

Original Research

Does Environmental Information Disclosure Affect Customer Stability?

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Abstract

As environmental problems are becoming increasingly severe, the environmental protection behavior of an enterprise directly affects the evaluation of customers towards the enterprise. Taking A-share manufacturing companies listed in China as the sample, this study investigates the impact of environmental information disclosure on customer stability. The results show that environmental information disclosure positively affects customer stability. Moreover, hard environment information has a stronger effect on enhancing customer stability due to its higher information quality. Mechanism tests indicate that environmental information disclosure exerts three effects on customer stability, namely “information effect”, “governance effect” and “reputation effect”. Environmental information disclosure can increase information transparency and improve corporate governance and firm reputation, thereby enhancing customer stability. Heterogeneity analysis demonstrates that environmental information disclosure has a more significant promoting effect on customer stability in enterprises with higher media attention. This study validates the benefits of environmental information disclosure from the perspective of customers and offers insights for emerging economies to enhance their environmental information disclosure systems.

Keywords: Environmental information disclosure, customer stability, information transparency, corporate governance, firm reputation

Introduction

According to the International Energy Agency, emerging markets and developing economies accounted for about two-thirds of global carbon emissions in 2021, with one-third occurring in China [1]. Therefore, future

global climate change depends largely on the emission reduction efforts of emerging markets and developing countries. As the largest developing country, China has been committed to global environmental governance. China’s measures and experience in carbon reduction and ecological protection are of great significance to emerging markets. As enterprises are the most significant users of resources and environmental destroyers, people pay great attention to the environmental impact of enterprises’

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business activities. In 2008, China's Ministry of Ecology and Environment issued the "Environmental Information Disclosure Measures" to encourage enterprises to disclose environmental information [2]. Subsequently, a series of policies and regulations standardized environmental information disclosure (EID) requirements further. According to the White Paper on ESG Development in China, the number of listed companies disclosing environmental responsibility-related information increased from 371 in 2009 to 1,121 in 2021. This shows that enterprises' environmental awareness is constantly strengthening, and the initiative of EID is increasing year by year. However, China's EID is mainly voluntary. Less than half of listed companies disclose environmental information in the form of independent reports each year, so the level of EID is generally low [3].

With the increasing public attention to environmental issues, EID has gained widespread interest in academic research and has become a popular topic. Existing studies have explored the impact of EID on enterprises' financial performance, risk management, and innovation. In terms of financial performance, the literature has found that EID enhances firm value and profitability. The main mechanisms include sending positive signals [4], improving liquidity and visibility [5], and obtaining cooperative resources [6, 7]. Although some scholars hold contrary opinions [8, 9], most studies have identified that EID has a positive impact on financial performance. With respect to risk management, EID has been found an effective means of reducing the information gap and obtaining more resources from stakeholders, hence reducing firm risk level [10, 11]. In addition, some literature found that EID encourages enterprises to engage in more research and development activities [2, 12, 13]. In general, it is beneficial for enterprises to disclose environmental information. However, existing research is primarily focused on the impacts of EID on the internal aspects of the enterprise and rarely studies the impacts of EID on external stakeholders. Since an enterprise is a set of contracts established by stakeholders [14], it is a potentially meaningful topic to explore whether and how EID affects stakeholders outside the firm.

As an important external stakeholder, customers are situated downstream in the supply chain and have a decisive impact on enterprises' operations and strategies [15]. Customers usually make relationship-specific investments in enterprises as a credible commitment to express long-term strategic cooperation [16]. Therefore, customers are an important relationship resource for enterprises. A stable customer relationship can reduce production costs [17], enhance revenue stability [18], improve operational efficiency [19] and promote innovation [20]. Once a relationship is broken, enterprises lose the advantage brought by relationship capital, leading to damage to their sustainable operational capabilities. Existing literature has pointed out that information asymmetry and opportunistic behavior are the key factors affecting the duration of supply chain relationships [4, 21]. Additionally, EID can improve information transparency, restrain managerial opportunistic behavior, and establish a good reputation [5, 22]. Would EID attract more customers to establish stable cooperative

relationships? Therefore, we investigate the impact of EID on customer stability in this paper.

This study has three contributions. First, it expands the research on the impact of corporate environmental information disclosure on customers. Few studies have investigated the mediating role of customer satisfaction in the link between corporate environmental performance and financial performance [23, 24]. Other studies indicated that corporate environmental responsibilities and practices influence consumer attitudes [25, 26]. This paper, by exploring the impact of EID on customer stability, chooses a novel research perspective and provides fresh evidence on the benefits of EID from the perspective of customer relationship continuity. Second, we find that media attention moderates the positive correlation between EID and customer stability. Media improves the efficiency and effectiveness of environmental information transmission, which provides insights for enterprises enhancing media coverage. Meanwhile, it expands the existing literature on the role of media attention. Third, this study shows that EID, by improving information transparency, corporate governance, and firm reputation, encourages more customers to maintain stable relationships. This, in turn, enhances intrinsic motivation for enterprises to disclose more environmental information, and attract more customers. Finally, the evidence gathered from China provides a reference for other emerging market countries looking to improve the construction of EID systems.

This study consists of five Sections. Section 2 reviews the existing literature and puts forward the hypotheses. Section 3 provides sample selection, data source, and variable definition. Section 4 constructs the baseline regression and mechanism test models. Section 5 reports the results of baseline regression, mechanism tests, and heterogeneity analysis. Section 6 provides conclusions and suggests implications.

Literature Review and Research Hypothesis

Literature Review

EID means that enterprises describe environmental protection concepts, environmental investment, pollution control, and other environment-related behaviors [27]. The carriers of EID are annual reports, environmental reports, and social media. Environmental information has become an important part of non-financial information disclosure of enterprises and has received increasing attention from stakeholders [28]. Existing literature has extensively investigated the impact of EID on enterprises' financial performance, risk management, and firm innovation. The conclusions about how EID affects financial performance are inconsistent. Most studies found that EID increases firm value and market competitiveness [4, 5, 7]. EID provides valuation-relevant information and plays a signaling role in enhancing firm value [4]. EID can increase firm visibility and liquidity, and promote firm financial performance [5]. In addition,

EID helps enterprises obtain more cooperative resources to strengthen market competitiveness [6, 7]. Other studies indicated that EID damages financial performance because environmental investment cannot make up for economic losses in the short term [8, 29]. In terms of risk management, EID reduces stock price crash risk by improving operational transparency and investors' reactions [22]. According to legitimacy theories, EID can build green images and then reduce idiosyncratic risk [10]. In the long run, EID serves as a hedge against cash flow risk by raising operational efficiency and stabilizing the supply chain [11]. Several studies identified that EID stimulates innovation input and output by improving information transparency and easing financing constraints [2, 12, 13].

Existing studies have verified the positive role of EID in improving financial performance, reducing risk levels, and promoting innovation. However, there is limited research on the impact of EID on customer relationships. Customers are important trading partners of the enterprises and can determine the firms' operating income and cash flows [11]. A stable customer relationship is a valuable relationship resource and provides a stable business environment for enterprises [30]. Due to the importance of customers, this study explores the impact of EID on customer stability. It should be noted that "customers" in this study refers to the major customers whose sales account for the firm's top five revenues.

Research Hypothesis

Environmental Information Disclosure and Customer Stability

Due to increasingly serious environmental problems, the Chinese government has promulgated a series of policies and regulations on EID [2]. Theoretically, EID may affect the stability of customer relationships through information, governance, and reputation mechanisms.

First, EID exerts an "information effect" by increasing information transparency, and then improves customer stability. There is a serious information asymmetry between the enterprises and their customers, which leads to short-term contracts [4, 31]. A stable supply chain relationship is based on reliable information exchange. Customers cannot observe the business conditions and product quality of enterprises due to the lack of information. Then, customers' transaction costs increase, and their willingness to trade decreases. Customers require the enterprises to share true information; otherwise, they will terminate cooperation [32]. EID provides customers with multi-dimensional sustainable development information, such as environmental management, environmental certification, and pollution control. Hence, customers can accurately judge the operation condition, risk level, financial performance, and product quality of the enterprises through that information. As a result, customers' willingness to transact with the enterprises increases. In short, EID reduces information asymmetry and therefore promotes the maintenance of customer relationships.

Second, EID exerts a "governance effect" by enhancing corporate governance, and thus promotes customer stability. Management may engage in opportunistic behaviors such as earnings management, on-the-job spending, and hiding bad news, which weakens enterprises' ability to fulfill contractual obligations. Hence, it will hurt the interests of customers. The research found that when enterprises smooth revenue or conceal negative information, their customers will terminate the relationship [33]. Customers usually choose suppliers with higher governance levels and supervise them during the contract duration [21]. EID exposes management to extensive scrutiny from creditors, investors, and other stakeholders [22]. Thus, it can constrain opportunistic behaviors, reduce agency costs, and make managers' decisions and behaviors consistent with customer interests [34]. With the improvement of corporate governance levels, customers' concerns about interest infringement diminish. Consequently, customers are more inclined to continue trading with enterprises, leading to improved customer stability.

Third, EID exerts a "reputation effect" by improving firm reputation, and hence enhances customer stability. According to voluntary disclosure theory, enterprises with better environmental performance disclose more environmental information [35]. Based on signaling theory, EID conveys signals that enterprises proactively fulfill environmental protection responsibilities and have excellent environmental management systems [36]. Through EID, enterprises can be distinguished from those with poor environmental performance. The environmentally friendly strategy helps enterprises build a responsible image and improves the likelihood of stakeholders trading with them [37]. Existing research found that consumers tend to buy products from suppliers with a reputation for environmental responsibility [38]. Therefore, EID may maintain customer relationships through a reputation mechanism. Based on the above analysis, we propose hypothesis 1.

H1: Environmental information disclosure positively affects customer stability.

In addition, different types of information have different levels of information content and credibility [4]. Objective and quantitative information is called hard information. Subjective and qualitative information is called soft information. Because hard information is more verifiable and provides more accurate data, it is more informative and reliable than soft information [39, 40]. Therefore, disclosing hard environment information will have a greater "information effect", "governance effect", and "reputation effect", leading to a stronger promotion of customer stability. We divide environmental information into hard information and soft information and examine their impact on customer stability. This can provide more comprehensive empirical evidence for the benefits of EID. Hence, hypothesis 2 is proposed.

H2: The association between environmental information disclosure and customer stability differs by information type and hard information has a stronger positive effect.

The Effect of Media Attention

As an external governance mechanism, media coverage is an important channel for stakeholders to gain and understand firm information timely. Getting and interpreting environmental information is more difficult than other information for stakeholders [13]. Therefore, the media plays a crucial role in environmental information transmission and affects stakeholders' decision-making. Thus, media attention may have a moderating effect on the positive relationship between EID and customer stability. First, media attention increases the amount of information available to customers and alleviates their information disadvantage [11]. By receiving more information about enterprises' environmental performance, customers can accurately judge the trade risks and benefits. Second, managers' environmental decisions face more supervision from the public under media attention. This can restrict managers' opportunistic behaviors and enhance customer cooperation [41]. Third, environmental information produces a great reputation through media coverage. Media attention improves the efficiency of information transmission and helps firms establish better public images. Therefore, when the level of media attention is higher, EID is more attractive to customers, thus enhancing customer stability. Hypothesis 3 is put forward.

H3: In enterprises with higher media attention, the positive impact of environmental information disclosure on customer stability is more significant.

Research Design

Sample and Data

Manufacturing listed companies are the main source of environmental pollution and should undertake more environmental responsibilities [3]. Therefore, we select A-share manufacturing listed companies from 2009 to 2022 as the research sample. We exclude ST companies, companies that do not disclose the name of their top five customers, and companies with missing data. In order to calculate customer stability, companies that did not disclose information about their top five customers for three consecutive years are excluded. All continuous variables are winsorized at the upper and lower 1% levels. The final sample includes 4747 firm-year observations of 237 firms. Media attention data from the Chinese Research Data Services (CNRDS) Platform. Other data are from the China Stock Market and Accounting Research Database (CSMAR).

Variable Definition

Customer Stability

Chinese listed companies only disclose the top five major customers whose sales account for a significant proportion of operating income. Therefore, we measure customer stability

(CS) by dividing the number of repeat customers of the top five customers in three consecutive years: the current year plus the past two years, by five [42, 43]. For example, the top five major customers this year are A, B, C, D, and E, while the top five major customers in the previous year are B, C, F, G, and H. They are B, C, I, J, and K in the year before last year. Here, B and C have been the firm's top five customers for three consecutive years. Therefore, the value of customer stability is $2/5$ (0.4) in this year. The value of customer stability ranges from 0 to 1. The larger the value, the more stable the customer relationship.

Environmental Information Disclosure

Environmental information includes five items: environmental management, environmental certification, pollution control, environmental liabilities, and information disclosure carriers [2, 40]. Environmental management includes eight indicators: environmental protection concept, environmental education and training, environmental protection honors or rewards, environmental protection goals, emergency mechanism for environmental incidents, environmental protection management system, environmental protection special action, and "Three Simultaneity" system. If a firm discloses one item, it gets a score of 1. The maximum score for this item of environmental management is 8. Environmental certification includes ISO14001 and ISO9001 certifications. If a firm has passed one of them, the score is 1, and the maximum score is 2. Pollution control includes six indicators: waste gas emission reduction, wastewater emission reduction, soot and dust control, utilization and disposal of solid waste, noise, light, and radiation governance, and clear production implementation. A secondary indicator takes the value of two if there is a quantitative description for it, of one if there is a qualitative description, and of zero if there is no description for it. Hence, the maximum score for pollution control is 12. Environmental liabilities include six indicators: wastewater discharge, COD emission, CO₂ emissions, smoke and dust emissions, SO₂ emission, and production of industrial solid waste. The value assignment rules are the same as pollution control. The information disclosure carriers take a value of one if there is disclosure of environmental information in an environmental report, social responsibility report, or annual report. Hence, the maximum score for it is three. *EID* is the sum of these five items divided by the maximum score, which is 37. In addition, according to existing studies [39, 40], we divide EID into hard information disclosure (*EID_hard*) and soft information disclosure (*EID_soft*). Environmental certification, pollution control, and environmental liabilities are hard information and other items are soft information.

Mediator

Information transparency (Trans). The Shenzhen Exchange conducts a comprehensive rating on the quality of information disclosure of listed companies every year. The rating result has four grades, which are A, B, C,

and D, ranked from high to low. According to existing research [44], the assigned values of A, B, C, and D are 4, 3, 2, and 1, respectively. The greater the value, the higher the information transparency (Trans).

Corporate governance (Gover). Following an existing study [45], we use the overhead ratio to measure the level of corporate governance (Gover). The overhead ratio is overhead divided by revenue. The higher the ratio, the lower the level of corporate governance.

Firm reputation (Reput). Analysts tend to follow firms with a better reputation [46], so we use analyst attention to measure firm reputation (Reput). Reput is the natural log of the number of analysts coverage plus one. The greater the value, the better the firm reputation.

Moderator

Media attention (Med). Following existing research [47], media attention is the natural log of the number of times a firm is covered by financial presses. Financial presses include eight major financial newspapers and more than 600 other economic newspapers. If the firm has more media reports than the annual industry median, the media attention is higher (Med_high). Otherwise, the media attention is lower (Med_low).

Control Variables

Following an existing study [48], we control for several variables that may affect customer relationships. ① Firm size (Size). It is the natural log of total assets. ② Firm age (Age). It is the natural log of the company's listed years. ③ Leverage (Lev). It is the ratio of total liabilities to total assets. ④ Return on total assets (ROA). It is equal to net profit divided by total assets. ⑤ Cash flow from operating activities (CFO). It is the ratio of net cash flow from operating activities to total assets. ⑥ Tobin's Q (TQ). It is measured by the ratio of market value to total assets. ⑦ Fixed assets (PPE). It is equal to the ratio of net fixed assets to total assets. ⑧ Customer concentration (CC). It is the sum of squares of the top five customers' sales proportion. ⑨ Nature of property rights (Soe). If a firm is state-owned, the value is 1; otherwise, it is 0. ⑩ Ownership concentration (Share). It is the share ratio of the largest shareholder. ⑪ Whether the chairperson and CEO are the same person (Both). If they are the same person, the value is 1; otherwise, it is 0. ⑫ Audited by the Big Four (Big4). If the firm is audited by the Big Four, the value is 1, otherwise it is 0. In addition, we control for industry-fixed (Ind) and year-fixed effects (Year) and cluster regression coefficient standard errors at the firm level. See Table 1 for the detailed definitions of the variables.

Table 1. Definitions of variables

Variables	Definitions
CS	Customer stability, number of repeat-customers in the past two years divided by five.
EID	Environmental information disclosure, sum of five items divided by the maximum score 37.
Trans	Information transparency, information disclosure quality rating of listed companies.
Gover	Corporate governance, overhead ratio.
Reput	Firm reputation, natural log of the number of analysts coverage plus one.
Med	Media attention, natural log of the number of times a firm covered by financial press.
EEU	External environmental uncertainty, industry-adjusted standard deviation of abnormal sales revenue in the past five years.
Size	Firm size, natural log of total assets.
Age	Firm age, natural log of the listed years.
Lev	Total liabilities divided by total assets.
ROA	Net profit divided by total assets.
CFO	Net cash flow from operating activities divided by total assets.
TQ	Market value divided by total assets.
PPE	Net fixed assets divided by total assets.
CC	Sum of squares of the top five customers' sales proportion.
Soe	Nature of property rights. If a firm is state-owned, the value is 1; otherwise, it is 0.
Share	Share ratio of the largest shareholder.
Both	If board chair and CEO are the same person, the value is 1; otherwise, it is 0.
Big4	If the firm is audited by Big Four, the value is 1, otherwise it is 0.

Model

Baseline Regression Model

We use ordinary least squares (OLS) regression to investigate how EID affects customer stability. The regression model is shown in model (1).

$$CS_{it} = \alpha_0 + \alpha_1 EID_{it} + \sum Controls_{it} + \sum Ind + \sum Year + \varepsilon_{it} \quad (1)$$

Where CS refers to customer stability; EID refers to environmental information disclosure. Controls includes all control variables; Ind is industry-fixed effect; Year is year-fixed effect; i denotes the firm; t denotes the year.

Mechanism Test Model

According to the theoretical analysis, EID improves customer stability by increasing information transparency and enhancing corporate governance and firm reputation. Following the existing research [49], we use stepwise regression to test these mechanisms. Based on model (1), model (2) and model (3) are built.

$$MV_{it} = \beta_0 + \beta_1 EID_{it} + \sum Controls_{it} + \sum Ind + \sum Year + \varepsilon_{it} \quad (2)$$

$$CS_{it} = \lambda_0 + \lambda_1 EID_{it} + \lambda_2 MV_{it} + \sum Controls_{it} + \sum Ind + \sum Year + \varepsilon_{it} \quad (3)$$

Here, MV is mediating variables including Trans, Gover, and Reput. Model (2) is used to test the impact of EID on mediators. Model (3) is used to examine the impact of EID on customer stability after controlling mediators to determine whether the mediating effect exists.

Empirical Results

Descriptive Statistics

Table 2 reports the descriptive statistics of the main variables. The mean value of CS is 0.25, indicating that generally one customer maintains an ongoing transaction with the enterprise. The mean and median values of EID are 0.153 and 0.081, respectively, meaning that the level

Table 2. Descriptive statistics of variables

Variables	N	Mean	SD	p50	Min	Max
CS	4747	0.250	0.242	0.200	0.000	1.000
EID	4747	0.153	0.169	0.081	0.000	1.000
EID_hard	4747	0.122	0.177	0.038	0.000	1.000
EID_soft	4747	0.227	0.191	0.182	0.000	1.000
Trans	4747	2.936	0.512	3.000	1.000	4.000
Gover	4747	0.095	0.072	0.078	0.014	0.410
Reput	4747	1.371	1.137	1.386	0.000	4.190
Size	4747	7.868	1.141	7.739	5.466	11.180
Age	4747	1.885	0.999	2.079	0.000	3.258
Lev	4747	0.419	0.230	0.402	0.044	1.193
ROA	4747	0.034	0.068	0.037	-0.315	0.220
CFO	4747	0.037	0.073	0.036	-0.209	0.256
TQ	4747	2.119	1.541	1.603	0.878	10.620
PPE	4747	0.243	0.151	0.212	0.010	0.674
CC	4747	0.323	0.209	0.266	0.041	0.940
Soe	4747	0.367	0.482	0.000	0.000	1.000
Share	4747	0.343	0.142	0.321	0.086	0.730
Both	4747	0.267	0.442	0.000	0.000	1.000
Big4	4747	0.032	0.177	0.000	0.000	1.000

of EID is generally low [3]. The mean values of EID_hard and EID_soft are 0.122 and 0.227, respectively. It shows that firms disclose less hard information than soft information and information quality needs to be improved. Table 3 reports the correlation coefficients between the variables. The results show that all the absolute values of correlation coefficients are below 0.52 and the mean value of VIF for the multicollinearity test is 1.59. Therefore, our model has no serious multicollinearity problems.

Baseline Regression

Table 4 reports the regression results of the impacts of EID on customer stability. In column (1), the coefficient

of EID is 0.104, with a t-value of 3.46, significant at the 1% level. The results show that EID significantly improves customer stability, thereby supporting H1. The regression results when EID is divided into EID_soft and EID_hard are shown in columns (2) and (3), respectively. In column (2), the coefficient of EID_soft is 0.057 and significant at the 5% level. Column (3) demonstrates that the coefficient of EID_hard is 0.101 and the significant level is 1%. The association between EID and customer stability differs by information type and hard information has a stronger positive effect. H2 is verified. Therefore, enterprises should actively improve EID quality and provide more hard information to attract more customers to maintain long-term relationships.

Table 3. Correlation coefficient matrix

	CS	EID	Trans	Gover	Reput	Size	Age	Lev	ROA
CS	1								
EID	0.204***	1							
Trans	0.064***	0.069***	1						
Gover	0.138***	0.210***	0.063***	1					
Reput	-0.027	0.078***	0.190***	0.074***	1				
Size	0.162***	0.452***	0.134***	0.196***	0.191***	1			
Age	0.249***	0.243***	-0.110***	0.214***	-0.077***	0.401***	1		
Lev	0.042**	0.159***	-0.154***	0.193***	-0.092***	0.389***	0.515***	1	
ROA	0.016	-0.006	0.252***	0.126***	0.409***	-0.007	-0.264***	-0.470***	1
CFO	0.131***	0.137***	0.099***	0.171***	0.184***	0.103***	0.051***	-0.139***	0.351***
TQ	-0.010	-0.137***	-0.100***	-0.047**	0.089***	-0.406***	0.180***	0.014	-0.043**
PPE	0.133***	0.268***	-0.036*	0.152***	-0.142***	0.247***	0.313***	0.321***	-0.197***
CC	0.067***	-0.103***	-0.080***	-0.116***	-0.151***	-0.218***	-0.122***	-0.053***	-0.065***
Soe	0.057***	0.229***	0.006	0.186***	-0.005	0.351***	0.454***	0.354***	-0.147***
Share	-0.016	0.083***	0.093***	0.170***	0.067***	0.166***	-0.138***	-0.031*	0.123***
Both	-0.033*	-0.132***	-0.006	-0.152***	0.050**	-0.167***	-0.246***	-0.167***	0.039**
Big4	0.038**	0.171***	0.046**	0.075***	0.106***	0.227***	0.081***	0.066***	0.016
	CFO	TQ	PPE	CC	Soe	Share	Both	Big4	
CFO	1								
TQ	0.009	1							
PPE	0.185***	-0.078***	1						
CC	-0.104***	0.154***	-0.130***	1					
Soe	0.022	-0.059***	0.288***	-0.090***	1				
Share	0.084***	-0.170***	0.087***	-0.046**	0.096***	1			
Both	-0.022	-0.003	-0.139***	0.030*	-0.270***	-0.056***	1		
Big4	0.064***	-0.063***	0.082***	-0.040**	0.099***	0.044**	-0.056***	1	

Table 4. Results of baseline regression

Variables	CS (1)	CS (2)	CS (3)
EID	0.104***		
	(3.46)		
EID_soft		0.057**	
		(2.21)	
EID_hard			0.101***
			(3.66)
Size	0.004	0.007	0.004
	(0.63)	(1.06)	(0.67)
Age	0.056***	0.056***	0.057***
	(9.43)	(9.24)	(9.49)
Lev	-0.052**	-0.054**	-0.052**
	(-2.03)	(-2.09)	(-2.04)
ROA	0.197***	0.198***	0.197***
	(2.68)	(2.70)	(2.68)
CFO	0.295***	0.297***	0.295***
	(5.47)	(5.52)	(5.48)
TQ	-0.004	-0.003	-0.004
	(-0.97)	(-0.83)	(-1.01)
PPE	0.140***	0.149***	0.141***
	(4.12)	(4.39)	(4.13)
CC	0.135***	0.133***	0.135***
	(5.86)	(5.77)	(5.88)
Soe	-0.018	-0.017	-0.018
	(-1.50)	(-1.37)	(-1.51)
Share	0.027	0.030	0.028
	(0.81)	(0.87)	(0.81)
Both	0.012	0.011	0.011
	(1.15)	(1.11)	(1.12)
Big4	0.007	0.011	0.007
	(0.22)	(0.32)	(0.20)
Ind	Yes	Yes	Yes
Year	Yes	Yes	Yes
Constant	-0.125**	-0.144***	-0.125**
	(-2.44)	(-2.86)	(-2.45)
Obs.	4747	4747	4747
R ²	0.210	0.208	0.211

Note: ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Robustness Tests

We conduct a series of robustness tests and the results are reported in Table 5.

First, we construct an instrumental variable. Following existing research [2], an instrumental variable is the mean of EID for other listed companies (EID_mean) within the same segmented industries. Then, we conduct a two-stage least square (2SLS) regression. In columns (1) and (2), the coefficients of EID_mean and EID are significantly positive. The F statistic of Cragg-Donald Wald is 326.030, so there is no weak instrumental variable problem. After controlling endogeneity by instrumental variable, EID still has a positive impact on customer stability.

Second, we adopt a propensity score matching approach to alleviate self-selection bias [50]. The sample is divided into three groups according to the quantile of EID. Observations in the highest quantile are categorized as the treatment group, and others are as the control group. The covariables are the control variables in model (1). We use the nearest-neighbor matching method of “one match one, no return” and get 2558 paired observations. The result is reported in column (3). The coefficient of EID is significantly positive, indicating that EID promotes customer stability.

Third, we also conduct other robustness tests. Column (4) shows the result for EID with a one-period lag (LEID). Column (5) reports the result for replacing customer stability (CSI) with the number of repeat customers in two consecutive years divided by five [42, 51]. Because the value of customer stability ranges from 0 to 1, we use Tobit estimation, and the result is presented in Column (6). Column (7) shows the result after controlling for the firm-fixed effect (Firm). The environmental problems of heavy-polluting enterprises are more serious, so EID is particularly important in these firms. Column (8) reports the result for heavy-polluting enterprises. Column (9) reports the result of the industry cluster. Column (10) shows the result for the sample limited to firms whose sales proportion of the top five customers is greater than the sample average. All the robustness tests show that the conclusion of baseline regression is robust.

Mechanism Tests

The result of baseline regression shows that EID has a promoting effect on customer stability. According to model (2) and model (3), we investigate the impact mechanism, and the results are reported in Table 6. Columns (1) and (2) show the result of the “information effect”. In column (1), the coefficient of EID is significantly positive, indicating that EID improves information transparency. In column (2), the coefficient of Trans and EID are all significantly positive. Moreover, the Z value of the Sobel test is 2.178. The results show that EID positively affects customer stability and information transparency partially mediates this relationship. EID encourages more customers to maintain relationships by enhancing information transparency.

Columns (3) and (4) report the result of the “governance effect”. Column (3) illustrates that the coefficient of EID is significantly negative, indicating that EID reduces agency costs and enhances corporate governance. Column (4) shows that the coefficient of Gover is negative and the coefficient of EID is positive. The Z value of the Sobel test is 2.395. The results demonstrate that corporate governance plays a significant mediating role. EID enhances customer stability through improving corporate governance.

Columns (5) and (6) display the result of the “reputation effect”. The coefficient of EID is positive in column (5), indicating that EID improves firm reputation. The coefficient of Reput and EID are all positive in column (6). The Z value of the Sobel test is 2.629. Therefore, firm reputation has a significant mediating effect on the positive relationship between EID and customer stability. EID attracts more customers to conduct ongoing transactions with enterprises by improving firm reputation.

Heterogeneity Analysis

According to our theoretical analysis, media attention can alleviate customers’ information disadvantage, supervise management effectively, and enhance extensive reputation. Therefore, we expect that in enterprises with higher media attention, EID has a more significant effect on customer stability. We divide the sample into the high media attention group (Med_high) and the low media attention group (Med_low). Then, grouped regression is performed according to model (1). The results are shown in Table 7. Column (1) shows that the coefficient of EID is significantly positive in Med_high. However, column (2) reports that the coefficient of EID is not significant in Med_low. The p-value of the between-group coefficient difference test is 0.040, indicating that the coefficients of the two groups are significantly different. The results show that media attention enhances the positive relationship between EID and customer stability. H3 is proved.

Conclusions, Discussions and Implications

Conclusions

As manufacturing enterprises are the most important resource users and environmental destroyers, there has been considerable concern regarding their EID. Taking the data from 237 Chinese manufacturing enterprises from 2009 to 2022 as the research sample, this study investigates the impact of EID on customer stability and its impact mechanisms. In addition, the moderating effects of media attention and external environment uncertainty are examined. The study found that EID has a significant positive impact on customer stability and the disclosure of hard environment information has a stronger positive effect. The mechanism tests found that information transparency, corporate governance, and firm reputation play a mediating role in this positive relationship. EID enhances customer stability by increasing information transparency

Table 5. Results of robustness tests

Variables	EID (1)	CS (2)	CS (3)	CS (4)	CS1 (5)	CS (6)	CS (7)	CS (8)	CS (9)	CS (10)
EID_mean	0.467***									
	(7.83)									
EID		0.461***	0.105***		0.099***	0.104***	0.065**	0.108***	0.104**	0.082*
		(3.10)	(3.09)		(2.93)	(3.47)	(1.99)	(2.95)	(5.02)	(1.92)
LEID				0.105***						
				(3.26)						
Size	0.043***	-0.015*	-0.003	0.009	0.007	0.004	-0.020*	0.014	0.004	0.009
	(8.47)	(-1.66)	(-0.405)	(1.37)	(0.96)	(0.64)	(-1.80)	(1.54)	(0.74)	(1.22)
Age	-0.005	0.059***	0.058***	0.018**	0.061***	0.056***	0.134***	0.042***	0.056**	0.060***
	(-1.00)	(9.46)	(7.553)	(2.36)	(8.58)	(9.45)	(10.84)	(4.48)	(5.13)	(8.54)
Lev	-0.029	-0.040	-0.028	-0.056**	-0.049	-0.052**	-0.113***	-0.063*	-0.052*	-0.057**
	(-1.54)	(-1.52)	(-0.853)	(-2.10)	(-1.61)	(-2.04)	(-3.38)	(-1.93)	(-3.02)	(-1.97)
ROA	0.048	0.183**	0.162*	0.187**	0.245***	0.197***	-0.046	0.017	0.197	0.094
	(1.11)	(2.46)	(1.679)	(2.50)	(2.75)	(2.69)	(-0.69)	(0.17)	(1.20)	(0.96)
CFO	0.070**	0.273***	0.286***	0.315***	0.352***	0.295***	0.030	0.230***	0.295***	0.402***
	(2.01)	(4.92)	(3.741)	(5.57)	(5.41)	(5.49)	(0.57)	(2.83)	(6.39)	(5.26)
TQ	0.006**	-0.006	-0.004	-0.003	-0.002	-0.004	-0.002	0.002	-0.004	-0.003
	(2.45)	(-1.60)	(-0.778)	(-0.72)	(-0.42)	(-0.98)	(-0.51)	(0.32)	(-0.63)	(-0.72)
PPE	0.117***	0.074*	0.125***	0.134***	0.161***	0.140***	0.026	0.060	0.140	0.222***
	(3.94)	(1.78)	(3.123)	(3.91)	(4.19)	(4.13)	(0.60)	(1.31)	(1.85)	(5.23)
CC	-0.026	0.141***	0.139***	0.156***	0.172***	0.135***	0.009	0.125***	0.135**	0.053
	(-1.53)	(6.01)	(4.694)	(6.20)	(6.54)	(5.88)	(0.26)	(3.21)	(5.50)	(1.64)
Soe	0.027***	-0.028**	-0.025*	-0.007	-0.023*	-0.018	-0.033*	-0.015	-0.018**	-0.029**
	(2.92)	(-2.14)	(-1.706)	(-0.55)	(-1.71)	(-1.51)	(-1.68)	(-0.89)	(-3.61)	(-2.17)
Share	0.023	0.011	0.035	0.023	0.046	0.027	0.011	-0.019	0.027	0.099**
	(0.83)	(0.32)	(0.767)	(0.63)	(1.19)	(0.81)	(0.19)	(-0.33)	(0.49)	(2.30)
Both	-0.016**	0.017	0.023	0.013	0.009	0.012	-0.012	0.012	0.012***	0.015
	(-2.28)	(1.60)	(1.640)	(1.17)	(0.77)	(1.15)	(-1.01)	(0.74)	(11.40)	(1.25)
Big4	0.065	-0.015	-0.019	0.026	0.009	0.007	-0.024	-0.028	0.007	0.005
	(1.59)	(-0.47)	(-0.625)	(0.69)	(0.25)	(0.22)	(-0.51)	(-1.02)	(0.33)	(0.12)
Ind	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm	No	No	No	No	No	No	Yes	No	No	No
Constant	-0.330***	0.009	-0.092	-0.092	-0.151**	-0.125**	-0.022	-0.170**	-0.113***	-0.189***
	(-7.94)	(0.14)	(-1.399)	(-1.73)	(-2.63)	(-2.45)	(-0.25)	(-2.42)	(-10.33)	(-3.03)
Obs.	4747	4747	2558	4268	4747	4747	4747	2024	4747	1890
R ²	0.372	0.168	0.182	0.176	0.159		0.218	0.174	0.206	0.219

Note: ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 6. Results of influential mechanisms

Variables	Information effect		Governance effect		Reputation effect	
	Trans (1)	CS (2)	Gover (3)	CS (4)	Reput (5)	CS (6)
EID	0.115*	0.100***	-0.020**	0.100***	0.242**	0.101***
	(1.66)	(3.33)	(-2.33)	(3.30)	(1.97)	(3.33)
Trans		0.036***				
		(4.03)				
Gover				-0.222***		
				(-2.97)		
Reput						0.016***
						(3.07)
Size	0.087***	0.001	-0.010***	0.002	0.609***	-0.005
	(6.56)	(0.13)	(-4.84)	(0.27)	(24.58)	(-0.80)
Age	-0.053***	0.058***	0.001	0.057***	-0.419***	0.063***
	(-3.97)	(9.86)	(0.58)	(9.47)	(-15.97)	(9.79)
Lev	-0.266***	-0.042*	-0.045***	-0.062**	-0.570***	-0.043*
	(-4.16)	(-1.66)	(-3.34)	(-2.38)	(-5.14)	(-1.67)
ROA	1.298***	0.150**	-0.317***	0.126*	3.291***	0.146**
	(6.54)	(2.04)	(-8.68)	(1.66)	(10.92)	(2.00)
CFO	0.041	0.293***	-0.032	0.288***	0.822***	0.282***
	(0.32)	(5.51)	(-1.35)	(5.30)	(3.69)	(5.28)
TQ	0.003	-0.004	0.015***	-0.000	0.173***	-0.006
	(0.29)	(-1.01)	(10.80)	(-0.09)	(11.66)	(-1.62)
PPE	-0.019	0.141***	-0.045***	0.130***	-0.388***	0.146***
	(-0.24)	(4.18)	(-3.97)	(3.83)	(-2.71)	(4.27)
CC	-0.113**	0.139***	-0.011	0.132***	-0.389***	0.141***
	(-2.15)	(6.05)	(-1.30)	(5.77)	(-4.36)	(6.13)
Soe	0.039	-0.020	0.006*	-0.017	-0.059	-0.017
	(1.44)	(-1.62)	(1.71)	(-1.39)	(-1.20)	(-1.42)
Share	-0.004	0.028	-0.035***	0.020	-0.466***	0.035
	(-0.05)	(0.81)	(-3.35)	(0.57)	(-2.95)	(1.02)
Both	-0.013	0.012	0.006**	0.013	0.086**	0.010
	(-0.56)	(1.20)	(2.10)	(1.30)	(2.08)	(1.02)
Big4	0.018	0.007	0.007	0.009	0.202**	0.004
	(0.22)	(0.21)	(1.07)	(0.26)	(2.06)	(0.12)
Ind	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.398***	-0.211***	0.167***	-0.088*	-2.055***	-0.093*
	(22.77)	(-3.68)	(11.57)	(-1.67)	(-10.10)	(-1.79)
Obs.	4747	4747	4747	4747	4747	4747
R ²	0.115	0.211	0.357	0.208	0.488	0.208
Sobel test	2.178		2.395		2.629	

Note: ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Table 7. Results of heterogeneity analysis

Variables	Med_high	Med_low
	CS (1)	CS (2)
EID	0.139***	0.076
	(3.89)	(1.64)
Size	0.006	0.008
	(0.75)	(0.86)
Age	0.057***	0.055***
	(7.28)	(6.28)
Lev	-0.041	-0.062*
	(-1.18)	(-1.85)
ROA	0.166	0.227**
	(1.64)	(2.25)
CFO	0.220***	0.391***
	(2.98)	(4.94)
TQ	-0.005	-0.000
	(-0.93)	(-0.05)
PPE	0.067	0.201***
	(1.46)	(4.24)
CC	0.141***	0.121***
	(4.75)	(3.90)
Soe	-0.008	-0.026
	(-0.52)	(-1.49)
Share	0.010	0.038
	(0.22)	(0.83)
Both	0.007	0.019
	(0.54)	(1.38)
Big4	0.002	0.017
	(0.06)	(0.40)
Ind	Yes	Yes
Year	Yes	Yes
Constant	-0.133*	-0.167**
	(-1.96)	(-2.28)
Obs.	2247	2500
R ²	0.211	0.207
p-value	0.040	

Note: ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

and improving corporate governance and firm reputation. The grouped tests found that when media attention is higher, EID has a stronger effect on customer stability. This study deepens our understanding of the benefits of EID from customers' perspective and provides practical implications for regulators and enterprise managers in emerging economies.

Discussions

First, we find that EID promotes customer stability and hard information has a stronger positive effect. Different from existing research, the results verify that EID plays an important role in maintaining customer relationships. However, less than half of listed companies disclose environmental information in the form of independent reports each year, and the mean value of *EID* in our sample is 0.153. The level of EID is generally low [3]. Additionally, most existing studies do not consider the different effects of different types of environmental information. Our evidence indicates that hard information has greater benefits, but enterprises disclose less hard information than soft information. Therefore, the quality of information needs to be improved.

Second, this study shows that EID exerts “information effect”, “governance effect” and “reputation effect” on customer stability. Existing studies demonstrate that EID provides more valuable information, increases visibility, and builds green images [10]. In addition to the information effect and reputation effect, we also find that EID has a governance effect on enhancing customer stability. These mechanisms deepen our understanding of the benefits of EID and provide intrinsic motivation for enterprises to disclose more environmental information.

Third, the results indicate that media attention strengthens the positive relationship between EID and customer stability. Media attention is an external governance mechanism and an important channel of information transmission. Some research found that media attention has a moderating effect on the relationship between EID and corporate innovation and debt financing costs [11, 13]. We supplement empirical evidence on the role of media attention.

Implications

The conclusions of this study have important implications for regulatory authorities. First, it is vital to standardize the content and standards of EID. At present, there is less quantitative information, incomplete content, and low-quality of EID. Regulators need to further perfect rules and formulate more detailed guidelines, thus standardizing EID content. Second, it is of great importance to establish an environmental information-sharing mechanism. The Securities Regulatory Commission, Ministry of Ecology and Environment, and other relevant departments can form a cooperation mechanism and then build an environmental information-sharing platform. Enterprises would be required to publish environmental information timely

and accurately on the platform. Then, regulators could use big data technology to verify information to improve data consistency and accuracy. Third, it is necessary to strengthen the reward and punishment mechanism. Incentives should be given to enterprises that regularly disclose environmental information with high quality. Financial penalties should be imposed on enterprises that violate EID obligations.

This study also provides important management implications for enterprises. The results show that EID has a positive effect on customer stability. Therefore, enterprises need to realize the importance of EID and use it to maintain long-term cooperative relationships with customers. First, enterprises should disclose more environmental information. EID can reduce information asymmetry and demonstrate excellent environmental performance to customers. Hence, enterprises should provide more environmental information to customers. Second, the quality of environmental information needs to be improved. Enterprises should provide more accurate and timely environmental information for customers to make decisions. Allowing third-party organizations to participate in the collection, collation, and publishing of environmental information is an effective method. At the same time, enterprises can conduct verification and audit of EID through third-party organizations. Third, enterprises should innovate the methods of EID. On the one hand, enterprises ought to publish independent environmental reports to stakeholders regularly. On the other hand, enterprises can establish a website to disclose environmental information through diversified means such as pictures, videos, and text at any time.

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Conflict of Interest

The authors declare no conflict of interest.

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