RESEARCH ARTICLE

Financing sustainability: How environmental disclosures shape bank lending decisions in emerging markets

Zhiyang Hui[1] | Haoyu Li[2] | Ahmed A. Elamer[2,3,4]

[1]School of Finance, Chongqing Technology and Business University, Chongqing, China

[2]Brunel Business School, Brunel University London, London, UK

[3]Gulf Financial Center, Gulf University for Science and Technology, Kuwait, Kuwait

[4]UNEC Accounting and Finance Research Center, Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan

Correspondence
Ahmed A. Elamer, Brunel Business School, Brunel University London, Kingston Lane, Uxbridge, London UB8 3PH, UK.
Email: ahmed.elamer@brunel.ac.uk

Abstract

As global awareness of environmental responsibilities intensifies, the significance of corporate Environmental information disclosure (EID) in decision-making becomes increasingly prominent. However, its influence on bank lending decisions, especially in emerging markets like China, remains debated. Using 27,095 firm-year observations between 2008 and 2020, this study examines the impact of both voluntary and mandatory EID on bank lending decisions. Findings indicate that banks incorporate EID into their lending decisions, offering favorable bank loan terms, both in terms of size and costs to firms with strong EID. To mitigate endogeneity concerns, we employ propensity score matching and a difference-in-difference methodology grounded in China's newly amended Environmental Protection Law, with consistent results across both tests. Our research identifies two possible economic mechanisms to explain why EID influences bank loan features: EID's potential to reduce firm-specific risks and its alignment with local governmental incentives for green finance. Furthermore, our research suggests that voluntary EID, previously overlooked, proves more valuable than mandatory EID. We also find that the effectiveness of EID relies on banks' evaluations of the firm's sincerity and incentives behind the disclosure. Banks show a preference for voluntary EID from firms with minimal adverse selection concerns and mandatory EID from those highly motivated to disclose voluntarily. Moreover, we identify a synergy between EID and bank loans in fostering green innovation. This research not only bridges gaps in the existing bank financing literature but also offers insights into how EID can drive sustainable economic activities in developing economies.

KEYWORDS
bank loans, emerging markets, environmental information disclosure, green innovation

JEL CLASSIFICATION
G21, G32, O31, M41

1 | INTRODUCTION

Environmental concerns have steadily integrated into corporate finance considerations, especially against the backdrop of global climate change discussions and sustainable development (Elmagrhi et al., 2019; Kazemi et al., 2023). Today's corporations are assessed not only on profitability and growth but also on their environmental responsibility and ethical standards (Chun, 2009; Li et al., 2022). This shift stems largely from increasing societal demands for corporations to demonstrate legitimacy, aligning with societal values and environmental priorities (Deegan, 2002). Here, environmental disclosures emerge as legitimacy tools, bridging the gap between corporations and stakeholders, notably investors (Cho & Patten, 2007). Yet, the efficacy of these disclosures and their influence on financial metrics, such as cost of capital, firm value, and lending patterns, is debated in the literature.

Central to this discussion is how environmental disclosures affect stakeholders' perceptions, especially among financial institutions (Alodat et al., 2023; Alshbili et al., 2021; Boulhaga et al., 2023; Ding et al., 2022). Akerlof's (1970) work on information asymmetry, emphasizing the challenges of quality uncertainty in markets, finds particular relevance in the context of environmental disclosures. Drawing insights from this, one recognizes the potential value of corporate environmental disclosures in reducing this asymmetry, as highlighted by Grossman (1981) and supported by existing literature (Diamond & Verrecchia, 1991; Gao & Wan, 2023; Glosten & Milgrom, 1985; Hassan et al., 2021; Lee et al., 2023).

In China, with its predominant bank-based financial system, bank loans have become the principal source of firm funding, totaling an unprecedented 21.31 trillion RMB in 2022. Given the potential financial consequences of environmental lapses and subsequent legal actions, banks have become more discerning about environmental risks in their lending decisions (Lin & Zhang, 2023; Lui & Zainuldin, 2022; Shi & Zhang, 2023). Corporate environmental information disclosure (EID) has become instrumental, allowing banks to evaluate a firm's environmental responsibility and credibility (Baiman & Verrecchia, 1996; Diamond & Verrecchia, 1991; Glosten & Milgrom, 1985; Leuz & Verrecchia, 2000). Consequently, understanding EID's influence on bank lending is vital.

Several reasons underpin the pivotal role of EID in our context. First, EID narrows the information gap between firms and lending institutions (Al Frijat et al., 2024; Gangi et al., 2023; Li et al., 2022; Veltri et al., 2023; Xia et al., 2023; Zhang, 2001), thereby effectively ameliorating concerns related to adverse selection (Roychowdhury et al., 2019). Firms that voluntarily engage in EID not only project themselves as environmentally attuned but also demonstrate their willingness to be subjected to public scrutiny—a resonance that signifies a robust commitment to bolstering corporate social responsibility (Du et al., 2017). Second, EID could reduce the uncertainty of environmental risk factors, improving the credibility assessment in the bank lending process (Clarkson et al., 2008; Schneider, 2011). Third, lending to firms with robust EID meets the government's intention to promote green finance in China, which is also a way for banks to fulfill their mission of social responsibility. China's unique interplay between

government connections, financial constraints, and corporate behavior brings a complicated perspective on corporate environmental strategies (Cull et al., 2015). Specifically, mandatory CSR disclosure has tangible effects on firm profitability and societal externalities in China (Chen et al., 2018).

Based on EID in annual reports of firms listed on the Shanghai and Shenzhen Stock Exchanges, we examine its impact on the size and cost of bank loans. EID is measured from two dimensions: the disclosure of environmental activities and environmental policies. Using 27,095 firm-year observations from 2008 to 2020, we find that a one-standard-deviation increase in the disclosed items of EID on environmental activities is associated with an additional bank loan of 108 million RMB and a reduced interest cost of 0.8 million RMB per year. EID on environmental protection policies leads to similar results. However, potential biases, including selection from observable and unobservable variables, could influence this relationship. We address endogeneity concerns in two ways. First, we employ the propensity score matching (PSM) approach. Our results remain robust based on the matched samples. Second, we regard the implementation of the newly revised Environmental Protection Law in 2015 as an exogenous shock and adopt a difference-in-difference (DID) approach. The results provide consistent evidence that corporate EID facilitates bank loans.

We then delve into the mechanisms through which EID affects loan terms. We find that firms with EID are associated with significantly lower corporate risks in terms of the volatility of stock returns and operational profit, respectively. This finding lends support to the view that EID provides greater transparency, enhances reputation, and reduces regulatory risk with environmental issues. We also find that the effect of EID is strengthened in provinces where the local government strongly intends to promote green finance, which is proxied by the local government's investment in environmental protection. This suggests that accomplishing the administration's aspiration also drives banks to value firms with robust EID. We also identify conditions that amplify EID's benefits, such as voluntary EID, marketization level, stock informativeness, and non-SOE ownership. Our findings underscore that the effectiveness of EID is deeply influenced by banking institutions' perception of a firm's transparency and underlying motives for disclosure. Banks are inclined toward voluntary EID from companies with fewer adverse selection dilemmas, and mandatory EID from those demonstrating a strong inclination toward voluntary disclosure. Moreover, while mandatory EID or bank loans alone may not significantly propel green innovation, their combined effect notably enhances it. In contrast, voluntary EID, especially when paired with differentiated loan sizes, fosters green innovation, either as a standalone initiative or synergistically.

Our paper contributes to the existing literature in the following ways. First, it offers a deeper understanding of the contentious utility of EID in the realm of bank lending decisions—a debate that has garnered significant academic attention but remains unresolved. Prior studies have investigated EID's implications for bank financing in developed markets like the United Kingdom (Campbell & Slack, 2011; Thompson & Cowton, 2004). Nonetheless, their findings remain polarized. On the one hand, scholars such as Diamond and Verrecchia

(1991) and Leuz and Verrecchia (2000) argue that public disclosures can diminish information asymmetry. On the contrary, there is an alternate school of thought suggesting that such disclosures might exacerbate information asymmetry due to diverse interpretations (Francis et al., 2008; Kim & Verrecchia, 1994) and underlying motives, be it for adverse selection (Akerlof, 1970), as a legitimacy tool (Cho & Patten, 2007; Deegan, 2002), or greenwashing (Finger et al., 2018). Importantly, transferring insights from developed economies to emerging markets like China may not always yield accurate extrapolations. Emerging markets also show a dichotomy in their findings, with Wang et al. (2019) opposing the beneficial role of EID in obtaining bank loans, while Luo et al. (2019) and Li et al. (2022) championing its advantages. Notably, our work expands the narrative by juxtaposing mandated EID—common to firms in pollutant-intensive sectors—with voluntary EID, arguing that the latter may provide a more genuine reflection of a firm's environmental ideology and the actual repercussions of EID, especially given the rising prevalence of voluntary disclosures among Chinese firms from 29.70% in 2008 to 75.62% in 2020.

Second, this paper provides an innovative lens to assess financing constraints in China. Although bank loans represent the primary source of financing in China, the chance to obtain bank loans is uneven, and the rates of loan costs also vary hugely among firms (Brandt & Li, 2003; Jiang & Kim, 2020). Due to imperfect legal and financial systems, many nonperformance-based factors, besides firms' performance, play crucial roles in accessing bank loans. Several papers document that banks' lending decisions can be affected by the ownership of SOE (Allen et al., 2005; Song et al., 2011), political capital (Zhao & Lu, 2016), social network (Talavera et al., 2012), and even bribery (Chen et al., 2013). It receives continuous attention on how to assist firms with disadvantaged statuses to compete for bank financing. Our study identifies the pivotal role of transparent environmental information as a critical factor in mitigating bank discrimination, potentially assisting firms to navigate and overcome systemic financial barriers. Lastly, we shed light on the plausible mechanisms underpinning how EID augments bank loan access. Based on the business strategy perspective, Li et al. (2022) explore the moderating effect of formal institutions (proxied by the official issuance of the Green Credit Guidelines) and informal institutions (proxied by bank connections) on the association between EID and bank lending. In contrast, our study emphasizes the economic and political underpinnings, suggesting that the reduced corporate risks highlighted by EID, combined with the government's push for green finance, are integral to understanding the impact of EID.

The rest of the paper is organized as follows: Section 2 provides literature and hypotheses. Section 3 describes our data and sample construction. Sections 4–8 present our findings, address endogeneity concerns, and provide additional tests. Section 9 concludes.

2 | LITERATURE AND HYPOTHESES

Environmental performance has quickly become a key component in banks' credibility checks. Banks are exposed to financial risks if borrowers fail to repay their loans, and this risk can be further compounded by borrowers' earnings loss due to physical climate hazards (Addoum et al., 2023) and fines that are levied due to environmental damage (Romero et al., 2018). Besides minimizing the direct risk of default and financial loss, banks also check environmental credibility to avoid indirect risks, such as lawsuits and reputation damage. Banks that finance firms later involved in environmental incidents are found liable in various court cases (Boyer & Laffont, 1997). If banks are perceived to fund environmentally harmful activities or fail to exhibit a dedication to sustainable lending practices, they also encounter the risk of damaging their reputation. (Thompson & Cowton, 2004). For banks to evaluate the financial credibility of a potential borrower, they strongly demand in-depth environmental information through decision-making and loan contracting processes, where EID brings into play.

EID provides various clues for banks to appraise credit risks. By making their environmental performance and policies public, firms demonstrate a commitment to sustainability and risk management. Companies with larger economic resources tend to provide more comprehensive disclosures, resulting in overall positive economic advantages (Qiu et al., 2016). Voluntary environmental disclosure quality is associated with firm value through both the cash flow and the cost of equity (Plumlee et al., 2015; Reverte, 2012). There is a strong correlation between favorable environmental performance and positive economic performance, as well as a positive relationship between environmental performance and the disclosure of quantifiable environmental information (Al-Tuwaijri et al., 2004). Clarkson et al. (2008) confirm the positive association between environmental performance and the level of discretionary environmental disclosures.

Besides, EID is a way to engage with stakeholders (e.g., suppliers, customers, shareholders, and institutional investors) who are interested in the firm's environmental performance (Flammer, 2013; Vitolla et al., 2019). For example, the wealth of shareholders is benefited from corporate environmental policies (Fernando et al., 2017). Moreover, institutional investors shun firms with poor climate risk disclosure (Ilhan et al., 2022) and those enhancing their perceived environmental friendliness (Fernando et al., 2017). Using US sample, Raimo et al. (2021) find that ESG disclosure is negatively associated with the cost of debt financing. Therefore, the relationship between firms and their stakeholders can be strengthened by EID, reducing banks' concerns about the operational uncertainty caused by environmental issues.

Based on the above discussions, we develop our first hypothesis on the positive impact of EID on band lending.

> **H1a.** There is a positive relation between EID and the size of bank lending.

> **H1b.** There is a negative relation between EID and the cost of bank lending.

Firms disclose environmental information for mandatory and voluntary reasons. The compulsory disclosure could be attributed to

compliance with regulations. For example, the *Plan for the Reform of the Legal Disclosure System of Environmental Information* issued by China's Ministry of Ecology and Environment requires that firms in 16 heavy-polluting industries disclose environmental information. Several recent studies have documented the importance of mandatory EID in Chinese bank lending. For example, Luo et al. (2019) use data from 842 publicly traded companies within heavily polluting industries from 2014 to 2016 and find that the quality of EID is negatively related to the cost of debt. In a study involving Chinese energy companies from 2008 to 2014, Fonseka et al. (2019) discovered a noteworthy inverse link between EID and debt costs. Xu et al. (2021) suggest that mandatory EID reduces the cost of debt financing and improves access to long-term bank loans in China. Employing the data of 946 listed companies of 16 heavily polluting industries in China, Du et al. (2022) find that EID helps companies increase bank credit support and reduce debt financing costs. Hung et al. (2013) find that mandatory CSR reporting firms experience decreased information asymmetry. Chen et al. (2018) suggest that mandatory CSR disclosure generates positive externalities at the expense of shareholders. Although there are many reports in the literature on the outcome of EID on bank lending in China, most are restricted to mandatory EID and firms in heavily polluting industries. By reviewing 35 literature from 1998 to 2013, Md Zaini et al. (2018) find that research on voluntary disclosure practices by companies in emerging countries remains low. It is unclear whether voluntary EID can benefit bank lending in China. This also indicates a need to discriminate between the various categories of EID that may function with different mechanisms.

Compared with mandatory disclosures, the voluntary perspective is motivated by the sense of corporate social responsibility and the ideology of altruism. Firms with voluntary EID tend to recognize the significance of environmental supervision beyond regulatory compliance. Voluntary EID demonstrates a proactive stance, reflecting a genuine concern for environmental impact and a willingness to be transparent about their practices beyond what is legally mandated. The motivation from altruism goes beyond the immediate financial gains and focuses on the broader impact of actions on the environment and communities. Firms also take voluntary EID to generate competitive advantages regarding economic and reputational benefits (Arevalo & Aravind, 2017; Gerwanski, 2020). As a result, banks might perceive voluntary EID as more convincing and credible, leading to more generous lending activities based on trust and transparency. Previous research has established that voluntary nonfinancial disclosure is associated with a lower cost of capital using samples from the United States (Dhaliwal et al., 2011) and South Africa (Guidara et al., 2014). Our second hypothesis regarding the effect of voluntary versus mandatory EID is stated as follows.

> **H2.** Voluntary EID leads to more favorable lending size and costs than mandatory EID does.

However, previous studies suggest that it is possible that voluntary disclosure is driven by its impact on how the firm is perceived in the capital market, resulting in an adverse selection problem (Akerlof, 1970; Grossman, 1981). According to the legitimacy theory, corporations with inadequate environmental performance are likely to disclose more positive environmental information or off-setting activities in their financial reports (Cho & Patten, 2007; Deegan, 2002). For example, firms facing high pollution issues and poor environmental reputations are more likely to take voluntary EID (Villiers & Van Staden, 2011). Xing et al. (2021) find that EID weakly impacts loan financing because of green washing in environmental disclosure. Wang et al. (2008) suggest that there is no evidence to show companies benefit from extensive voluntary disclosure by having a lower cost of debt capital. Acting as a strategy for window dressing, voluntary CSR reporting in China is associated with greater earnings management (Carey et al., 2017). Cho et al. (2020) find that firms that adopt conservative financial reporting are less likely to disclose CSR information. Zhang, Yap, and Park (2021) find that Chinese firms with better voluntary CSR disclosure tend to engage in earnings management through discretionary accruals. Moreover, consistent with the political cost theory, the voluntary disclosure of CSR has been found to be associated with company political interests in the United States and China (Gamerschlag et al., 2011; Griffin & Sun, 2013; Lee et al., 2017; Zheng & Ren, 2019). One could reasonably speculate that challenges related to adverse selection diminish the beneficial effects of voluntary EID and prompt banks to assess the authenticity of a firm's commitment to voluntary EID. The above discussions lead to the following hypothesis.

> **H3.** Within the sample of voluntary EID, banks favor firms with less concern about adverse selection.

In the context of mandatory EID, certain firms might harbor an intention to disclose environmental information voluntarily. However, these firms find themselves compelled to adhere to mandatory EID solely due to the constraints imposed by their categorization within heavily polluting industries. Moreover, while mandatory EID serves as a mechanism to fulfill legitimacy requirements by offering additional information and showcasing a firm's commitment to sustainability, there remains skepticism regarding the persistence of such behavior in the absence of external oversight. Therefore, it is necessary to distinguish the firms with the motivation of voluntary EID as a subgroup of sample in the mandatory EID. Due to the more altruistic ideologies, better commitment to transparency, and enhanced trust, banks may exhibit a preference for firms that are inclined to continue EID even in the absence of legitimacy requirements. These discussions lead to the formulation of the following hypothesis:

> **H4.** Within the sample of mandatory EID, banks favor firms with the intention of voluntary EID.

3 | DATA AND VARIABLES

Our sample consists of all publicly traded firms listed on Shanghai and Shenzhen Stock Exchanges from 2008 to 2020. From the sample, we

exclude (1) firms in the financial sector whose disclosure requirements and accounting rules are unique; (2) firm-year observations when firms are labeled as "special treatment (ST)"; (3) firms with sample periods less than 2 years. Observations with missing data on major variables are also excluded. We winsorize all continuous variables at the 1st and 99th percentiles to alleviate the impact of outliers.

3.1 | Bank loan features

We extract bank loan information from the China Securities Market and Accounting Research (CSMAR) database and measure two features of banking finance (i.e., size and cost). Following Cull et al. (2015), Luo et al. (2018), Cline et al. (2020), and Li et al. (2022), we measure the size of bank loans using borrowings from banks in a year scaled by total assets at the end of the year (*Loan size*). We use interest expenses in a year divided by borrowings from banks in the same year to capture the cost of bank loans (*Loan cost*).

3.2 | Measure of environmental information disclosure

We construct two measures of EID for each firm/year. The data is obtained from the CSMAR database. The first is the firm's disclosure of environmental protection activities (*Env. activity*) in its annual report. It contains six items, including the disclosure of (1) actions taken to reduce waste gas emission; (2) actions taken to reduce wastewater emission; (3) actions taken to reduce dust and soot; (4) actions taken to recycle and dispose of solid waste; (5) actions taken to control noise, light, and radiation pollution; and (6) actions taken to produce environment-friendly products. Each item scores zero, one, and two if the firm has no disclosure, a qualitative disclosure, and a quantitative disclosure (monetary/numerical) in its annual report, respectively. *Env. Activity* scores a combined total of the six items. This measure considers both the number of disclosed items and the quality of the disclosure.

The second measure is the firm's disclosure of environmental protection policy and guidelines (*Env. policy*) in its annual report. It has eight items, including the disclosure of (1) policies, patterns, and ideas of environment protection; (2) aims and vision of environment protection and how it was/will be fulfilled; (3) rules, norms, and regulations of environment protection; (4) training and education of environment protection; (5) participation of environmental social welfare activities; (6) contingency plan for environmental emergencies; (7) honors or awards of environment protection; (8) implementation of "three-parallel policy" required by the Environmental Protection law.[1] Each item scores one if the firm has disclosed it in the annual report and zero otherwise. *Env. policy* scores a combined total of the six items.

3.3 | Descriptive statistics

Table 1 Panel A reports summary statistics for major variables. The mean value of the size of bank loans is 15.375% of total assets, which is comparable with that of Cline et al. (2020). The deviation and range of the size of bank loans are largely relative to its mean, indicating a big difference in the size of bank loans among Chinese listed firms. As for the cost of bank loans, the mean (median) value is 6.750% (6.657%), which is close to the features of Luo et al. (2018). The mean scores of the disclosure of environmental activities (*Env. activity*) and policies (*Env. policy*) are 1.652 and 1.258, respectively. It implies that, on average, the level of EID is relatively low and needs to be improved. Other firm characteristics are comparable to similar studies (e.g., Cline et al., 2020; Li et al., 2018; Li et al., 2022).

3.4 | Univariate test

Table 1 Panel B presents the results of the univariate test. We divide the full sample into two subgroups: with EID and without EID. Firms that exhibit both environmental activity and environmental policy values greater than zero are categorized as belonging to the group with EID, while the rest are classified into the group without EID. The results show that firms with EID have greater loan sizes and lower loan costs, which is significant at the 1% level. While the univariate test offers initial evidence supporting the notion that EID positively impacts loan features, it is imperative to undertake multivariate analysis to account for other potential influencing factors and attain a more comprehensive understanding. Our subsequent section will present the baseline regression analysis, which allows for a more rigorous examination of the relationship between EID and loan characteristics.

4 | BASELINE REGRESSION

We start our analysis by examining the association between EID and the features of bank loans. The baseline ordinary least squares (OLS) regression model is as follows:

$$Loan\ size_{i,t}\ (or\ Loan\ cost_{i,t}) = \alpha + \beta EID_{i,t-1} + \gamma V_{i,t-1} + \sum Firm + \sum Year + \varepsilon_{i,t} \quad (1)$$

The dependent variable is bank loans for firm i in year t, including the size of bank loans (*Loan size$_{i,t}$*) and the cost of bank loans (*Loan cost$_{i,t}$*). The primary explanatory variable is the EID of firm i in year $t-1$, measured by the disclosure of environmental activities (*Env.activity$_{i,t-1}$*) and policies (*Env.policy$_{i,t-1}$*).[2] The matrix V is other economic determinants of bank loans chosen from prior studies (e.g., Altman, 1968; Cline et al., 2020; Cull et al., 2015; Leary, 2009;

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[1]The "three-parallel policy" indicates that the facilities for preventing and controlling pollution in a construction project should be designed, constructed, and put into operation simultaneously with the main project.

[2]In all regressions, the two measures of EID (i.e., *Env. activity* and *Env. policy*) are standardized (Bring, 1994; Milligan & Cooper, 1988). Our findings remain consistent and valid when using the original scale of EID measures.

TABLE 1 Descriptive statistics.

Panel A: Summary statistics						
Variables	**Obs.**	**Mean**	**SD**	**25th**	**Median**	**75th**
Loan size (%)	27,095	15.375	26.551	0.000	0.000	21.310
Loan cost (%)	22,660	6.750	1.415	6.216	6.657	6.953
Env. activity	27,095	1.652	2.467	0.000	1.000	3.000
Env. policy	27,095	1.258	1.726	0.000	1.000	2.000
Firm size	27,095	22.099	1.284	21.166	21.927	22.838
Leverage	27,095	0.433	0.209	0.265	0.428	0.593
EBITDA	27,095	0.044	0.041	0.020	0.038	0.063
Tangibility	27,095	0.927	0.090	0.915	0.957	0.980
Tobin Q	27,095	2.453	1.673	1.362	1.922	2.909
Top1	27,095	0.349	0.148	0.232	0.329	0.450
HHI	27,095	0.095	0.089	0.038	0.063	0.119
Z-score	27,095	5.692	6.280	2.327	3.633	6.284
SOE	27,095	0.399	0.490	0.000	0.000	1.000
Dual	27,095	0.256	0.436	0.000	0.000	1.000
Management share	27,095	0.125	0.199	0.000	0.001	0.213
Board size	27,095	2.253	0.181	0.000	2.079	2.303
Female director	27,095	0.140	0.128	0.000	0.000	0.111
Independent director	27,095	0.372	0.054	0.333	0.333	0.429
Kyoto protocol Ind.	27,095	0.151	0.358	0.000	0.000	0.000
Pledged loan (%)	19,736	8.200	35.443	0.000	0.000	0.000
Guaranteed loan (%)	15,285	38.188	124.461	0.000	0.321	19.388
Credit loan (%)	25,254	31.639	35.771	0.000	15.347	60.636
Collateral loan (%)	16,816	17.376	65.940	0.000	0.000	3.840
Green patents apply	24,148	0.325	0.709	0.000	0.000	0.288
Green patents grant	24,148	0.249	0.590	0.000	0.000	0.288
Bond size (%)	27,095	0.134	0.437	0.000	0.000	0.000
Equity size (%)	27,095	5.159	14.137	0.781	3.336	7.452
Commercial credit (%)	27,095	9.315	573.231	−0.768	1.349	5.098
Sd. return (%)	26,379	2.880	0.888	2.271	2.737	3.311
Sd. ROA (%)	27,097	1.676	2.796	0.407	0.821	1.729
Env. input	1319	7.444	2.186	6.043	7.378	8.974
If high env. input	1319	0.449	0.498	0.000	0.000	1.000

Panel B: Univariate test					
	With EID		**Without EID**		**Diff (*T*-test)**
	Obs.	**Mean**	**Obs.**	**Mean**	**With EID−without EID**
Loan size	15,396	17.471	13,925	12.908	4.562***
Loan cost	12,933	6.742	10,927	7.044	−0.302***

Note: Panel A reports summary statistics of our sample. Panel B reports the results of the univariate test. Appendix A provides detailed descriptions of variable definitions.

Lemmon et al., 2008; Li et al., 2018; Li et al., 2022; Luo et al., 2018; Sundarasen et al., 2016), including firm size (*Firm size*), financial leverage (*Leverage*), profitability (*EBITDA*), tangible assets (*Tangibility*), Tobin's q (*Tobin Q*), the portion of shares held by the largest shareholders (*Top 1*), industry concentration (HHI), Z-score (*Z-Score*), SOE

(*SOE*), CEO duality (*Dual*), management shareholding (*Management share*), board size (*Director size*), board independence (*Independent director*), and the potion of female directors (*Female director*). Following Freedman and Jaggi (2005), we control industries that are severely impacted by the Kyoto Protocol (*Kyoto protocol Ind.*). The detailed

variable definitions are provided in Appendix A. In addition, we include firm fixed effects to control for similarities in bank loans within firms. We control year dummy variables to allow changes in investment efficiency to vary year by year. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm.

Table 2 reports the results of the baseline regression. The dependent variable in Columns (1) and (2) is the size of bank loans. The results show that the coefficients estimated for the disclosure of environmental activities and policies are positive and statistically significant at the 5% level or better. The economic magnitude is also significant. A one-standard-deviation increase in *Env. activity* increases the size of bank loans by 0.576%. Given the average total assets is 18,755 million RMB, this is an additional bank loan of 108 million RMB. When examining the cost of loans in Columns (3) and (4), we find that the cost is negatively associated with the disclosure of environmental activities and policies at the 1% significant level. The coefficient in Column (4) implies that a one-standard-deviation increase of *Env. policy* decreases the loan cost by 0.028%. Since the average bank loan is 2859 million RMB, disclosing environmental policies could save a firm 0.8 million RMB on interest payments each year. These findings suggest that banks value the disclosure of environmental protection information. Firms disclosing environmental activities and policies enjoy more bank loans with lower costs, confirming H1a and H1b.

The coefficients on other explanatory variables are mainly consistent with the existing literature. For example, firms with more tangible assets can get more bank loans, and their cost of bank loans is lower (Cline et al., 2020; Leary, 2009; Lemmon et al., 2008; Li et al., 2022). The leverage ratio is positively associated with both the size and the cost of bank loans (Li et al., 2022). Higher share ratios of the largest shareholder usually result in more equity financing and, thus, fewer bank loans (Li et al., 2018).

5 | ENDOGENEITY CONCERNS

The above results suggest that firms with higher levels of EID have more bank loans and lower interest costs. However, our results could be subject to endogeneity concerns and insufficient to support a causal relationship. For example, although our lagged EID measures in the baseline regression can help to alleviate the potential reverse causality to some extent, reverse causality may still affect our analysis. In particular, firms may take "greenwash" activities and report environmental protection information deceptively to please banks. Moreover, some omitted or unobservable local conditions may affect both bank loans and EID. For instance, harmful environmental incidents, better environmental awareness of citizens, and stricter governmental monitoring may lead to more corporate EID and make banks favor firms with robust ecological performance. In the following sections, we conduct PSM and DID analyses to mitigate these endogeneity concerns.

5.1 | Propensity score matching analysis

We use PSM to alleviate nonrandom treatment assignment and selection bias from observable variables. We first split our sample into two groups based on high and low information disclosure. For example, if a firm's disclosure on environmental activities (*Env. activity*) is above the industry median in a year, we define the firm as high-EID. *If high Env. activity* is a dummy variable if a firm belongs to the high-EID group and zero otherwise. We use the same approach to define *If high Env. policy*. Then, we use the dummy variables (*If high Env. activity* or *If high Env. policy*) as the dependent variable and run the logistic regression to obtain the propensity score. The explanatory variables are the same as those used in the baseline regression. The results of logistic regression are reported in Table 3 Panel A. Many variables have explanatory power to EID. For example, firms with large sizes, low leverage, high profitability, more tangible assets, high market valuation, and high risk outperform their peers in EID.

Then, we match each firm in the treatment group with another one in the control group (ratio = 1:1) using a nearest-neighbor matching technique (caliper = 0.05) without replacement. Panel B reports descriptive statistics for the matched samples. We conduct the two-group *T*-test to compare the mean value of firms' characteristics. The results suggest that the high- and low-EID groups are similar, indicating that these two samples are well-matched.

Panel C reports the univariate results. The loan sizes of the firms in the treatment group (i.e., firms disclose more information regarding environmental activities and policies) are higher than that in the control group and significant at the 1% level. Moreover, the loan costs of firms in the treatment group are significantly lower than those in the control group. Finally, we re-run the baseline regression based on the matched samples and present the results in Panel D. The coefficients on both measures of EID (*Env. activity* and *Env. policy*) are significant, at least at the 5% level, and their signs are consistent with the counterparts in Table 2. Besides, the economic magnitude of coefficients is also similar to the baseline regression. In general, the results of PSM support the essential role of EID in bank loans.

5.2 | Difference-in-difference analysis

We acknowledge that corporate EID may not be randomly determined and might be associated with the location of the headquarters or other unobservable geographic characteristics (Garcia-Sanchez et al., 2019; Sierra-Garcia et al., 2015). For example, some provinces may simultaneously have greater support for bank loans and have high public awareness of environmental protection. We next conduct a DID analysis and use the implementation of the newly revised *Environmental Protection Law* (hereafter "the law") in January 2015 as an exogenous shock. The law results in systematic changes in environmental protection regulations (Zhou et al., 2021), environmental awareness and attitude (Fang et al., 2021; Li, 2018), and environmental inspections (Karplus & Wu, 2019) faced by a firm.

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TABLE 2 Environmental information disclosure and bank loan.

	Loan size		Loan cost	
	(1)	(2)	(3)	(4)
Env. activity	0.576**		−0.032***	
	(2.03)		(−3.42)	
Env. policy		0.751***		−0.028***
		(2.66)		(−2.59)
Firm size	−1.316**	−1.352**	−0.176***	−0.174***
	(−2.33)	(−2.39)	(−4.38)	(−4.32)
Leverage	16.002***	16.015***	0.952***	0.949***
	(7.75)	(7.75)	(5.58)	(5.56)
EBITDA	−7.327	−7.208	−16.149***	−16.145***
	(−1.16)	(−1.14)	(−28.05)	(−28.05)
Tangibility	11.267***	11.112***	−0.632**	−0.625**
	(3.78)	(3.73)	(−2.26)	(−2.23)
Tobin Q	−0.039	−0.035	−0.047***	−0.048***
	(−0.21)	(−0.19)	(−2.84)	(−2.84)
Top1	−10.279***	−10.292***	−0.972***	−0.965***
	(−3.23)	(−3.24)	(−4.48)	(−4.45)
HHI	2.531	2.466	−0.667*	−0.672*
	(0.53)	(0.52)	(−1.68)	(−1.69)
Z-score	−0.042	−0.043	0.003	0.003
	(−0.85)	(−0.86)	(0.56)	(0.56)
SOE	1.488	1.469	−0.063	−0.062
	(1.17)	(1.15)	(−0.57)	(−0.56)
Dual	−0.095	−0.094	−0.018	−0.019
	(−0.16)	(−0.15)	(−0.51)	(−0.52)
Management share	−5.090*	−5.155*	−0.310*	−0.309*
	(−1.80)	(−1.82)	(−1.73)	(−1.72)
Board size	−0.731	−0.778	0.004	0.008
	(−0.31)	(−0.33)	(0.03)	(0.07)
Independent director	1.670	1.677	0.108	0.114
	(0.26)	(0.26)	(0.33)	(0.35)
Female director	5.118**	5.152**	−0.061	−0.062
	(2.29)	(2.30)	(−0.48)	(−0.49)
Kyoto protocol Ind.	−2.671	−2.660	−0.109	−0.111
	(−1.59)	(−1.59)	(−1.08)	(−1.10)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	25,695	25,695	22,465	22,465
Adj. R^2	0.509	0.509	0.468	0.468

Note: This table shows the results of EID and bank loan for Chinese listed firms from 2008 to 2020. The main explanatory variable is the size of bank loan in Columns (1)–(2) and the cost of bank loan in Columns (3)–(4). In Columns (1) and (3) [Columns (2) and (4)], EID is measured by the disclosure of information on corporate environmental activities (policies). Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

We expect that the law, as an exogenous event, has a more significant impact on areas with more severe pollution issues. First, the law links firms' environmental performance with the local government's political achievements. Therefore, the government of provinces with poor environmental performance is more likely to take campaign-style enforcement (Jia & Chen, 2019). Second, considering

TABLE 3 Propensity score matching analysis.

Panel A: Logistic regression		
	If high Env. activity	If high Env. policy
	(1)	(2)
Firm size	0.602***	0.693***
	(33.78)	(38.42)
Leverage	−0.681***	−0.466***
	(−6.01)	(−4.19)
EBITDA	1.597***	3.377***
	(3.78)	(8.05)
Tangibility	1.304***	1.527***
	(7.15)	(8.54)
Tobin Q	0.043***	0.039***
	(2.86)	(2.62)
Top1	0.145	0.089
	(1.37)	(0.85)
HHI	0.562**	−0.137
	(2.12)	(−0.54)
Z-score	−0.020***	−0.012***
	(−4.81)	(−2.95)
SOE	0.221***	0.390***
	(5.80)	(10.49)
Dual	−0.060*	−0.102***
	(−1.68)	(−2.84)
Management share	−0.143	−0.242**
	(−1.52)	(−2.56)
Board size	0.489***	0.377***
	(4.76)	(3.74)
Independent director	0.150	0.026
	(0.47)	(0.08)
Female director	−0.019	−0.271**
	(−0.16)	(−2.23)
Kyoto protocol Ind.	−0.592***	−0.514***
	(−3.85)	(−3.22)
Constant	−16.597***	−18.208***
	(−33.43)	(−36.74)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Obs.	27,059	27,108
Pseudo R^2	0.161	0.161

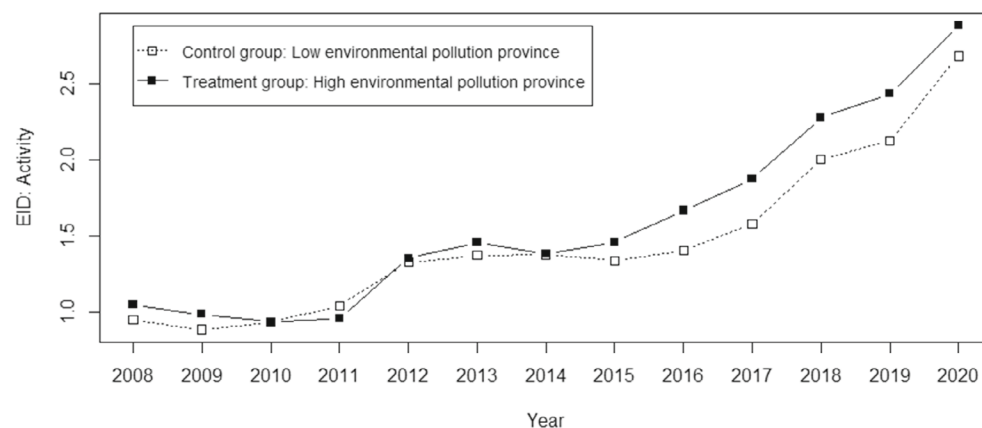| Panel B: Descriptive statistics for propensity-score matched samples (MR = 1:1, caliper = 0.05)					
	Env. activity			Env. policy		
	Treatment (N = 7687)	Control (N = 7687)	Diff. = (1)–(2)	Treatment (N = 8068)	Control (N = 8068)	Diff. = (4)–(5)
	(1)	(2)	(3)	(4)	(5)	(6)
Firm size	22.652	22.628	0.024	22.724	22.700	0.024
Leverage	0.462	0.463	−0.001	0.475	0.478	−0.003

TABLE 3 (Continued)

Panel B: Descriptive statistics for propensity-score matched samples (MR = 1:1, caliper = 0.05)

	Env. activity			Env. policy		
	Treatment (N = 7687)	**Control (N = 7687)**	**Diff. = (1)–(2)**	**Treatment (N = 8068)**	**Control (N = 8068)**	**Diff. = (4)–(5)**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
EBITDA	0.048	0.047	0.001	0.048	0.049	−0.001
Tangibility	0.931	0.932	−0.001	0.933	0.936	−0.002
Tobin Q	2.130	2.115	0.015	2.093	2.076	0.017
Top1	0.367	0.371	−0.004	0.369	0.373	−0.004
HHI	0.088	0.085	0.003	0.089	0.087	0.002
Z-score	4.778	4.692	0.086	4.643	4.605	0.038
SOE	0.487	0.492	−0.005	0.523	0.529	−0.006
Dual	0.217	0.208	0.008	0.203	0.203	−0.001
Management share	0.096	0.095	0.001	0.085	0.087	−0.002
Board size	2.285	2.285	0.001	2.289	2.287	0.002
Independent director	0.371	0.372	−0.001	0.371	0.371	0.001
Female director	0.130	0.130	0.000	0.126	0.125	0.001
Kyoto protocol Ind.	0.209	0.212	−0.004	0.200	0.203	−0.004

Panel C: Univariate results

	If high Env. activity			If high Env. policy		
	Treatment (N = 7687)	**Control (N = 77,687)**	**Diff. = (1)–(2)**	**Treatment (N = 7984)**	**Control (N = 7984)**	**Diff. = (4)–(5)**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Loan size	16.839	14.632	2.208***	16.743	14.849	1.894***
Loan cost	6.823	6.625	−0.199***	6.620	6.834	−0.214***

Panel D: Regression for matched samples

	Loan size			Loan cost	
	(1)	**(2)**		**(3)**	**(4)**
Env. activity	0.550**			−0.044***	
	(2.00)			(−2.67)	
Env. policy		0.595**			−0.030***
		(2.33)			(−3.91)
Controls	Yes	Yes		Yes	Yes
Firm FE	Yes	Yes		Yes	Yes
Year FE	Yes	Yes		Yes	Yes
Obs.	15,027	15,628		15,027	15,628
Adj. R^2	0.526	0.526		0.475	0.460

Note: This table reports the results of PSM. The treatment group is composed of firms the EID of which is above the industry median. Panel A presents the logistic regression output. The dependent variable is a dummy variable (*If high Env. activity* or *If high Env. policy*) which equals to one if the firm belongs to the treatment group and zero otherwise. Panel B shows the after-matching comparison between treatment and control group. Panels C and D report the results of the univariate test and the multiple variables regression, respectively. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

that most of the banks in China are state-owned, we expect banks to favor firms with transparent information on environmental performance after the law was put into force. Lastly, lending to firms in places with serious pollution issues is associated with more risks and uncertainties (Campbell & Slack, 2011). Therefore, firms in those places might have strong motivations to show banks their robustness in environmental performance and disclose more information. This incentive can be strengthened after the implementation of the law.

(a) Disclosure of environmental activity (Treatment vs. control group)

(b) Disclosure of environmental policy (Treatment vs. control group)

FIGURE 1 Time trend in environmental information disclosure. (a) Disclosure of environmental activity (Treatment vs. control group). (b) Disclosure of environmental policy (Treatment vs. control group). Panel (a) shows the time trend in firms' environmental information disclosure on activities (*Env. activity*); Panel (b) shows the time trend in firms' environmental information disclosure on policies (*Env. policy*). The solid line with black squares presents the results of firms locate in provinces with high environmental pollution (treatment group); the dot line with hollow squares presents the results of firms locate in provinces with low environmental pollution (control group). The sample spans the 2008–2020 window, including all publicly traded firms listed on Shanghai and Shenzhen Stock Exchange. The new *Environmental Protection Law* was first introduced on January 1, 2015, in China.

To confirm our conjecture, we first use the entropy method to calculate the environmental pollution index at the province level,[3] which measures the discharge of industrial wastewater, industrial sulfur dioxide, industrial smoke, and dust. Next, we divide sample firms into the high pollution group (treatment group) and the low pollution group (control group) according to whether the index of the province where the firm is located is above the sample median in a year.

Figure 1 compares the evolution of firms' EDI between the treatment and control groups, where Panel A shows the disclosure of environmental activities and Panel B shows the disclosure of environmental policies. As presented in both panels, the level of EID of activities and policies was similar between the treatment and control groups before the law was enacted. However, after the law was implemented in 2015, the EID of the treatment group surpassed that of the control group substantially. The *T*-test results presented in Panel A of Table 4 provide further confirmation of parallel trends. Specifically, between the years 2008 and 2014, there is no statistically

significant difference observed between the control group and the treatment group with respect to EID activity and EID policy. However, it is noteworthy that starting in the year 2015, the EID levels of the treatment group became significantly higher than those of the control group. This shift in EID behavior highlights a distinct divergence in the treatment group's approach to environmental disclosure compared to the control group during this period. The results support our conjecture that the law is more influential to firms in areas with poor environmental performance, providing preliminary evidence that our settings apply to the DID model.

We construct the following DID regression:

$$
\begin{aligned}
Loan\ size_{i,t} & (or\ Loan\ cost_{i,t}) \\
& = +_1 Treat_i * Post_t + V_{i,t-1} + \sum Firm + \sum Year +_{i,t}
\end{aligned}
\tag{2}
$$

where $Treat_i$ is a dummy variable equaling one if the firm belongs to the treatment group. $Post_t$ is a dummy variable equaling one for observations in or after 2015 and zero otherwise. The key explanatory variable is the interaction term, $Treat_i * Post_t$, whose coefficient essentially measures the average treatment effect of EID on bank loan features. Other explanatory variables are the same as the baseline regression in Equation (1). We do not include $Treat_i$ and $Post_t$ as

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[3] $=1/3 * \{(wastewater_{province\ mean}/wastewater_{China\ mean}) * [(wastewater_{province\ max} - wastewater_{China\ min})/(wastewater_{China\ max} - wastewater_{China\ min})] + (SO_{2\_province\ mean}/ SO_{2\_China\ mean}) * [(SO_{2\_province\ max} - SO_{2\_China\ min})/(SO_{2\_China\ max} - SO_{2\_China\ min})] + (smoke_{province\ mean}/smoke_{China\ mean}) * [(smoke_{province\ max} - smoke_{China\ min})/ (smoke_{China\ max} - smoke_{China\ min})]\}.$

TABLE 4 Difference-in-difference analysis.

Panel A: *T*-test on parallel trends								
	2008–2014				**2015–2020**			
	Control group	**Treatment group**	**Diff (2)–(1)**	***p*-Value (*T*-test)**	**Control group**	**Treatment group**	**Diff (6)–(5)**	***p*-Value (*T*-test)**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EID: Activity	0.887	0.851	−0.036	0.320	1.464	1.625	0.161***	0.000
EID: Policy	1.128	1.181	0.052	0.147	1.856	2.098	0.242***	0.000

Panel B: Difference-in-difference				
	Loan size		**Loan cost**	
	(1)	(2)	(3)	(4)
Treat * Post	0.805**		−0.110**	
	(2.34)		(−2.50)	
Treat * Before 2 years		1.113		−0.016
		(0.29)		(−0.18)
Treat * Before 1 year		1.125		0.119
		(0.62)		(1.36)
Treat * Current year		1.002***		−0.153*
		(3.04)		(−1.78)
Treat * After 1 year		0.738**		−0.185**
		(2.17)		(−2.17)
Treat * After 2 years		1.463**		−0.222***
		(2.39)		(−2.63)
Treat * After 3 years		1.830**		−0.263***
		(2.41)		(−4.68)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	16,870	16,870	14,033	14,033
Adj. R^2	0.477	0.477	0.485	0.485

Note: In this table, Panel A presents the difference between treatment and control group before and after 2015 when the newly revised *Environmental Protection Law* took effect. Panel B reports the difference-in-difference results of the environmental information disclosure (EID) and bank loan [the size of bank loan in Columns (1)–(2) and the cost of bank loan in Columns (3)–(4)], using the implementation of the new *Environmental Protection Law* as an exogenous shock. Columns (1) and (3) show the results of parallel trends. Columns (2) and (4) present the results of the difference-in-difference regressions. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

individual controls because they are perfect collinearity with firm fixed effects and year fixed effects, respectively. Columns (1) and (3) of Table 4 report the results. The coefficient of the interaction item is positively associated with loan size and negatively associated with loan cost, statistically significant at the 5% level. These findings suggest that after firms increase their disclosure of environmental information, they can obtain larger bank loans with favored interest costs.

To show the full picture of the time trend, we then create a series of dummy variables to indicate the *N*th year before and after the

implementation of the law. *Before N years* (*After N years*) takes the value of one if the observation is in the *N*th year before (after) 2015 and zero otherwise. *Current* is an indicator variable equaling one for observations in 2015 and zero otherwise. Table 4, Columns (2) and (4) reports the results. As shown in Column (2), the coefficients of the interaction terms between *Treat* and time indicators before 2015 (*Before 2 years* and *Before 1 year*) are insignificant at the 10% level, suggesting there is no significant difference in the loan size between the treatment group and control group before the new law is enacted. As a comparison, the coefficients of the interaction terms between

Treat and time indicators in or after 2015 (*Current year, After 1 year, After 2 years*, and *After 3 years*) are positively associated with loan size and significant at the 5% level or better. The results indicate that implementing the law and, subsequently, more EDI significantly increases loan size for firms in the high pollution provinces. Column (4) tells a similar story that the additional EDI following the law reduces loan costs for firms in provinces with poor environmental performance.

Taken together, the consistent results of PSM and DID analyses increase our confidence in the notion that disclosures on environmental information facilitate bank loans for Chinese listed firms.

6 | MECHANISMS

6.1 | Corporate risks

Thus far, we have shown that banks favor firms reporting environmental information. If EID captures the imagination of banks, we would expect EID to suit a critical consideration of banks when they make lending decisions: credit risk. Besides providing environmental information that banks review in credit checks, EID also reflects operational risks. Firms with robust EID can be considered more reliable and prudent in daily operations (Hope, 2003; Konar & Cohen, 1997). EID mitigates banks' concerns about the uncertainty in firms' day-to-day running, including but not limited to the risk of environmental pollution incidents, being punished by the inspection department, or having a bad reputation on social responsibility. We, therefore, run regressions of corporate risks on EID to identify if a lower risk level is a channel through which EID influences bank loans.

We report the results in Table 5. The measure of corporate risk (dependent variables) in Columns (1) and (2) is the standard deviation of daily stock return in a year; the dependent variables in Columns (3) and (4) is the standard deviation of quarterly return on asset (ROA) in a year. The results suggest that EID on activities and policies is associated with lower stock return risk and lower uncertainty in operational profits, both significant at the 1% level. Specifically, a one-standard-deviation increase in the disclosure of environmental activities reduces the standard deviation of stock return by 0.015 and that of ROA by 0.078. These results are consistent with the conjecture that the favorable loan features are due to reduced corporate risk.

6.2 | Government's intention to promote green finance

Another reason EID is associated with favorable bank loans might be that firms with EID meet local governments' intention to promote green finance. Governance of environmental pollution has become an essential political mission for local governments in China and is linked with evaluating the achievement of local officials and their promotion. In the last decade, green finance has become a significant focus area for the government as it seeks to address environmental challenges

and meet its commitment to the Paris Agreement on climate change. China has established a comprehensive policy framework to promote green finance, including issuing green bonds and bank loans. The government has set up a green development fund to support green projects financially. The size of the green finance market in China has reached 16 trillion RMB, accounting for about 8% of the entire Chinese financial system. The Chinese government has also encouraged financial institutions to increase lending to green projects, and major banks have established dedicated green finance departments. Green bank loans are often offered at lower interest rates than traditional loans to encourage borrowers to pursue green projects.

As we argued earlier, major banks in China are state-owned and work closely with the government (Brandt & Li, 2003; Song et al., 2011). Therefore, banks may loan to firms with robust EID to complete the political task. If this is indeed a channel through which EID, we expect EID to have a more significant influence on bank loans in areas where the government has a high intention to promote green finance. As it is hard to measure the government's intention directly, we use the local government's investment in environmental protection (*Govt. env. investment*) as a proxy variable, which is collected from *China Statistical Yearbook on Environment*.

Table 6 reports the results. We add an interaction term between *Govt. env. investment* and the EID measure in each model. The interaction terms in Columns (1) and (2) receive significant positive coefficients at the 5% level or better. Their counterparts in Columns (3) and (4) receive significantly negative coefficients. The results imply that disclosing environmental information is more beneficial to bank loans in provinces where the government makes more environmental investments, which also tend to have a strong intention to promote green finance.

7 | CROSS-SECTIONAL HETEROGENEITY

To explore the relationship between EDI and bank loans in more detail and to alleviate the concern about omitted variables, we conduct a series of cross-sectional heterogeneity tests in this section. Specifically, we explore cross-sectional variations in voluntariness, marketization, stock informativeness, and firm identities.

7.1 | Mandatory versus voluntary disclosure

We first investigate whether voluntary EID is more valuable in winning favorable loan features than mandatory EID. Voluntary EID implies that the firm's behavior is motivated by its values, beliefs, and interests, which can lead to greater engagement and commitment to environmental protection. Additionally, voluntary EID can be seen as a result of ethical decision-making, which further reduces banks' concerns about the firm's credibility. According to existing studies, voluntary disclosure contributes to meeting the needs of stakeholders for nonfinancial information (Francis et al., 2008; Moser & Martin, 2012),

TABLE 5 Environmental information disclosure and firm risks.

	SD return		SD ROA	
	(1)	(2)	(3)	(4)
Env. activity	−0.015***		−0.078***	
	(−2.69)		(−2.74)	
Env. policy		−0.020***		−0.100***
		(−3.31)		(−3.71)
Firm size	−0.048***	−0.047***	−0.370***	−0.366***
	(−3.64)	(−3.57)	(−4.11)	(−4.06)
Leverage	0.336***	0.335***	0.850**	0.847**
	(6.88)	(6.87)	(2.47)	(2.46)
EBITDA	−0.459***	−0.462***	−4.419***	−4.433***
	(−2.97)	(−2.98)	(−3.66)	(−3.68)
Tangibility	−0.170**	−0.166**	−2.468***	−2.447***
	(−2.21)	(−2.16)	(−4.66)	(−4.63)
Tobin Q	0.119***	0.119***	0.142***	0.142***
	(19.97)	(19.93)	(3.79)	(3.77)
Top1	−0.146**	−0.146**	−1.230***	−1.227***
	(−2.04)	(−2.04)	(−2.62)	(−2.61)
HHI	−0.097	−0.095	−2.624***	−2.615***
	(−0.94)	(−0.93)	(−3.20)	(−3.18)
Z-score	−0.000	−0.000	−0.010	−0.010
	(−0.15)	(−0.14)	(−1.15)	(−1.14)
SOE	0.039	0.039	−0.364	−0.362
	(0.99)	(1.00)	(−1.54)	(−1.53)
Dual	0.009	0.008	0.096	0.095
	(0.59)	(0.58)	(1.07)	(1.06)
Management share	0.160***	0.162***	−2.323***	−2.314***
	(2.64)	(2.68)	(−5.47)	(−5.45)
Board size	0.006	0.007	0.042	0.049
	(0.12)	(0.15)	(0.14)	(0.16)
Independent director	−0.080	−0.080	0.475	0.474
	(−0.62)	(−0.62)	(0.64)	(0.64)
Female director	−0.009	−0.010	−0.054	−0.060
	(−0.18)	(−0.20)	(−0.19)	(−0.21)
Kyoto protocol Ind.	0.058	0.058	−0.293	−0.294
	(1.44)	(1.44)	(−1.29)	(−1.29)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	25,033	25,033	25,690	25,690
Adj. R^2	0.710	0.710	0.246	0.246

Note: This table explores the risk mechanism through which EID affects bank loan. In Columns (1) and (2), the dependent variable is operational risk measured by the standard deviation of return on asset. In Columns (3) and (4), the dependent variable is stock risk measured by the standard deviation of stock return. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

mitigating information asymmetry among capital market participants (Plumlee et al., 2015), and improving the allocation of credit resources (Healy & Palepu, 2001).

According to the *Plan for the Reform of the Legal Disclosure System of Environmental Information* (hereafter "the plan") issued by China's Ministry of Ecology and Environment, the following enterprises shall

TABLE 6 Impact of government environmental intention.

	Loan size		Loan cost	
	(1)	(2)	(3)	(4)
Env. activity	0.639**		−0.011	
	(2.53)		(−1.09)	
Env. activity * Govt. env. investment	12.598***		−0.868**	
	(3.56)		(−2.15)	
Env. policy		0.672***		−0.003
		(2.70)		(−0.24)
Env. policy * Govt. env. investment		17.323**		−0.575***
		(2.22)		(−2.77)
Govt. env. investment	−28.252**	−27.927***	−0.274	−0.235
	(−2.47)	(−3.24)	(−0.71)	(−0.69)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	18,210	18,210	15,098	15,098
Adj. R^2	0.403	0.403	0.532	0.532

Note: This table reports the fixed-effect regression results of the impact of government environmental investment, which is used as a proxy of government's intention to promote green finance. The dependent variable in Columns (1) and (2) is loan size, and loan cost in Columns (3) and (4). Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

be subject to compulsory disclosure of environmental information: key pollutant discharging entities, enterprises subject to compulsory cleaner production examination, listed companies and bond-issuing enterprises that are held criminally liable or are subject to major administrative penalties for violations of ecological or environmental laws. Following the spirit of the plan, we define a dummy variable, *If mandatory EID*, that equals one if the firm is required to disclose environmental information and zero otherwise (Appendix A presents the detailed industry list).[4] We then interact it with EID measures and add the interaction terms to our baseline regression.

Table 7 reports the results. The dependent variable in Panel A is *Loan size*, and that in Panel B is *Loan cost*. As the nature of mandatory disclosure is constant and included in the firm or industry fixed effect, we control for the fixed effect of each province-year pair (i.e., year × province). In Columns (1) and (2) in panels A and B, we find that mandatory EID leads to fewer bank loans and greater loan costs than voluntary EID, all significant at the 10% level or better. In Panel C of our analysis, we divide our sample into two distinct groups based on whether firms engage in mandatory or voluntary EID. Our findings reveal that the positive relation between EID and bank loan size, as well as the negative relationship between EID and loan costs, is notably more significant within

the voluntary EID group. This increased significance level and coefficient magnitude in the voluntary EID group provide support for H2, which posits that Voluntary EID leads to more favorable lending terms in terms of loan size and costs compared to mandatory EID. This suggests that voluntary environmental disclosure practices hold a stronger influence on bank lending outcomes than mandatory disclosure requirements.

7.2 | Marketization

Since the 1980s, China has continually improved its marketization to create a market-oriented economic system. One major change caused by marketization is the development of competition, which has led to improved productivity, innovation, and quality. However, the process of marketization is uneven among provinces. We conjecture that EID plays a more important role for firms in deeper marketized provinces because they face more competition to obtain financing from banks. Moreover, provinces with a higher level of marketization usually have a higher level of governmental governance and more profit-oriented financial systems (Zhang, 2008), fully bringing EID's significance into play.

We collect each province's marketization index (Marketization) from Wang et al. (2021) and add the interaction term between *Marketization* and EID measures to the baseline regression. The results shown in Columns (3) and (4) (both panels A and B, Table 7)

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[4]In our sample, 1170 firms are classified as mandatory disclosure companies. Specifically, 782 (66.84%) firms are key pollutant discharging entities; 223 (19.06%) firms are held criminally liable or are subject to major administrative penalties for violations of ecological or environmental laws.

TABLE 7 Heterogeneity.

Panel A: Dependent variable = loan size

	If mandatory EID		Marketization		Stock info.		SOE	
Interaction =	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	1.210***		0.619**		0.594**		1.120***	
	(5.99)		(3.07)		(2.71)		(2.75)	
Env. activity * Interaction	−0.660*		0.248***		1.666**		−1.091**	
	(−1.70)		(3.26)		(2.31)		(−1.99)	
Env. policy		1.480***		0.752***		0.793***		1.476***
		(7.11)		(4.79)		(3.64)		(3.59)
Env. policy * Interaction		−0.844**		0.138**		1.481**		−1.391**
		(−2.17)		(2.38)		(2.00)		(−2.52)
Interaction	1.707***	1.791***	0.367	0.393	−0.435	−0.402	1.346	1.332
	(3.00)	(3.26)	(0.91)	(0.96)	(−0.45)	(−0.47)	(1.06)	(1.04)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year * Province FE	Yes	Yes	No	No	No	No	No	No
Obs.	25,802	25,802	25,695	25,695	25,091	25,091	25,695	25,695
Adj. R^2	0.225	0.226	0.510	0.510	0.513	0.513	0.510	0.510

Panel B: Dependent variable = loan cost

	If mandatory EID		Marketization		Stock info.		SOE	
Interaction =	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	−0.020***		−0.017		−0.031**		−0.055***	
	(−3.54)		(−1.45)		(−2.56)		(−4.63)	
Env. activity * Interaction	0.017*		−0.014***		−0.102***		0.023***	
	(1.68)		(−3.85)		(−3.10)		(2.61)	
Env. policy		−0.022***		−0.006		−0.023*		−0.062***
		(−3.23)		(−0.54)		(−1.90)		(−4.04)
Env. policy * Interaction		0.020**		−0.011***		−0.097**		0.027***
		(2.08)		(−3.09)		(−2.42)		(2.72)
Interaction	0.037	0.038	−0.039**	−0.039**	0.208***	0.210***	−0.103	−0.103
	(1.38)	(1.43)	(−2.02)	(−2.05)	(3.71)	(4.16)	(−1.01)	(−0.96)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year * Province FE	Yes	Yes	No	No	No	No	No	No
Obs.	21,482	21,482	21,276	21,276	20,753	20,753	21,276	21,276
Adj. R^2	0.283	0.283	0.465	0.465	0.476	0.476	0.465	0.465

Panel C: Subsample of mandatory and voluntary EID and bank loan

	Subsample of mandatory EID				Subsample of voluntary EID			
	Loan size		Loan cost		Loan size		Loan cost	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	0.458*		−0.014**		0.623***		−0.034***	
	(1.89)		(−2.10)		(2.97)		(−3.09)	

(Continues)

TABLE 7 (Continued)

Panel C: Subsample of mandatory and voluntary EID and bank loan							
	Subsample of mandatory EID				Subsample of voluntary EID			
	Loan size		Loan cost		Loan size		Loan cost	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. policy		0.458*		−0.011		0.821***		−0.043***
		(1.93)		(−1.58)		(3.15)		(−3.36)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	9575	9575	8679	8679	15,869	15,869	13,550	13,550
Adj. R^2	0.542	0.542	0.587	0.587	0.510	0.510	0.459	0.459

Note: This table reports the heterogeneous influence of EID on bank loan (the size of bank loan in Panel A, the cost of bank loan in Panel B, subsamples of mandatory versus voluntary EID in Panel C). In Panels A and B, Columns (1) and (2) show the heterogeneities based on voluntary versus mandatory EID (*If voluntary EID*). Columns (3) and (4) present the heterogeneities based on the level of marketization (*Marketization*), which is measured by the marketization index designed by Wang et al. (2021). Columns (5) and (6) display the heterogeneities based on stock price informativeness (*Stock Info.*). Columns (7) and (8) display the heterogeneities based on the identity of the firm (*SOE*). In Panel C, Columns (1)–(4) present the results of the subsample of mandatory EID; Columns (5)–(8) present the subsample of voluntary EID. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

suggest that the positive (negative) relationship between EID and loan size (loan costs) is strengthened by the level of local marketization.

7.3 | Stock informativeness

Stock informativeness refers to the extent to which the firm's stock reflects firm-specific information. Releasing environmental information might benefit firms with a high level of stock informativeness because its stock price can incorporate the information dynamically and achieve a higher return. On the other hand, macro economy factors and the market return can explain a relatively larger part of the variance of stock return for firms with less informativeness, impairing the importance of EID. Therefore, we conjecture that EID is more meaningful to firms whose stocks depend more on firm-specific information.

To examine the above conjecture, we first run the following regression following Chen et al. (2007):

$$r_{i,j,t} = \beta_{i,0} + \beta_{i,m} r_{m,t} + \beta_{i,j} r_{j,t} + \varepsilon_{i,t} \qquad (3)$$

where $r_{i,j,t}$ is the return of firm i in industry j at year t, $r_{m,t}$ is the market return at year t, and $r_{j,t}$ is the return of industry j. We use the 1-R^2 to measure the stock price informativeness (*Stock Info.*), where R^2 is the R-square from the above regression (Equation 3). Table 7 Columns (5)–(6) present the results. Consistent with our conjecture, coefficients on the interaction terms are significantly positive (negative) in Panel A (Panel B), indicating that the benefits of EID on bank loans are reinforced when the firm's stock price is more informative.

7.4 | SOE versus non-SOE

The last heterogeneity test explores the discrepancy between SOEs and non-SOEs. In general, SOEs are more environmentally aware and have lower environmental risks than non-SOEs (Chun, 2009; Tan et al., 2022) for the following reasons. First, SOEs are often held to higher environmental standards and are subject to more rigorous environmental supervision. Second, SOEs are less driven by profit motives and more focused on fulfilling the government's development goals. Moreover, SOEs in China often have greater access to financial resources. We expect that the influence of EID on bank loans is weaker for SOEs than for non-SOEs.

We first differentiate firms into SOEs and non-SOEs according to the identities of their controlling shareholders and then add an interaction term between *SOE* and the EID measures to the baseline regression. The results are reported in Columns (7) and (8) on both panels of Table 7. Consistent with our conjecture, EID benefits non-SOEs more than SOEs in terms of larger loan sizes and lower loan costs. We divide the sample into two groups based on SOE or non-SOE in another unreported test. We find that the relationship between EID and bank loan features is more significant in the non-SOE group. The coefficients on EID of the two groups are statistically different at the 5% level or better.

8 | ADDITIONAL TESTS

8.1 | Voluntary EID and adverse selection issue

Thus far, we have shown that both voluntary and mandatory EID benefit bank loans, and voluntary EID is more beneficial. However, as

TABLE 8 Voluntary environmental information disclosure and adverse selection issue.

Panel A: Environmental penalties

	Without penalties				With penalties			
	Loan size		Loan cost		Loan size		Loan cost	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	0.745**		−0.117***		−0.329		−0.032	
	(2.57)		(−3.48)		(−0.32)		(−0.77)	
Env. policy		0.874***		−0.136***		−0.166		0.007
		(2.86)		(−7.56)		(−0.16)		(0.18)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	14,645	14,645	12,408	12,408	1224	1224	1142	1142
Adj. R^2	0.509	0.509	0.457	0.457	0.526	0.526	0.524	0.523

Panel B: Analyst coverage

	Low analyst coverage				High analyst coverage			
	Loan size		Loan cost		Loan size		Loan cost	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	0.318		−0.024		0.771**		−0.045**	
	(0.47)		(−0.62)		(2.04)		(−2.59)	
Env. policy		0.395		−0.056		0.891**		−0.053**
		(0.62)		(−1.55)		(2.48)		(−2.41)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	5070	5070	4269	4269	5894	5894	5119	5119
Adj. R^2	0.516	0.516	0.463	0.463	0.516	0.516	0.645	0.645

Note: This table reports the heterogeneous influence of environmental penalties (Panel A) and the degree of analyst coverage (Panel B) within the subgroup of voluntary EID. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

discussed in the previous section of literature review, the motivation behind voluntary EID might not originate from altruism but from self-interest, such as managerial benefit (Zheng & Ren, 2019), political interest (Gamerschlag et al., 2011; Griffin & Sun, 2013; Lee et al., 2017), earnings management (Carey et al., 2017), and off-setting blemishes (Cho & Patten, 2007; Deegan, 2002). Therefore, banks may face the adverse selection issue while assessing firms' voluntary EID and question the motivation due to information asymmetry. If a company sees voluntary EID as a genuine reflection of its motivation, it is more likely to gain advantages and credibility from banks. However, if adopting voluntary EID is viewed as symbolic, the company might miss out on rewards and face negative evaluations instead. To purify voluntariness, we focus on the subsample of voluntary EID and divide it further into two groups based on high or low tendency to sincere voluntary EID.

The first way we use to distinguish the variation in the propensity for altruism-motivated voluntarily EID is the number of environmental

penalties received by the firm. Firms without environmental penalties might be more likely to take voluntary EID out of the belief in corporate social responsibility and the philosophy of selflessness. In contrast, firms subject to penalties tend to use voluntary EID as a tool to take interest-motivated EID (Zhang, Ruan, et al., 2021). Therefore, banks should value the voluntary EID of firms without environmental penalties more than those of firms with penalties. We collect the environmental penalty information at the firm level from the CNRDS database. Employing the subsample of voluntary EID, Table 8 Panel A confirms our conjecture. In the subgroup without penalties [Columns (1)–(4)], voluntary EID leads to greater loan size and lower loan cost, while this relationship does not exist in the group with penalties [Columns (5)–(8)].

Second, we use analyst coverage to discriminate the sincerity behind voluntary EID. Firms with high external monitoring and attention, proxied by analyst coverage, tend to have less misconduct (Xu et al., 2021;

TABLE 9 Mandatory environmental information disclosure and the intention of voluntary disclosure.

Panel A: Environmental penalties

	Without penalties				With penalties			
	Loan size		Loan cost		Loan size		Loan cost	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	0.537**		−0.028**		−0.354		−0.002	
	(2.35)		(−2.49)		(−0.62)		(−0.11)	
Env. policy		0.677***		−0.020***		−0.211		0.001
		(3.22)		(−2.64)		(−0.33)		(0.04)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	7622	7622	6857	6857	1953	1953	1822	1822
Adj. R^2	0.554	0.555	0.590	0.589	0.498	0.498	0.588	0.588

Panel B: Analyst coverage

	Low analyst coverage				High analyst coverage			
	Loan size		Loan cost		Loan size		Loan cost	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	1.056**		−0.048**		−0.002		0.007	
	(2.07)		(−2.17)		(−0.00)		(0.70)	
Env. policy		1.421**		−0.021**		0.475		0.017
		(2.57)		(−2.23)		(1.01)		(1.57)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2990	2990	2543	2543	3650	3650	3136	3136
Adj. R^2	0.566	0.566	0.551	0.550	0.526	0.526	0.706	0.706

Note: This table reports the heterogeneous influence of environmental penalties (Panel A) and the degree of analyst coverage (Panel B) within the subgroup of mandatory EID. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

Zhang, 2022). Therefore, we conjecture that the voluntary EID of firms subject to higher analyst coverage is more favored by banks. We gather the analyst coverage data from the CSMAR database. A firm is categorized into the high-analyst-coverage group if the number of analysts (teams) tracking the firm is higher than the median of the same industry and year. Table 8 Panel B presents the results. Voluntary EID can only enhance bank loans when firms receive substantial analyst coverage. Our results indicate that the effect of voluntary EID relies on banks' evaluations of the firm's sincerity, confirming H3.

8.2 | Mandatory EID and the intention of voluntary disclosure

Undeniably, the motivation behind mandatory EID is also variant. Jackson et al. (2020) point out that mandatory social responsibility

regulation creates greater stringency around minimum standards, but it can also lead to inflexibility due to a "one-size-fits-all" approach. It is possible that some firms subject to mandatory EID have the intention to disclose environmental information even without the mandatory requirements or want to disclose additional information beyond those required by regulations. We conjecture that within the group of mandatory EID, banks prefer firms with a higher likelihood of taking EID from their initiative.

In Table 9, we focus on mandatory EID only and divide it into two groups according to high and low intention to undertake voluntary disclosure. We use firm-level environmental penalties and analyst coverage to make a distinction between these two subgroups. First, firms without environmental penalties might be more likely to disclose environmental information stemming from a genuine commitment to sustainability. Second, if the compulsory request of EID is removed, firms receiving less analyst coverage might have a higher intention to

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TABLE 10 Environmental information disclosure (EID), bank loan, and green innovation.

	Mandatory EID				Voluntary EID			
	Green patents apply		Green patents grant		Green patents apply		Green patents grant	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	0.007		0.005		0.013*		0.010*	
	(1.36)		(1.09)		(1.83)		(1.76)	
Env. activity * Loan size	0.0006***		0.0005***		0.0013***		0.0015***	
	(4.85)		(4.08)		(7.53)		(10.18)	
Env. policy		0.009*		0.015***		0.013**		0.012**
		(1.66)		(3.17)		(1.99)		(2.13)
Env. policy * Loan size		0.0007***		0.0004***		0.0014***		0.0015***
		(5.11)		(3.80)		(8.98)		(10.85)
Loan size	−0.000	−0.000	−0.000	−0.000	0.001***	0.001***	0.001***	0.001***
	(−0.93)	(−0.94)	(−0.98)	(−0.80)	(5.64)	(5.09)	(8.30)	(7.44)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	8768	8768	8768	8768	13,614	13,614	13,614	13,614
Adj. R^2	0.818	0.818	0.803	0.803	0.765	0.766	0.752	0.753

Note: This table reports the fixed-effect regression results of EID, bank loan, and corporate green innovations. Columns (1)–(4) present the results for mandatory EID, followed by voluntary EID in Columns (5)–(8). In Columns (1)–(2) and (5)–(6), the dependent variable is the natural logarithm of the averages of green patent application numbers in the next 3 years. In Columns (3)–(4) and (7)–(8), the dependent variable is the natural logarithm of the averages of green patent grant numbers in the next 3 years. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

voluntarily disclose the achievement on corporate social responsibility. Compared with firms that are carefully studied by analysts and widely known by the public, voluntary EID is an information channel to disperse favorable information and compensate for the shortage of analyst coverage (Garcia-Sanchez & Noguera-Gamez, 2017). Wang et al. (2018) find that mandatory CSR disclosure firms constrain earnings management, which is particularly noticeable among companies with limited analyst coverage. The findings substantiate our speculation. In Panel A, banks favor mandatory EID of firms without any history of environmental penalties; in Panel B, for firms with low analyst coverage, mandatory EID can facilitate securing larger loans at reduced costs. Our results are consistent with H4.

8.3 | EID, bank loan, and green innovation

Besides green finance, green innovation also plays a vital role in China's plan of environmental governance. A natural question is whether firms with robust EID and adequate funding from banks are associated with more green innovation. First, EID reflects firms' intention to reduce environmental impact. Therefore, firms performing well in EID might also be willing to develop novel products or processes that are more environmentally friendly than their traditional counterparts. Second, innovation requires significant monetary investment. As we have shown in the above text, EID is associated with larger bank loans, which can be used to develop green innovation. Third,

China's government has implemented a range of policies to encourage green innovation, including loan support. Green innovation helps firms comply with environmental regulations and is an essential way for firms to respond to ecological calls and carry out environmental protection (Chen et al., 2006).

Considering that it may take years to complete a green innovation, we explore the effects of EID, the size of bank loans, and their interaction on corporate green innovation using firms' average green innovations over 3 years following a given year. We capture two features of corporate green innovation: the number of applications for green patents and the number of granted patents.

Table 10 presents the results. We split our sample into two groups based on mandatory [Columns (1)–(4)] and voluntary [Columns (5)–(8)] EID. The dependent variables in Columns (1)–(2) and (5)–(6) are the natural logarithm of one plus the average number of green patent applications (*Green patents apply*$_{[avg.year+1,+2,+3]}$). And that in Columns (3)–(4) and (7)–(8) is the natural logarithm of one plus the average number of green patent grants (*Green patents grant*$_{[avg.year+1,+2,+3]}$). Columns (1) through (8) show that the coefficients of the interaction terms between EID and loan size are all significantly positive at the 1% level. Moreover, while the coefficients of EID features or *Loan size* are insignificant in the mandatory EID group, they are individually significant in the voluntary EID group. These results suggest that EID or the size of bank loans alone cannot significantly foster corporate green innovation in the mandatory EID group. However, when EID is combined with the size of bank loans, the mixed impact is

TABLE 11 Environmental information disclosure and different types of bank loans.

	Pledged loan		Credit loan		Guaranteed loan		Collateral loan	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Env. activity	9.908**		0.426*		4.958		1.519	
	(2.04)		(1.66)		(1.07)		(0.32)	
Env. policy		10.590**		0.442*		−2.434		4.828
		(2.12)		(1.70)		(−0.51)		(0.99)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	16,572	16,572	21,275	21,275	12,952	12,952	14,415	14,415
Adj. R^2	0.204	0.204	0.635	0.635	0.340	0.340	0.380	0.380

Note: This table reports the association between EID and different types of bank loans, including pledged loans [Columns (1) and (2)], credit loans [Columns (3) and (4)], guaranteed loans [Columns (5) and (6)], and collateral loans [Columns (7) and (8)]. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

convincing. In the voluntary EID group, EID and loan size alone and their interaction item can positively influence green innovation.

These findings suggest that, within the context of mandatory EID, neither EID nor the size of bank loans alone have a substantial impact on promoting corporate green innovation. It is only when these two factors are combined that their mixed impact becomes convincing. In contrast, in the voluntary EID group, both EID and loan size, as well as their interaction, can independently and synergistically drive positive changes in green innovation, highlighting the distinctive dynamics between mandatory and voluntary EID in influencing sustainable practices within firms.

8.4 | Types of bank loans

Our bank loan samples include various bank loans, including pledged loans, guaranteed loans, credit loans, and collateral loans. Their sensitivities to EID may vary noticeably. For example, pledge loans apply financial assets (usually the firm's stock) as a security, while collateral loans require physical assets as the security. When firms experience environmental incidents, the value of stock tends to decrease significantly, while the value of physical assets is less likely to be affected. Moreover, guaranteed loans indicate that a firm is certain to be accepted for a given amount of loan, regardless of the firm's circumstances, affordability, or credibility. However, the size and cost of credit loans are dependent on the credit check and the firm's reputation, which can be considerably influenced by exposure to environmental risks. We conjecture that banks value EID particularly in pledged and credit loans.

The results in Table 11 are consistent with the conjecture. The dependent variable in each column is the size of a specific type of loan. If a firm-year sample has no record of a given type of loan, it takes the empty value. We find that the positive relationship between EID and loan size is only statistically significant for pledged loans [Columns (1) and (2)] and credit loans [Columns (3) and (4)]. These findings

may provide new insights into the unsettled issues about whether environmental information is considered in bank lending (Campbell & Slack, 2011; Li et al., 2022; Thompson & Cowton, 2004).

8.5 | Other financing channels

There could be substitution effects among different financing channels when firms make financing decisions. To investigate whether EID also influences other financing channels, we examine the impact of EID on bond financing (*Bond size*), commercial credit financing (*Commercial credit*), and equity financing (*Equity size*). Table 12 presents the results, and none of the coefficients on EID measures is significant at the 10% level. These results demonstrate the exclusive relationship between EID and bank loans.

8.6 | Consecutive EID measure

In an additional robustness test presented in Table 13, we use the disclosed firm-level monetary investment in environmental protection as a quantitative and consecutive measure of EID. The major explanatory variable in Columns (1) and (2) is the natural logarithm of environmental investments. In Columns (3) and (4), the major explanatory variable is a dummy variable, which equals one if the environmental investment of the firm is higher than the median value of the same industry and year, and zero otherwise. Our results are robust to the alternative measure of EID.

9 | DISCUSSION AND CONCLUSION

The centrality of EID in representing firms' environmental performance and responsibility has undeniably escalated in significance, primarily due to heightened interests from public entities and

TABLE 12 Environmental information disclosure and other financing channels.

	Bond size		Equity size		Commercial credit	
	(1)	(2)	(3)	(4)	(5)	(6)
Env. activity	−0.004		−0.008		0.124	
	(−1.00)		(−0.08)		(1.43)	
Env. policy		−0.009		−0.199		−0.139
		(−1.31)		(−1.12)		(−1.59)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	25,695	25,695	25,695	25,695	25,695	25,695
Adj. R^2	0.231	0.232	0.195	0.195	0.201	0.201

Note: This table reports the fixed-effect regression results of EID and other financing channels, including bond financing [Columns (1)–(2)], equity financing [Columns (3)–(4)], and commercial credit financing [Columns (5)–(6)]. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level to control for heteroscedasticity and serial correlation among observations of the same firm. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

TABLE 13 Monetary investment in environment.

	Loan size		Loan cost	
	(1)	(2)	(3)	(4)
Env. input	0.255***		−0.013**	
	(2.72)		(−2.29)	
If high env. input		0.985*		−0.032*
		(1.80)		(−1.94)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Obs.	1319	1319	1193	1193
Adj. R^2	0.203	0.203	0.473	0.473

Note: This table shows the impact of firms' monetary investment in environment on bank loan. The main explanatory variable is the size of bank loan in Columns (1)–(2) and the cost of bank loan in Columns (3)–(4). In Columns (1) and (3) [Columns (2) and (4)]. Appendix A provides detailed descriptions of variable definitions. Standard errors are clustered at the firm level. *T*-statistics are reported in parentheses. *, **, *** denote significance at less than 10%, 5%, and 1% levels, two-tailed tests, respectively.

governmental agencies. However, there is an ongoing debate over whether corporate EID is decision-useful for capital market participants. A growing body of empirical studies has explored the usefulness of EID in bank lending decisions but has yet to reach an agreement. This study, therefore, revisits this topic by shedding light on the effectiveness of corporate EID in bank lending decisions in China, using both voluntary and mandatory EID data.

Our empirical investigations yield compelling evidence asserting the pivotal role of EID in shaping bank lending trajectories. Specifically, we ascertain that EID not only gains traction in bank lending deliberations but also accentuates the ease of bank loans, both

quantitatively (loan size) and qualitatively (loan costs). To address endogeneity concerns, we adopt a PSM analysis and a DID test based on the implementation of the newly revised Environmental Protection Law. Our conclusions remained consistent, emphasizing the robustness of our findings. We identify two possible economic mechanisms to explain why EID influences bank loan features. First, we find that EID is associated with less corporate risk. Second, we find evidence that the local government's intention to promote green finance also makes EID influential in banks' lending decisions. Extending our analytical horizon, our research also unveiled the intriguing interplay between corporate EID and green innovation, suggesting that a synergy between EID and bank loans potentially stimulates firms toward green innovation endeavors.

Our study offers several key contributions to the extant literature on business strategy and the environment and its implications for bank lending decisions. First, we bridge the current divergent discussions surrounding the utility of EID for capital market participants. By doing so, we provide a nuanced understanding that holds particular relevance for emerging markets like China. By considering both voluntary and mandatory EID data, we adopt a more comprehensive analytical approach than many prior studies.

Although EID is increasingly recognized as an influential factor in bank lending in China, most previous research has predominantly relied on data related to mandatory EID and firms primarily operating within heavily polluting sectors (e.g., Du et al., 2022; Fonseka et al., 2019; Luo et al., 2019; Xu et al., 2021). There has been no detailed investigation of voluntary EID. Research has yet to systematically investigate and discriminate the effect of mandatory and voluntary EID. Our research strives to address these gaps comprehensively. In particular, we find that, while both voluntary and mandatory EID contribute positively to bank lending, banks exhibit a notable preference for voluntary EID over its mandatory counterpart. This preference underscores the pivotal role of a firm's authentic

commitment to environmental transparency in shaping sustainable financial practices.

Moreover, our study goes beyond surface-level analysis. To mitigate the potential issues of adverse selection and greenwashing, we employ a nuanced approach by dividing the voluntary EID group into subsamples based on environmental penalties and analyst coverage. These factors serve as proxies for the propensity for altruism-motivated voluntary EID. The results show that voluntary EID works better for firms with a low likelihood of adverse selection and greenwash (i.e., without environmental penalty and high analyst coverage). On the other hand, we also identify the possibility that some mandatory EID may hide the motivation for voluntary disclosure. We find that mandatory EID is more effective for firms with a high intention of voluntary disclosure (i.e., without environmental penalty and low analyst coverage). This examination addresses concerns related to adverse selection and greenwashing, ensuring the accuracy and reliability of our findings regarding EID. By fostering transparency in this manner, our study contributes to more informed decision-making by banks and facilitates a more efficient allocation of resources within the market.

Second, our robust methodology, which employs both PSM and a DID strategy, positions our findings against the context of China's revised Environmental Protection Law. This approach ensures that our conclusions are not simply artifacts of unique data structures, but reflect underlying economic realities. Delving deeper than most preceding investigations, we uncover the economic underpinnings behind EID. We confirm that EID is not merely a regulatory formality; it signals reduced corporate risk, becoming a central consideration in bank lending decisions. Additionally, our results illuminate the alignment of EID with local government policies championing green finance, emphasizing EID's importance beyond mere compliance measures. Finally, we are among the first to explore the broader economic implications of EID, illustrating how it, combined with bank loans, can spur corporate green innovation. This suggests that EID can play a pivotal role in driving sustainable economic growth, especially in rapidly evolving markets. Taken together, these insights advance both academic understanding and offer invaluable perspectives for financial institutions, policymakers, and corporations operating within emerging economic contexts.

Our findings carry pivotal implications for both lenders and policymakers. For banks in emerging markets, EID serves as a crucial indicator of reduced corporate risk, warranting its integration into credit assessments. This inclusion could optimize lending decisions and enhance loan portfolio outcomes. Corporations, especially in sectors with significant environmental impact, should prioritize thorough environmental disclosures, recognizing their strategic implications in financing dynamics. On the policy front, the evident link between EID and green finance objectives suggests an opportunity for regulatory bodies to fine-tune environmental disclosure standards, emphasizing both transparency and alignment with broader sustainability objectives. Moreover, the interplay of EID and bank lending in bolstering green innovations accentuates the imperative for a financial framework that champions sustainability-driven initiatives, ensuring a robust and green-forward economic trajectory in emerging economies.

Despite our rigorous approach, our study has limitations. The cultural and regulatory environment in China, though providing a rich context for our study, may limit the direct applicability of our findings to other jurisdictions. Our bifurcated approach to EID, classifying it as "mandated" and "voluntary," may omit subtle nuances within the spectrum of EID practices. Furthermore, the evolving nature of environmental norms necessitates that our results be viewed in the context of the current regulatory landscape. Future research can address these limitations. A cross-country study would help validate or nuance our findings, and a more detailed classification of EID could offer insights into its various impacts. As environmental norms and regulations evolve, there is an evident need for longitudinal studies to track the changing relevance and impact of EID in financial decision.

ORCID

Ahmed A. Elamer 🄳 https://orcid.org/0000-0002-9241-9081

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APPENDIX A: VARIABLE DEFINITIONS

Variables	Definitions
Dependent variable	
Loan size (%)	Borrowings from banks in a year divided by total assets at the end of the year.
Loan cost (%)	Interest expenses in a year divided by borrowings from banks in the year.
Sd. return	Standard deviation of daily stock returns in a year.
Sd. ROA	Standard deviation of quarterly return on asset in a year.
Pledged loan (%)	Pledged loans in a year divided by borrowings from banks in the year.
Guaranteed loan (%)	Guaranteed loans in a year divided by borrowings from banks in the year.
Credit loan (%)	Credit loans in a year divided by borrowings from banks in the year.
Collateral loan (%)	Collateral loans in a year divided by borrowings from banks in the year.
Green patents apply	Natural logarithm of one plus the number of green patent applications.
Green patents grant	Natural logarithm of one plus the number of green patent granted.
Bond size (%)	Book value of bonds divided by total assets.
Equity size (%)	The difference between book value of equity and retained earnings, divided by total assets.
Commercial credit (%)	Accounts payable, notes payable, and payments received in advance divided by total assets.
Independent variables	
Env. activity	Environmental information disclosure on environmental activities. It contains six items, including the disclosure of
	(1) Actions taken to reduce waste gas emission.
	(2) Actions taken to reduce wastewater emission.
	(3) Actions taken to reduce dust and soot.
	(4) Actions taken to recycle and dispose solid waste.
	(5) Actions taken to control noise, light, and radiation pollution.
	(6) Actions taken to produce environmentally friendly products.
	Each item scores zero, one, and two if the firm has no disclosure, a qualitative disclosure, and a quantitative disclosure (monetary/numerical) in its annual report, respectively. *Env. Activity* scores a combined total of the six items.
Env. policy	Environmental information disclosure on environmental policies and guidelines. It contains eight items, including the disclosure of
	(1) Policies, patterns, and ideas of environment protection.
	(2) Aims and vision of environment protection and how it was/will be fulfilled.
	(3) Rules, norms, and regulations of environment protection.
	(4) Training and education of environment protection.
	(5) Participation of environmental social welfare activities
	(6) Contingency plan for environmental emergencies.
	(7) Honors or awards of environment protection.
	(8) Implementation of "three-parallel policy" required by the Environmental Protection law: The facilities for preventing and controlling pollution in a construction project should be designed, constructed, and put into operation simultaneously with the main project.
	Each item scores one if the firm has disclosed it in the annual report and zero otherwise. *Env. policy* scores a combined total of the six items.
Env. input	Natural logarithm of environmental investments.
If high env. input	A dummy variable that equals one if the environmental investments of the firm is higher than the median value of the same industry and year, and zero otherwise.
Control variables	
Firm size	Natural logarithm of total assets.
Leverage	Book value of debts divided by total assets.
EBITDA	Earnings before interest, taxes, depreciation, and amortization divided by total assets.

Variables	Definitions
Tangibility	Tangible assets divided by total assets.
Tobin Q	Sum of market value of equity and book value of debt divided by total assets.
Top 1	Portion of shares held by the largest shareholder.
HHI	Industry concentration measured by the Herfindahl–Hirschman index of firms' sales. Industries classification is based on *Guidelines for the Industry Classification of Listed Companies* (2012 Revision) by China Securities Regulatory Commission. Nineteen industries in total.
Z-score	Sum of return on assets and the equity ratio divided by the standard deviation of the returns (over a 3-year window) (Altman, 1968).
SOE	A dummy variable that equals one if a firm is a state-owned enterprise and zero otherwise.
Dual	A dummy variable that equals one if a firm combines the roles of the CEO and chairman of the board, and zero otherwise.
Management share	Portion of shares held by the management.
Board size	Natural logarithm of the number of board of directors.
Independent director	Number of independent directors divided by total number of directors.
Female director	Number of female directors divided by total number of directors.
Kyoto protocol Ind.	A dummy variable that equals one if the firm is in the industries that are heavily affected by the Kyoto Protocol, including motor vehicles, oil and gas, energy, and chemicals, and zero otherwise. (Freedman & Jaggi, 2005).
Govt. env. investment (%)	Local government's investment in environmental protection divided by GPD at the province level.
If mandatory EID	A dummy variable that equals one if the firm is in the industries that are required to disclose environmental protection reports by China's Ministry of Environmental Protection and zero otherwise, including thermal-electricity (D44), steel (C33), cement (C30), aluminum electrolysis (C32), coal (B6), metallurgy (C31), chemical industry (C28, C29), petrochemical industry (B7, C25, C26), building materials (C30), papermaking (C22), brewing (C15), pharmaceuticals (C27), fermentation (C15), textile (C17, C18), leather production (C19), and mining (B8, B9, B10, B11). The industry codes showing in brackets are based on *Guidelines for the Industry Classification of Listed Companies* (2012 Revision) by China Securities Regulatory Commission.
Marketization	Marketization index at the province level, following Wang et al. (2021).
Stock info.	Stock informativeness is $1 - R^2$ (R-square) of the following regression model: $r_{i,j,t} = \beta_{i,0} + \beta_{i,m} r_{m,t} + \beta_{i,j} r_{j,t} + \varepsilon_{i,t}$ (Chen et al., 2007). $r_{i,j,t}$ is daily stock returns of firm i in industry j in year t. $\beta_{i,m}$ is the daily market return in year t. $\beta_{i,j}$ is the daily return of industry j in year t.