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Corporate environmental disclosures and financial distress: evidence from an emerging market

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Abstract

This study examines the effect of corporate environmental disclosures on financial distress in Vietnam. From sustainability reports and annual reports of firms listed on the Ho Chi Minh Stock Exchange, we manually collected a dataset on environmental information disclosures about seven management standards, including the utilization of raw materials, energy usage, water consumption, conservation of land and soil, gas emissions, wastewater and solid waste, and compliance with environmental protection laws. We measure the level of environmental information disclosures based on the counts of these standards that a firm has disclosed and employed both Altman's Z-score and Ohlson's O-score as proxies for financial distress. The research sample includes 269 firms from 2015 to 2020. The findings indicate that firms with better corporate environmental disclosures tend to have lower financial distress levels. The results are robust with respect to different measures of environmental information disclosures and financial distress, and have implications for investors, creditors, and policymakers. We contribute to the literature by providing evidence from a frontier market with weak legal institutions, where various environmental issues and regulations about disclosing environmental information have just gone into effect.

Keywords: Environment, Financial distress, Information disclosure, Vietnam

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1. Introduction

Corporate environmental management practices have increasingly gained the attention of stakeholders because firms with better environmental management are more profitable and pose less financial risk (Cai *et al.*, 2016; Clarkson *et al.*, 2008; Attig *et al.*, 2013). Thus, disclosures about environmental issues made in sustainability reports or a specific section of annual reports are a way for firms to convey important information about their environmental management practices to concerned stakeholders (Gonzalez-Benito and Gonzalez-Benito, 2005; Neu *et al.*, 1998; Huang and Kung, 2010). However, there is substantial variation in environmental information disclosures across firms due to the heterogeneity of national sustainability disclosure regulations. Indeed, many countries' regulations include an opt-out clause enabling companies to disclose information on a discretionary basis (Brooks and Oikonomou, 2018).

From a stakeholder theory perspective, though, environmental disclosures help an enterprise build relationship with its stakeholders and thus potentially strengthen its financial position. Many studies have investigated the relationship between environmental information disclosures, environmental management practices, and corporate social responsibility (CSR) activities with such financial variables as capital constraints (Cheng *et al.*, 2014), cost of capital (El Ghouli *et al.*, 2011; Sharfman and Fernando, 2008), credit ratings (Attig *et al.*, 2013), and financial distress (Al-Hadi *et al.*, 2019; Jia and Li, 2022).

This paper investigates the impact of environmental information disclosures on financial distress in the Vietnamese stock market. This relationship has been examined in developed countries such as Australia (Jia and Li, 2022) and developing countries such as China (Shahab *et al.*, 2018). Jia and Li (2022) and Shahab *et al.* (2018) report a negative association between environmental performance and financial distress. Motivated by these findings, we examine this relationship in the Vietnamese context. Roy and Mukherjee (2022) report that Vietnam has the lowest average ESG (Environmental, Social and Governance) score among 56 countries in their dataset on corporate ESG disclosures. Additionally, Ghoul *et al.* (2017) indicate that CSR initiatives are more likely to improve access to financing in countries with weaker equity and credit markets and to enhance sales growth in countries with less powerful legal institutions. Vietnam is a frontier market with weak legal institutions and thus serves as an ideal context for investigating the relationship between environmental management and the extent of financial distress.

Moreover, due to its rapid economic growth, Vietnam has been experiencing various environmental issues. To improve businesses' environmental management practices, Circular No. 155/TT-BTC of the Ministry of Finance guiding information disclosures in the stock market was issued on 06 October 2015. It was the first legal document compelling Vietnamese listed firms to disclose information on sustainable development. Companies are required to report their impacts on the environment and society through separate sustainability reports or a special section in their annual reports. These reports include information about their management of raw materials, energy usage, water consumption, and compliance with the

laws on environmental protection. Based on this circular, the State Securities Commission of Vietnam (SSC) and the International Finance Corporation (IFC), a member of the World Bank Group, have issued guidance on environmental and social disclosures. The guidance encourages listed firms to adopt and improve disclosure practices.

Large Vietnamese firms such as Vietnam Dairy Products Joint Stock Company (“Vinamilk”) and Hoang Anh Gia Lai Joint Stock Company prepare sustainability reports based on the GRI (Global Reporting Initiative), but most listed firms just include a section, namely “the impacts of the company on the environment and society” in their annual reports to comply with the Ministry of Finance’s circular. Yet, many companies fail to report any environmental information in this section. Thus, the extent to which Vietnamese listed firms disclose environmental impacts varies widely. This variation, in turn, motivates us to answer the research question about the relationship between environmental information disclosures and financial distress in Vietnam.

To measure the number of environmental disclosures, we used 1 and 0 to score the disclosures related to seven management standards for using raw materials, energy usage, water consumption, land and soil conservation, gas emissions, wastewater and solid waste, and compliance with environmental protection laws. These standards are among 36 sustainability reporting standards suggested by the GRI and Circular No. 155. For each standard, we scored 1 if the firm mentions in the sustainability report or the annual report that it has engaged in environmentally beneficial activities, or it provides numbers pertaining to the standard, and scored 0 otherwise. Additionally, two dummy variables indicated whether an enterprise issues a stand-alone sustainability report and whether the firm discloses information related to its environmental responsibilities. We found that the extent to which a company discloses environmental information has a negative impact on financial distress as measured by Altman’s (1968) Z-score, i.e., firms with higher levels of environmental disclosures have lower levels of financial distress. The results are robust to Ohlson’s (1980) O-score (a different proxy for financial distress).

We contribute to existing literature by complementing evidence from a frontier market characterized by weak legal institutions, where various environmental challenges exist, and requirements for environmental information disclosures have gone into effect. The results are consistent with findings from Australia (a developed market) by Al-Hadi *et al.* (2019) and Jia and Li (2022), and China (a developing market) by Shahab *et al.* (2018) and Shahab *et al.* (2019). Moreover, we complement the studies on the association between CSR or ESG disclosures and bankruptcy risk in Vietnam. Nguyen *et al.* (2020) and Thuy *et al.* (2021) report negative associations between CSR disclosures and bankruptcy risk or firm risk. We have provided evidence of a negative association between environmental information disclosures and financial distress.

The remainder of this paper is structured as follows. Section 2 provides a literature review and develops a testable research hypothesis. Section 3 describes the data collection, variable

construction, and estimation methods. Section 4 reports and discusses the results. Finally, the paper is concluded in section 5.

2. Literature review and hypothesis development

Corporate environmental responsibility has become an important stakeholders' concern because firms are considered major sources of pollution and having poor environmental records tends to come with unexpected negative financial consequences (Jia and Li, 2022; da Silva Monteiro *et al.*, 2010). Stakeholders keep an eye on companies' environmental practices (da Silva Monteiro *et al.*, 2010; Huang and Kung, 2010). Thus, disclosure of environmental issues is a way that an enterprise communicates with its stakeholders to influence their image about its activities in corporate environment management (Gonzalez-Benito and Gonzalez-Benito, 2005; Neu *et al.*, 1998; Huang and Kung, 2010). A business can disclose information about environmental issues through either a sustainability report or a specific section in its annual report (Neu *et al.*, 1998; Huang and Kung, 2010).

Social disclosures, including environmental disclosures, can be mandatory or voluntary. Moreover, there is substantial variation in the extent and nature of reporting across firms. Many countries have adopted mandatory sustainability disclosure regulations; however, these regulations are typically introduced on a “comply or explain” basis. This basis facilitates firms' failure to disclose crucial information (Brooks and Oikonomou, 2018).

A line of literature has discussed the importance of environmental performance in improving a company's financial condition. From a stakeholder theory perspective, corporate environmental performance or environmental information disclosure helps a firm build a relationship with its stakeholders, which, in turn, could improve its financial condition. Cheng *et al.* (2014) show that enterprises with better CSR performance are less likely to have capital constraints. El Ghouli *et al.* (2011) find that better CSR practices reduce the cost of equity. Minor and Morgan (2011) document that CSR activities are important in a business's risk-management strategy. Attig *et al.* (2013) report a positive association between CSR activities and credit ratings. Al-Hadi *et al.* (2019) also show a negative association between CSR activities and financial distress. Finally, Jia and Li (2022) demonstrate that firms with better environmental performance have a lower probability of experiencing financial distress.

This paper investigates the impact of environmental information disclosures on financial distress. As just argued, through disclosures of environmental issues, a company can communicate with its stakeholders, thereby developing a relationship with them (Gonzalez-Benito and Gonzalez-Benito, 2005; Neu *et al.*, 1998; Huang and Kung, 2010), and thus can improve its financial condition. There are several explanations for this argument.

First, the relationship between environmental information disclosures and financial distress can be explained by the profitability of enterprises that disclose environmental information. From a voluntary disclosure perspective, businesses with better environmental performance due to their proactive environmental strategy have incentives to disclose relevant information to investors and other stakeholders (Clarkson *et al.*, 2008). Furthermore, environmental

disclosures improve corporate governance, changing the way a firm conducts its business (Ioannou and Serafeim, 2017). Disclosures induce a company to manage environmental issues efficiently to avoid reporting poor performance in this regard. Clarkson *et al.* (2008) find that enterprises disclosing more environmental information have better environmental performance. Moreover, businesses with better social and environmental management practices can gain some benefits such as product market advantages, attracting new customers, enhancing sales growth, improving employee productivity, operating efficiency, good relations with regulators, and enhanced branding, all of which contribute to profitability (Malik, 2015; Ghoul *et al.*, 2017). Profitable firms manage their assets efficiently and generate sufficient funds to meet financial obligations (Campbell *et al.*, 2008; Pindado *et al.*, 2008).

Second, the lower idiosyncratic risk of companies with better environmental performance or environmental information disclosures could explain the relationship between environmental information disclosures and financial distress. Past studies indicate that CSR activities that “do good” and “avoid harm” serve like insurance in a business’s risk management (Minor and Morgan, 2011; Godfrey *et al.*, 2009). Disclosures of these activities signal to stakeholders that the firm is a responsible member of society. If an adverse event occurs, it is thought to be due to bad luck rather than bad management, which helps the company save money, avoid regulatory scrutiny, and preserve its brand (Minor and Morgan, 2011). Using a sample of U.S. public enterprises, Cai *et al.* (2016) find that corporate environmental responsibility can reduce firm risk. Similarly, analyzing a sample of 17 EU countries, Tzouvanas *et al.* (2020) report that environmental disclosures reduce idiosyncratic risk. Corporate disclosure eliminates information asymmetries between a business and its stakeholders. By disclosing environmental information, a firm can improve its relationship with investors, customers, and regulators, thereby reducing its vulnerability to external and internal shocks (Tzouvanas *et al.*, 2020). In keeping with these arguments, Sharfman and Fernando (2008) find that firms with better environmental risk management have a lower cost of debt, while Attig *et al.* (2013) report that firms with better CSR activities have higher credit ratings. Environmental information disclosures reduce idiosyncratic risk, and less risky companies are less likely to become financially distressed (Campbell *et al.*, 2008). Evidence on the relationship between environmental management engagement or CSR activities and financial distress is found in both developed and developing countries. Attig *et al.* (2013) report that higher credit ratings tend to be awarded to US firms with better CSR performance. Al-Hadi *et al.* (2019) and Jia and Li (2022) find a negative association between CSR or environmental performance and the level of financial distress in Australia. Shahab *et al.* (2018) and Shahab *et al.* (2019) show that environmental performance or CSR activities can reduce the extent of financial distress in China.

There are several studies on Vietnamese corporate disclosures of ESG and CSR activities. Using data from 56 countries, Roy and Mukherjee (2022) document that, as previously noted, Vietnam has the lowest average ESG score in their sample. As Roy and Mukherjee (2022) indicated, Vietnamese society has a high power distance index and a low individualistic

culture, which could influence the ESG score. Nguyen *et al.* (2020) report that firms with higher CSR disclosure levels have lower bankruptcy risk. Thuy *et al.* (2021) show a negative relationship between the level of CSR disclosures and firm risk. Motivated by the prior studies in Vietnam, we propose the following hypothesis:

H1: Corporate environmental disclosures reduce the level of financial distress.

3. Research method

3.1 Data collection and variable construction

Environmental information disclosures

We manually collected data on environmental information disclosures from sustainability reports and annual reports of enterprises listed on the Ho Chi Minh Stock Exchange. Since Circular No. 155 took effect at the end of 2015, we used this year as the start of the research period. Additionally, we chose firms operating in seven industries that have an impact on the environment, including agriculture, energy, consumer goods, manufacturing, basic materials, medical, and real estate.

There are two ways to measure the level of environmental disclosures (Al-Tuwajri *et al.*, 2004). The first procedure is to count the number of pages, sentences, or words in the sustainability report or the environmental disclosure part of the annual report. The second method is to score the content of the environmental information disclosures. Because the first alternative has some limitations, Al-Tuwajri *et al.* (2004) employ the second one. We followed Al-Tuwajri *et al.* (2004) in scoring the environmental information disclosures of Vietnamese listed firms.

36 GRI sustainability reporting standards published in 2016 include environmental standards for managing eight areas: utilization of raw materials, energy usage, water consumption, conservation of land and soil, gas emissions, wastewater and solid waste, compliance with environmental protection laws, and environmental assessment of suppliers. Circular 155 mentions only four management standards: utilization of raw materials, energy usage, water consumption, and compliance with environmental protection laws. The standard on supplier environmental assessment is not mentioned in Circular No. 155 nor in most sustainability reports and annual reports of Vietnamese listed companies. Nevertheless, combating land degradation and restoring eroded land and soil are among the government's environmental concerns². Consequently, some listed enterprises, such as Vinamilk, disclose activities about their efforts to preserve land quality and prevent soil erosion. Accordingly, we focused our data collection on the first seven of the eight GRI environmental reporting standards. Because in Vietnam, there are no specific requirements for formatting the contents of sustainability reports or the specific sections in the annual reports, listed firms can follow the suggestions of the GRI and/or Circular 155 to present their activities related to these standards. Almost all reported information is about “doing good activities” such as solutions to reduce demand for raw

² See Final Country Report of the Land Degradation Neutrality Target Setting Programme in Vietnam

materials, energy usage, water consumption, and waste. Some businesses provide quantitative data about their activities. Still, negative information is rare in their reports. Many companies add a section about “the company’s impacts on the environment and society” as required but without any specific information. Although environmental information disclosure is mandatory in Vietnam, there are significant differences in the amount of information enterprises make public. Firms seem to be unfamiliar with disclosing environmental information compared to financial data. They also try to offset their activities’ negative environmental consequences by describing positive contributions to their communities.

Since the reported information is both quantitative (e.g., the amounts of materials, water, and energy consumed) and qualitative (e.g., description of efforts to reduce materials, water, and energy usage), it is difficult to score both forms meaningfully. So, for each of the seven management standards, we scored 1 if the company mentioned that it has done good things or provided relevant numbers in its sustainability report or the annual report and 0 if it did not. TSCORE is the total score for the seven standards of a given enterprise each year.

Moreover, because disclosed environmental information in sustainability reports tends to be better than in the annual reports, a dummy variable, SDR, that takes the value of 1 if the business issued a sustainability report and 0 otherwise, is used to measure the quality of environmental information disclosed.

Financial data and corporate governance data

Financial and state ownership data were retrieved from the FiiPro database, whereas Tai Viet Corporation (Vietstock) provided data on the board of directors. After merging the datasets and excluding observations missing data on at least one of our variables, we attained a sample of 1,158 observations from 269 listed firms on the Ho Chi Minh Stock Exchange from 2015 to 2020. Z-score, O-score, MARGIN, and MTB were winsorized at the first and 99th percentiles to control for the effect of outliers.

Variable construction

We use the following model to test the hypothesis:

$$Financial\ Distress_{i,t} = \alpha_0 + \alpha_1 Envi\ Disclosure_{i,t} + \sum_{j=1}^k \beta_j X_{j,i,t} + \varepsilon_{i,t}. \quad (1)$$

Dependent variable - Financial distress

We employ Altman’s (1968) Z-score as a proxy for corporate financial distress risk because of its wide application and efficiency in predicting bankruptcy (Agarwal and Taffler, 2008). A lower Z-score implies a higher level of financial distress. In Altman (1968), the Z-score is calculated as follows:

$$Z\text{-score} = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5 \quad (2)$$

where X_1 , X_2 , X_3 , and X_5 are working capital, retained earnings, EBIT, and sales deflated by total assets, respectively. X_4 is the ratio of the market value of equity to total liabilities. Altman (2013) explained that “due to the original computer format arrangement, variables X_1

through X4 must be calculated as absolute percentage values”. Thus, the Z-score has appeared in literature as described in Equation (3) (Dichev, 1998; Al-Hadi *et al.*, 2019) as follows:

$$Z\text{-score} = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5. \quad (3)$$

Altman (1968) uses cutoffs of 1.81 and 2.99 to classify firms into three zones: “Distress”, “Grey” and “Safe” zone. Particularly, firms having a Z-score below 1.81 are defined as “Distress” firms, firms with a Z-score between 1.81 and 2.99 are categorized as “Grey” firms, and those having a Z-score greater than 2.99 are considered as “Safe” firms. We also use a binary variable, DISTRESS, which equals 1 if the firm falls in the “Distress” zone and 0 otherwise.

Ohlson’s (1980) O-score serves as another proxy for corporate financial distress risk. The O-score is calculated with a higher O-score indicating a higher level of financial distress as follows:

$$O\text{-score} = -1.32 - 0.407SIZE + 6.03TLTA - 1.43WCTA + 0.076CLCA - 1.72OENEG - 2.37NITA - 1.83FUTL + 0.285INTWO - 0.521CHIN \quad (4)$$

where the variables are computed as follows. SIZE is the logarithm of total assets. In Ohlson (1980), total assets are deflated by the GDP price level index to assure the real-time implementation of the model. However, past literature such as Griffin and Lemmon (2002) and Guotai *et al.* (2023) often ignores this deflation. TLTA, WCTA, and NITA are total liabilities, working capital, and net income divided by total assets, respectively. CLCA is current liabilities deflated by current assets. OENEG is a dummy variable that takes 1 if total liabilities exceed total assets and 0 otherwise. FUTL is cash flows from operating activities divided by total liabilities. INTWO is a dummy variable that takes 1 if net income was negative for the last two years and 0 otherwise. CHIN is a change in net income deflated by the total absolute net income values of the current and previous years.

Explanatory variable of interest - Envi Disclosure

After computing the total score (*TSCORE*) over the seven standards of each firm in each year, we apply the method of Kim *et al.* (2014) to standardize the score as below:

$$ESCORE_{i,t} = \frac{TSCORE_{i,t} - Min.TSCORE_{j,t}}{Max.TSCORE_{j,t} - Min.TSCORE_{j,t}} \quad (5)$$

where $TSCORE_{i,t}$ is the total score of an individual firm i in year t , $Min.TSCORE_{j,t}$ and $Max.TSCORE_{j,t}$ are minimum and maximum values in year t of *TSCORE* in the industry j that firm i belongs to, respectively. $ESCORE_{i,t}$ is the standardized score of firm i in year t , ranging from 0 to 1.

In addition, we employ two more dummy variables: $SDR_{i,t}$ and $DISCLOSE_{i,t}$. As previously explained, $SDR_{i,t}$ equals 1 if in year t , firm i issues a standalone sustainability report, and 0 otherwise. Similarly, $DISCLOSE_{i,t}$ equals 1 if in year t , firm i discloses information related to

environmental issues (i.e., firms with a positive $TSCORE_{i,t}$), regardless of the report's form, and 0 otherwise.

Control variables

In keeping with previous research such as Darrat *et al.* (2016), Al-Hadi *et al.* (2019), Jia and Li (2022), and Deng and Wang (2006), we use a set of firm characteristics and governance characteristics as control variables: MARGIN (profit margin), SIZE (firm size), MTB (market-to-book ratio), LEV (leverage), DIV (dividend paying), CASH (cash and cash equivalents), LOSS (loss), LNAME (firm age), BSIZE (board size), DUAL (duality), BIND (Board independence), and STATEOWN (state ownership).

MARGIN (profit margin) is net income deflated by sales. LOSS (loss experience) is one more dummy variable. It equals 1 if the firm experienced a net loss and 0 otherwise. MARGIN and LOSS are controlled for the firms' profitability (Al-Hadi *et al.*, 2019; Attig *et al.*, 2013) because profitable firms have lower financial distress levels (Al-Hadi *et al.*, 2019).

SIZE (firm size) is a common factor in predicting financial distress (Altman, 1968). Here, firm size is measured as the logarithm of total assets. Larger firms have greater market power, better reputation and competitive advantages, and better access to credit and are less likely to become financially distressed (Kane *et al.*, 2005; Al-Hadi *et al.*, 2019). On the other hand, small firms tend to be more innovative and resilient, and thus, are less likely to experience financial distress (Kane *et al.*, 2005). Additionally, due to better access to finance, larger firms are inclined to use more debt (Heyman *et al.*, 2008) and to have more complex financial structures. These structures facilitate managers in undertaking sophisticated but risky investments, and thus a higher probability of financial distress (ElBannan, 2021). Even so, the empirical results are mixed. Darrat *et al.* (2016) find that larger firms tend to have a lower likelihood of bankruptcy, while Kane *et al.* (2005) and ElBannan (2021) report an opposite result.

MTB (market-to-book ratio), measured as the market value of equity scaled by the book value of equity, is used in predicting financial distress (ElBannan, 2021; Darrat *et al.*, 2016; Jia and Li, 2022). Darrat *et al.* (2016) report that firms with a low market-to-book ratio have a lower probability of bankruptcy, but Jia and Li (2022) and ElBannan (2021) show contrary results, namely a negative association between the market-to-book ratio and the level of financial distress.

LEV (leverage) is an important factor in estimating financial distress (Altman, 1968). Firms with high leverage tend to have a higher likelihood of financial distress (Kane *et al.*, 2005; Darrat *et al.*, 2016; Jia and Li, 2022). LEV was measured as long-term debt divided by the sum of long-term debt and the market value of equity.

DIV (dividend paying) is another dummy variable that takes a value of 1 if the firm pays dividends in the year and 0 otherwise. Firms that pay dividends are less subject to financial constraints than non-dividend-paying firms and less dependent on debt financing

(Verwijmeren and Derwall, 2010). Furthermore, Verwijmeren and Derwall (2010) find that firms with dividend payments have higher credit ratings than non-dividend paying firms.

CASH (cash and cash equivalents) is an indicator of liquidity with which to meet short-term obligations. Firms with higher liquidity are less likely to fall into financial distress (Darrat *et al.*, 2016). CASH is calculated as cash plus cash equivalents deflated by total assets (ElBannan, 2021; Al-Hadi *et al.*, 2019).

LNAGE (firm age) is the logarithm of the number of years since the firm was first listed on the stock exchange. Earlier research argues that bankruptcy risk depends on firm age because younger firms are likely to have more financial risk (Altman *et al.*, 2017).

The board characteristics and ownership structure variables, BSIZE (board size), DUAL (duality), BIND (board independence), and STATEOWN (state ownership), are employed to measure the effectiveness of shareholders' monitoring and any governmental intervention. Better corporate governance can reduce managerial self-interest and lead to shareholder wealth maximization. State-owned enterprises often implement government policies, such as promoting employment and maintaining economic stability. The state therefore tries to prevent them from falling into financial distress (Deng and Wang, 2006). Correspondingly, these corporate governance variables can influence the level of firms' financial distress (Platt and Platt, 2012; Elloumi and Gueyie, 2001; Fich and Slezak, 2008; Deng and Wang, 2006). BSIZE is measured by the total number of members on the board of directors. In prior studies, empirical results about the relationship between board size and financial distress are mixed (Jia and Li, 2022; Fich and Slezak, 2008). DUAL is a dummy that takes the value of 1 if the chairman/woman is the CEO and 0 otherwise. BIND is the proportion of the number of independent members on the board. Fich and Slezak (2008) and Jia and Li (2022) show that firms with more independent directors are less likely to fall into financial distress.

Lastly, industry and year dummy variables are included to control for industry and year fixed effects.

3.2 Estimation method

To estimate Equation (1), we utilize the ordinary least square (OLS) method for the dependent variables of Z-score and O-score and use the maximum likelihood estimation of the logistic regressions with the binary dependent variable of DISTRESS. We estimate heteroskedasticity-robust standard errors to handle the potential heteroskedasticity issue of the panel data.

4. Results

Table 1 presents summary statistics on the variables included in our models. The mean value of the Z-score is 3.21, implying that, on average, our sample firms belong to the "Safe" zone (i.e., firms with a Z-score greater than 2.99). Yet, the mean value of DISTRESS indicates that 30.3% of the sample firms fall into the distress zone. ESCORE's mean value is 0.412, which has no economic meaning per se. However, TSCORE's mean is 2.54, suggesting

that, on average, Vietnamese listed firms reported information about just two or three of the seven standards. The means of SDR and DISCLOSE indicate that sustainability reports were released in only 1.9% of the sample firms, whereas 75.2% of the companies studied disclosed environmental information in their annual reports. Although Circular No.155 had taken effect, 24.8% of the sample firms had no reports with information about the impacts of their business on the environment. On average, levels of environmental information disclosures by the Vietnamese listed firms are somewhat limited.

Table 1. Descriptive statistics of key variables

Variables	No. of obs.	Mean	Median	Std. Dev.	Min	Max
Z-score	1,158	3.210	2.340	3.112	0.324	23.192
O-score	1,158	-5.284	-4.932	2.376	-16.537	-1.683
DISTRESS	1,158	0.303	0	0.460	0	1
ESCORE	1,158	0.412	0.429	0.314	0	1
TSCORE	1,158	2.540	3.000	1.935	0	7
SDR	1,158	0.019	0.000	0.137	0	1
DISCLOSE	1,158	0.752	1.000	0.432	0	1
MARGIN	1,158	0.112	0.070	0.140	-0.207	0.663
SIZE	1,158	14.325	14.225	1.248	6.806	19.864
MTB	1,158	1.673	1.447	1.068	0.129	5.973
LEV	1,158	0.091	0.039	0.121	0	1
DIV	1,158	0.797	1.000	0.402	0	1
CASH	1,158	0.084	0.054	0.094	0	0.696
LOSS	1,158	0.039	0.000	0.193	0	1
BSIZE	1,158	5.715	5.000	1.311	3	11
DUAL	1,158	0.172	0.000	0.377	0	1
BIND	1,158	0.571	0.600	0.259	0	1
STATEOWN	1,158	0.203	0.000	0.258	0	0.958

Sources: Authors' calculation

Table 2 reports Pearson pairwise correlations among our models' variables. The correlation between the Z-score and O-score is negative because the Z-score measures financial strength (a higher Z-score thus indicates a lower probability of financial distress) and the O-score is a measure of financial distress (a higher O-score indicates a higher probability of financial distress). The positive correlation between Z-score and ESCORE and the negative correlation between O-score and ESCORE suggest that firms providing more environmental information are less likely to fall into financial distress. Moreover, the low correlations among the explanatory variables indicate that multicollinearity is not a concern.

Table 2. Pearson pairwise correlation coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Z-Score	1.000														
(2) O-Score	-0.774	1.000													
(3) ESCORE	0.147	-0.122	1.000												
(4) MARGIN	0.345	-0.468	0.038	1.000											
(5) SIZE	-0.200	0.144	0.103	0.072	1.000										
(6) MTB	0.152	0.150	0.151	0.123	0.358	1.000									
(7) LEV	-0.305	0.217	-0.079	-0.005	0.186	0.078	1.000								
(8) DIV	0.182	-0.169	0.092	0.131	0.026	0.049	-0.068	1.000							
(9) CASH	0.233	-0.234	0.086	0.080	-0.163	-0.067	-0.140	0.184	1.000						
(10) LOSS	-0.123	0.170	-0.092	-0.295	-0.007	-0.005	0.049	-0.187	-0.098	1.000					
(11) LNAGE	-0.031	-0.034	-0.059	-0.061	-0.003	-0.163	-0.011	0.087	-0.008	0.038	1.000				
(12) BSIZE	0.023	-0.067	0.051	0.054	0.278	0.150	0.046	0.141	-0.021	-0.069	0.047	1.000			
(13) DUAL	-0.098	0.072	0.071	-0.055	-0.054	-0.083	-0.023	-0.060	-0.076	0.027	-0.080	-0.048	1.000		
(14) IND	0.012	-0.027	0.032	0.013	0.044	0.006	-0.010	-0.056	-0.012	0.025	-0.001	0.085	-0.108	1.000	
(15) STATEOWN	0.148	-0.116	0.017	0.079	-0.091	0.016	0.055	0.267	0.116	-0.084	0.049	-0.177	-0.251	-0.022	1.000

Notes: Bold correlation coefficients indicate significance at the 5% level.

Sources: Authors' calculation

Table 3. Regression of Altman's (1968) Z-score

VARIABLES	(1) Z-score	(2) Z-score	(3) Z-score
ESCORE	0.603** (2.39)		
SDR		1.371*** (3.10)	
DISCLOSE			0.223 (1.32)
MARGIN	6.798*** (6.66)	6.811*** (6.69)	6.798*** (6.66)
SIZE	-0.552*** (-7.56)	-0.556*** (-7.57)	-0.541*** (-7.42)
MTB	0.561*** (5.20)	0.569*** (5.34)	0.574*** (5.26)
LEV	-7.222*** (-10.52)	-7.374*** (-10.57)	-7.287*** (-10.60)
DIV	0.366** (2.58)	0.365** (2.54)	0.375*** (2.63)
CASH	3.023** (2.20)	3.106** (2.33)	3.129** (2.31)
LOSS	0.437 (1.40)	0.372 (1.20)	0.417 (1.35)
LNAGE	-0.0132 (-0.12)	-0.00488 (-0.04)	-0.0140 (-0.13)
BSIZE	0.112** (2.15)	0.106** (2.03)	0.112** (2.16)
DUAL	-0.259* (-1.75)	-0.214 (-1.53)	-0.214 (-1.48)
BIND	0.302 (0.75)	0.354 (0.88)	0.315 (0.79)
STATEOWN	0.674** (2.07)	0.652** (2.00)	0.687** (2.10)
Constant	8.113*** (7.99)	8.310*** (8.19)	7.929*** (7.84)
Observations	1,158	1,158	1,158
R-squared	0.373	0.373	0.370
Year fixed effects	YES	YES	YES
Industry fixed effects	YES	YES	YES

Notes: This table reports the effect of environmental information disclosures on the level of financial distress. The regressions are based on the ordinary least squares method. Z-score is Altman's (1968) Z-score. ESCORE is the standardized total score based on the sum of individual scores for seven management standards: utilization of raw materials, energy usage, water consumption, conservation of land and soil, gas emissions, wastewater and solid waste, and compliance with environmental protection laws. SDR is a dummy variable, which equals 1 if the firm issues a sustainability report in the year and 0 otherwise. DISCLOSE also is a dummy variable, which equals 1 if the firm discloses environmental information (i.e., firms with positive TSCORE) and 0 otherwise. Control variables are profit margin (MARGIN), firm size (SIZE), market-to-book ratio (MTB), leverage (LEV), dividend paying (DIV), cash-holding (CASH), loss (LOSS), firm age (LNAGE), board size (BSIZE), duality (DUAL), board independence (BIND), and state ownership (STATEOWN). Year and industry fixed effects are controlled for in all regressions. Robust t-statistics in parentheses. *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Sources: Authors' calculation

Table 3 reports regression results from Equation (1). The coefficient of ESCORE in Column (1) is statistically significant and positive, indicating that companies with a high level of environmental disclosures have a higher Z-score. The coefficient of SDR in Column (2) also is statistically significant and positive, implying that firms releasing a standalone sustainability report have a higher Z-score. A standalone sustainability report provides much more environmental information than a special section in the annual report. This finding is consistent with Al-Hadi *et al.* (2019) and Jia and Li (2022). It supports our hypothesis that companies with a high level of environmental disclosures tend to have a higher Z-score or a lower level of financial distress.

As indicated in past literature, firms that disclose more environmental information have better social and environmental management practices (Clarkson *et al.*, 2008) and thus can gain some benefits such as product market advantages, better employee productivity, higher efficiency in operations, good relations with regulators, and enhanced branding, all of which contribute to profitability (Malik, 2015). Additionally, by disclosing environmental information, a firm can develop its relationship with investors, customers, and regulators, thereby diminishing its vulnerability to external and internal shocks (Tzouvanas *et al.*, 2020) and reducing firm idiosyncratic risk. Furthermore, a standalone sustainability report also indicates the managers' efforts to communicate with the stakeholders and to build trust with them. Finally, profitable and less risky companies are less likely to become financially distressed (Campbell *et al.*, 2008).

The coefficient on MARGIN is significant and positive, indicating that more profitable firms have lower financial distress levels. This finding is in line with prior literature by Al-Hadi *et al.* (2019) and Jia and Li (2022). Profitable firms generate sufficient funds to meet their financial obligations and thus are less likely to fall into financial distress (Campbell *et al.*, 2008; Pindado *et al.*, 2008).

The SIZE coefficient is significant and negative, suggesting that the larger an enterprise's size, the higher its level of financial distress. The result aligns with the evidence presented by Kane *et al.* (2005) and ElBannan (2021). Distressed firms tend to have larger sizes. With better access to finance, larger firms tend to use more debt (Heyman *et al.*, 2008) and have more complex financial structures, enabling managers to undertake sophisticated but risky investments, thus increasing the probability of financial distress (ElBannan, 2021).

The coefficients on MTB, LEV, DIV, and CASH are consistent with findings in earlier research (Kane *et al.*, 2005; Darrat *et al.*, 2016; Jia and Li, 2022; Verwijmeren and Derwall, 2010). Businesses with a high market-to-book ratio, low leverage, dividend paying, and larger cash holdings are less likely to fall into financial distress. Furthermore, the positive and significant coefficient of BSIZE implies that firms with more directors have a lower probability of financial distress, which is consistent with the findings of Fich and Slezak (2008) but differs from Jia and Li (2022).

The positive and significant coefficient of STATEOWN suggests that greater state ownership is associated with a lower likelihood of a firm falling into financial distress. This finding is consistent with the evidence on the negative association between state ownership and financial distress in Deng and Wang (2006). State-owned enterprises often implement government policies, and the state therefore tries to “keep” them from falling into financial distress (Deng and Wang, 2006). The marginally significant, negative coefficient of DUAL in Column (1) indicates that firms with CEO duality are more likely to be financially distressed (Jia and Li, 2022).

Then, we replace the dependent Z-score with the binary DISTRESS variable and estimate logistic regressions to test our hypothesis. Table 4 reports the results. The coefficients on ESCORE and DISCLOSE are significant and negative, which is in line with the results in Table 3 that firms disclosing more environmental information are less likely to fall into the “Distress” zone.

Table 4. Regression results of logit models

VARIABLES	(1) DISTRESS	(2) DISTRESS	(3) DISTRESS
ESCORE	-0.657** (-2.33)		
SDR		-1.549 (-1.40)	
DISCLOSE			-0.441** (-2.27)
MARGIN	-1.607** (-2.30)	-1.632** (-2.37)	-1.617** (-2.34)
SIZE	0.170** (2.29)	0.160** (2.11)	0.161** (2.16)
MTB	-0.107 (-1.19)	-0.119 (-1.34)	-0.109 (-1.23)

Table 4. Regression results of logit models (*continued*)

VARIABLES	(1)	(2)	(3)
	DISTRESS	DISTRESS	DISTRESS
LEV	7.015*** (9.96)	7.211*** (9.97)	7.019*** (9.88)
DIV	-0.428** (-1.99)	-0.420** (-1.97)	-0.434** (-2.01)
CASH	-9.520*** (-5.40)	-9.526*** (-5.45)	-9.574*** (-5.43)
LOSS	2.103*** (4.22)	2.182*** (4.49)	2.106*** (4.17)
LNAGE	0.144 (1.14)	0.128 (1.01)	0.128 (1.02)
BSIZE	0.0250 (0.36)	0.0251 (0.36)	0.0312 (0.45)
DUAL	-0.376 (-1.52)	-0.444* (-1.82)	-0.420* (-1.70)
BIND	0.189 (0.41)	0.161 (0.35)	0.202 (0.44)
STATEOWN	0.335 (0.93)	0.324 (0.90)	0.352 (0.97)
Constant	-3.159*** (-2.98)	-3.132*** (-2.91)	-2.938*** (-2.75)
Observations	1,158	1,158	1,158
Year fixed effects	YES	YES	YES
Industry fixed effects	YES	YES	YES

Notes: This table reports the effect of environmental information disclosures on the level of financial distress. The regressions are based on logistic regressions. DISTRESS is a binary variable, that is 1 if the firm falls in the distress zone (i.e., firms with a Z-score lower than 1.81) and 0 otherwise. E-SCORE is the standardized total score based on the sum of individual scores for seven management standards: utilization of raw materials, energy usage, water consumption, conservation of land and soil, gas emissions, wastewater and solid waste, and compliance with environmental protection laws. SDR is a dummy variable, which equals 1 if the firm issues a sustainability report in the year and 0 otherwise. DISCLOSE also is a dummy variable, which equals 1 if the firm discloses environmental information (i.e., firms with positive TSCORE) and 0 otherwise. Control variables are profit margin (MARGIN), firm size (SIZE), market-to-book ratio (MTB), leverage (LEV), dividend paying (DIV), cash-holding (CASH), loss (LOSS), firm age (LNAGE), board size (BSIZE), duality (DUAL), board independence (BIND), and state ownership (STATEOWN). Year and industry fixed effects are controlled in all regressions. Standard errors are robust. Robust z-statistics in parentheses. *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Sources: Authors' calculation

To check the robustness of our results, we utilize Ohlson's (1980) O-score instead of Altman's (1968) Z-score and re-estimate Equation (1). The results are shown in Table 5. As expected, the coefficients on ESCORE and SDR are significant and negative, indicating that companies with better environmental disclosures have a lower probability of financial distress, which is consistent with our previous finding and supports our hypothesis.

Table 5. Regression of Ohlson's (1980) O-score

VARIABLES	(1) O-score	(2) O-score	(3) O-score
ESCORE	-0.654*** (-3.08)		
SDR		-1.153*** (-3.61)	
DISCLOSE			-0.132 (-1.02)
MARGIN	-8.186*** (-11.04)	-8.198*** (-11.20)	-8.189*** (-11.12)
SIZE	0.135 (1.28)	0.135 (1.27)	0.122 (1.15)
MTB	0.443*** (6.29)	0.431*** (6.13)	0.424*** (5.93)
LEV	3.229*** (3.31)	3.389*** (3.46)	3.332*** (3.38)
DIV	-0.204 (-1.59)	-0.207 (-1.60)	-0.218* (-1.70)
CASH	-2.768*** (-3.36)	-2.873*** (-3.57)	-2.904*** (-3.57)
LOSS	-0.255 (-0.97)	-0.186 (-0.71)	-0.213 (-0.82)
LNAGE	-0.0480 (-0.57)	-0.0519 (-0.60)	-0.0412 (-0.48)
BFSIZE	-0.157*** (-3.30)	-0.153*** (-3.19)	-0.159*** (-3.30)
DUAL	0.0907 (0.65)	0.0368 (0.27)	0.0315 (0.23)
BIND	-0.296 (-1.02)	-0.350 (-1.19)	-0.322 (-1.10)
STATEOWN	-0.478** (-2.02)	-0.465* (-1.95)	-0.498** (-2.09)

Table 5. Regression of Ohlson’s (1980) O-score (*continued*)

VARIABLES	(1)	(2)	(3)
	O-score	O-score	O-score
Constant	-5.637*** (-4.53)	-5.769*** (-4.58)	-5.460*** (-4.41)
Observations	1,158	1,158	1,158
R-squared	0.402	0.399	0.396
Year fixed effects	YES	YES	YES
Industry fixed effects	YES	YES	YES

Notes: This table reports the effect of environmental disclosures on the level of financial distress. The regressions are based on the ordinary least squares method. O-score is Ohlson’s (1980) O-score. ESCORE is the standardized total score based on the sum of individual scores for seven management standards: utilization of raw materials, energy usage, water consumption, conservation of land and soil, gas emissions, wastewater and solid waste, and compliance with environmental protection laws. SDR is a dummy variable, which equals 1 if the firm issues a sustainability report in the year and 0 otherwise. Control variables are profit margin (MARGIN), firm size (SIZE), market-to-book ratio (MTB), leverage (LEV), dividend paying (DIV), cash-holding (CASH), loss (LOSS), firm age (LNAGE), board size (BSIZE), duality (DUAL), board independence (BIND), and state ownership (STATEOWN). Year and industry fixed effects are all controlled in all regressions. Robust t-statistics in parentheses. *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Sources: Authors’ calculation

In addition to the above robustness checks, we also used alternative measures of environmental information disclosures: *TSCORE* is the total score for the seven standards of a given enterprise each year; a standardized z-score of *TSCORE*; and *TSCORE* deflated by the total management standards, i.e., 7, and obtained results qualitatively similar to the ones presented in this paper.

5. Conclusion

Using a manually collected dataset on disclosures of environmental information by Vietnamese listed firms, we investigated the relationship between the extent of environmental information disclosures and financial distress. We found that firms with more environmental information disclosures have a lower level of financial distress. Our results are robust with respect to different measures of environmental information disclosures and financial distress. Furthermore, although the disclosure of environmental information has become mandatory, there still are significant differences in the extent of the information disclosures among firms (Brooks and Oikonomou, 2018). Our results are consistent with the findings in a developed market like Australia (Jia and Li, 2022) and a developing market like China (Shahab *et al.*, 2018).

Our findings provide helpful insights for investors, creditors, and policymakers. Even in Vietnam, a frontier market, where regulations about disclosing environmental information have

just gone into effect to respond to various environmental issues, the extent of environmental information disclosures provides a good predictor for financial distress. Thus, investors and creditors can refer to environmental information disclosures in sustainability reports and annual reports when examining an enterprise's risk of bankruptcy. Their attention could induce businesses to provide further information in their reports. Moreover, given the importance of environmental issues nowadays, economic policymakers should issue further regulations or guidelines requiring firms to disclose all relevant information about their impacts on the environment and society.

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