounting Standards Board (SASB) industry-based rankings to test whether our results are sensitive to the choice of ESG measure. Although all models include industry fixed effects and our greenwashing measures are constructed on an industry-adjusted basis, cross-industry heterogeneity in the relevance and materiality of ESG issues may still affect our findings. In practice, ESG rating agencies such as MSCI typically evaluate firms relative to industry peers that face similar stakeholder expectations and material ESG risks. We therefore follow this industry-relative approach and construct ESG rankings based on the SASB industry classification, which provides industry-specific guidance on financially material sustainability issues.

Using the SASB-based rankings as substitutes for the TESG scores, Appendix D reports results that are broadly consistent with our baseline findings. Firms with higher SASB-based ESG rankings receive lower loan spreads and face lower collateral requirements for the overall score and all three ESG pillars. They also obtain larger loan amounts, with the effects driven by the overall ESG, environmental, and governance rankings, and longer loan maturities, with the effects driven by the overall ESG, social, and governance rankings. Overall, these robustness tests indicate that our main findings are not driven by the choice of ESG measure or a particular empirical specification.

5 Conclusion and Implications

This study examines the role of corporate ESG performance in shaping bank loan terms. Using loan contract data for Taiwan-listed firms from 2020 to 2024, we document four principal findings. First, stronger ESG performance is associated with more favorable loan terms, although the effects vary across different dimensions of ESG performance. Overall, ESG appears to serve both as a positive signal of firm quality and as a risk-mitigation mechanism, thereby reducing the risk premium demanded by banks. These benefits, however, are not uniform among financially weaker firms. When lending to borrowers with low profitability but strong ESG performance, banks adopt a coherent yet selective contracting strategy. They lower loan spreads in recognition of the positive ESG signal while shortening

loan maturities to preserve flexibility for dynamic monitoring and periodic reassessment. Adjustments in loan amounts and collateral requirements are more pillar dependent. Governance performance receives the most consistent favorable response because of its direct role in mitigating agency problems, whereas environmental and social performance elicit more heterogeneous lending responses.

Second, bank ESG preferences also shape this relationship, with the strength of the moderating effect varying according to the alignment between a bank's ESG orientation and a firm's pillar-level performance (Hao and Wu, 2024). Governance-oriented banks exhibit the strongest willingness to reward firms with superior ESG performance, regardless of the pillar in which such performance is concentrated. In contrast, banks oriented toward other ESG pillars are less likely to reward strong performance in dimensions outside their areas of expertise. Among the three pillars, borrower governance performance emerges as the most consistently rewarded dimension, with its benefits further amplified when the lending bank itself maintains a strong ESG orientation.

Third, substantive ESG actions are more important than disclosure efforts in banks' lending decisions. Decomposing the TESG score into quantifiable substantive-performance and information-disclosure dimensions shows that substantive performance, rather than disclosure, is the key factor associated with lower loan spreads. Moreover, when disclosure outpaces substantive action, banks tend to tighten loan terms. As Taiwan's FSC moves listed companies toward the direct adoption of IFRS S1 and IFRS S2 in three phases beginning in fiscal year 2026, requiring standardized quantitative sustainability indicators in annual reports and progressively expanding third-party assurance, our findings suggest that this shift from a disclosure-oriented framework toward greater verification of substantive performance is economically meaningful.

Finally, exploiting Taiwan's mandatory ESG disclosure requirements, we further find that newly regulated firms tend to expand ESG disclosure more rapidly than their substantive ESG actions. Such divergence may arise because disclosure practices can be adjusted relatively quickly, whereas substantive improvements in ESG performance generally require more time and resources to materialize. These findings highlight a potentially unintended consequence of mandatory disclosure regulation. In the short run, strengthened disclosure requirements may widen the gap between reported ESG information and underlying substantive performance. This possibility warrants careful consideration in the design and implementation of future ESG disclosure policies.

Declarations

Author Contribution

Chien-Lin Lu contributed to conceptualization and writing of the original draft. Chia-Wei Yen contributed to formal analysis and validation. All authors reviewed the manuscript.

Data Availability

The data analyzed in this study are obtained from the Taiwan Economic Journal database. These datasets are proprietary and subject to licensing restrictions; therefore, they are not publicly available.

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Footnotes

1. Please refer to the FSC press release of October 29, 2024, “The FSC Launches the ‘Green and Transition Finance Action Plan’ to Support Taiwan’s Net-Zero Carbon Emissions and Sustainable

Development.”

2. See the Joint Credit Information Center, “Green Credit and Sustainability Performance-Linked Credit Zone,” <https://www.jcic.org.tw>.
3. Because ESG scores never take a value of 0, this natural-logarithm adjustment does not follow the $\ln(\text{ESG score} + 1)$ approach.
4. In practice, banks may identify inconsistencies between ESG disclosure and substantive performance during post-loan reviews by examining whether borrowers violate ESG-related regulations such as Taiwan’s Labor Standards Act or Air Pollution Control Act in the future. However, such ex-post measures have limited ability to capture potential greenwashing when loan officers assess borrowers at the initial lending stage. By contrast, loan officers can more readily quantify disclosure–substance inconsistencies by applying the scoring framework underlying the TESG score.
5. We do not directly apply the coefficients from the Hadlock–Pierce index to construct our financial-constraint measure because the relationships between firm size, firm age, and financial constraints documented for U.S. firms may not apply directly to Taiwanese firms.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [AppendixABCD.docx](#)