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ESG Performance and Bank Loan Interest Rates

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Abstract

This study investigates whether firms strategically enhance their Environmental, Social, and Governance (ESG) performance to obtain more favorable financing terms in the bank loan market. Building on the Resource-Based View and Legitimacy Theory, we argue that superior ESG performance serves as a non-financial signal of firm quality that strengthens stakeholder confidence, mitigates agency conflicts, and reduces information asymmetry between borrowers and lenders. These effects enhance banks' assessments of firms' creditworthiness and lower perceived default risk, thereby translating into more advantageous loan pricing. Using a panel of Taiwanese listed non-financial firms over the 2016–2023 period, we estimate multivariate regression models controlling for firm-specific characteristics, corporate governance attributes, and industry- and year-fixed effects. The results reveal a statistically and economically significant negative relation between ESG performance and loan interest rates, firms with stronger ESG profiles enjoy lower costs of bank borrowing. The evidence indicates that banks in Taiwan increasingly incorporate ESG considerations into their credit risk assessment frameworks and pricing mechanisms. This study contributes to the corporate finance literature by providing novel evidence that ESG engagement constitutes a strategic asset that enhances firms' financing capacity and capital access, thereby linking sustainability performance to the cost of external debt financing.

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1. Introduction

Since the early 20th century, global firms have increasingly confronted ethical and environmental challenges, leading to financial scandals that affect a broad spectrum of stakeholders. Scholars have emphasized the importance of integrating social ethics with the interests of both internal and external stakeholders in managerial decision-making. Early seminal works include Thompson and Sheldon's (1923) advocacy for Corporate Social Responsibility (CSR) and Bowen's (1953) assertion in The Social Responsibility of the Businessman that firms must not only ensure financial viability but also address environmental protection and social obligations. Elkington (1997) further argued that companies should consider social and environmental issues with equal importance as profit.

Some scholars have expressed skepticism, arguing that socially responsible actions yield minimal easily quantifiable economic benefits (Friedman, 1970; Jensen, 2002), and that the short-term costs of CSR often outweigh immediate financial gains, thereby increasing earnings volatility (Meng and Wang, 2019; Alexander and Buchholz, 1978; Frooman et al. 2008). Additionally, senior executives may prioritize enhancing their own reputation at the expense of shareholder value (Barnea and Rubin, 2010). In contrast, the stakeholder perspective suggests that CSR can create firm value. Stakeholders reciprocate by providing support, employees exhibit greater loyalty, and external stakeholders are more inclined to endorse the firm (Clarkson, 1998; Waddock and Graves, 1997). Empirical evidence further indicates that CSR engagement is associated with improved financial performance (Radhakrishnan, Tsang and Liu, 2018), easier access to financing (Cheng, Ioannou and Serafeim, 2014; Dhaliwal, Li, Tsang and Yang, 2011), and lower cost of capital (Bae et al., 2018; Chava, 2014; El Ghoul et al., 2011; Goss and Roberts, 2011; Ng and Rezaee, 2015; Tan et al., 2020).

Recent studies continue to support the positive relationship between CSR and financial performance. For instance, Coelho et al. (2023) found that CSR directly impacts a firm's financial performance, with the effect becoming more significant as the environmental, social, and governance (ESG) performance improves. Similarly, Fandella (2023) demonstrated that CSR performance affects the costs of debt, equity, and the weighted average cost of capital, suggesting that enhanced CSR can reduce a firm's cost of capital. Furthermore, Prasad et al. (2022) examined the impact of CSR on the cost of capital, highlighting that firms with strong CSR performance tend to have lower costs of debt and equity. These findings underscore the evolving understanding of CSR as a strategic component that not only fulfills ethical obligations but also contributes to financial success, challenging the traditional view that CSR is merely a cost without tangible economic benefits.

Since the early 21st century, financial institutions have increasingly recognized the importance of integrating environmental and social considerations into their decision-making processes. In 2003, the Equator Principles Association introduced the Equator Principles (EPs), a risk management framework designed to assist financial institutions in identifying, assessing, and managing environmental and

social risks associated with large-scale projects. These principles provide a standardized approach to ensure that projects are developed in a socially responsible manner and reflect sound environmental management practices. Building upon this foundation, in June 2004, the United Nations, in collaboration with the World Bank, released the report "Who Cares Wins: Connecting Financial Markets to a Changing World." This report, developed through a joint initiative of financial institutions invited by UN Secretary-General Kofi Annan, emphasized the need for the financial sector to incorporate environmental, social, and governance (ESG) factors into financial analysis and investment decisions. It highlighted that integrating ESG considerations could enhance long-term value creation and mitigate risks.

Further advancing the agenda for sustainable development, in 2015, the United Nations adopted the Sustainable Development Goals (SDGs), comprising 17 interconnected objectives aimed at addressing global challenges and promoting prosperity while protecting the planet. These goals underscore the importance of responsible investment practices and the need for financial institutions to align their strategies with broader societal objectives. The Principles for Responsible Investment (PRI) initiative, launched in 2006, provides a framework for investors to incorporate ESG factors into their investment processes, thereby contributing to the achievement of the SDGs.

In recent developments, the Equator Principles have undergone updates to strengthen their applicability and effectiveness. The latest iteration, EP4, which came into effect on October 1, 2020, introduces enhanced requirements for environmental and social risk management, including the consideration of climate change impacts and human rights issues. This evolution reflects the growing recognition of the need for comprehensive and forward-looking approaches to sustainable finance. These initiatives collectively represent a significant shift in the financial sector's approach to risk management and investment decision-making, emphasizing the integration of ESG factors as central components of responsible and sustainable business practices

In recent years, stakeholders—including lending banks—have increasingly emphasized not only traditional financial metrics but also the disclosure of firms' ESG performance. Among the most widely recognized international frameworks for sustainability reporting are the Task Force on Climate-related Financial Disclosures (TCFD), the Sustainability Accounting Standards Board (SASB), and the Global Reporting Initiative (GRI). The TCFD, established by the Financial Stability Board (FSB, 2015), provides a structured approach to reporting climate-related financial risks, focusing on governance, strategy, risk management, and metrics & targets. Its framework encourages firms to integrate climate-related considerations into strategic and financial decision-making. SASB, through its 2018 Materiality Map, identifies five dimensions—environment, social capital, human capital, business model & innovation, and leadership & governance—spanning 11 industries and 77 sub-industries, with 26 universal ESG topics. SASB aims to align qualitative and quantitative sustainability disclosures with financially material impacts, thereby facilitating investor decision-making while allowing firms to

demonstrate long-term value creation (SASB, 2018). Notably, SASB provides industry-specific metrics to ensure comparability across firms operating within the same sector, enhancing the relevance of ESG information for investors. GRI, through the Universal Standards 2021, requires disclosures covering GRI 1 Foundation, GRI 2 General Disclosures, and GRI 3 Material Topics (GRI, 2021). While SASB emphasizes financially material ESG information, GRI encourages comprehensive disclosure across all sustainability dimensions. In practice, firms—such as those in Taiwan—often adopt a hybrid reporting approach, integrating both frameworks and providing cross-referenced tables to meet the informational needs of diverse stakeholders. Collectively, these frameworks reflect the evolution of ESG reporting from voluntary, qualitative disclosures to structured, financially material metrics that are increasingly integral to investment analysis and corporate governance (Eccles and Klimenko, 2019; Khan, Serafeim and Yoon, 2016).

A growing body of literature has examined the factors influencing banks' willingness to support corporate Environmental, Social, and Governance (ESG) initiatives. Beyond the influence of government regulations and international mandates, such as those from the European Central Bank (European Central Bank, 2020) and the European Banking Authority (European Banking Authority, 2020), which have incorporated ESG risk assessments into lending criteria, banks that proactively integrate ESG considerations into their risk management frameworks tend to exhibit superior financial performance and enhanced returns (Ahmed and Uddin, 2018). Conversely, neglecting ESG risks in lending decisions can lead to underestimation of credit risks and potential reputational damage (Adeabah et al., 2023; Breitenstein et al., 2021). Consequently, banks can leverage their financial influence to guide corporate decisions, directing capital flows toward industries and investments that positively contribute to ESG objectives. This can be achieved by offering favorable loan terms, such as reduced interest rates, to incentivize firms to adopt ESG practices. In essence, firms that disregard ESG considerations may face higher capital costs and increased financing challenges.

This study is premised on the relatively high proportion of indirect financing in Taiwan's financial market. According to data from the Central Bank of the Republic of China, the percentages of indirect and direct finance were 82.61% and 17.39%, respectively, based on 2019 statistics. In this context, corporate Environmental, Social, and Governance (ESG) performance has become a significant reference indicator in financial market evaluations. Financial institutions, guided by directives and requirements from relevant government authorities, proactively assess borrowers' ESG performance, either voluntarily or in alignment with government policies. Therefore, this study utilizes data from 1,675 non-financial listed companies in Taiwan. By integrating firm-specific data from different banks for specific years, the research aims to assess whether companies with better ESG performance can secure lower bank loan interest rates. Alternatively, this can be interpreted as evaluating whether banks offer more favorable loan terms to companies with superior ESG performance.

This study makes three primary contributions to the literature. First, expansion of

ESG impact analysis. While existing research predominantly examines the influence of corporate Environmental, Social, and Governance (ESG) performance on financial and non-financial indicators (e.g., Zhang, 2025; Shan et al., 2024), there is a scarcity of studies addressing how ESG performance affects corporate financing needs and costs, particularly in the context of bank loan interest rates. This research fills this gap by investigating whether companies with superior ESG performance can secure more favorable loan terms. Second. incorporation of non-financial factors in loan conditions: Most studies on determinants of bank loan conditions focus on financial characteristics and corporate governance factors (e.g., Zhang, 2024; Khoza et al., 2024). This study introduces and confirms that a company's investment in managing ESG-related stakeholder relationships significantly influences loan interest rates, thereby highlighting the importance of non-financial factors in determining financing conditions. Third, comprehensive ESG performance metrics. This research employs an integrated approach by developing multiple ESG indicators, including overall ESG performance, individual dimensions (Environmental, Social, and Governance), and industry-adjusted metrics. This methodology allows for a nuanced analysis of how specific aspects of ESG performance impact loan interest rates, considering the company's industry context. It demonstrates that even firms in high environmental risk industries can achieve lower loan rates by enhancing their ESG performance within their sector.

2. Literature Review and Hypothesis Development

2.1 The Development of ESG and Related Regulations

At the 2021 United Nations Climate Change Conference (COP26) held in Glasgow, the Network of Central Banks and Supervisors for Greening the Financial System (NGFS)—an information-sharing organization comprising 95 central banks and supervisory authorities along with 16 observers, representing five continents and approximately 85% of global greenhouse gas emissions—issued the Glasgow Declaration (Global Reporting Initiative, 2021). The declaration reaffirmed the commitment to actively pursue the objectives of the Paris Agreement.

International financial institutions have increasingly responded to this call, leveraging financial mechanisms to support the global net-zero transition and raise awareness of the climate crisis. These initiatives aim to channel financial resources effectively toward climate solutions while providing support to developing countries and vulnerable regions. Notable examples include the Sustainability-Linked Loan Principles (LMA, LSTA, APLMA, 2019) issued in March 2019 and the European Union’s Corporate Sustainability Due Diligence Directive (CSDDD) formally adopted in July 2024 (European Commission, 2024).

Globally, over 130 countries and regions have pledged to achieve net-zero emissions by 2050. National governments have mandated that financial regulatory authorities incorporate climate considerations into supervision to guide capital allocation toward sustainable projects, thereby mitigating the risks of “greenwashing” or “sustainability-washing.” Taiwan, as a critical link in the global

industrial supply chain with approximately 40% foreign ownership in its stock market, has seen foreign investors integrate ESG considerations into their investment decisions in accordance with responsible investment principles.

Since 2021, Taiwanese financial regulators have required companies with capital exceeding NT$5 billion to rename their corporate social responsibility (CSR) reports as sustainability or ESG reports. In 2022, regulators mandated that listed companies disclose quantitative and specific ESG information in their financial reports. Beginning in 2023, listed firms are expected to follow TCFD and SASB guidelines in their sustainability reports, with dedicated sections reporting climate-related information, including greenhouse gas emissions. By August 2025, all listed companies must submit sustainability reports disclosing baseline years for greenhouse gas emissions, reduction targets, strategies, and action plans in a phased manner.

In terms of regulatory alignment, in April 2022, the Bankers Association of the Republic of China (BAROC, 2022) amended Article 20, Section 5 of the Credit Standards for Members of the Association of Banks, stipulating that "when conducting corporate credit reviews, banks should consider whether the borrower exercises environmental protection, business integrity, and social responsibility." In September 2023, the Joint Credit Information Center established an ESG data platform to allow financial institutions to report corporate ESG information. Simultaneously, the Taiwan Stock Exchange completed the construction of a new digital ESG platform, which includes functionalities for corporate ESG disclosure, sustainability report submission, greenhouse gas emissions and reduction reporting, and sustainability-related economic activity questionnaires.

2.2 The Benefits and Costs of ESG

Stellner et al. (2015) argue that firms can mitigate their risk profiles through active engagement in Corporate Social Responsibility (CSR) initiatives, thereby fostering and maintaining close relationships with key stakeholders and subsequently creating valuable internal resources and intangible assets. Similarly, Buysse and Verbeke (2003) suggest that integrating environmental, social, and governance (ESG) factors into business strategies can reduce financial risks associated with potential operational failures. Further empirical studies have explored the relationship between ESG performance and corporate financial outcomes. For instance, Eccles et al. (2014) and Khan et al. (2016) find a positive correlation between robust ESG practices and superior financial performance, attributing this to cost reductions from energy efficiency, avoidance of regulatory fines, enhanced employee satisfaction, and improved brand loyalty. Bannier et al. (2022) and Gillan et al. (2010) also highlight that strong ESG performance can enhance risk management capabilities, thereby reducing debt costs and increasing firm value.

However, some studies present a contrasting view. Erragragui (2018), Hoepner et al. (2016), and Stellner et al. (2015) observe that the relationship between CSR and credit risk is not always straightforward, with some evidence suggesting a neutral

or even positive correlation under certain conditions. Goss and Roberts (2011) argue that if investors perceive the marginal costs of CSR activities to outweigh the marginal benefits, they may demand higher risk premiums. Frooman et al. (2008) further suggest that increased fixed costs associated with CSR can lead to greater earnings volatility, potentially elevating default risks. From an agency theory perspective, Barnea and Rubin (2010) and Kim et al. (2009) contend that executives might engage in CSR activities to enhance their reputations, sometimes at the expense of shareholder value. These perspectives highlight the complex interplay between CSR initiatives, stakeholder perceptions, and financial performance, suggesting that the impact of ESG practices on corporate financial outcomes can vary based on contextual factors and stakeholder interpretations.

2.3 Determinants of Bank Loan Interest Rates

In banking practice, credit assessment traditionally relies on the "5P" framework (people, purpose, payment, protect, perspective) and the "5C" doctrine (character, capacity, capital, collateral, condition). Subject to these frameworks, loan pricing is influenced by multiple factors: prevailing market rates, the bank's own funding cost, operating expenses, expected credit losses, the borrower's overall contribution to the banking relationship, loan type and maturity, competitive pressures, regulatory mandates, interest rate risk, and the borrower's bargaining power. However, when borrowers face environmental or ethical shocks—such as pollution fines, workplace accidents, litigation, scandals, regulatory penalties (e.g. EU CBAM), environmental disasters, supply-chain disruption, labor disputes or gender discrimination—banks bear not only higher default risk but also significant reputation and regulatory risk (Adeabah et al., 2023; Weber et al., 2015). Accordingly, banks must increasingly scrutinize borrowers' ESG performance in their credit assessments.

Recent empirical studies document that banks expect ESG performance to mitigate default risk and have begun to embed ESG metrics in loan pricing. For instance, Hoepner et al. (2024) find evidence that banks encourage ESG adoption to reduce borrower default risk. Works by Chava (2014), Goss and Roberts (2011), and Hasan et al. (2017) document a linkage between ESG ratings and loan pricing. Hauptmann (2017) also notes that lenders price in sustainability attributes in credit spreads. Beyond default risk, reputational risk introduces a further channel: lending to firms with poor ESG profiles may expose the bank to regulatory scrutiny or public backlash, possibly harming future business prospects. Thus, banks may demand higher spreads or impose stricter terms for borrowers perceived to carry ESG risk. Recent contributions further nuance this relationship. For example, a study on sustainable syndicated loans shows that sustainable and conventional loans are differently priced, and that banks consider borrower sustainable attributes in their pricing, though not always resulting in lower spreads (Alves et al., 2023). Also, research exploring the bank–borrower ESG similarity finds that banks with high ESG scores are more likely to price favorable terms to borrowers whose ESG profiles align with their own. Together, these strands of research suggest that the

traditional determinants of bank loan interest rates are now being supplemented by ESG-driven risk and reputation considerations, thereby altering the calculus of credit pricing in modern banking.

2.4 The Link Between ESG Performance and Bank Loan Interest Rates

Banks constitute the dominant source of external financing in most economies and play a pivotal role in facilitating economic development and the commercialization of innovation (King and Levine, 1993). Through their credit allocation function, banks exert substantial economic influence on firms' investment decisions and can provide critical support for sustainable development initiatives pursued by both governments and institutional investors (Houston and Shan, 2022). The banking literature has long recognized that banks differ fundamentally from other stakeholders due to their privileged access to proprietary information about borrowers (Diamond, 1984; Fama, 1985). This informational advantage enables banks to assess a firm's creditworthiness ex ante and to engage in continuous monitoring ex post to ensure repayment compliance. Such monitoring mechanisms contribute directly to the informational efficiency of the loan market.

Empirical evidence supports the notion that the syndicated loan market exhibits higher informational efficiency relative to the public bond market. For instance, Altman(2010) show that loan prices tend to anticipate corporate default events earlier than do bond prices, suggesting that banks incorporate private information into credit spreads more swiftly. Similarly, Allen, Gottesman, Saunders and Tang (2004) document that the loan market impounds negative information about firms before it becomes fully reflected in equity prices following adverse earnings announcements. Building on this foundation, subsequent studies argue that banks may serve as one of the most capable external monitors in assessing the economic value of firm-level nonfinancial activities, including corporate responsibility and governance quality (Goss and Roberts, 2011; Norden and Weber, 2010). Banks' evaluation of such attributes is often internalized into loan contract terms, such as spreads, collateral requirements, and covenants. Firms with superior reputations for responsible management practices or sound governance structures tend to exhibit lower idiosyncratic and credit risk, which may be capitalized in the form of favorable financing terms (Fu, 2009; Hasan, Hoi, Wu and Zhang, 2017).

More recent studies extend this perspective by analyzing how banks incorporate firm transparency, disclosure credibility, and nonfinancial risk management into credit pricing models (Acharya, Eisfeldt, and Sundaram, 2021; Gao, Kim, and Zhang, 2022; Nandy and Lodh, 2012). These works collectively reinforce the view that informational asymmetry and monitoring efficiency remain central to the determination of loan spreads. Given this theoretical and empirical foundation, the linkage between firms' environmental, social, and governance (ESG) performance and the cost of bank debt can be understood as a modern manifestation of how banks process and price multi-dimensional firm risk in the credit market.

Therefore, the banking system exerts a systemic influence over firms' ESG policies (Houston and Shan, 2022). Some authors (Herbohn et al., 2019; Wu and Shen, 2013) have extended traditional banking-monitoring theories to incorporate CSR performance and risk. High levels of ESG adoption and elevated ESG scores are positively correlated with corporate solvency, as firms with strong ESG metrics can better control a broad range of environmental, social, legal, reputational, operational, and regulatory risks (Ahmed and Uddin, 2018; Apergis et al., 2022). Empirical evidence suggests that banks that first integrate ESG factors into their lending practices are compensated through enhanced borrower financial performance. For example, Drago and Carnevale (2020) find that higher CSR ratings are significantly associated with narrower loan spreads among European firms, implying that firms benefit from improving ESG performance and disclosure, which in turn translates into lower capital costs for lenders. Firms with strong environmental, social, and governance track records face lower idiosyncratic risk, which may manifest in pricing premiums (Eliwa et al., 2021; Lee and Faff, 2009). Using data from 6,018 firm-years across EU countries, Lee and Faff (2009) document that firms with higher ESG efficiency and disclosure enjoy lower debt costs. Other studies provide empirical support for a negative relationship between ESG performance and debt costs (Crifo et al., 2017; Ge and Liu, 2015; Goss and Roberts, 2011; Hasan et al., 2017; Ye and Zhang, 2011).

According to the statistics published by the Central Bank of Taiwan, the indirect finance ratio in Taiwan has reached as high as 77.5% in the period from 2016 to 2023, underscoring the leverage banks hold in influencing firms' emphasis on ESG via credit provision. Yet, in the context of Taiwan's listed firms, empirical investigations into whether ESG performance is meaningfully and negatively associated with borrowing interest rates remain scarce. Therefore, we posit our first hypothesis as follows:

Hypothesis 1: Firm ESG performance is negatively related to bank loan interest rates.

2.5 Differential Effects of Individual ESG Dimensions on Bank Lending Terms

Empirical studies examining the three dimensions of ESG—environmental, social, and governance—have yielded heterogeneous findings across countries and institutional contexts. Using data from 2003 to 2018, Bannier et al. (2022) investigate the credit risk implications of environmental and social dimensions and find that, in the United States, only environmental performance mitigates various measures of credit risk. By contrast, both environmental and social dimensions significantly reduce credit risk among European firms. Similarly, Arora and Sharma (2022), employing a large sample of Indian listed firms, document that among the three ESG pillars, the social dimension exhibits the strongest and most statistically significant negative association with firms' cost of debt, suggesting that socially

responsible behavior contributes most effectively to reducing lenders' perceived default risk.

Moreover, Garel and Petit-Romec (2021) demonstrate that the impact of ESG factors on bank loan contracting exhibits considerable heterogeneity between developed and emerging markets. For instance, Kim and Li (2021) report that in China, the social pillar of ESG exerts the greatest positive effect on firms' credit ratings, whereas the environmental dimension shows a surprisingly adverse relationship, possibly reflecting transitional costs and regulatory uncertainty in environmental compliance. Consistent with these findings, Qian et al. (2023) show that higher ESG performance is associated with larger loan amounts, lower collateral requirements, and lower lending spreads. Interestingly, this association is predominantly driven by the social and governance components, while the environmental dimension appears to play a negligible or even insignificant role. This may reflect that environmental improvements are often motivated by regulatory pressures or avoidance of penalties rather than proactive environmental innovation. Conversely, Erragragui (2018) finds that environmental controversies tend to increase firms' cost of debt, whereas governance issues have no significant impact. Taken together, these findings suggest that the relative importance of ESG components in shaping lending terms differs systematically across institutional and regional settings. Accordingly, this study proposes the following hypothesis:

Hypothesis 2: The effects of individual ESG dimensions on bank loan interest rates are heterogeneous, with differing magnitudes and significance across the environmental, social, and governance components.

3. Variables, Econometric Model, and Data

3.1 Variables

3.1.1 Dependent Variables

This study employs six alternative measures of firm-specific annual bank loan interest rates as the dependent variables. First, the average interest rate (*avgrate*) represents the mean of all interest rates offered by banks to a specific firm in a given year. Second, the minimum interest rate (*minrate*) reflects the lowest interest rate among all loan contracts extended to the same firm within the same year. Third, the maximum interest rate (*maxrate*) captures the highest rate offered by banks to the firm in the same period. These three measures jointly capture different dimensions of the firm's borrowing cost and the heterogeneity of bank–firm relationships. Specifically, *avgrate* reflects the average cost of debt financing and is commonly used in studies examining loan pricing efficiency and borrower quality (e.g., Santos and Winton, 2008; Degryse, Kim and Ongena, 2009). The *minrate* is more sensitive to the strength of bank–firm relationships and the firm's creditworthiness, as relationship banks often extend preferential terms to low-risk borrowers (Petersen and Rajan, 1994; Ioannidou and Ongena, 2010). Conversely, *maxrate* captures the upper bound of credit risk premiums, reflecting the degree of risk perceived by less-

informed or more transaction-based lenders (Jiménez, Ongena, Peydró and Saurina, 2014; Berg, Saunders and Steffen, 2016).

Additionally, this study constructs two loan spread measures to capture the cost of borrowing relative to benchmark rates. The first loan spread measure (*spread1*) is defined as the difference between a firm's average annual loan interest rate and the one-year fixed postal savings deposit rate. This measure reflects the excess borrowing cost relative to a quasi–risk-free domestic deposit benchmark, thus incorporating both credit and liquidity premiums (Carey and Hrycay, 2001; Santos and Winton, 2008). To address potential distortions from zero or negative spreads, the adjusted first loan spread (*spread1nn*) excludes all firm-year observations where the computed spread is less than or equal to zero, thereby ensuring that only economically meaningful positive spreads are retained for estimation (Altunbaş, Kara and Marques-Ibanez, 2010). The second loan spread measure (*spread2*) is calculated as the difference between a firm's average annual loan interest rate and the benchmark lending rate of the five major commercial banks. This alternative proxy captures the credit risk premium component relative to prevailing market lending standards (Bharath, Dahiya, Saunders and Srinivasan, 2011; Qian and Strahan, 2007). Comparing these two spread definitions enables a more nuanced examination of how firm-specific and relational factors affect bank loan pricing across both deposit-based and lending-based benchmarks.

3.1.2 Main Explanatory Variables

Against the backdrop of increasing emphasis on sustainable development and corporate social responsibility, ESG (environmental, social, and governance) indicators have emerged as critical measures of corporate resilience and long-term value. Accordingly, based on the Taiwan Economic Journal (TEJ) database, this study utilizes multiple ESG measures. First, the ESG rating (*esgrating*) is derived from the TESG Taiwan Sustainability Index under TESG evaluation system, which categorizes firms into A+, A, B+, B, C+, C, and C– levels. These categories are further transformed into numerical values ranging from 7 (A+) to 1 (C–). Second, the ESG score (*esgscore*) represents the annual composite score under the TESG Taiwan Sustainability Index. Third, ESG within-ranking (*esgwr*) measures a firm's relative standing among all firms assessed within the SASB (Sustainability Accounting Standards Board) primary elements. For example, if a firm's ESG score ranks second among 23 firms in a given year, the transformed score equals $[100 - (2/23 \times 100)] = 92$, with higher values indicating superior relative performance within industry. In addition, ESG scores are benchmarked across different industry classifications: ESG ranking within the Taiwan Stock Exchange industry classification (*esgwr*), ESG ranking within SASB primary industry groups (*esgmr*), and ESG ranking within SASB sub-industries (*esgsr*), which reflects a firm's position relative to all firms evaluated in a given year.

Secondly, the environmental dimension score (*envscore*) represents the annual total score of the environmental pillar in the TESG Taiwan Sustainability Index under

TESG evaluation system. The firm's ranking of the environmental dimension score within the SASB major industry classification (*envmr*) indicates its relative standing among peers in the SASB primary industry category, while the ranking within the SASB sub-industry classification (*envsr*) reflects the firm's relative position in the corresponding SASB sub-sector. Third, the social dimension score (*socscore*) denotes the annual total score of the social pillar. The ranking of the social dimension score within the SASB major industry classification (*socmr*) captures the firm's position relative to peers in the SASB primary industry group, whereas the ranking within the SASB sub-industry classification (*socsr*) represents the firm's relative performance within the SASB sub-sector. Finally, the corporate governance dimension score (*govscore*) measures the annual total score of the governance pillar. The ranking of the governance dimension score within the SASB major industry classification (*govmr*) indicates the firm's relative standing among peers in the SASB primary industry, while the ranking within the SASB sub-industry classification (*govsr*) reflects the firm's position relative to peers in the SASB sub-sector. In sum, these fifteen proxies for environmental, social, and governance performance are constructed such that higher values correspond to stronger firm-level ESG performance.

Using multiple ESG proxies yields several methodological and substantive advantages. First, it mitigates measurement error and rating heterogeneity. Extant research documents large disagreements across ESG providers and measurement approaches, with scope, measurement choices, and weighting schemes driving substantial divergence in firm scores (Berg, Kölbel and Rigobon, 2022). Because any single provider's rating may reflect idiosyncratic coverage or methodological bias, triangulating across an ordinal rating (*esgrating*), a continuous composite score (*esgscore*), and alternative transforms (e.g., within-industry percentile ranks) reduces the risk that results hinge on a specific scoreboard and thus increases the credibility and robustness of empirical inference (Berg, Kölbel and Rigobon, 2022; Liu, He and Zhang, 2024).

Second, industry-adjusted indicators capture materiality and comparability. Material ESG issues differ markedly across industries (Khan, Serafeim and Yoon, 2016); a raw cross-industry score can obscure whether a firm is managing the ESG factors that matter most to its sector. Industry-relative rankings (*esgwr*, *esgmr*, *esgsr*) place firms in the context of peer expectations and regulatory realities, enabling more meaningful comparisons and reducing cross-industry heterogeneity that would otherwise confound estimates. Several practitioners and scholars therefore recommend industry-normalization when using ESG metrics for financial analysis (Berg, Kölbel and Rigobon, 2022).

Third, disaggregating ESG into E, S, and G pillars (and their industry-adjusted counterparts) permits the detection of heterogeneous channels and economic mechanisms. Environmental, social, and governance attributes operate through distinct channels—e.g., environmental performance often reduces regulatory and physical risk, social performance affects human-capital and reputational channels, and governance influences agency costs and disclosure credibility (Chava, 2014;

Eccles, Ioannou and Serafeim, 2014; Goss and Roberts, 2011). By estimating dimension-specific effects, researchers can identify which pillar drives a particular financial outcome and test competing theoretical mechanisms rather than masking offsetting effects in an aggregate index (Eccles et al., 2014; Chava, 2014).
Fourth, the use of both absolute scores and relative rankings enhances the analysis of both firm-level improvements and peer-relative positioning. Absolute scores (*esgscore*) capture a firm's raw progress over time, useful for panel-style identification of within-firm change; relative ranks (*esgwr*, *envmr*, etc.) capture competitive standing and signaling to investors and banks that compare firms within the same industry. Combining both enables separation of within-firm dynamics from cross-sectional peer effects (Santos and Winton, 2008; Khan, Serafeim and Yoon, 2016). Fifth, multiple proxies enable robustness checks and sensitivity analysis, a standard best practice in empirical finance. Convergent results across alternative constructions (ordinal rating, continuous score, and industry-adjusted percentile) strengthen causal claims and reassure reviewers that findings are not artifacts of a particular measurement choice (Berg, Kölbel and Rigobon, 2022; Alves and Meneses, 2024; Alves, Gonçalo and Pinto, 2023)
Finally, employing a rich set of ESG measures facilitates mechanism testing and policy relevance. Industry-adjusted and pillar-specific metrics allow the researcher to test whether effects operate through regulation-driven channels (environmental), workforce/productivity channels (social), or governance/agency channels (governance) - information that is valuable for bank risk officers and regulators seeking to translate ESG assessments into credit risk models and supervisory guidance (Khan, Serafeim and Yoon, 2016; Chava, 2014; Goss and Roberts, 2011).

3.1.3 Control Variables

In this study, several control variables are included to account for the characteristics of loan contracts, firm financial attributes, and corporate governance, all of which have been documented to influence bank loan pricing. Regarding loan contract characteristics, larger loan amounts (*amount*) generally indicate stronger borrower bargaining power, which is associated with lower interest rates (Gao, Ritter and Zhu, 2013; Santos and Winton, 2008). Similarly, shorter loan maturities (*maturity*) reduce the time exposure to risk and are expected to lower loan rates (Jiménez & Saurina, 2004). The provision of collateral (*coll*) serves as a risk mitigation mechanism for banks, but it often leads to higher loan rates to compensate for monitoring and enforcement costs (Berger and Udell, 1990; Chava and Roberts, 2008). Syndicated loans (*sydn*), which require at least two banks to share the lending risk, may increase the average loan rate due to additional coordination and monitoring costs (Altman and Suggitt, 2000).
Firm financial characteristics also play a critical role. Higher leverage (*debtr*), measured by the debt ratio, elevates financial risk and typically leads to higher loan rates (Klock, Mansi and Maxwell, 2005; Hovakimian, Opler and Titman, 2001), whereas higher profitability, proxied by return on assets (*roa*), signals financial

stability and is expected to reduce borrowing costs (Berger and Udell, 2006). Greater variability in return on assets (*roavar*) reflects higher earnings volatility and, therefore, greater risk exposure, which can increase loan rates (Jiménez, Ongena, Peydró and Saurina, 2017). Rapid sales growth (*salesgr*) suggests larger short-term financing needs, potentially elevating interest rates due to liquidity risk (Gamba and Triantis, 2008). Prior-period losses (*loss*) indicate financial distress, increasing the perceived default risk and the corresponding loan rates (Faulkender & Petersen, 2006).

Corporate governance factors are also considered. A higher proportion of independent directors (*indr*) may introduce more rigorous oversight and diverse opinions on firm management, potentially increasing perceived agency risk and the cost of borrowing (Pathan and Faff, 2013; Qian, Shi, Song and Wu, 2023). Conversely, greater directors' shareholdings (*dirhold*) aligns managerial incentives with shareholder interests, enhances commitment to financial performance, and is expected to reduce loan rates (Gompers, Ishii, Metrick, 2003; Mehran, 1995). By including these control variables, this study accounts for observable characteristics that systematically influence bank loan pricing, allowing for a clearer identification of the incremental effect of ESG performance on corporate borrowing costs.

In addition, the regression models incorporate industry-specific dummy variables (INDUSTRY) and year-specific dummy variables (YEAR) to control for the potential influence of sectoral and temporal heterogeneity on bank loan pricing. Given that the firm sample spans 33 industries, 32 industry dummies are included in the models to capture industry-specific effects on lending conditions, such as variations in business risk, capital intensity, and regulatory exposure (Berger and Udell, 1990; Chava and Roberts, 2008). Similarly, the study period covers eight years (2016–2023), and seven year dummies are incorporated to account for time-specific factors, including macroeconomic conditions, monetary policy shifts, and regulatory changes that may affect loan interest rates (Jiménez and Saurina, 2004; Pathan and Faff, 2013). Controlling for industry and year effects ensures that the estimated relationships between firm-specific characteristics and bank loan pricing are not confounded by broader sectoral or temporal variations.

Table 1: Abbreviations and Definitions of Variable

Variable	Abbreviation	Definition
Explained Variables		
Average interest rate	*avgrate*	The mean of all interest rates offered by banks to a specific firm in a given year.
Minimum interest rate	*minrate*	The lowest interest rate among all loan contracts extended to the same firm within the same year.
Maximum interest rate	*maxrate*	The highest rate offered by banks to the firm.
Loan spread measure1	*spread1*	The difference between a firm's average annual loan interest rate and the one-year fixed postal savings deposit rate.
Adjusted loan spread measure1	*spread1nn*	Excludes all firm-year observations where the computed spread is less than or equal to zero.
Loan spread measure 2	*spread2*	The difference between a firm's average annual loan interest rate and the benchmark lending rate of the five major commercial banks.
Main Explanatory Variables		
ESG ratings	*esgrating*	TESG ratings are classified into seven levels: A+, A, B+, B, B-, C, and C-. Assigning integer values from 7 to 1 to these levels, respectively, such that a higher value corresponds to a better TESG rating.
ESG score	*esgscore*	The TESG score is ranged from 0 to 100 points, with 0 being the worst and 100 being the best.
The rank of ESG score in full samples	*esgwr*	If a firm's TESG score in a given year ranks 2nd out of 25 firms in the full sample, the database records this as (2/25). This rank can be converted to a percentile score using the formula [100 - (2/25)*100] = 92, where a higher percentile indicates a higher ranking and better TESG performance within the full sample.
The rank of ESG score in Taiwan Stock Exchange and main industry classification	*esgexr*	If a firm's TESG score in a given year ranks 2nd out of 25 firms within its industry classification on the Taiwan Stock Exchange, the database records the rank as (2/25). This rank can be transformed into a percentile score using the formula: [100 - (2/25)*100] = 92.
The rank of ESG score in SASB main industry classification	*esgmr*	A firm's TESG score ranking within the main industry classification of the Sustainability Accounting Standards Board (SASB), with the rank converted to a percentile using the same formula as described above.
The rank of ESG score in SASB sub-industry classification	*esgsr*	A firm's TESG score ranking within the sub industry classification of the SASB, with the rank converted to a percentile using the same formula as described above.
ESG environment score	*envscore*	The TESG environment score is ranged from 0 to 100 points, with 0 being the worst and 100 being the best.
The rank of ESG environment score in SASB main industry classification	*envmr*	A firm's TESG environment score ranking within the main industry classification of the SASB, with the rank converted to a percentile using the same formula as described above.
The rank of ESG environment score in SASB sub- industry classification	*envsr*	A firm's TESG environment score ranking within the sub industry classification of the SASB, with the rank converted to a percentile using the same formula as described above.

ESG social score	*socscore*	The TESG social score is ranged from 0 to 100 points, with 0 being the worst and 100 being the best.
The rank of ESG social score in SASB main industry classification	*socmr*	A firm's TESG social score ranking within the main industry classification of the SASB, with the rank converted to a percentile using the same formula as described above.
The rank of ESG social score in SASB sub-industry classification	*socsr*	A firm's TESG social score ranking within the sub industry classification of the SASB, with the rank converted to a percentile using the same formula as described above.
ESG corporate governance score	*govscore*	The TESG corporate governance score is ranged from 0 to 100 points, with 0 being the worst and 100 being the best.
The rank of ESG corporate governance score in SASB main industry classification	*govmr*	A firm's TESG corporate governance score ranking within the main industry classification of the SASB, with the rank converted to a percentile using the same formula as described above.
The rank of ESG corporate governance score in SASB sub- industry classification	*govsr*	A firm's TESG corporate governance score ranking within the sub industry classification of the SASB, with the rank converted to a percentile using the same formula as described above.
Control Variables		
Loan amount	*amount*	The natural logarithm of the average loan amount extended by all banks to a given firm in a given year
Loan maturity	*maturity*	The average loan maturity in years for a firm in a given year.
Collateral	*coll*	The average collateral provision across banks for a firm in a given year; for example, if a firm borrows from five banks in a given year and provides collateral to two of them, but not to the other three, this variable equals 2/5 = 0.4.
Syndicated loan	*sydn*	The average syndicated loan participation across banks for a firm in a given year, which is defined analogously.
Debt ratio	*debtr*	The firm’s total debt divided by total equity.
Return on assets	*roa*	Earnings before tax, interest, and depreciation divided by average total assets.
Variance of returns on assets	*roavar*	The variance of pre-tax, pre-interest, and pre-depreciation ROA over the previous five years.
Sales growth	*salesgr*	the annual percentage change in net sales.
Prior-period loss	*loss*	A binary indicator captures whether the firm reported a loss in the previous year (1 = yes, 0 = no).
Proportion of independent directors	*indr*	The proportion of independent directors to total board members.
Directors’ shareholdings	*dirhold*	The proportion of shares held by all directors relative to total shares outstanding.
Industry dummies	INDUSTRY	A vector of 32 dummy variables corresponding to 33 industry classifications based on the stock exchange industry codes.
Year dummies	YEAR	A vector of seven annual dummy variables for the eight-year sample period spanning 2016 to 2023.

Note: This table reports the abbreviations and definitions of the variables. Variable definitions are based on the Taiwan Economic Journal (TEJ) database and the authors' own specifications.

3.2 Econometric Model

This study employs multiple regression analysis to examine whether a firm's ESG performance affects the level of bank loan interest rates, either by reducing or increasing them. The regression model is specified as follows:

$$\text{RATE}_{i,t} = \beta_0 + \beta_1 \text{ESG}_{i,t} + \beta_2 amount_{i,t} + \beta_3 maturity_{i,t} + \beta_4 coll_{i,t} + \beta_5 sydn_{i,t} + \beta_6 debtr_{i,t} + \beta_7 roa_{i,t} + \beta_8 roavar_{i,t} + \beta_9 salesgr_{i,t} + \beta_{10} loss_{i,t} + + \beta_{11} indr_{i,t} + \beta_{12} dirhold_{i,t} + \varepsilon_{i,t}$$

where the subscripts *i* and *t* denote firm *i* in year *t*, respectively. RATE represents the vector of firm's bank loan interest rates, including average interest rate (*avgrate*), minimum interest rate (*minrate*), maximum interest rate (*maxrate*), loan spread measure1 (*spread1*), adjusted loan spread measure1 (*spread1nn*) and loan spread measure 2 (*spread2*). ESG represents the vector of firm's ESG performance measures, including ESG rating (*esgrating*), ESG score (*esgscore*), ESG score ranking in the full sample (*esgwr*), ESG score ranking within the Taiwan Stock Exchange industry classification (*esgexr*), ESG score ranking within the SASB main industry classification (*esgmr*), ESG score ranking within the SASB sub industry classification (*esgsr*), ESG environment score (*envscore*), the rank of ESG environment score in SASB main industry classification (*envmr*), the rank of ESG environment score in SASB sub- industry classification (*envsr*), ESG social score (*socscore*), the rank of ESG social score in SASB main industry classification (*socmr*), the rank of ESG social score in SASB sub- industry classification (*socsr*), ESG corporate governance score (*govscore*), the rank of ESG corporate governance score in SASB main industry classification (*govmr*) and the rank of ESG corporate governance score in SASB sub-industry classification (*govsr*). The remaining variables are control variables for firm's bank loan interest rates, including loan amount (*amount*), loan maturity (*maturity*), collateral (*coll*), syndicated loan (*sydn*), debt ratio (*debtr*), return on assets *(roa*), variance of returns on assets (*roavar*), sales growth rate (*salesgr*), prior-period loss (*loss*), proportion of independent directors (*indr*), directors' shareholdings (*dirhold*). The regression is estimated by pooled ordinary least squares (OLS). A significantly negative sign of the estimated coefficient β_1 indicates that the empirical results support the hypothesis 1.

3.3 Firm Samples and Data

The sample of this study consists of 1,675 nonfinancial firms listed on the Taiwan Stock Exchange (TWSE) and the Taipei Exchange (TPEx), excluding financial institutions such as banks, billings firms, life insurers, property insurers, securities firms, and financial holding companies. Financial firms are excluded because their accounting standards, account structures, performance evaluation measures, regulatory environment, and industry competition differ substantially from those of non-financial firms. Data on corporate bank loan interest rates and loan contract characteristics were primarily constructed by aggregating tens of thousands of loan

contracts extended by publicly listed banks in Taiwan to the 1,675 firms in firm sample over the study period, resulting in a firm-year panel dataset. Loan contract data were obtained from the Taiwan Economic Journal (TEJ) database. Firm-specific financial characteristics, corporate governance variables, and ESG measures were collected from the TEJ database and the Taiwan Stock Exchange's Market Observation Post System (MOPS).

4. Empirical Result

4.1 Summary Statistics and Correlation Analysis

Table 2 reports the descriptive statistics of all variables, including the number of observations, mean, standard deviation, minimum, and maximum values. Panel B presents the subsample of firms with superior ESG performance (*esgscore* above the median), while Panel C reports the subsample of firms with inferior ESG performance (*esgscore* at or below the median). Panel D shows the mean differences of each variable between the two groups (the former minus the latter). Examination of Panel D reveals that the mean differences for all interest rate and loan spread variables are negative and statistically significant at the 1% level, indicating that firms with superior ESG performance consistently obtain lower average loan rates, minimum loan rates, maximum loan rates, and loan spreads compared to their counterparts with inferior ESG performance.

Above results suggest that banks recognize ESG strength as a credible signal of reduced credit risk and improved stakeholder management, thereby rewarding ESG-active borrowers with more favorable lending terms. This finding is consistent with the notion that ESG performance enhances firms' reputational capital, reduces information asymmetry, and improves the predictability of future cash flows, which collectively lower the perceived default risk and funding costs (Goss and Roberts, 2011; Chava, 2014). Furthermore, the evidence aligns with recent research documenting that banks integrate non-financial criteria such as sustainability into their credit assessments, treating ESG engagement as a proxy for long-term resilience and lower downside risk (Kölbel, Heeb, Paetzold and Busch, 2020; Krüger, 2015). Hence, the significantly lower loan costs for ESG-strong firms corroborate the central hypothesis of this study: enhancing ESG performance yields tangible financial benefits by improving firms' access to cheaper bank financing.

Firms with superior ESG performance exhibit distinct financial and governance characteristics relative to their lower-performing counterparts. Specifically, these firms tend to obtain larger loan amounts, although their loan contracts are of shorter maturity on average, and they are less likely to pledge collateral, consistent with banks' perception of reduced credit risk. Moreover, they are more likely to secure syndicated loans, indicating that higher ESG quality mitigates coordination frictions among lenders and fosters broader lending participation (Houston and James, 1996; Ivashina, 2009). On the balance sheet side, ESG-strong firms display higher debt ratios and superior return on assets, coupled with lower variability in operating performance, suggesting greater stability in cash flows and reduced downside risk

(Goss and Roberts, 2011; Chava, 2014). At the same time, these firms exhibit lower sales growth and a reduced probability of reporting a loss in the prior year, implying that banks may interpret ESG engagement as a signal of prudent risk management rather than aggressive expansion (El Ghoul et al., 2011; Albuquerque, Koskinen and Zhang, 2019). From a governance perspective, ESG-strong firms are characterized by lower board independence, while the shareholdings of directors do not significantly differ between the two ESG groups. Taken together, these patterns highlight that strong ESG performance is associated with a favorable credit environment, enhanced operational resilience, and governance structures that deviate from conventional monitoring mechanisms, thereby influencing both debt contracting and firm value in economically meaningful ways.

Table 3 reports the pairwise Pearson correlation matrix for bank loan interest rate rates, bank loan spreads and ESG variables. Focusing on the correlations between ESG performance measures and bank lending rates and spreads, we observe that all coefficients are negative and statistically significant at least at the 10% level. This pattern holds consistently across both overall ESG performance measures—whether industry-adjusted or not—and the individual environmental, social, and governance dimensions. The negative correlations indicate that firms with stronger ESG performance are associated with lower bank lending rates and narrower spreads, suggesting a tangible reduction in borrowing costs. This implies that superior ESG engagement is interpreted by lenders as a signal of lower default risk and higher operational resilience, thereby facilitating more favorable credit terms (El Ghoul et al., 2011; Goss and Roberts, 2011; Chava, 2014). These results provide empirical support for our hypothesized relationship, reinforcing the notion that ESG performance functions as a valuable non-financial signal in debt contracting, consistent with the broader literature on the risk-mitigating role of corporate social responsibility (Albuquerque, Koskinen and Zhang, 2019; Qian, Shi, Song and Wu, 2023).

Table 2: Summary Statistics

	Panel A. Full Sample					Panel B. Subsample of Firms with Superior ESG Performance (firms with *esgscore* above the sample median)					Panel C. Subsample of Firms with Inferior ESG Performance (firms with *esgscore* at or below the sample median)					Panel D.
	# of obs.	Mean	St. Dev.	Min.	Max.	# of obs.	Mean	St. Dev.	Min.	Max.	# of obs.	Mean	St. Dev.	Min.	Max.	Dif. in Means
avgrate	7,451	1.6114	0.6265	0.5013	3.9762	3,643	1.5337	0.6280	0.5013	3.9762	3,695	1.6903	0.6176	0.5013	3.9762	-0.1566***
minrate	7,451	1.5313	0.5895	0.4263	3.6275	3,643	1.4441	0.5801	0.4263	3.6275	3,695	1.6190	0.5889	0.4263	3.6275	-0.1749***
maxrate	7,451	1.6900	0.7230	0.5164	4.8563	3,643	1.6200	0.7360	0.5164	4.8563	3,695	1.7621	0.7054	0.5164	4.8563	-0.1421***
spread1	7,451	0.5135	0.5550	-0.4888	2.6300	3,643	0.4268	0.5449	-0.4888	2.6300	3,695	0.5970	0.5537	-0.4888	2.6300	-0.1702***
spread1nn	6,519	0.6116	0.5255	0.0101	2.6950	3,026	0.5477	0.5215	0.0101	2.6950	3,390	0.6674	0.5248	0.0101	2.6950	-0.1197***
spread2	7,451	-1.0589	0.5645	-2.0454	1.1308	3,643	-1.1440	0.5573	-2.0454	1.1308	3,695	-0.9758	0.5607	-2.0454	1.1308	-0.1682***
esgrating	12,744	3.9062	1.5146	1.0000	7.0000	6,368	5.1085	0.9453	4.0000	7.0000	6,376	2.7053	0.8982	1.0000	4.0000	2.4032***
esgscore	12,744	54.616	8.1287	29.890	83.730	6,368	61.127	5.4448	54.000	83.730	6,376	48.112	4.2215	29.890	53.990	13.015***
esgwr	12,744	56.063	28.503	0.0000	99.958	6,368	80.475	11.624	57.024	99.958	6,376	31.681	17.295	0.0000	60.544	48.794***
esgexr	12,744	54.691	28.511	0.0000	99.609	6,368	78.129	14.097	0.0000	99.609	6,376	31.283	18.155	0.0000	77.966	46.847***
esgmr	12,744	55.940	28.296	0.0000	99.882	6,368	80.038	11.932	34.286	99.882	6,376	31.873	17.289	0.0000	75.676	48.165***
esgsr	12,744	54.462	28.403	0.0000	99.762	6,368	77.390	14.740	0.0000	99.762	6,376	31.563	18.602	0.0000	85.714	45.827***
envscore	12,744	54.893	11.624	23.320	90.960	6,368	61.789	11.179	26.340	90.960	6,376	48.005	7.0940	23.320	83.460	13.785***
envmr	12,744	54.832	28.054	0.0000	99.882	6,368	71.517	23.619	0.0000	99.882	6,376	38.168	21.451	0.0000	99.251	33.349***
envsr	12,744	53.604	27.738	0.0000	99.762	6,368	69.485	24.002	0.0000	99.762	6,376	37.744	21.426	0.0000	98.511	31.740***
socscore	12,744	54.922	10.676	26.440	91.000	6,368	61.544	9.3305	32.540	91.000	6,376	48.308	7.3036	26.440	84.010	13.236***
socmr	12,744	55.419	28.483	0.0000	99.882	6,368	73.411	20.488	0.0000	99.882	6,376	37.450	23.584	0.0000	99.105	35.961***
socsr	12,744	54.067	28.566	0.0000	99.762	6,368	70.978	21.713	0.0000	99.762	6,376	37.178	24.276	0.0000	98.611	33.800***
govscore	12,744	54.194	10.614	19.650	84.410	6,368	60.267	8.4555	30.730	84.410	6,376	48.129	8.9539	19.650	77.240	12.138***
govmr	12,744	52.994	28.968	0.0000	99.882	6,368	69.917	22.894	1.7241	99.882	6,376	36.093	24.127	0.0000	99.324	33.824***
govsr	12,744	51.706	28.992	0.0000	99.759	6,368	67.988	23.595	0.0000	99.759	6,376	35.445	24.390	0.0000	98.734	32.542***
amount	7,504	11.526	1.3170	3.9120	16.211	3,681	11.920	1.3638	5.7683	16.211	3,708	11.161	1.1441	3.9120	16.013	0.7589***
maturity	6,646	3.0519	3.5180	0.0000	40.205	3,234	2.9035	3.2192	0.0100	24.220	3,312	3.1432	3.7241	0.0000	40.205	-0.2398***
coll	7,504	0.4569	0.3946	0.0000	1.0000	3,681	0.3693	0.3819	0.0000	1.0000	3,708	0.5408	0.3872	0.0000	1.0000	-0.1716***
sydn	7,504	0.0394	0.1578	0.0000	1.0000	3,681	0.0484	0.1763	0.0000	1.0000	3,708	0.0318	0.1390	0.0000	1.0000	0.0166***
debtr	13,259	36.772	18.315	2.3741	83.922	6,368	37.038	17.359	2.3741	83.922	6,372	36.261	19.018	2.3741	83.922	0.7770**
roa	13,175	7.6915	9.8960	-26.684	36.390	6,367	9.3995	8.9009	-26.684	36.390	6,372	5.5359	10.117	-26.684	36.390	3.8636***
roavar	12,951	40.614	97.514	0.2129	757.83	6,363	28.706	68.422	0.2129	757.83	6,368	51.020	114.93	0.2129	757.83	-22.314***
salesgr	13,080	9.3306	58.412	-81.205	424.38	6,357	6.6157	46.464	-81.205	424.38	6,325	10.725	67.055	-81.205	424.38	-4.1089***
loss	13,146	0.1940	0.3954	0.0000	1.0000	6,367	0.1194	0.3242	0.0000	1.0000	6,372	0.2742	0.4461	0.0000	1.0000	-0.1548***
indr	12,896	36.358	9.9446	0.0000	80.000	6,366	36.082	9.5725	0.0000	66.667	6,372	36.834	9.8680	0.0000	80.000	-0.7519***
dirhold	12,896	22.787	15.384	2.3350	69.105	6,366	22.532	15.915	2.3350	69.105	6,372	22.680	14.552	2.3350	69.105	-0.1473

Notes: This table reports the descriptive statistics of all variables, including the number of observations, mean, standard deviation, minimum, and maximum values. Panel B presents the subsample of firms with superior ESG performance (*esgscore* above the median), while Panel C reports the subsample of firms with inferior ESG performance (*esgscore* at or below the median). Panel D shows the difference in means of each variable between the two groups (the former minus the latter). Symbols *, **, and *** denote statistical significance of the mean-difference *t*-tests at the 10%, 5%, and 1% levels, respectively. The sample period spans 2016–2023.

Table 3: Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(1) ***avgrate***	1.0000																				
(2) ***minrate***	0.9341*	1.0000																			
(3) ***maxrate***	0.9651*	0.8154*	1.0000																		
(4) ***spread1***	0.8980*	0.8263*	0.8774*	1.0000																	
(5) ***spread1nn***	0.8891*	0.7972*	0.8727*	0.9999*	1.0000																
(6) ***spread2***	0.9440*	0.8710*	0.9199*	0.9873*	0.9860*	1.0000															
(7) ***esgrating***	-0.1606*	-0.1856*	-0.1291*	-0.1841*	-0.1366*	-0.1801*	1.0000														
(8) ***esgscore***	-0.1542*	-0.1810*	-0.1218*	-0.1856*	-0.1337*	-0.1813*	0.9685*	1.0000													
(9) ***esgwr***	-0.1573*	-0.1823*	-0.1259*	-0.1840*	-0.1396*	-0.1806*	0.9675*	0.9619*	1.0000												
(10) ***esgexr***	-0.1533*	-0.1755*	-0.1244*	-0.1788*	-0.1362*	-0.1750*	0.9323*	0.9281*	0.9623*	1.0000											
(11) ***esgmr***	-0.1592*	-0.1838*	-0.1281*	-0.1861*	-0.1420*	-0.1827*	0.9607*	0.9560*	0.9929*	0.9635*	1.0000										
(12) ***esgsr***	-0.1581*	-0.1793*	-0.1298*	-0.1840*	-0.1449*	-0.1803*	0.9153*	0.9106*	0.9465*	0.9367*	0.9532*	1.0000									
(13) ***envscore***	-0.1116*	-0.1400*	-0.0814*	-0.1363*	-0.0813*	-0.1329*	0.7015*	0.7397*	0.6852*	0.6641*	0.6752*	0.6526*	1.0000								
(14) ***envmr***	-0.1081*	-0.1336*	-0.0805*	-0.1241*	-0.0749*	-0.1223*	0.6755*	0.6915*	0.6770*	0.6583*	0.6693*	0.6457*	0.9356*	1.0000							
(15) ***envsr***	-0.1059*	-0.1265*	-0.0819*	-0.1201*	-0.0775*	-0.1182*	0.6513*	0.6659*	0.6525*	0.6417*	0.6466*	0.6727*	0.9009*	0.9588*	1.0000						
(16) ***socscore***	-0.1395*	-0.1680*	-0.1063*	-0.1540*	-0.1126*	-0.1535*	0.7542*	0.7819*	0.7424*	0.7057*	0.7351*	0.6836*	0.5104*	0.4731*	0.4504*	1.0000					
(17) ***socmr***	-0.1375*	-0.1671*	-0.1037*	-0.1482*	-0.1122*	-0.1486*	0.7336*	0.7431*	0.7438*	0.7094*	0.7449*	0.6963*	0.4734*	0.4568*	0.4406*	0.9530*	1.0000				
(18) ***socsr***	-0.1365*	-0.1627*	-0.1053*	-0.1489*	-0.1165*	-0.1484*	0.6942*	0.7030*	0.7033*	0.6873*	0.7047*	0.7354*	0.4648*	0.4487*	0.4698*	0.8898*	0.9378*	1.0000			
(19) ***govscore***	-0.0914*	-0.0971*	-0.0805*	-0.1253*	-0.0983*	-0.1190*	0.6959*	0.7039*	0.7059*	0.6896*	0.7088*	0.6824*	0.2614*	0.2501*	0.2433*	0.2461*	0.2305*	0.2171*	1.0000		
(20) ***govmr***	-0.0857*	-0.0901*	-0.0762*	-0.1221*	-0.0984*	-0.1149*	0.6882*	0.6895*	0.7051*	0.6895*	0.7097*	0.6839*	0.2607*	0.2491*	0.2432*	0.2433*	0.2277*	0.2145*	0.9750*	1.0000	
(21) ***govsr***	-0.0838*	-0.0876*	-0.0752*	-0.1169*	-0.0969*	-0.1100*	0.6616*	0.6629*	0.6793*	0.6735*	0.6840*	0.7063*	0.2562*	0.2443*	0.2613*	0.2251*	0.2123*	0.2338*	0.9388*	0.9626*	1.0000

Notes: This table reports the Pearson correlation coefficients among the variables over the sample period 2016–2023. An asterisk (*) indicates statistical significance at the 10% level.

4.2 Baseline Regression Results

Table 4 reports ordinary least squares (OLS) estimates of the relation between firms' overall ESG performance and the average bank loan interest rate (*avgrate*). Model (1)–(6) employ alternative proxies for overall ESG performance, including ESG rating (*esgrating*), ESG score (*esgscore*), the ranking of ESG scores among all rated firms (*esgwr*), the ranking of ESG scores based on the Taiwan Stock Exchange industry classification (*esgexr*), the ranking of ESG scores based on Sustainability Accounting Standards Board (SASB) main industry classification (*esgmr*), and the ranking of ESG scores based on SASB sub industry classification. All regressions include the same set of control variables, as mentioned before. The coefficients on all ESG performance measures are consistently negative and highly significant at the 1% level across specifications. This evidence suggests that, holding other firm and macroeconomic conditions constant, firms with higher ESG ratings, higher absolute ESG scores, or superior industry-adjusted ESG rankings tend to secure loans at lower interest rates.

This finding implies that banks incorporate ESG performance into their credit risk assessments and pricing strategies. Strong ESG performance may serve as a credible signal of lower long-term risk exposure, improved stakeholder relations, and enhanced reputational capital, thereby reducing perceived default risk and monitoring costs from the lender's perspective. Consequently, banks are willing to offer more favorable lending terms to firms with superior ESG profiles. Overall, the empirical results lend strong support to the hypothesis that ESG engagement enhances a firm's borrowing capacity by lowering the cost of bank debt financing.

Turning to the control variables, the regression results reported in Table 4 provide consistent and economically meaningful insights. First, the estimated coefficients on loan amount (*amount*) are predominantly negative and statistically significant at the 1% level, suggesting that larger loan facilities are associated with lower borrowing costs. This evidence implies that banks may grant preferential pricing to firms with greater borrowing needs, potentially reflecting economies of scale in lending relationships or the bargaining power of large borrowers. Second, the coefficients on loan maturity (*maturity*) are uniformly negative and in most cases statistically significant at the 5% level, indicating that loans with longer maturities tend to carry lower interest rates. This pattern may reflect lenders' perception that longer-term lending relationships reduce monitoring costs or signal lower default risk over the loan horizon. Third, the coefficients on collateral provision (*coll*) are generally positive and significant at the 1% level, implying that loans secured with collateral are associated with higher borrowing costs. This finding is consistent with the notion that collateralized loans are often extended to riskier borrowers, thereby requiring lenders to charge higher interest rates as compensation for elevated credit risk. Finally, the coefficients on syndicated loans (*sydn*) are positive and significant at the 1% level, suggesting that loan syndication is associated with higher interest rates. This outcome may reflect coordination costs among multiple lenders or the fact that syndication is often used for more complex and riskier loan arrangements.

Overall, the control variable estimates align with established theories of bank loan contracting and reinforce the robustness of the main findings.

For the firm-specific financial characteristics, the regression estimates reveal that the debt ratio (*debtr*) consistently enters with a positive and statistically significant coefficient at the 1% level. This finding indicates that more highly leveraged firms are systematically charged higher loan rates, consistent with banks incorporating the elevated probability of financial distress and default risk into their pricing decisions. By contrast, return on assets (*roa*) is uniformly negative and strongly significant at the 1% level, suggesting that more profitable firms obtain cheaper credit. The interpretation is straightforward: banks appear to reward profitability as a signal of superior operational efficiency and repayment capacity, thereby reducing the risk premium embedded in lending rates. In addition, the variance of return on assets (*roavar*), which captures volatility in profitability, enters positively and significantly, implying that banks penalize firms with higher earnings volatility through higher loan rates. This is consistent with the notion that unstable cash flows increase the uncertainty of repayment and therefore justify risk-adjusted pricing. Furthermore, sales growth (*salesgr*) is estimated to be positive and significant, indicating that firms with faster sales expansion face higher borrowing costs. This counterintuitive result may reflect banks' concerns that rapid growth is often associated with heightened financing needs, increased agency problems, or potential overinvestment risk. Finally, the dummy variable for prior-period losses (*loss*) is consistently positive and highly significant at the 1% level, underscoring that banks demand a higher risk premium from firms with a history of financial underperformance. Collectively, these findings highlight that banks rationally price loan contracts by embedding both level and volatility dimensions of firm fundamentals into credit risk assessments, thereby aligning loan pricing with the underlying risk-return tradeoff.

With respect to corporate governance characteristics, the estimates indicate that the proportion of independent directors (*indr*) generally enters with a positive and statistically significant coefficient at the 1% level. This finding implies that firms with a higher share of independent directors tend to face higher bank loan rates. One possible interpretation is that banks perceive stronger board independence not necessarily as a signal of reduced risk, but as an indicator of increased monitoring intensity and potential conflicts with controlling shareholders, which could elevate coordination costs or highlight governance frictions. Alternatively, banks may view the reliance on independent directors as a substitute for weak internal governance mechanisms, thereby adjusting loan pricing upward to reflect heightened agency concerns. In contrast, the coefficient on directors' shareholding ratio (*dirhold*) is predominantly negative and significant at the 1% level, suggesting that greater equity ownership by directors is associated with lower loan rates. This result is consistent with the alignment-of-interests hypothesis, whereby higher insider ownership mitigates agency conflicts between managers and shareholders, enhances credibility of repayment incentives, and ultimately lowers perceived credit risk. Taken together, these results highlight that banks embed governance structures

into loan pricing, penalizing governance mechanisms that may signal heightened agency frictions while rewarding ownership structures that credibly align managerial incentives with debt-holder protection.

Table 4: OLS Regression Estimates of the Effects of Overall ESG Performance on Bank Loan Interest Rate (*avgrate*)

Explanatory Variables	Explained Variable: *avgrate*					
	(1)	(2)	(3)	(4)	(5)	(6)
esgrating	-0.0239***					
	(-4.55)					
esgscore		-0.00360***				
		(-3.62)				
esgwr			-0.00112***			
			(-4.02)			
esgexr				-0.00130***		
				(-4.69)		
esgmr					-0.00118***	
					(-4.21)	
esgsr						-0.00124***
						(-4.48)
amount	-0.0375***	-0.0387***	-0.0387***	-0.0383***	-0.0385***	-0.0386***
	(-5.93)	(-6.09)	(-6.14)	(-6.13)	(-6.13)	(-6.17)
maturity	-0.00558**	-0.00563**	-0.00568**	-0.00545**	-0.00564**	-0.00552**
	(-2.44)	(-2.46)	(-2.49)	(-2.39)	(-2.47)	(-2.41)
coll	0.249***	0.252***	0.251***	0.250***	0.251***	0.250***
	(11.54)	(11.65)	(11.65)	(11.65)	(11.63)	(11.62)
sydn	0.466***	0.466***	0.467***	0.466***	0.466***	0.465***
	(9.88)	(9.87)	(9.89)	(9.89)	(9.87)	(9.86)
debtr	0.00527***	0.00528***	0.00527***	0.00530***	0.00527***	0.00524***
	(11.12)	(11.12)	(11.11)	(11.19)	(11.11)	(11.04)
roa	-0.0108***	-0.0109***	-0.0109***	-0.0108***	-0.0108***	-0.0108***
	(-10.60)	(-10.72)	(-10.70)	(-10.59)	(-10.66)	(-10.65)
roavar	0.000555***	0.000557***	0.000556***	0.000552***	0.000554***	0.000555***
	(5.72)	(5.75)	(5.73)	(5.70)	(5.72)	(5.73)
salesgr	0.000319**	0.000322**	0.000321**	0.000310**	0.000319**	0.000316**
	(2.35)	(2.37)	(2.36)	(2.28)	(2.35)	(2.32)
loss	0.0716***	0.0724***	0.0712***	0.0711***	0.0706***	0.0715***
	(3.46)	(3.49)	(3.43)	(3.43)	(3.40)	(3.45)
indr	0.00374***	0.00377***	0.00374***	0.00374***	0.00376***	0.00378***
	(4.93)	(4.97)	(4.93)	(4.93)	(4.97)	(4.98)
dirhold	-0.00165***	-0.00164***	-0.00164***	-0.00164***	-0.00164***	-0.00170***
	(-3.25)	(-3.23)	(-3.22)	(-3.23)	(-3.23)	(-3.34)
constant	1.728***	1.843***	1.710***	1.713***	1.712***	1.716***
	(22.12)	(21.44)	(21.91)	(21.95)	(21.93)	(21.98)
No. of observation	6,486	6,486	6,486	6,486	6,486	6,486
Adjusted R^2	0.145	0.144	0.144	0.145	0.145	0.145
Model Significance (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: This table reports the ordinary least squares (OLS) regression results examining the effect of firms' overall ESG performance on bank loan pricing, measured by the average bank loan interest rate (*avgrate*). Specifications (1)–(6) employ alternative measures of overall ESG performance, including the ESG rating (*esgrating*), ESG score (*esgscore*), ranking in ESG score among all rated firms (*esgwr*), ranking in ESG score within Taiwan Stock Exchange industry classifications (*esgexr*), ranking in ESG score within SASB main industry classifications (*esgmr*), and ranking in ESG score within SASB sub industry classifications (*esgsr*). Control variables include loan amount (*amount*), loan maturity (*maturity*), collateral requirement (*coll*), syndication loan dummy (*sydn*), debt ratio (*debtr*), return on assets (*roa*), variance of return on assets (*roavar*), sales growth rate (*salesgr*), prior-year loss indicator (*loss*), the proportion of independent directors (*indr*), and directors' shareholding (*dirhold*). The sample period covers 2016–2023. Reported in parentheses are the *t*-statistics based on robust standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5 reports the OLS regression estimates of the effects of firms' individual ESG dimensions on bank loan pricing, measured by the average loan interest rate (*avgrate*). Specifications (1)–(9) employ alternative proxies, including the ESG environment score (*envscore*), the rank of the environment score within SASB main industry classifications (*envmr*), the rank within SASB sub-industry classifications (*envsr*), the ESG social score (*socscore*), the corresponding SASB main and sub-industry rankings (*socmr* and *socsr*), as well as the ESG corporate governance score (*govscore*) and its industry-adjusted rankings (*govmr* and *govsr*). The results indicate that the coefficient on the environment score (*envscore*) is negative and statistically significant at the 10% level, suggesting that stronger environmental performance is associated with lower loan rates. By contrast, while the coefficient on the main-industry rank of the environment score (*envmr*) is also negative, it fails to reach conventional significance thresholds, implying that relative standing within broad industry categories does not materially alter the pricing of bank credit. Notably, the sub-industry rank of the environment score (*envsr*) enters with a negative and significant coefficient at the 10% level, indicating that superior performance relative to close industry peers exerts a meaningful downward effect on borrowing costs.

The interpretation is that banks place greater weight on firms' environmental performance when benchmarked against narrowly defined, more homogeneous competitors, as such peer-based comparisons may better capture industry-specific environmental risks and operational standards. Thus, while absolute environmental performance matters in lowering bank loan interest rate, its risk-reducing value appears most salient when assessed in a sub-industry context where comparability and informational relevance are highest.

In addition, the coefficients on the ESG social score (*socscore*), its industry-adjusted ranks within both SASB main and sub-industry classifications (*socmr* and *socsr*), as well as the ESG corporate governance score (*govscore*) and its corresponding rankings (*govmr* and *govsr*), are almost uniformly negative and statistically significant at least at the 10% level. These results indicate that stronger performance in the social and governance dimensions - whether measured directly or relative to industry peers - consistently reduces firms' cost of bank loan. More interestingly, when comparing across the three ESG pillars, both the statistical significance and the economic magnitude of the estimated effects suggest that the social dimension

exerts the strongest influence in lowering loan rates, while governance and environmental performance, although still statistically significant, play comparatively smaller roles. The economic interpretation of these findings is that banks may place particular emphasis on social practices—such as labor relations, workplace safety, and community engagement—as they directly affect firms' operational stability and reputational standing, thereby lowering default probabilities and mitigating non-financial risks that could impair repayment capacity (Goss and Roberts, 2011; Chava, 2014). By contrast, governance improvements reduce agency conflicts and enhance creditor protection, but banks may perceive these benefits as partially substitutable with contractual covenants or collateral requirements (John, Litov and Yeung, 2008; Boubakri, El Ghoul and Saffar, 2013; Cheng, Ioannou and Serafeim, 2014). Environmental performance, though important in the long run, may be discounted in the short-to-medium horizon of bank lending, given the slower materialization of environmental risks in cash flows (Krüger, 2015). Taken together, these results suggest that while all three ESG dimensions contribute to reducing borrowing costs, banks appear to assign the highest risk-adjusted value to social performance, consistent with its more immediate implications for firm cash flow stability and downside risk mitigation.

From a broader perspective, these findings also have implications for banks' own risk management and capital allocation strategies. By rewarding firms with superior ESG performance—particularly along the social dimension—banks are not only pricing firm-specific credit risk but also protecting themselves from reputational risk associated with lending to firms that may face labor disputes, regulatory sanctions, or community backlash (Sharfman and Fernando, 2008; Houston and Shan, 2022). In this sense, ESG-sensitive loan pricing reflects banks' effort to safeguard their intermediation role and maintain legitimacy in the eyes of regulators, investors, and depositors (Suchman, 1995; Godfrey, Merrill and Hansen, 2009). Moreover, by differentiating loan terms based on ESG profiles, banks contribute to a more efficient allocation of capital, channeling financial resources toward firms that are better positioned to sustain long-term value creation and risk mitigation (Cheng, Ioannou and Serafeim, 2014). This mechanism aligns with the growing view that ESG integration in credit markets functions as both a risk-management tool and a means of promoting financial system stability (Lins, Servaes and Tamayo, 2017; Albuquerque, Koskinen and Zhang, 2019). In particular, the strong emphasis on social performance underscores that banks value immediate risk-reducing effects on firm cash flows, while governance and environmental performance provide complementary but comparatively smaller benefits over the horizon relevant for loan contracts.

The regression estimates of the control variables reported in Table 5 reveal several consistent patterns regarding the determinants of bank loan interest rate. Specifically, the estimated coefficients on loan amount (*amount*) are generally negative and statistically significant, indicating that larger loan facilities are associated with lower borrowing costs. This suggests that loan size may serve as a proxy for borrower quality or bargaining power, as larger firms with sizable credit

demands often possess stronger negotiating positions and more established banking relationships (Berger and Udell, 1990, 1995; Bharath, Dahiya, Saunders and Srinivasan, 2011). Similarly, loan maturity (*maturity*) exhibits a significantly negative relation with loan rates, implying that banks extend more favorable terms to longer-maturity borrowers, which is consistent with screening mechanisms whereby lenders reserve long-term financing for firms perceived as more creditworthy (Diamond, 1991). Conversely, the presence of collateral is found to increase loan pricing, as evidenced by the significantly positive coefficients on collateral dummy variables. This finding aligns with the view that collateral is not solely a signal of borrower quality but rather reflects greater ex-ante risk, with banks requiring collateral precisely from riskier borrowers (Jiménez and Saurina, 2004). Likewise, syndicated loans (*sydn*) are associated with higher loan rates, consistent with prior evidence that the complexity and coordination costs inherent in multi-bank arrangements are often passed on to borrowers (Dennis and Mullineaux, 2000). Turning to firm-specific characteristics, debt ratio (*debtr*) is significantly and positively related to loan rates, suggesting that more highly levered firms are penalized for their elevated financial risk (Graham, Li and Qiu, 2008). Firms with greater earnings volatility, proxied by variance of return on asset (*roavar*), higher sales growth (*salesgr*), or a loss in the previous fiscal year (*loss*) are also charged higher spreads, consistent with lenders incorporating both cash flow uncertainty and downside risk into pricing decisions. Interestingly, a higher proportion of independent directors (*indr*) is positively associated with loan costs, which may reflect banks' perception that enhanced board independence increases monitoring intensity but simultaneously signals underlying governance concerns or agency frictions (Anderson, Mansi and Reeb, 2004). In contrast, firms with stronger profitability (*roa*) and higher levels of director shareholdings (*dirhold*) benefit from lower borrowing costs, underscoring that both robust operating performance and insider alignment alleviate banks' concerns over repayment risk. Collectively, these findings highlight how loan pricing incorporates not only observable contract characteristics but also firm fundamentals and governance structures, thereby reinforcing the notion that bank lending operates as a multi-dimensional screening process rather than a uniform cost of capital mechanism.

Table 5: OLS Regression Estimates of the Effects of Individual ESG Performance on Bank Loan Interest Rate (avgrate)

Explanatory Variables	Explained Variable: *avgrate*								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
envscore	-0.00120*								
	(-1.77)								
envmr		-0.000390							
		(-1.39)							
envsr			-0.000541*						
			(-1.92)						
socscore				-0.00252***					
				(-3.42)					
socmr					-0.000969***				
					(-3.54)				
socsr						-0.00105***			
						(-3.88)			
govscore							-0.00129*		
							(-1.82)		
govmr								-0.000466*	
								(-1.80)	
govsr									-0.000440*
									(-1.71)
amount	-0.0422***	-0.0431***	-0.0424***	-0.0385***	-0.0391***	-0.0388***	-0.0443***	-0.0444***	-0.0445***
	(-6.67)	(-6.85)	(-6.76)	(-6.02)	(-6.18)	(-6.16)	(-7.25)	(-7.27)	(-7.29)
maturity	-0.00595***	-0.00599***	-0.00587**	-0.00575**	-0.00580**	-0.00565**	-0.00591***	-0.00592***	-0.00595***
	(-2.60)	(-2.62)	(-2.57)	(-2.51)	(-2.54)	(-2.47)	(-2.58)	(-2.58)	(-2.60)
coll	0.260***	0.262***	0.261***	0.255***	0.255***	0.254***	0.265***	0.265***	0.265***
	(12.05)	(12.16)	(12.12)	(11.85)	(11.87)	(11.85)	(12.46)	(12.46)	(12.47)
sydn	0.466***	0.466***	0.466***	0.469***	0.471***	0.470***	0.461***	0.461***	0.461***
	(9.86)	(9.86)	(9.87)	(9.94)	(9.97)	(9.95)	(9.76)	(9.76)	(9.76)
debtr	0.00532***	0.00533***	0.00532***	0.00530***	0.00531***	0.00527***	0.00532***	0.00532***	0.00531***
	(11.20)	(11.22)	(11.20)	(11.17)	(11.20)	(11.11)	(11.22)	(11.22)	(11.19)
roa	-0.0112***	-0.0112***	-0.0112***	-0.0110***	-0.0110***	-0.0110***	-0.0111***	-0.0111***	-0.0112***
	(-11.12)	(-11.11)	(-11.07)	(-10.90)	(-10.89)	(-10.87)	(-10.97)	(-10.99)	(-11.02)
roavar	0.000568***	0.000567***	0.000567***	0.000555***	0.000552***	0.000552***	0.000567***	0.000568***	0.000568***
	(5.86)	(5.85)	(5.84)	(5.72)	(5.69)	(5.69)	(5.85)	(5.86)	(5.86)

salesgr	0.000334**	0.000338**	0.000334**	0.000326**	0.000328**	0.000327**	0.000344**	0.000344**	0.000344**
	(2.45)	(2.48)	(2.45)	(2.40)	(2.42)	(2.40)	(2.53)	(2.53)	(2.53)
loss	0.0758***	0.0761***	0.0762***	0.0752***	0.0745***	0.0758***	0.0747***	0.0749***	0.0751***
	(3.65)	(3.67)	(3.68)	(3.63)	(3.60)	(3.66)	(3.60)	(3.61)	(3.62)
indr	0.00374***	0.00374***	0.00373***	0.00357***	0.00360***	0.00360***	0.00390***	0.00391***	0.00391***
	(4.93)	(4.93)	(4.91)	(4.69)	(4.73)	(4.74)	(5.12)	(5.13)	(5.13)
dirhold	-0.00165***	-0.00164***	-0.00167***	-0.00161***	-0.00162***	-0.00168***	-0.00157***	-0.00157***	-0.00160***
	(-3.22)	(-3.21)	(-3.26)	(-3.16)	(-3.18)	(-3.29)	(-3.07)	(-3.09)	(-3.13)
constant	1.751***	1.715***	1.716***	1.788***	1.709***	1.711***	1.769***	1.724***	1.725***
	(21.60)	(21.94)	(21.96)	(22.04)	(21.88)	(21.91)	(21.06)	(21.99)	(21.98)
No. of observation	6,486	6,486	6,486	6,486	6,486	6,486	6,486	6,486	6,486
Adjusted R^2	0.143	0.142	0.143	0.144	0.144	0.144	0.143	0.143	0.143
Model Significance (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: This table reports the ordinary least squares (OLS) regression results examining the effect of firms' individual ESG performance on bank loan pricing, measured by the average bank loan interest rate (*avgrate*). Specifications (1)–(9) employ alternative measures of individual ESG performance, including ESG environment score (*envscore*), the rank of ESG environment score in SASB main industry classification (*envmr*), the rank of ESG environment score in SASB sub industry classification (*envsr*), ESG social score (*socscore*), the rank of ESG social score in SASB main industry classification (*socmr*), the rank of ESG social score in SASB sub industry classification (*socsr*), ESG corporate governance score (*govscore*), the rank of ESG corporate governance score in SASB main industry classification (*govmr*) and the rank of ESG corporate governance score in SASB sub industry classification (*govsr*). Control variables include loan amount (*amount*), loan maturity (*maturity*), collateral requirement (*coll*), syndication loan dummy (*sydn*), debt ratio (*debtr*), return on assets (*roa*), variance of return on assets (*roavar*), sales growth rate (*salesgr*), prior-year loss indicator (*loss*), the proportion of independent directors (*indr*), and directors' shareholding (*dirhold*). The sample period covers 2016–2023. Reported in parentheses are the *t*-statistics based on robust standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Consistent with the framework presented in Tables 4, Table 6 reports the OLS regression estimates of the effects of overall ESG performance on bank loan pricing. Panel A employs the maximum loan interest rate (*maxrate*) contracted between firms and banks as the dependent variable, whereas Panel B uses the minimum loan interest rate (*minrate*). The introduction of the maximum interest rate is motivated by the fact that many corporate bank loans in the sample are structured as floating-rate contracts rather than fixed-rate agreements. Such contracts explicitly stipulate both upper and lower bounds of interest rates applicable during the loan period. Accordingly, the maximum loan rate for a given firm-year is defined as the average of the contractual upper limits across all floating-rate agreements signed in that year; if a firm signs only one floating-rate contract in a given year, the maximum rate corresponds to that contract's stated ceiling. The minimum loan rate is defined analogously, based on the contractual lower bounds specified in floating-rate agreements.

From an economic standpoint, analyzing ESG performance in relation to both maximum and minimum loan rates provides a richer understanding of how sustainability factors shape credit market outcomes. Maximum rates capture the degree to which banks protect themselves against downside borrower risk in adverse states, while minimum rates reflect the baseline borrowing cost under favorable conditions. By examining both measures, we can assess whether ESG performance primarily reduces the downside risk priced into loan contracts (reflected in lowering maximum rates) or whether it also improves firms' baseline credit standing (reflected in lowering minimum rates). This dual perspective is important because banks typically design floating-rate contracts to balance their risk exposure and competitive pricing: stronger ESG profiles may be perceived as enhancing borrower resilience, thereby lowering the risk premium embedded in the maximum rate, while simultaneously reducing information asymmetry and reputational risk, which can translate into more favorable minimum rates (Goss and Roberts, 2011; Cheng, Ioannou, and Serafeim, 2014, Houston and Shan, 2022). Hence, the empirical design not only extends prior work on ESG and loan spreads but also provides evidence on how banks embed ESG considerations into the contractual flexibility of loan pricing structures.

The regression results presented in Panels A and B of Table 6, which focus on overall ESG performance, are directionally consistent with those reported in Table 4. For parsimony, the coefficients of the control variables and intercepts are omitted and denoted as "yes," indicating their inclusion in the estimation. Across specifications, the estimated coefficients of the overall ESG performance measures are uniformly negative and statistically significant, suggesting that firms with stronger ESG profiles, whether or not adjusted for specific industry classifications, face both lower maximum and lower minimum loan rates in their bank borrowing. From an economic perspective, these findings imply that ESG performance enhances firms' creditworthiness in ways that directly influence the contractual terms of lending. Lower maximum loan rates indicate that banks perceive high-ESG firms as less prone to extreme downside risk, thereby requiring smaller contractual

cushions against adverse states of the world. Similarly, lower minimum loan rates suggest that ESG strength improves firms' baseline bargaining position by mitigating information asymmetry, reputational concerns, and potential agency conflicts, which in turn translates into more favorable baseline pricing (Goss and Roberts, 2011, Houston and Shan, 2022). Together, these results demonstrate that ESG performance not only reduces risk premia embedded in the ceiling of floating-rate contracts but also improves firms' fundamental access to credit at the floor of their contractual borrowing costs. In sum, ESG quality is priced into both the downside protection and baseline lending terms, highlighting its dual role in mitigating perceived credit risk and strengthening firms' financial flexibility.

Table 6: OLS Regression Estimates of the Effects of Overall ESG Performance on Maximum and Minimum Bank Loan Interest Rate

Panel A Explanatory Variables	**Explained Variable: *maxrate***					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
esgrating	-0.0239***					
	(-3.88)					
esgscore		-0.00347***				
		(-2.98)				
esgwr			-0.00107***			
			(-3.31)			
esgexr				-0.00131***		
				(-4.05)		
esgmr					-0.00115***	
					(-3.49)	
esgsr						-0.00128***
						(-3.94)
CONTROLs	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes
No. of observation	6,486	6,486	6,486	6,486	6,486	6,486
Adjusted R^2	0.145	0.144	0.144	0.145	0.145	0.145
Model Significance (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000
Panel B Explanatory Variables	**Explained Variable: *minrate***					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
esgrating	-0.0252***					
	(-5.13)					
esgscore		-0.00399***				
		(-4.30)				
esgwr			-0.00122***			
			(-4.71)			
esgexr				-0.00134***		
				(-5.19)		
esgmr					-0.00128***	
					(-4.88)	
esgsr						-0.00126***
						(-4.89)
CONTROLs	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes
No. of observation	6,486	6,486	6,486	6,486	6,486	6,486
Adjusted R^2	0.145	0.144	0.144	0.145	0.145	0.145
Model Significance (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: This table reports the ordinary least squares (OLS) regression results examining the effect of firms' overall ESG performance on bank loan pricing, measured by the maximum loan interest rate (*maxrate*) in Panel

A and minimum loan interest rate (*minrate*) in Panel B, respectively. Specifications (1)–(6) employ alternative measures of overall ESG performance, including the ESG rating (*esgrating*), ESG score (*esgscore*), ranking in ESG score among all rated firms (*esgwr*), ranking in ESG score within Taiwan Stock Exchange industry classifications (*esgexr*), ranking in ESG score within SASB main industry classifications (*esgmr*), and ranking in ESG score within SASB sub industry classifications (*esgsr*). The coefficients of the control variables and intercepts are omitted and denoted as "yes," indicating their inclusion in the estimation. The sample period covers 2016–2023. Reported in parentheses are the *t*-statistics based on robust standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Consistent with the framework presented in Tables 5, Table 7 reports the OLS regression estimates of the effects of overall ESG performance on bank loan pricing. Similarly, Panel A employs as the dependent variable the maximum loan interest rate (*maxrate*) contracted between firms and banks, whereas Panel B uses the minimum loan interest rate (*minrate*). For parsimony, the coefficients of the control variables and intercepts are omitted in reporting but still included in the estimation. An intriguing finding emerges from Table 7. In Panel A, both raw scores and industry-adjusted rankings indicate that firms' social and corporate governance performance exert a significantly negative effect on the maximum loan rate, whereas environmental performance does not exhibit a statistically significant association. This suggests that environmental strength does not materially alleviate banks' perceptions of extreme downside risk embedded in floating-rate loan contracts. In contrast, Panel B reveals that firms with stronger environmental and social performance benefit from significantly lower minimum loan rates, while governance performance does not exert a statistically meaningful effect. This asymmetry implies that governance quality, although valued by lenders in mitigating agency conflicts at the upper bound of contractual pricing, does not necessarily translate into more favorable baseline lending terms.

From an economic perspective, these results highlight the nuanced role of ESG dimensions in credit pricing. Environmental initiatives may be perceived by banks as long-term strategic investments with uncertain near-term risk implications, limiting their relevance in constraining worst-case scenarios (Krüger, 2015). By contrast, social performance—through stronger labor relations, customer trust, and stakeholder legitimacy—directly reduces both tail risk and baseline credit risk, yielding more favorable loan terms (Cheng, Ioannou, and Serafeim, 2014; Goss and Roberts, 2011). Governance quality, meanwhile, appears particularly effective in lowering the ceiling of borrowing costs by signaling stronger monitoring and alignment with creditors' interests (Laeven and Levine, 2009), but its incremental value in affecting the floor of lending rates seems limited once other firm fundamentals are accounted for. Taken together, these findings indicate that banks price ESG dimensions differentially across the structure of floating-rate contracts. Social performance is consistently rewarded across both maximum and minimum rates, governance is particularly valued in constraining lenders' downside exposure, and environmental performance primarily affects baseline lending terms but not extreme risk buffers. This multidimensional effect underscores that ESG is not a uniform construct in credit markets but is selectively priced depending on the contractual channel through which risk is shared between firms and banks.

Table 7: OLS Regression Estimates of the Effects of Individual ESG Performance on Maximum and Minimum Bank Loan Interest Rate

Panel A Explanatory Variables	**Explained Variable: *maxrate***								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
envscore	-0.000734								
	(-0.93)								
envmr		-0.000194							
		(-0.59)							
envsr			-0.000442						
			(-1.34)						
socscore				-0.00230***					
				(-2.67)					
socmr					-0.000826**				
					(-2.58)				
socsr						-0.000968***			
						(-3.05)			
govscore							-0.00165**		
							(-1.99)		
govmr								-0.000611**	
								(-2.02)	
govsr									-0.000598**
									(-1.99)

Panel B Explanatory Variables	**Explained Variable: *minrate***								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
envscore	-0.00181***								
	(-2.88)								
envmr		-0.000634**							
		(-2.42)							
envsr			-0.000666**						
			(-2.54)						
socscore				-0.00284***					
				(-4.15)					
socmr					-0.00115***				
					(-4.52)				
socsr						-0.00116***			
						(-4.61)			
govscore							-0.00105		
							(-1.59)		
govmr								-0.000364	
								(-1.50)	
govsr									-0.000328
									(-1.37)

Notes: This table reports the ordinary least squares (OLS) regression results examining the effect of firms' individual ESG performance on bank loan pricing, measured by the maximum loan interest rate (*maxrate*) in Panel A and minimum loan interest rate (*minrate*) in Panel B, respectively. Specifications (1)–(9) employ alternative measures of individual ESG performance, including ESG environment score (*envscore*), the rank of ESG environment score in SASB main industry classification (*envmr*), the rank of ESG environment score in SASB sub industry classification (*envsr*), ESG social score (*socscore*), the rank of ESG social score in SASB main industry classification (*socmr*), the rank of ESG social score in SASB sub industry classification (*socsr*), ESG corporate governance score (*govscore*), the rank of ESG corporate governance score in SASB main industry classification (*govmr*) and the rank of ESG corporate governance score in SASB sub industry classification (*govsr*). The coefficients of the control variables and intercepts are omitted and denoted as "yes," indicating their inclusion in the estimation. The sample period covers 2016–2023. Reported in parentheses are the *t*-statistics based on robust standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8 and Table 9 further reports the regression estimates of the effect of firms' overall ESG performance and individual ESG performance on bank loan pricing, with the dependent variable defined in terms of loan spreads. Following established practice in the banking and corporate finance literature, loan spreads are often employed rather than raw interest rates, as spreads benchmark loan pricing against a relevant market rate and thereby isolate the credit risk premium charged to the borrowing firm (e.g., Santos and Winton, 2008; Graham, Li and Qiu, 2008). In this study, the first definition of the spread (*spread1*) is constructed as the difference between the firm's average bank loan rate and the one-year time deposit rate offered by the large domestic financial institution (the Chunghwa Post Co.). This measure captures the excess cost of borrowing relative to a near risk-free institutional benchmark, with corresponding regression estimates reported in Panel A in Table 8 and Table 9.

However, due to the benchmark rate occasionally exceeding or equaling the contracted loan rate, negative or zero spreads may arise. Such cases reflect circumstances where bank lending rates approach the deposit rate benchmark, which could be driven by competitive lending markets or implicit government guarantees (Houston and James, 1996). As these observations may distort the interpretation of risk premia, we exclude negative spreads and construct a non-negative spread measure (*spread1nn*), with estimation results presented in Panel B in Table 8 and Table 9. To further validate the robustness of our findings, we define an alternative spread measure (*spread2*), calculated as the difference between the firm's average bank loan rate and the average of the prime lending rates quoted by the five largest domestic financial institutions. Unlike *spread1*, which anchors loan rates against a quasi–risk-free deposit benchmark, *spread2* reflects the cost of borrowing relative to market-wide commercial lending standards, thereby providing a measure more closely tied to the opportunity cost of credit provision in the domestic financial system (Carey and Nini, 2007; Ivashina, 2009). Panel C in Table 8 and Table 9 reports he corresponding regression estimates under this alternative definition.

From an economic perspective, the use of different spread definitions ensures that the results are not mechanically driven by benchmark choice and allows us to disentangle whether ESG performance reduces bank loan costs relative to safe deposit-based benchmarks (reflecting banks' perception of default risk) or relative to prevailing commercial lending standards (capturing broader market pricing of borrower quality). The consistency of findings across alternative spread measures strengthens the inference that ESG engagement materially lowers firms' borrowing costs from banks.

The regression estimates reported in Table 8 reveal that the coefficients on overall ESG performance are consistently negative and statistically significant at the 1% level across all three loan spread measures. This finding suggests that firms with stronger ESG profiles—whether measured by ratings, scores, or relative rankings within industry-adjusted percentiles - are systematically able to secure bank loans at lower spreads, thereby reducing their cost of debt financing. Economically, these

results are consistent with the notion that ESG engagement mitigates non-financial risks, enhances firm reputation, and strengthens creditor confidence in borrowers' long-term viability. Lenders may interpret higher ESG performance as a signal of superior risk management practices and reduced probability of adverse events, thereby lowering the required compensation for bearing credit risk. This interpretation aligns with prior literature emphasizing that ESG performance enhances firms' access to external financing and reduces the cost of capital by alleviating information asymmetry and agency conflicts (e.g., Goss and Roberts, 2011; Cheng, Ioannou and Serafeim, 2014).

Turning to Table 9, the disaggregated analysis demonstrates that the individual ESG pillars also exert significantly negative effects on loan spreads, with the exception of environmental scores and their SASB-adjusted percentiles in panel B, where the coefficients on *spread1nn* do not reach statistical significance. In all other cases, the results hold at conventional significance levels (at least 10%), indicating that stronger performance in any specific ESG dimension helps reduce borrowing costs. Notably, consistent with earlier findings in Table 5, the social pillar exerts the most pronounced influence on lowering loan spreads, followed by corporate governance and, to a lesser extent, environmental performance. From an economic standpoint, this hierarchy underscores the importance of stakeholder relations and human capital management in shaping lenders' risk assessments. Banks may perceive robust social practices as directly mitigating operational and reputational risks, while strong governance reduces concerns of expropriation and agency conflicts, both of which translate into lower expected credit losses. These results reinforce the view that ESG performance is not merely symbolic but carries tangible financial consequences through its effect on the cost of bank financing.

Table 8: OLS Regression Estimates of the Effects of Overall ESG Performance on Bank Loan Spread

Panel A	**Explained Variable: *spread1***					
Explanatory Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
esgrating	-0.0225***					
	(-4.97)					
esgscore		-0.00405***				
		(-4.75)				
esgwr			-0.00116***			
			(-4.85)			
esgexr				-0.00128***		
				(-5.38)		
esgmr					-0.00121***	
					(-5.00)	
esgsr						-0.00124***
						(-5.19)
Panel B	**Explained Variable: *spread1nn***					
Explanatory Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
esgrating	-0.0157***					
	(-3.30)					
esgscore		-0.00254***				
		(-2.80)				
esgwr			-0.000854***			
			(-3.44)			
esgexr				-0.000978***		
				(-3.95)		
esgmr					-0.000908***	
					(-3.61)	
esgsr						-0.00104***
						(-4.21)
Panel C	**Explained Variable: *spread2***					
Explanatory Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
esgrating	-0.0230***					
	(-4.97)					
esgscore		-0.00413***				
		(-4.73)				
esgwr			-0.00118***			
			(-4.84)			
esgexr				-0.00131***		
				(-5.40)		
esgmr					-0.00124***	
					(-5.02)	
esgsr						-0.00126***
						(-5.18)

Notes: This table reports the ordinary least squares (OLS) regression results examining the effect of firms' overall ESG performance on bank loan pricing, measured by the first definition of loan spread (*spread1*) in Panel A, the first definition of loan spread with positive values (*spread1nn*) in Panel B, and the second definition of loan spread (*spread2*) in Panel C, respectively. Specifications (1)–(6) employ alternative measures of overall ESG performance, including the ESG rating (*esgrating*), ESG score (*esgscore*), ranking in ESG score among all rated firms (*esgwr*), ranking in ESG score within Taiwan Stock Exchange industry classifications (*esgexr*), ranking in ESG score within SASB main industry classifications (*esgmr*), and ranking in ESG score within SASB sub industry classifications (*esgsr*). The coefficients of the control variables and intercepts are omitted in reporting but still included in the estimation. The sample period covers 2016–2023. Reported in parentheses are the *t*-statistics based on robust standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9: OLS Regression Estimates of the Effects of Individual ESG Performance on Bank Loan Spread

Panel A Explanatory Variables	**Explained Variable: *spread1***								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
envscore	-0.00163***								
	(-2.81)								
envmr		-0.000399*							
		(-1.65)							
envsr			-0.000500**						
			(-2.06)						
socscore				-0.00239***					
				(-3.79)					
socmr					0.000859***				
					(-3.65)				
socsr						-0.000955***			
						(-4.10)			
govscore							-0.00187***		
							(-3.07)		
govmr								-0.000727***	
								(-3.27)	
govsr									-0.000639***
									(-2.89)
Panel B Explanatory Variables	**Explained Variable: *spread1nn***								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
envscore	-0.000410								
	(-0.66)								
envmr		-0.00000668							
		(-0.03)							
envsr			-0.000228						
			(-0.90)						
socscore				-0.00180***					
				(-2.69)					
socmr					-0.000721***				
					(-2.94)				
socsr						-0.000893***			
						(-3.69)			

govscore							-0.00127**		
							(-2.00)		
govmr								-0.000562**	
								(-2.43)	
govsr									-0.000568**
									(-2.47)
Panel C Explanatory Variables	**Explained Variable: *spread2***								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
envscore	-0.00161***								
	(-2.70)								
envmr		-0.000415*							
		(-1.68)							
envsr			-0.000516**						
			(-2.08)						
socscore				-0.00250***					
				(-3.85)					
socmr					-0.000905***				
					(-3.75)				
socsr						-0.000986***			
						(-4.14)			
govscore							-0.00187***		
							(-2.99)		
govmr								-0.000713***	
								(-3.12)	
govsr									-0.000624***
									(-2.76)

Notes: This table reports the ordinary least squares (OLS) regression results examining the effect of firms' individual ESG performance on bank loan pricing, measured by the first definition of loan spread (spread1) in Panel A, the first definition of loan spread with positive values (spread1nn) in Panel B, and the second definition of loan spread (spread2) in Panel C, respectively. Specifications (1)–(9) employ alternative measures of individual ESG performance, including ESG environment score (envscore), the rank of ESG environment score in SASB main industry classification (envmr), the rank of ESG environment score in SASB sub industry classification (envsr), ESG social score (socscore), the rank of ESG social score in SASB main industry classification (socmr), the rank of ESG social score in SASB sub industry classification (socsr), ESG corporate governance score (govscore), the rank of ESG corporate governance score in SASB main industry classification (govmr) and the rank of ESG corporate governance score in SASB sub industry classification (govsr). The coefficients of the control variables and intercepts are omitted in reporting but still included in the estimation. The sample period covers 2016–2023. Reported in parentheses are the t-statistics based on robust standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

4.3 Additional Tests

4.3.1 Controlling for Industry and Year Effect

Given that the sample comprises 1,675 publicly listed non-financial firms in Taiwan across 33 industry classifications defined by the Taiwan Stock Exchange, this study incorporated 32 industry dummy variables in the regression specifications to account for systematic heterogeneity in firms' operating environments and industry-specific characteristics that may affect bank loan pricing. Controlling for industry fixed effects is particularly important in this context, as lending institutions often benchmark borrowers against peers within the same sector when assessing default probabilities and determining loan contract terms (Houston and James, 1996; Santos, 2011). Furthermore, the sample period spans 2016–2023, covering eight fiscal years, during which Taiwan's macroeconomic and credit market conditions underwent significant variation, including the COVID-19 shock and subsequent monetary policy adjustments. To mitigate potential biases from time-varying macroeconomic shocks, this study includes seven year dummy variables in the regressions to absorb the influence of unobserved, economy-wide factors on loan interest rates.

From an economic standpoint, controlling for industry and year heterogeneity ensures that the estimated relationship between firms' ESG performance and loan pricing is not spuriously driven by sectoral credit risk differentials or macroeconomic cycles. For instance, firms operating in capital-intensive industries such as electronics or petrochemicals inherently face different risk-return profiles and financing conditions compared to service-oriented sectors, which may otherwise confound ESG-related effects on borrowing costs. Similarly, shifts in monetary policy stance or systemic liquidity during the sample period could disproportionately affect loan spreads irrespective of firm-level ESG practices. By incorporating these controls, our estimates more precisely capture the incremental effect of ESG performance on loan pricing beyond industry- and time-specific determinants. This empirical design is consistent with prior literature emphasizing the importance of industry and temporal controls in identifying causal drivers of corporate financing costs (Lemmon, Roberts and Zender, 2008; Chava and Roberts, 2008; Acharya, Eisert, Eufinger and Hirsch, 2019).

An examination of the estimates reported in Panel A of Table 10 reveals that, even after controlling for industry- and year-specific heterogeneity that could affect bank loan interest rates and loan spreads, firms' overall ESG performance—as well as performance across the environmental, social, and governance dimensions—remains significantly and negatively associated with borrowing costs. In economic terms, this result indicates that superior ESG engagement reduces the perceived risk premium charged by banks, thereby lowering loan pricing. This finding is consistent with the hypothesis of this study, suggesting that ESG serves as a non-financial indicator of firm quality that enhances lenders' confidence in borrowers' long-term solvency and mitigates information asymmetry in credit markets (Diamond, 1991; Houston and James, 1996; Goss and Roberts, 2011). Furthermore, the results align with recent evidence that banks increasingly incorporate ESG considerations into credit risk assessments and loan contracting, both as a mechanism to manage downside risk exposure and as a strategic response to regulatory and reputational pressures (Chava, 2014; Krüger, 2015). From an economic perspective, the observed reduction in loan spreads suggests that the marginal benefit of ESG investment extends beyond equity market valuations to tangible cost-of-capital advantages in debt financing, reinforcing the view that ESG can be interpreted as an intangible capital that directly influences firms' financing conditions (Lins,

Servaes and Tamayo, 2017; Albuquerque, Koskinen, and Zhang, 2019).

4.3.2 Dynamic Regression Estimation

In the baseline regression specification, the dependent variable (loan interest rates or loan spreads) and the explanatory variables (ESG measures) are aligned contemporaneously. Such a design may raise concerns regarding the so-called contemporaneous correlation fallacy, in which the dependent variable could plausibly exert a reverse effect on the independent variables. In the present context, firms enjoying lower borrowing costs may possess greater free resources or enhanced profitability, thereby enabling them to allocate additional resources toward improving stakeholder welfare and, in turn, achieving superior ESG performance. This reverse-causality channel risks biasing the estimated coefficients upward and obscuring the causal interpretation of the ESG-loan pricing relation.

To mitigate this concern, this research re-estimates the models by lagging the ESG variables by one period relative to the loan interest rate or loan spread measures, thereby imposing a temporal structure that reduces the potential endogeneity from simultaneous determination. This econometric adjustment is consistent with prior corporate finance and banking studies that emphasize the need to account for dynamic interactions between firm characteristics and financing outcomes (Petersen and Rajan, 1994; Lemmon, Roberts, and Zender, 2008; Almeida, Campello, and Weisbach, 2011). Economically, this approach strengthens the argument that superior ESG performance functions as a forward-looking signal of credit quality rather than a mere outcome of reduced financing frictions. By lagging ESG variables, we enhance the plausibility of the interpretation that ESG serves as an ex ante determinant of banks' loan pricing decisions, consistent with the view that ESG acts as a non-financial indicator of reduced borrower risk and improved long-term sustainability (Goss and Roberts, 2011; Chava, 2014; Albuquerque, Koskinen, and Zhang, 2019).

Turning to the estimates reported in Panel B in Table 10, where all ESG-related explanatory variables are lagged by one period (with lowercase *t-1*) to address concerns of contemporaneous correlation, we find that most ESG coefficients remain negative and statistically significant (with few exceptions). This result indicates that a firm's prior-year overall ESG performance, as well as its environmental, social, and governance dimensions, continues to exert a downward effect on loan interest rates. This finding reinforces the interpretation that ESG performance functions as a forward-looking indicator of credit quality rather than a contemporaneous byproduct of favorable financing conditions. In particular, superior ESG outcomes in the prior year may signal reduced default risk, stronger stakeholder engagement, and enhanced managerial discipline, which are subsequently rewarded by banks through lower loan pricing. This temporal separation strengthens the causal interpretation of ESG as an ex ante determinant of lending terms, consistent with the notion that banks incorporate ESG information into their credit-risk assessment frameworks (Goss and Roberts, 2011; Chava, 2014; Albuquerque, Koskinen, and Zhang, 2019).

Table 10: OLS Regression Estimates of the Effects of Overall and Individual ESG Performance on Bank Loan Rate and Spread

Panel A	**Explained Variable: *avgrate***					**Explained Variable: *spread1nn***				
Explanatory Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
esgrating	-0.0274***					-0.0203***				
	(-6.15)					(-4.30)				
esgscore		-0.00493***					-0.00340***			
		(-5.85)					(-3.79)			
envscore			-0.00155***					-0.000292		
			(-2.73)					(-0.48)		
socscore				-0.00276***					-0.00208***	
				(-4.37)					(-3.10)	
govscore					-0.00262***					-0.00208***
					(-4.44)					(-3.38)
CONTROLs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Ind. & Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Panel B	**Explained Variable: *avgrate***					**Explained Variable: *spread1nn***				
Explanatory Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
$esgrating_{t-1}$	-0.0261***					-0.0141***				
	(-4.52)					(-2.72)				
$esgscore_{t-1}$		-0.00478***					-0.00253**			
		(-4.24)					(-2.48)			
$envscore_{t-1}$			-0.00251***					-0.00108		
			(-3.23)					(-1.52)		
$socscore_{t-1}$				-0.00313***					-0.00208***	
				(-3.73)					(-2.75)	
$govscore_{t-1}$					-0.00126					-0.000353
					(-1.63)					(-0.51)
CONTROLs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

This table reports the ordinary least squares (OLS) regression results examining the effect of firms' overall and individual ESG performance on bank loan rate (average bank loan interest rate, *avgrate*) and loan spread (the first definition of loan spread with positive values, spread1nn). In Model (1)~(5), ESG performance measures include ESG rating (*esgrating*), ESG score (*esgscore*), environment score (*envscore*), social score (*socscore*), and corporate governance score (*govscore*). In Panel A, 32 industry dummy variables and 7 year dummy variables are include in regression estimations (Ind. & Year Dummies, yet the coefficients are omitted and denoted as "yes," indicating their inclusion in the estimation). In Panel B, ESG-related explanatory variables are lagged by one period (with lowercase *t-1*). The coefficients of the control variables and intercepts are omitted and denoted as "yes," indicating their inclusion in the estimation. The sample period covers 2016–2023. Reported in parentheses are the *t*-statistics based on robust standard errors. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusion

5.1 Research Findings and Recommendations

In Taiwan's financial system, indirect financing continues to dominate corporate funding sources, indicating that firms remain highly dependent on bank-based financing for their operational and investment needs. Alongside the global momentum toward sustainable finance, the business environment has evolved such that firms are increasingly compelled to incorporate environmental, social, and governance (ESG) considerations into their strategic and managerial practices. Simultaneously, financial regulators have required banks to strengthen the assessment of their counterparties' ESG performance in both lending and investment decisions. As a result, banks have gradually internalized ESG factors into their credit risk evaluation and loan pricing mechanisms, making ESG performance an integral component of financial intermediation. Against this backdrop, this study employs a comprehensive panel dataset of listed non-financial firms in Taiwan from 2016 to 2023 to empirically examine whether firms' ESG performance contributes to lower borrowing costs, as reflected in bank loan interest rates. From an alternative perspective, the analysis also explores whether banks reward firms with superior ESG performance by offering more favorable lending terms. This investigation not only sheds light on the economic linkage between corporate ESG performance and the cost of debt financing but also provides insights into how financial institutions incorporate sustainability considerations into credit risk assessment and pricing in the era of sustainable finance.

Overall, the empirical results reveal a significantly negative association between firms' overall ESG performance and bank loan interest rates. Across all specifications employing different measures of bank loan interest rate, the estimated coefficients are consistently significant at the 1% level, indicating that listed non-financial firms in Taiwan can effectively reduce their borrowing costs by actively engaging in ESG practices. When decomposing overall ESG performance into the three dimensions of environmental (E), social (S), and governance (G) performance, all nine indicators exhibit negative effects on loan rates, though the magnitude and significance differ across models. Except for the model using the minimum loan rate as the dependent variable, the social dimension demonstrates the strongest significance, followed by corporate governance, while the environmental dimension appears the weakest. This pattern aligns with Taiwan's regulatory context, where, since 2023, listed firms have been required to disclose climate-related information in their sustainability reports. Consequently, banks possess relatively limited and less standardized data for evaluating firms' environmental performance, weakening its impact on loan pricing decisions.

Further analyses across alternative bank loan rate measures provide additional insights. Firms with superior environmental performance tend to receive lower minimum loan rates, leading to a significantly negative coefficient for the environmental dimension in this specification, whereas the effect becomes insignificant for the maximum loan rate. This implies that banks reward

environmentally responsible firms through lower borrowing costs, but remain conservative when pricing higher-risk loans. In contrast, the governance dimension exhibits the opposite pattern-being insignificant for the minimum loan rate but significant for the maximum loan rate-suggesting that firms with stronger governance structures are more likely to obtain favorable terms, which are already reflected in the lower-rate segment. As the loan spread (the average loan rate minus the one-year postal savings deposit rate) is employed, the social dimension consistently shows a 1% level of significance across specifications, while the governance dimension displays mixed results (1% and 5% significance levels across specifications). The environmental dimension, meanwhile, is only significant in certain specifications. Additional robustness tests incorporating industry and year fixed effects confirm that the environmental dimension exerts the weakest explanatory power on loan spreads, reflecting the limited availability of verifiable environmental information in banks' credit evaluation processes. Furthermore, the lagged governance score demonstrates the lowest significance among the three ESG dimensions, suggesting that banks prioritize firms' current governance quality in their "real-time" risk assessment and lending decisions.

The empirical findings of the study reveal a significantly negative association between firms' ESG performance and bank loan interest rates, suggesting that active engagement in ESG practices effectively reduces firms' borrowing costs. These results are consistent with recent empirical evidence in the finance and management literature, which documents that superior ESG performance mitigates firms' cost of capital. For instance, Chava (2014) finds that firms with poor environmental records face higher loan spreads, while Goss and Roberts (2011) report that firms with weaker social responsibility performance incur higher borrowing costs. Similarly, Kölbel, Heeb, Paetzold and Busch (2020) and Nandy and Lodh (2012) demonstrate that banks increasingly integrate ESG factors into credit risk assessments and loan pricing decisions. In the Taiwanese context, this study further shows that the social and governance dimensions exert stronger effects than the environmental dimension, reflecting banks' greater ability to quantify and evaluate social and governance information, whereas environmental information remains less standardized. Overall, the findings not only corroborate prior literature on the negative relationship between ESG performance and financing costs but also extend the understanding of how ESG factors are operationalized within bank-based financial systems in Asia, offering important economic implications for sustainable credit market dynamics.

The findings of the study yield important policy and managerial implications for financial regulators, corporate executives, and investors. For regulators and policymakers, the evidence indicates that ESG performance has become a critical determinant in bank loan pricing, suggesting that the implementation of sustainable finance and disclosure regulations has begun to influence real capital allocation. Supervisory authorities such as the Financial Supervisory Commission (FSC) and the Central Bank in Taiwan may further enhance the standardization of ESG disclosure and quantitative assessment in credit evaluation, while encouraging financial institutions to integrate ESG factors into internal credit rating systems and

capital adequacy assessments. For corporate decision-makers, improved ESG performance not only demonstrates social responsibility but also translates into tangible financial benefits through lower borrowing costs and stronger relationships with lenders, underscoring that sustainability initiatives carry clear economic incentives. Firms should therefore strengthen governance mechanisms, enhance social responsibility practices, and increase transparency in sustainability disclosures to improve financing efficiency. For investors, ESG performance serves as a meaningful indicator of firms' long-term risk profiles and financial resilience, offering valuable insights for portfolio risk-return optimization and responsible investment strategies.

5.2 Research Limitations and Future Research Directions

Several limitations remain that open avenues for future research. First, the ESG data used in this analysis rely primarily on third-party annual ratings, which may suffer from inconsistencies in methodology and time lags, failing to capture the "dynamic ESG information" utilized by banks in their lending decisions. Future studies may apply natural language processing (NLP)-based textual analysis to extract ESG sentiment and risk disclosure metrics from firms' sustainability reports and news releases (e.g., Schimanski, Reding, Reding, Bingler, Kraus and Leippold, 2024; Lagasio, 2024), providing a more timely and granular measure of ESG activities. Second, the current model assumes a linear relationship between ESG and borrowing costs, whereas recent evidence suggests nonlinear or threshold effects may exist (Li, Padmanabhan and Huang, 2024; Wang and Sonenshine, 2025). Future research could employ panel threshold regression or quadratic regression estimation to uncover nonlinear effects of ESG performance on bank loan rate or other financial consequences.

Third, this study does not incorporate bank-level heterogeneity in ESG credit policies, which may introduce sample selection bias. Incorporating bank-firm matched data (individual bank loan contracts) could provide a more comprehensive view of how ESG information is transmitted through the financial intermediation process (e.g., Qian, Shi, Song and Wu, 2023; Anginer, Hrazdil, Li and Zhang, 2024; Kim, Kumar, Lee and Oh, 2025). Finally, future extensions could explore the heterogeneous effects of ESG under varying macroeconomic conditions or regulatory shifts-such as the introduction of green taxonomies or carbon pricing, the enforcement (or entry into force) of international climate accords or treaties (e.g. Paris Agreement)-to test the robustness of the ESG-financing nexus across different institutional and policy environments.

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