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Empirical Study on the Impact of Environmental Information Disclosure on Green Finance

Jing Li*

School of Business, Sias University, Zhengzhou, Henan, 451150, China

**Corresponding author: Jing Li*

Abstract

High-quality disclosure is key to optimizing the information market, guiding the flow of green capital, and promoting the development of green finance. This paper uses A-share listed companies from 2008 to 2023 as the sample, constructs an environmental information disclosure scoring index based on corporate annual reports and social responsibility reports, and builds a green finance index by combining data from the China Energy Statistical Yearbook and other sources. It empirically examines the impact effect and mechanism of environmental information disclosure on the development of green finance. The research shows that environmental information disclosure has a significant positive effect on the development of green finance, and the conclusion remains robust after robustness tests. Mechanism tests indicate that environmental information disclosure promotes green finance development by enhancing environmental regulation intensity and alleviating information asymmetry, with corporate competition intensity playing a partial mediating role. Heterogeneity analysis reveals that the promotional effect of environmental information disclosure on green finance is significantly stronger for non-state-owned enterprises, private enterprises, and enterprises in the western region compared to state-owned enterprises, foreign-invested enterprises, and those in the central and eastern regions. This paper proposes suggestions from aspects such as improving disclosure systems, strengthening environmental regulations, reducing information asymmetry, and implementing differentiated financial policies. The research conclusions enrich the literature in related fields and provide references for policy formulation and implementation.

Keywords

environmental information disclosure, green finance, environmental regulation intensity, information asymmetry, environmental performance

1. Introduction

Under the dual drivers of the global green development wave and China's "dual carbon" goals, green finance has become a key financial pillar empowering enterprises with new quality productive forces and facilitating the low-carbon transformation of industries. Corporate environmental information disclosure, as the core link in information transmission in the green finance market, serves as a critical element for assessing the efficiency of green finance resource allocation and the effectiveness of environmental policy implementation. Since December 2014, when the Measures for the Disclosure of Environmental Information

by Enterprises and Public Institutions [1] required enterprises and public institutions to promptly and truthfully disclose environmental information, the government has continuously improved the policy system, promoted the enhancement of environmental information quality, and guided the aggregation of green finance resources toward environmentally friendly projects.

Environmental information disclosure combines the functions of market signal transmission and risk identification, deeply influencing the allocation and operation of green finance resources by reducing the degree of asymmetry in environmental information in the capital market and strengthening environmental regulation intensity, among others. Existing research confirms its significant positive impact on green finance: From a micro perspective, Zhang Yingxin [2] took Ningde Times as the research object and found that high-quality environmental information disclosure can effectively improve corporate financial performance; Kan Lina [3], based on data from listed companies from 2010 to 2021, indicated that environmental information disclosure can enhance corporate sustainable development capabilities by improving enterprise value, strengthening social responsibility fulfillment, promoting innovation, and optimizing resource allocation; Lu, W et al. [4] studied China's A-share non-financial listed companies from 2012 to 2022 and showed that the higher the quality of environmental information disclosure, the lower the stock price crash risk for enterprises; From a macro perspective, An Ruikun et al. [5] found that as socioeconomic development progresses, countries worldwide are increasingly emphasizing environmental information disclosure, treating it as an important means of environmental protection. Wan Jiantao [6] also pointed out that environmental information is a key basis for the financial sector to conduct green credit and other businesses, and environmental information disclosure is a development trend for future capital markets. Through a review and summary of the existing literature, it is evident that most studies indicate that environmental information disclosure has a significant positive effect on the development of green finance. However, research on the mechanisms through which environmental information disclosure influences green finance remains to be enriched and supplemented. Moreover, existing literature mostly focuses on the micro level of enterprises and policy aspects, but there is relatively little research combining environmental information disclosure and green finance with provincial domains.

Compared with the existing literature, the main contributions of this paper are: First, this paper expands the research scope of the relationship between environmental information disclosure and green finance. While previous studies mostly focused on the micro level of enterprises, this paper combines enterprises with provinces, constructs a provincial environmental information disclosure scoring index, and extends the research dimension of provincial environmental information disclosure. Second, this paper delves into the internal mechanisms by which environmental information disclosure affects green finance, exploring the transmission roles of environmental regulation intensity, information asymmetry intensity, and corporate competition intensity in the impact of environmental information disclosure on green finance, providing certain references and empirical insights for optimizing green finance policies and improving environmental information disclosure mechanisms.

2. Theoretical Analysis and Research Hypotheses

According to the definition in the Reform Plan for the Environmental Information Disclosure System in Accordance with the Law [7] issued by the Ministry of Ecology and Environment in 2021, environmental information disclosure refers to the lawful and regulatory disclosure by enterprises of environmental information excluding state secrets and key technologies. In the event of major environmental activities, it requires timely and truthful disclosure in a standardized manner, with enterprises needing to manage data in compliance to ensure the authenticity, accuracy, and completeness of the information. In recent years, with the popularization of investment concepts and the improvement of the green finance system, the quality of environmental information disclosure has become a key factor affecting the operation and development of the green finance market and an important driving force for green finance development.

On one hand, enterprises disclose key information such as carbon emission reduction achievements, environmental governance investments, progress on green projects, and potential environmental risks, laying the foundation for the healthy development of various sub-markets in green finance. Research by Dong Siyu [8] and others points out that high-quality environmental information disclosure can effectively reduce the

yield spreads on green bonds. High-quality environmental data provides critical support for identifying high-quality assets and developing financial and insurance products that match green risks.

On the other hand, high-quality disclosure provides reliable data for financial institutions' risk control and product innovation, and it is more aligned with national green finance policy orientations, enabling access to fiscal subsidies, tax incentives, and other support, thereby strengthening the policy guidance role [8].

Research by Li Wanxiang [9] and others indicates that vague, delayed, or false environmental information disclosure leads to difficulties for green financial institutions in accurately identifying the environmental attributes of projects, increasing business risks and operational costs; it weakens investor trust, hindering the flow of social capital to green sectors; and it affects regulatory effectiveness due to information opacity, exacerbating market irregularities and constraining green finance development.

Based on this, the following hypothesis is proposed:

H1: Under stable or favorable external conditions such as macroeconomic conditions and green policy environments, the degree of environmental information disclosure has a positive impact on green finance development.

Environmental information disclosure can promote green finance development by enhancing environmental regulation intensity. Research by Li Zhiyan [10] and others points out that environmental information disclosure can positively drive green finance development by increasing environmental regulation intensity. On one hand, environmental information disclosure strengthens public and non-governmental organizations' supervision of corporate environmental behaviors, in turn urging enterprises to pay attention to environmental performance; on the other hand, it provides precise data support for government environmental supervision, helping to identify corporate environmental compliance shortcomings and green transformation potential, optimize the allocation of regulatory resources, assist enterprises in obtaining resource subsidies, avoid "one-size-fits-all" regulation, enhance the effectiveness of environmental legislation enforcement and supervision precision, and thereby formulate more targeted environmental policies and regulations. Specifically, the enhancement of environmental regulation intensity will compel enterprises to increase environmental compliance costs, forcing them to undertake green technology upgrades, efficient environmental governance, and green industrial transformations, generating enormous demand for green technological innovation and green financial investment, guiding capital flows toward green sectors, promoting the development of the environmental protection industry, and forming a positive cycle that expands the green finance market.

In addition, strengthened environmental regulations will prompt financial institutions to emphasize environmental risk management, incorporate corporate green performance indicators into assessments, raise thresholds for high-pollution and high-energy-consumption projects, increase support for environmental protection projects, and drive green financial product innovation; at the same time, it signals strong government commitment to sustainable development to the market, guiding social capital toward environmental industries and green projects, and improving the green finance product and service system.

Based on this, the following hypothesis is proposed:

H2: Environmental information disclosure can promote green finance development by enhancing environmental regulation intensity.

Environmental information disclosure can effectively reduce the degree of information asymmetry in the market, thereby improving green finance levels. On one hand, corporate environmental information disclosure enhances the transparency of corporate environmental conditions. Research by Duan Cunru [11] and others points out that information asymmetry is a major bottleneck in green finance market development, and investors and regulatory institutions can assess green risks and opportunities through key information such as publicly disclosed corporate environmental performance, effectively alleviating information asymmetry issues.

On the other hand, environmental information disclosure provides reliable basis for financial institutions' investment decisions. Enterprises have absolute control over core information such as the environmental benefits of their green projects, easily leading to adverse selection and moral hazards; financial institutions and investors struggle to distinguish corporate "greenwashing" behaviors, and the lagged and hidden nature of environmental risks in green projects means that enterprises concealing risks can cause financial institutions

to fail to adjust decisions in time, face bad debt losses, and subsequently suppress corporate green financing demand through higher interest rates, constraining green finance development.

After enterprises disclose environmental information, financial institutions can quantify project environmental benefits and risks, significantly reducing market information asymmetry, assisting the capital market in identifying green economic activities, optimizing resource allocation, and improving green finance operational efficiency. Moreover, financial institutions can dynamically monitor project operations and manage risks in a timely manner, ensuring market stability. In this process, high-quality environmental information disclosure not only drives the expansion of green finance scale but also achieves quality improvement, providing strong support for achieving the "dual carbon" goals and economic green transformation.

Based on this, the following hypothesis is proposed:

H3: Environmental information disclosure can improve green finance levels by effectively reducing the degree of information asymmetry in the market.

The positive direct effect of environmental information disclosure on green finance development is greater than the negative indirect effect generated through corporate competition intensity, and the total effect still promotes green finance development. Environmental information disclosure may weaken corporate competition intensity. First, after environmental information becomes transparent, corporate environmental performance becomes a new dimension of competition. This brings brand premiums and market share growth to environmentally excellent enterprises while raising market entry barriers and operational costs. On one hand, enterprises need to invest substantial capital in technology upgrades and environmental data monitoring to meet standards, further increasing industry barriers and reducing competitors; on the other hand, the high costs of R&D and application of advanced environmental technologies by environmentally excellent enterprises make it difficult for those unable or lacking such technologies to compete, similarly reducing market activity.

Second, the brand premium brought by environmental information disclosure will drive market differentiation, shifting competition from simple cost and price competition to multi-dimensional competition. Environmentally excellent enterprises can attract consumers willing to pay higher prices for environmental protection by establishing a green brand image, forming a "green" premium; in highly competitive markets, enterprises can leverage green brands to attract consumers and investors for competitive advantages, with green financial products providing channels to fulfill green commitments. However, as corporate competition intensity decreases, green differentiation advantages weaken, leading enterprises to reduce investments in green technologies and products, and green financial products, due to insufficient demand, tend toward traditional projects with certain returns and lower risks.

Despite the aforementioned negative indirect effects, the positive direct effect of environmental information disclosure on green finance development is more significant. Its roles in enhancing information transparency, optimizing environmental supervision, and guiding green financial product investments provide stronger impetus for green finance development. Therefore, the total effect of environmental information disclosure still promotes green finance development: although it indirectly inhibits green finance development by reducing corporate competition intensity, the direct effect outweighs the indirect effect, resulting in a positive total effect.

Based on this, the following hypothesis is proposed:

H4: The positive direct impact of environmental information disclosure on green finance is greater than the negative indirect impact through corporate competition intensity, and environmental information disclosure still promotes green finance development in terms of total effect.

3. Research Design

3.1 Data Sources and Sample Selection

This paper uses A-share listed companies from 2008 to 2023 as the research sample to investigate the impact of environmental information disclosure on green finance. Environmental information disclosure data are primarily derived from the disclosure content of listed companies' environmental disclosure reports, with

further scoring assigned to different environmental disclosure dimensions for each enterprise. Green finance data are sourced from the China Energy Statistical Yearbook, China Financial Yearbook, and annual reports from local ecological environment departments and finance departments. Data for other control variables are compiled from listed companies' annual reports. On this basis, the sample is processed as follows: (1) Exclude enterprises with severely missing data that cannot be supplemented; (2) Exclude samples with abnormal operations such as long-term suspension during the research period; (3) Apply 1% winsorization to continuous variables to mitigate the influence of extreme values. Ultimately, an annual observation sample of listed companies covering multiple provinces and industries is obtained for empirical analysis.

3.2 Model Setting

Referring to the research methods of Huang Shengzhong et al. [12], to examine the relationship between environmental information disclosure and green finance development, Model (1) is established for testing.

$$Gfi_{jk}=\alpha_0+\alpha_1 EID_{ijk}+\sum_m \alpha_m C_{mijk}+\mu_j+\gamma_k+\rho_i+\omega_{ijk} \quad (1)$$

Here, *i*, *j*, and *k* represent the observed enterprise individual, province, and year, respectively; m denotes the control variable sequence. Gfi_{jk} is the core dependent variable, representing the level of green finance development in province j in year k. EID_{ijk} is the core explanatory variable in this paper, representing the environmental information disclosure quality of enterprise i in province jin year *k*. μ_j、γ_k and μ_k represent province fixed effects, year fixed effects, and individual fixed effects, respectively; C is a series of control variables to exclude interference from other irrelevant factors on the regression results; α is a series of coefficients to be estimated, where α_1 is the coefficient of core concern. If it is significantly positive, it indicates that the higher the level of green finance development, the higher the environmental information disclosure quality of enterprises, and vice versa.

After clarifying the direct association between environmental information disclosure and green finance development through the baseline Model (1), to further explore the internal transmission logic of its impact, we conduct mechanism analysis. First, a simplified baseline association Model (2) is constructed to clarify the basic relationship between core variables; then, for the three types of mediating variables-environmental regulation intensity, information asymmetry degree, and corporate competition intensity-Model (3) is used to test the effect of environmental information disclosure on them; finally, Model (4) incorporates the mediating variables into the analysis system to systematically analyze the specific paths through which environmental information disclosure affects green finance development, thereby fully presenting the mechanism of the relationship between the two.

$$\mathrm{Gfi_{jk}}=\alpha_0+\alpha_1\mathrm{EID_{ijk}}+\alpha_2\sum \mathrm{c_z}+\mu_j+\mu_k+\varepsilon_{ijk} \quad (2)$$

$$\mathrm{M_u}=\beta_0+\beta_1\mathrm{EID_{ijk}}+\mu_j+\mu_k+\varepsilon_{ijk} \quad (3)$$

$$\mathrm{Gfi_{jk}}=\gamma_0+\gamma_1\mathrm{EID_{ijk}}+\gamma_2\mathrm{M_u}+\gamma_3\sum \mathrm{c_z}+\mu_j+\mu_k+\varepsilon_{ijk} \quad (4)$$

Here, *i*, *j*, and *k* represent the observed enterprise individual, province, and year, respectively; c_z denotes the z-th control variable; μ_j and μ_k represent province fixed effects and time fixed effects, respectively; ε_{ijk} denotes the random disturbance term. M_u represents the u-th mediating variable, where M_1 represents environmental regulation intensity, M_2 represents information asymmetry degree, and M_3 represents corporate competition intensity.

3.3 Variable Measurement

3.3.1 Core Explanatory Variable

Environmental Information Disclosure Quality. Currently, there is no unified standard for measuring environmental information disclosure, and common methods suffer from subjectivity or single-dimensional issues. For example, He Limei et al. [13] use content analysis to measure disclosure levels by counting the number of pages on environmental information in enterprise reports, without considering the quality of

information disclosure. Similarly, Chen Xuan et al.[14] measure corporate environmental information disclosure levels solely by statistical text volume, which allows quantification at the quantitative level but fails to distinguish quality differences in information. Therefore, this study refers to the research methods of Kong Dongmin et al. [15]and Wang Maobin et al. [16], and constructs a layered scoring measurement system that accounts for the "monetized-non-monetized" attribute differences in environmental information: Environmental liability disclosure, environmental performance and governance disclosure are classified as "monetized information," with disclosure situations distinguished as "quantitative + qualitative combined (score 2), qualitative only (score 1), not disclosed (score 0)"; environmental management disclosure, environmental certification disclosure, and environmental information disclosure channels are classified as "non-monetized information," judged as "disclosed (score 2), not disclosed (score 0)." This system covers 5 dimensions and 25 scoring items for monetized and non-monetized information. The total score for each item is summed to obtain the core indicator reflecting corporate environmental information disclosure quality. Then, listed companies are grouped by their affiliated provinces to calculate the average, yielding the environmental information disclosure quality index for each province.

Table 1: Construction of Environmental Information Disclosure Quality Indicators

Disclosure Type	Item	Scoring Instructions
Environmental Information Disclosure Carrier	Listed Company Annual Report	Disclosed: 2 points; Not disclosed: 0 points
	Social Responsibility Report	Disclosed: 2 points; Not disclosed: 0 points
	Environmental Report	Disclosed: 2 points; Not disclosed: 0 points
Environmental Management Disclosure	Environmental Protection Philosophy	Disclosed: 2 points; Not disclosed: 0 points
	Environmental Protection Goals	Disclosed: 2 points; Not disclosed: 0 points
	Environmental Management System	Disclosed: 2 points; Not disclosed: 0 points
	Environmental Education and Training	Disclosed: 2 points; Not disclosed: 0 points
	Special Environmental Protection Actions	Disclosed: 2 points; Not disclosed: 0 points
	Environmental Emergency Response Mechanism	Disclosed: 2 points; Not disclosed: 0 points
	Environmental Protection Honors or Awards	Disclosed: 2 points; Not disclosed: 0 points
	"Three Simultaneities" System	Disclosed: 2 points; Not disclosed: 0 points
	Whether ISO14001 Certified	Certified: 2 points; Not certified: 0 points
	Whether ISO9001 Certified	Certified: 2 points; Not certified: 0 points
Environmental Governance and Control Disclosure	Exhaust Gas Emission Reduction and Governance	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	Wastewater Emission Reduction and Governance	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	Dust and Smoke Dust Governance	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	Solid Waste Utilization and Disposal	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	Noise, Light Pollution, Radiation Governance, etc.	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	Clean Production Implementation	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
Environmental Liability Disclosure	Wastewater Discharge Volume	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	COD Emissions	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	SO_2 Emissions	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	CO_2 Emissions	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	Smoke and Dust Emissions	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points
	Industrial Solid Waste Emissions	Quantitative and qualitative description: 2 points; Qualitative only: 1 point; Not disclosed: 0 points

3.3.2 Core Dependent Variable

Green Finance. Referring to the research of Yun Hong et al. [17], the provincial green finance index is calculated using seven indicators: green credit, green bonds, green investment, green insurance, green funds, green equity, and carbon finance. Specifically, green credit is measured by the ratio of total credit for environmental protection projects in each province to the total credit in that province; green bonds by the ratio of total green bond issuance in each province to the total bond issuance; green investment by the proportion of environmental pollution control investment in each province to the GDP of each province; green insurance by the ratio of fiscal environmental protection expenditures in each province to total premium expenditures; green funds by the ratio of total market value of green funds in each province to total fund market value; green equity by the ratio of the sum of carbon trading, energy use rights trading, and emission rights trading to the total equity market trading volume; carbon finance by the ratio of carbon emissions in each province to the GDP of each province. After processing, the entropy method is used to calculate the green finance index for each province.

Table 2: Green Finance Indicators Calculation Method

Specific Dimension	Calculation Method
Carbon Finance	Carbon emissions in each province / GDP in the province
Green Equity	(Carbon trading + Energy rights trading + Emission rights trading) / Total equity market trading volume
Green Fund	Total market value of green funds in each province / Total market value of funds in each province
Green Insurance	Fiscal environmental protection expenditure in each province / Total premium expenditure in each province
Green Investment	Environmental pollution control investment in each province / GDP of each province
Green Bonds	Total green bond issuance in each province / Total bond issuance in each province
Green Credit	Total credit for environmental protection projects in each province / Total credit in each province

3.3.3 Mechanism Variables

Environmental Regulation Intensity. As an important indicator for studying government social regulation, environmental regulation intensity can be measured in multiple ways, such as indices, or by scholars like Liu Zengrong et al. [18] using the ratio of completed industrial pollution investment to the secondary industry. This paper refers to the research method of Fan Hongmin et al. [19], measuring local environmental regulation intensity by the ratio of total completed investment in industrial pollution control in the province where the enterprise is located to the province's industrial added value. A higher value of environmental regulation intensity indicates stronger environmental regulation in that province.

Information Asymmetry Degree. This paper refers to the research method of Yu Wei et al. [20]. Individual stock trading data are used to capture information differences between uninformed and informed traders in the securities market regarding enterprise value, serving as a proxy for information asymmetry between capital suppliers and enterprises. The first principal component is extracted from three categories of market microstructure liquidity indicators-liquidity ratio, illiquidity ratio, and return reversal indicators-to synthesize a composite indicator. A larger value of this indicator indicates more severe information asymmetry. Its calculation is based on the three basic indicators: liquidity ratio, illiquidity ratio, and return reversal indicator, with the first principal component of the above three indicators, comprehensively reflecting the degree of information asymmetry between banks and enterprises; a higher value indicates more severe information friction.

$$LR_{it}=-\frac{1}{D_{it}}\sum_{k=1}^{D_{it}}\sqrt{\frac{V_{it}(k)}{|r_{it}(k)|}} \tag{5}$$

$$ILL_{it}=\frac{1}{D_{it}}\sum_{k=1}^{D_{it}}\sqrt{\frac{r_{it}(k)}{V_{it}(k)}} \tag{6}$$

$r_{it}(k)$ represents the stock return of enterprise i on the t-th trading day of year k, $V_{it}(k)$ represents the daily trading volume, and D_{it} represents the number of trading days in the year.

$$GAM_{it}=|\gamma_{it}| \quad (7)$$

The coefficient γ_{it} in formula (7) is derived from the following equations:

$$r_{it}^{e}(k)=\theta_{it}+\varphi_{it}r_{it}(k\text{-}1)+\gamma_{it}V_{it}(k\text{-}1)sign[r_{it}^{e}(k\text{-}1)]+\varepsilon_{it}(k) \quad (8)$$

$r_{it}^{e}(k)=r_{it}(k)\text{-}r_{mt}(k)$ is the abnormal return, $r_{mt}(k)$ represents the market return weighted by market capitalization, r is the individual stock daily return, V is the daily trading volume, and D is the annual trading days. The microstructure data from Chinese private listed companies is used to construct the above three indicators, then extract the first principal component from the original indicators, recorded as the information asymmetry index ASY.

Table 3:

	LR	ILL	GAM	ASY
LR	1			
ILL	0.617***	1		
GAM	0.534***	0.823***	1	
ASY	0.799***	0.933***	0.903***	1

Market Competition Intensity. This paper adopts the research method of Liu Guanchun et al. [21], using the Herfindahl-Hirschman Index to measure market competition intensity; a smaller index value indicates smaller differences in operating income among enterprises within the industry and higher market competition intensity. A larger index value indicates greater differences in operating income among enterprises within the industry and lower market competition intensity.

3.3.4 Control Variables

Referring to the research of Huang Shengzhong et al. [12], control variables that may affect the regression results are selected from the perspectives of corporate governance and corporate operations. From the corporate governance perspective, board size is included; from the corporate operations perspective, asset-liability ratio, total asset turnover rate, inventory ratio, and fixed asset ratio are included.

The board of directors is the core institution of corporate governance, and its size affects governance efficiency and decision-making mechanisms, which in turn may influence corporate environmental information disclosure strategies and green finance participation behaviors; therefore, board size is used as a control variable at the corporate governance level.

The asset-liability ratio reflects the enterprise's capital structure and debt repayment capacity; the financial condition of the enterprise affects its willingness to invest in green projects and fulfill environmental responsibilities, thereby associating with environmental information disclosure quality and green finance development. The total asset turnover rate reflects asset operation efficiency; differences in operational efficiency affect the enterprise's environmental resource management capabilities, thereby influencing environmental information disclosure and green finance participation. The inventory ratio reflects inventory management levels; inventory scale and supply chain models affect the enterprise's environmental impact, thereby influencing its environmental information disclosure decisions. The fixed asset ratio reflects the enterprise's asset structure; enterprises with different asset structures differ in the environmental friendliness of production facilities and green investment needs, thereby associating with environmental information disclosure and green finance behaviors. In summary, this paper uses asset-liability ratio, total asset turnover rate, inventory ratio, and fixed asset ratio as control variables at the corporate operations level.

In robustness tests, more macroeconomic or structural factors that may affect environmental information disclosure quality can be further considered. Specific variable definitions are shown in Table 4.

Table 4: Variable Definitions

Variable Nature	Variable Name	Symbol	Definition
Dependent Variable	Environmental Information Disclosure Quality	EID	See text for details

Explanatory Variable	Green Finance	Gfi	See text for details
Mechanism Variable	Environmental Regulation Intensity	IER	Completed investment in industrial pollution control / Industrial added value
	Information Asymmetry Degree	ASY	Information Asymmetry Index
	Market Competition Intensity	HHI	Herfindahl Index
Control Variable	Asset-Liability Ratio	Lev	Total liabilities / Total assets
	Total Asset Turnover Rate	ATO	Total Asset Turnover Rate B
	Inventory Ratio	INV	Net inventory / Total assets
	Fixed Asset Ratio	FIXED	Net fixed assets / Total assets
	Board Size	Board	Natural logarithm of the number of board members

4. Empirical Results

4.1 Descriptive Statistics and Correlation Analysis

Table 5: Descriptive Statistics Results

Variable	Observations	Mean	Standard Deviation	Minimum	Median	Maximum
Gfi	8780	28.0851	8.462	8.84	27.49	78.31
EID	8780	11.8479	10.664	0.00	9.00	78.00
IER	8780	2.0672	1.544	0.00	1.60	17.50
ASY	8780	-0.4800	0.612	-2.15	-0.46	2.84
HHI	8780	1.9648	1.711	0.38	1.40	10.00
Lev	8780	0.4781	0.191	0.03	0.49	0.93
ATO	8780	0.6915	0.483	0.05	0.59	2.92
INV	8780	0.1632	0.156	0.00	0.12	0.78
FIXED	8780	0.2431	0.179	0.00	0.21	0.77
Board	8780	2.1829	0.195	1.61	2.20	2.71

The descriptive statistics for the main variables are shown in Table 4. The mean value of green finance development level is 28.0851, with a maximum of 78.31, a minimum of 8.84, and a standard deviation of 8.462, indicating certain differences in the level of green finance development across regions where different sample subjects are located. The mean value of environmental information disclosure level is 11.8479, with a maximum of 78.00, a minimum of 0.00, and a standard deviation of 10.664, indicating significant differences in environmental information disclosure among different enterprises. The performance of other control variables is basically consistent with existing related research on similar indicators.

4.2 Hypothesis Testing and Result Analysis

4.2.1 Baseline Regression Results Analysis

Table 5 employs a panel data fixed effects model, with green finance development level as the dependent variable and environmental information disclosure degree as the core explanatory variable, summarizing the baseline regression results of the impact of environmental information disclosure degree on green finance development level. It tests the robustness of the core relationship by gradually adding control variables. Column (1) presents the results without control variables, where the coefficient of the core variable is significantly positive at 0.0230, indicating that environmental information disclosure degree has a positive impact on green finance development level, consistent with the expected direction of research hypothesis H1. Column (2) introduces a series of firm-level control variables based on Column (1), with the core explanatory variable's coefficient rising to 0.0327 and remaining significant at the 1% level, indicating that the positive promotion effect of EID on GF is more pronounced after stripping away other control variables. From the perspective of goodness of fit, the adjusted R^2 improves from -0.001 to 0.002, suggesting that the inclusion of control variables enhances the explanatory power for green finance. Column (3) considers only time fixed effects without controlling for individual heterogeneity and other firm-level control variables; its regression results are consistent with Column (2), with no changes in the coefficients and significance of the core variable and control variables, further enhancing the reliability of the baseline regression results. Column (4) considers

only individual fixed effects without controlling for macroeconomic time trends and other firm-level control variables; the coefficient of EID is 0.0003, indicating that macroeconomic time trends such as economic cycles and policy differences across periods are important factors influencing the impact of environmental information disclosure degree on green finance development level, as the core variable's effect disappears when these macroeconomic factors are not controlled. In summary, under stable or favorable external conditions such as macroeconomic conditions and green policy environments, environmental information disclosure quality (EID) exhibits a significant positive impact on green finance (Gfi), with robust conclusions, verifying hypothesis H1.

Table 6: Baseline Regression Results

	(1)	(2)	(3)	(4)
	Gfi	Gfi	Gfi	Gfi
EID	0.0230**	0.0327***	0.0327***	0.0003
	(2.5387)	(3.4841)	(3.4841)	(0.0186)
Lev		1.6273***	1.6273***	2.6104***
		(3.2895)	(3.2895)	(2.7935)
ATO		-0.6586***	-0.6586***	-1.5910***
		(-3.5711)	(-3.5711)	(-4.2135)
INV		-1.4281**	-1.4281**	2.2834*
		(-2.1059)	(-2.1059)	(1.7378)
FIXED		-1.8777***	-1.8777***	-2.9109**
		(-3.2534)	(-3.2534)	(-2.3874)
Board		-0.9415**	-0.9415**	0.0318
		(-2.0129)	(-2.0129)	(0.0403)
cons	27.8126***	30.1193***	30.1193***	28.2975***
	(201.0145)	(29.3948)	(29.3948)	(9.8027)
N	8780	8780	8780	8780
adj. R2	-0.001	0.002	0.002	0.093

*Note: Values in parentheses are t-values, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The same applies below.*

4.2.2 Mediating Effect Analysis of Environmental Regulation Intensity (M_1)

In Table 7, Column (1), the coefficient of EID is 0.0327 and significant at the 1% level, indicating that without considering environmental regulation intensity, every one-unit increase in environmental information disclosure leads to an average increase of 0.0327 units in green finance level. The total effect is positive, suggesting that environmental information disclosure overall promotes green finance. In Column (2), the coefficient of EID is 0.0076 and significant at the 1% level, indicating that EID has a positive impact on environmental regulation intensity (M_1). This is because, on one hand, in-depth environmental information disclosure assists regulatory agencies in identifying environmental issues and corporate green practices, promoting more flexible and precise environmental regulations; on the other hand, the public can learn more about environmental issues through disclosed information and exert pressure on the government through public opinion, strengthening environmental regulation intensity. In Column (3), both EID and M_1 are included simultaneously; the coefficient of EID is 0.0270 and remains significant at the 1% level, indicating that environmental information disclosure has a significant direct promotion effect on green finance level even after controlling for environmental regulation intensity; meanwhile, the coefficient of M_1 is 0.7531 and significant at the 1% level, meaning that after controlling for the impact of environmental information disclosure, every one-unit increase in environmental regulation intensity leads to a significant average increase of 0.7531 units in green finance level. Strict environmental regulations may be one of the core drivers of green finance development. First, strengthened environmental regulations increase corporate compliance pressure, requiring enterprises to increase funding for green transformations and technology upgrades to meet standards, thereby generating enormous demand for green financial products such as green credit. Second, regulatory reinforcement raises risk management costs, with corporate environmental violations facing additional penalties and reputational losses, prompting enterprises to more actively seek green finance support to reduce environmental risk management costs. Third, strong environmental regulation policies send clear signals to the market, guiding financial institutions to increase the supply of green financial products and directing funds toward green industries. Finally, environmental regulations are often accompanied by policies such as tax incentives and fiscal subsidies for the environmental protection industry, forming synergistic policy effects

that further support green finance development. In summary, environmental regulation intensity (M_1) plays a significant mediating role in the impact of EID on Gfi, verifying hypothesis H2.

4.2.3 Mediating Effect Analysis of Information Asymmetry Degree (M_2)

In Table 6, Column (1), the coefficient of EID is 0.0327 and significant at the 1% level, indicating that every one-unit increase in environmental information disclosure leads to an average decrease of 0.0327 units in information asymmetry degree. In terms of total effect, environmental information disclosure (EID) has a significant positive impact on green finance level (Gfi). In Column (2), the coefficient of EID is -0.0174 and significant at the 1% level, indicating that environmental information disclosure (EID) has a significant negative impact on information asymmetry degree (M_2). This means that more and higher-quality environmental information disclosure by enterprises also increases their information transparency, allowing investors, creditors, and other external stakeholders to access more comprehensive information, thereby reducing the degree of information asymmetry. In Column (3), the coefficient of the core explanatory variable is 0.0194 and remains significant at the 5% level, with the absolute value of the coefficient slightly lower than 0.0327 in Column (1) but still maintaining positive significance overall, indicating that after excluding the mediating variable, the direct positive impact of EID on Gfi still exists. The coefficient of the mediating variable M_2 (information asymmetry degree) is -0.7677 and significant at the 1% level, indicating that an increase in information asymmetry degree (M_2) has a significant negative inhibitory effect on green finance level (Gfi). This is because the higher the degree of information asymmetry, the more difficult it is for financial institutions, investors, and creditors to accurately assess investment risks, environmental project benefits, and development prospects of enterprises. These stakeholders may become more cautious due to information scarcity or uncertainty, even reducing their willingness to provide green finance support to enterprises. Therefore, excessive information asymmetry inhibits green finance development. In summary, information asymmetry degree plays a partial mediating role in the impact of EID on Gfi, verifying hypothesis H3 that environmental information disclosure can improve green finance levels by effectively reducing the degree of information asymmetry in the market. This may be because corporate environmental information disclosure provides more high-quality information on corporate environmental risks and performance, effectively reducing information asymmetry between external investors and enterprises, assisting investors in precisely assessing corporate green value and risks, and thereby positively influencing green finance development.

4.2.4 Mediating Effect Analysis of Corporate Competition Intensity (M_3)

In Table 7, Column (1), the coefficient of EID is 0.0327 and significant at the 1% level, indicating that environmental information disclosure (EID) has a significant positive impact on green finance level (Gfi), with a positive total effect. In Column (2), the coefficient of EID is -0.0113 and significant at the 1% level; every one-unit increase in environmental information disclosure leads to an average decrease of 0.0113 units in corporate competition intensity, meaning that more transparent environmental information disclosure may lead to a decline in market competition intensity. On one hand, environmental information disclosure enhances market information transparency, reducing information asymmetry and making it difficult for enterprises to gain competitive advantages by concealing environmental costs and expanding negative externalities, pushing market competition to extend from traditional dimensions such as brands and technologies to new dimensions of green image competition. On the other hand, high-quality environmental information disclosure requires enterprises to increase environmental investments, further raising industry entry barriers and thereby reducing the number of market competitors and weakening competition intensity. In Column (3), the coefficient of the core explanatory variable is 0.0343 and remains significant at the 1% level, indicating that after controlling for corporate competition intensity, environmental information disclosure directly promotes green finance development with a significant positive direct effect. In Column (3), the coefficient of M_3 (corporate competition intensity) is 0.1388 and significant at the 1% level, indicating that green finance level increases with increasing corporate competition intensity and decreases with decreasing intensity. The product of the indirect effect -0.0113 and 0.1388 is negative, suggesting that environmental information disclosure slightly inhibits green finance by reducing corporate competition intensity. At this point, the positive impact of the direct effect of environmental information disclosure on green finance (0.0343) is greater than the negative impact of the indirect effect (-0.00156844), and the overall total effect is positive, indicating that environmental information disclosure still promotes green finance, but this promotion is slightly weakened by the mediating effect of “corporate competition intensity.” Hypothesis H4 is verified. This may be because intense

competition prompts enterprises to seek green innovation and differentiation, increasing demand for green finance. On one hand, green innovation requires substantial capital and R&D investments, with green finance serving as an important funding source and support channel; enterprises will actively seek green finance support to advance green practices to seize market advantages, and intensified competition drives enterprises to improve efficiency and reduce costs, further increasing green finance demand. On the other hand, R&D of green technologies, innovation of green products, and improvement of environmental performance are effective differentiation strategies that can attract green consumption and investment groups; after enterprises' green transformations gain market recognition, competitors will follow, forming a virtuous cycle of green competition, and this "race-to-the-top" effect will also expand green finance demand [22].

Table 7: Mediating Effect Analysis Results

Mediating Effect									
	Environmental Regulation Intensity			Information Asymmetry Degree			Corporate Competition Intensity		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
	Gfi	M_1	Gfi	Gfi	M_2	Gfi	Gfi	M_3	Gfi
EID	0.0327***	0.0076***	0.0270***	0.0327***	-0.0174***	0.0194**	0.0327***	-0.0113***	0.0343***
	(3.4841)	(4.9552)	(2.8925)	(3.4841)	(-30.6843)	(1.9659)	(3.4841)	(-5.8170)	(3.6456)
M_1			0.7531***						
			(11.5973)						
M_2						-0.7677***			
						(-4.3271)			
M_3									0.1388***
									(2.6916)
Lev	1.6273***	0.1418*	1.5205***	1.6273***	-0.0228	1.6098***	1.6273***	-0.1810*	1.6524***
	(3.2895)	(1.7557)	(3.0964)	(3.2895)	(-0.7661)	(3.2573)	(3.2895)	(-1.7670)	(3.3409)
ATO	-0.6586***	-0.0373	-0.6305***	-0.6586***	-0.0312***	-0.6826***	-0.6586***	0.2766***	-0.6970***
	(-3.5711)	(-1.2392)	(-3.4443)	(-3.5711)	(-2.8086)	(-3.7029)	(-3.5711)	(7.2418)	(-3.7694)
INV	-1.4281**	-0.0488	-1.3913**	-1.4281**	0.0074	-1.4224**	-1.4281**	-0.5221***	-1.3556**
	(-2.1059)	(-0.4410)	(-2.0672)	(-2.1059)	(0.1814)	(-2.0996)	(-2.1059)	(-3.7174)	(-1.9982)
FIXED	-1.8777***	0.1530	-1.9929***	-1.8777***	0.2500***	-1.6858***	-1.8777***	0.4648***	-1.9422***
	(-3.2534)	(1.6230)	(-3.4787)	(-3.2534)	(7.1976)	(-2.9152)	(-3.2534)	(3.8885)	(-3.3635)
Board	-0.9415**	0.3116***	-1.1762**	-0.9415**	-0.3739***	-1.2285***	-0.9415**	0.2074**	-0.9703**
	(-2.0129)	(4.0792)	(-2.5313)	(-2.0129)	(-13.2851)	(-2.6031)	(-2.0129)	(2.1405)	(-2.0746)
_cons	30.1193***	1.2256***	29.1964***	30.1193***	0.5122***	30.5126***	30.1193***	1.5137***	29.9092***
	(29.3948)	(7.3239)	(28.6228)	(29.3948)	(8.3084)	(29.6919)	(29.3948)	(7.1326)	(29.1157)
N	8780	8780	8780	8780	8780	8780	8780	8780	8780
adj. R^2	0.002	0.006	0.017	0.002	0.124	0.004	0.002	0.013	0.003

4.3 Endogeneity and Robustness Tests

4.3.1 Centering Treatment

In Table 8, to eliminate the interference of variable scale differences on regression results, the core explanatory variable (environmental information disclosure) and control variables are centered (variables minus their means). The results in Column (1) show that the core explanatory variable coefficient is significantly positive at the 1% level, consistent with the baseline regression conclusions, indicating that the conclusion of environmental information disclosure's positive promotion effect on green finance is robust.

4.3.2 Standardization Treatment

In Table 8, the core explanatory variable and control variables are standardized (variables minus mean divided by standard deviation) to unify variable units and more intuitively reflect the economic significance of coefficients. In Column (2), the core explanatory variable coefficient remains significantly positive at the 1%

level, further verifying the robustness of the positive impact of environmental information disclosure on green finance.

4.3.3 Controlling Omitted Variables as Much as Possible

To alleviate endogeneity issues caused by omitted variables, based on the baseline regression, this paper fully incorporates control variables related to enterprise financial characteristics and governance structures, verifying the control effect of omitted variables by observing the stability of control variable coefficients. The results are shown in Columns (1)–(4) of Table 8.

After incorporating control variables, Lev remains significantly positive, while ATO, INV, FIXED, and Board remain significantly negative, and the positive significance of the core explanatory variable is unaffected. This indicates that by fully incorporating key control variables, the interference of omitted variables has been minimized to the greatest extent, and the positive impact of environmental information disclosure on green finance is not driven by unobserved variables, with robust conclusions.

4.3.4 Restricted Sample

To exclude the interference of abnormal observations on regression results, this study removes extreme values from the sample. After restricting the sample size, the positive promotion effect of environmental information disclosure on green finance is not significantly affected, indicating no serious sample abnormality interference issues, with robust conclusions.

4.3.5 Re-measurement by Dividing High and Low Based on the Median of Information Disclosure Quality

As shown in Table 8, based on the median of the corporate environmental information disclosure quality index, the sample is divided into a "high information disclosure quality group" (index above the median) and a "low information disclosure quality group" (index below the median), constructing a binary dependent variable and employing Logit model regression. The results show that the core explanatory variable coefficient is significantly positive at the 1% level, indicating that improving environmental information disclosure quality significantly increases the probability of enterprises obtaining green finance support, verifying the robustness of conclusions from a grouping perspective.

Table 8:

	（1） High Information Disclosure Quality Group	（2） Low Information Disclosure Quality Group
	Gfi	Gfi
EID	0.0507***	0.2553***
	(3.4815)	(5.0886)
Lev	2.1638***	1.0743
	(3.0595)	(1.4415)
ATO	-1.1967***	-0.8201***
	(-4.3789)	(-3.1119)
INV	-2.3024**	-2.9029***
	(-2.1907)	(-3.0604)
FIXED	-2.2904***	-4.2773***
	(-2.8425)	(-5.0706)
Board	-1.9817***	-1.3913**
	(-3.0525)	(-1.9759)
_cons	32.8154***	31.0819***
	(22.5035)	(20.1999)
N	4310	4261
adj. R^2	0.011	0.015

4.3.6 GMM Estimation

Considering the possible bidirectional causal relationship between environmental information disclosure and green finance-where green finance support may also drive enterprises to improve environmental information disclosure quality-this study adopts the system GMM estimation method to alleviate endogeneity

issues, while using the one-period lag of environmental information disclosure L.x for measurement. The results in Column (3) of Table 8 show that the core explanatory variable coefficient is significantly positive at the 5% level, with no serial correlation or over-identification issues in instrumental variables, indicating that after addressing endogeneity, the positive impact of environmental information disclosure on green finance remains robust.

4.3.7 2SLS Estimation

In Table 9, instrumental variables such as regional environmental information disclosure policy implementation intensity and the average environmental information disclosure quality of same-industry enterprises are selected, and the two-stage least squares method is employed to further alleviate endogeneity. The results in Column (4) show that the core explanatory variable coefficient is significantly positive at the 1% level, and in the first-stage regression, the instrumental variables are significantly correlated with the core explanatory variable, satisfying the validity requirements for instrumental variables, once again proving the endogeneity robustness of the positive impact of environmental information disclosure on green finance.

Table 9:

	(1)	(2)	(3)	(4)
	y_c	z_y	y	y
x_c	0.0801***			
	(10.0309)			
z_x		0.1009***		
		(10.0309)		
L.x			0.0778**	0.4570***
			(2.3265)	(13.3862)
Lev	1.5961***	0.1886***	15.9867	0.4204
	(3.1263)	(3.1263)	(0.4437)	(0.7234)
ATO	-1.0900***	-0.1288***	-4.0384	-1.3743***
	(-5.8488)	(-5.8488)	(-0.6658)	(-6.4502)
INV	-2.8467***	-0.3364***	-21.1352	-0.4566
	(-4.1530)	(-4.1530)	(-0.8201)	(-0.5685)
FIXED	-3.3636***	-0.3975***	-4.7734	-5.8835***
	(-5.6679)	(-5.6679)	(-0.1052)	(-8.5423)
Board	-1.8048***	-0.2133***	-8.0685	-2.9811***
	(-3.8258)	(-3.8258)	(-0.2255)	(-5.4733)
_cons	5.2126***	0.6160***	44.6651	31.4122***
	(5.0761)	(5.0761)	(0.7253)	(26.6514)
N	8780	8780	8400	8400
adj. R2	0.018	0.018		.

5. Heterogeneity Tests

5.1 Tests Based on Different Enterprise Natures

The impact of environmental information disclosure on green finance development is significantly influenced by differences in enterprise ownership structure. This paper explores the differences in the impact on green finance when enterprises of different natures disclose environmental information, based on ownership structure.

State-owned enterprises and non-state-owned enterprises differ in ownership attribution, government-enterprise relations, and market constraints, which may affect the “signal transmission efficiency” of environmental information disclosure and the “resource allocation efficiency” of green credit. On one hand, state-owned enterprises are closely linked with government departments and state-owned financial institutions, with “implicit guarantees” in resource acquisition, potentially weakening the signal value of environmental information disclosure; on the other hand, non-state-owned enterprises face stricter market financing constraints, making environmental information disclosure a key tool for alleviating information asymmetry, with a more significant impact on obtaining green credit. Columns (1) and (2) present the results for state-owned and non-state-owned enterprise samples, respectively; the coefficients EID in both groups are

significantly positive at the 1% level, but there are clear differences in impact strength. In the state-owned enterprise sample, the coefficient EID is 0.0302; in the non-state-owned enterprise sample, it is 0.1534, with the impact magnitude for non-state-owned enterprises being five times that of state-owned enterprises. The results indicate that the promotional effect of environmental information disclosure by non-state-owned enterprises on green finance development is significantly stronger than that of state-owned enterprises. The underlying reason is that state-owned enterprises have close ties with the government and state-owned financial institutions, possessing "institutional advantages" in accessing green finance resources, with limited marginal signal value from environmental information disclosure; non-state-owned enterprises face stronger financing constraints and must rely on high-quality environmental information disclosure to convey environmental commitments and green qualifications, compensating for "ownership disadvantages," thus making its impact on green finance more pronounced.

Within non-state-owned enterprises, foreign-invested enterprises and private enterprises differ in governance structures, environmental standards, and market positioning, leading to further differentiation in the impact of environmental information disclosure on green finance. Columns (3) and (4) present the regression results for foreign-invested and private enterprise samples, respectively; the coefficients EID in both are significantly positive at the 1% level, but there are certain differences in the coefficients. In the foreign-invested enterprise sample, the coefficient EID is 0.1128; in the private enterprise sample, it is 0.1895, with the impact magnitude for private enterprises being approximately 1.68 times that of foreign-invested enterprises, indicating that the promotional effect of environmental information disclosure by private enterprises on green finance is higher than that of foreign-invested enterprises.

The reasons for this difference may include: private enterprises face more intense domestic financing competition, making environmental information disclosure a core competitiveness in competing for green finance resources, with stronger targeted signal content in disclosures; some foreign-invested enterprises follow international standards in disclosures, but the content may deviate from the assessment systems and policy orientations of domestic green financial institutions, reducing signal transmission efficiency. In contrast, private enterprises are familiar with domestic market rules, making their disclosed information more aligned with review requirements, thus having a more pronounced promotional effect on green finance.

Table 10:

Variable	(1) State-owned Enterprises	(2) Non-State-owned Enterprises	(3) Foreign-invested Enterprises	(4) Private Enterprises
	Gfi	Gfi	Gfi	Gfi
EID	0.0302***	0.1534***	0.1128***	0.1895***
	(2.9420)	(10.2743)	(4.9124)	(9.5174)
Lev	1.0341*	2.0751**	0.6692	1.6967
	(1.6991)	(2.3569)	(0.4626)	(1.5044)
ATO	-0.5864**	-1.7441***	-3.0834***	-1.5333***
	(-2.5416)	(-5.6696)	(-5.0025)	(-4.1759)
INV	-1.5938*	-5.4027***	-6.7118***	-2.6547
	(-1.9327)	(-4.5011)	(-3.8496)	(-1.5811)
FIXED	-2.9236***	-4.5442***	-2.1735	-4.9318***
	(-4.2125)	(-4.5098)	(-1.1654)	(-4.0747)
Board	-1.1136**	-3.4068***	-5.1606***	-2.3432**
	(-2.0210)	(-3.8367)	(-3.5166)	(-2.1133)
_cons	31.4502***	35.3184***	40.0631***	32.7442***
	(26.1182)	(18.1596)	(12.1212)	(13.6299)
N	5375	3405	1126	2279
adj. R2	0.006	0.047	0.050	0.052

5.2 Tests Based on Different Regional Divisions

China's eastern, central, and western regions exhibit significant differences in economic development levels, industrial structure distribution, environmental regulatory intensity, and financial resource endowments. This regional heterogeneity may affect the effect of environmental information disclosure (EID) on green finance (Gfi), leading to regional differentiation characteristics. On one hand, the eastern region has a developed

economy, mature financial markets, and strict environmental regulations, with corporate environmental information disclosure being standardized and transparent, making its signal value more easily recognized by financial institutions; on the other hand, the central and western regions lag in economic development, with some areas dominated by high-energy-consuming industries and imperfect environmental information disclosure systems, potentially differing from the eastern region in driving green finance.

Columns (1), (2), and (3) present the regression results for enterprise samples from the eastern, central, and western regions, respectively; the coefficients EID in all three groups are significantly positive at the 1% level, but there are clear regional differences in impact strength. Specifically, the eastern region's coefficient is 0.0888, the central region's is 0.0962, and the western region's is the highest at 0.1947, with the western region's impact magnitude being approximately 2.19 times that of the eastern region and 2.02 times that of the central region. This result indicates that the promotional effect of environmental information disclosure by enterprises in the western region on green finance development is significantly stronger than that in the central and eastern regions, with the central region slightly higher than the eastern region but with relatively small differences.

The causes of this phenomenon are twofold: First, the eastern region's financial system is well-developed and green finance resources are abundant, so enterprises do not rely on environmental information disclosure to access green funds, with limited marginal signal value from disclosures; the western region's financial resources are scarce and enterprise financing constraints are strong, making environmental information disclosure a key tool for conveying environmental compliance and green potential, amplifying its signal value and making its driving effect more significant. Second, although the central region's economic level is intermediate, some provinces are dominated by traditional manufacturing, with insufficient standardization in corporate environmental information disclosure, weakening signal transmission efficiency; the western region, under the "dual carbon" goals, receives industrial transfers and strengthens environmental governance, with high-energy-consuming enterprises proactively improving disclosure quality to obtain green credit, and the content aligning closely with local policy orientations, resulting in stronger targeted signals and a more prominent promotional effect on green finance.

Table 11:

Variable	(1) Eastern	(2) Central	(3) Western
	Gfi	Gfi	Gfi
EID	0.0888***	0.0962***	0.1947***
	(8.3808)	(5.6121)	(7.8837)
Lev	1.5682***	0.4387	2.1783
	(2.5926)	(0.3741)	(1.4837)
ATO	-1.2498***	-0.7257*	0.5217
	(-5.6757)	(-1.8457)	(0.8142)
INV	-3.1865***	-0.5372	-4.8837**
	(-4.0099)	(-0.3267)	(-2.1527)
FIXED	-4.3614***	-0.7815	-0.4464
	(-6.1946)	(-0.6326)	(-0.2673)
Board	-1.3216**	-2.8343***	-2.4294*
	(-2.2953)	(-2.7342)	(-1.8946)
_cons	31.8421***	31.4629***	32.1178***
	(25.4645)	(13.2245)	(11.6329)
N	6127	1448	1085
adj. R2	0.021	0.023	0.061

6. Conclusions and Recommendations

Environmental information disclosure plays an important role in promoting green finance development. Based on data from A-share listed companies from 2008 to 2023, this paper empirically examines the impact and internal mechanisms of environmental information disclosure on green finance development from both enterprise and provincial perspectives. The main conclusions are as follows: First, environmental information disclosure has a stable promotional effect on green finance development. The baseline regression shows that

after incorporating control variables such as company size, financial leverage, asset structure, and governance characteristics, and controlling for individual, year, and province effects, the two still exhibit a significant positive relationship, indicating that improving environmental information disclosure quality can provide a reliable information foundation for the green finance market, promoting the aggregation of green finance resources and enhancing allocation efficiency. Second, mechanism tests indicate that environmental information disclosure promotes green finance development through two paths: "strengthening environmental regulation" and "alleviating information asymmetry." The former assists regulatory departments in precise enforcement, forming a virtuous cycle; the latter improves the green finance development environment, enhancing market recognition and trust in green assets. Third, corporate competition intensity does not exhibit a significant mediating effect, meaning that green finance development relies more on macroeconomic structural factors such as policy promotion, institutional environment, and information transparency, rather than short-term fluctuations in market competition conditions; the core factor determining whether enterprises can obtain green finance support lies in their own environmental performance and information disclosure quality.

Based on the above conclusions, this paper proposes the following policy recommendations:

First, improve the environmental information disclosure system. It is recommended that regulatory departments issue detailed guidelines for corporate environmental information disclosure, promote the standardization, quantification, and institutionalization of disclosure content and third-party verification, with a focus on strengthening disclosure requirements for key indicators such as carbon emissions, pollution control investments, and green technology applications, to build a solid data foundation for green finance development.

Second, strengthen the coordinated development of environmental regulation and information disclosure. The government should enhance regulatory efforts on corporate environmental information disclosure, providing policy incentives such as environmental subsidies, preferential green credit quotas, and interest rate discounts to enterprises with high disclosure quality, to construct a virtuous governance cycle.

Third, build a green finance information sharing platform. Relevant institutions should take the lead in establishing a green finance and environmental information sharing system that integrates corporate disclosure information, regulatory data, and financial institutions' green business data, utilizing technologies such as big data and blockchain to enhance information transparency and alleviate information barriers in the green finance market.

Fourth, implement differentiated green finance policies. Financial institutions should develop personalized and diversified green finance products based on the ownership structures of different enterprises, especially targeting non-state-owned and foreign-invested enterprises, to stimulate their disclosure enthusiasm.

Fifth, enhance financial institutions' environmental risk identification and management capabilities. Encourage financial institutions to develop risk rating models based on environmental information disclosure data, optimize risk assessment mechanisms, strengthen the identification of green assets and transition finance assets, reduce credit allocation misalignments caused by information gaps, and systematically improve the efficiency and coverage of the green finance market.

Sixth, increase support for the green transformation of small and medium-sized enterprises. The government should coordinate policy tools such as special funds for targeted support and specialized transformation training to precisely address the needs of small and medium-sized enterprises in technology upgrades, equipment renovations, and model innovations, breaking through bottlenecks in funding, technology, and awareness to promote the integration of small and medium-sized enterprises into green industrial and supply chain systems..

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Conflicts of Interest
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