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Corporate Environmental Information Disclosure and Earnings Management in China: Ethical Behaviour or Opportunism Motivation?

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Abstract: China has entered a new stage of high-quality economic development, which puts forward in-depth requirements for environmental protection. Companies in heavily polluting industries are required to disclose environmental information. Fulfilling environmental responsibilities and disclosing this information may be either a responsible moral act or an opportunistic act. Taking listed companies in China's heavily polluting industries from 2009 to 2020 as a sample, this study examines the economic consequences of enterprise environmental information disclosure (EID) from the earnings management (EM) perspective, as an external representation of 'ethical behaviour' and 'opportunism motivations' of EID and considers the effects of internal management competency and operating environment volatility. Findings include: (1) EID can restrain EM and support the 'ethical behaviour' motivation of EID. (2) Compared with the 'soft disclosure' of environmental information, the effect of 'hard disclosure' on EM is more obvious. (3) Greater management competency can strengthen the EM governance role of EID, while greater environmental uncertainty weakens this mechanism. (4) EID in enterprises in a mature period, state-owned, western regions, or low public environmental concern areas show an inhibitory effect on EM. Furthermore, its moralistic tendencies are more obvious compared with enterprises in growth or recession periods, non-state-owned, eastern regions, and those with high public environmental concerns.

Keywords: environmental information disclosure; earnings management; managerial competency; environmental uncertainty

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1. Introduction

Recently, rapid economic growth in China has caused serious environmental pollution, which in turn has restricted economic development. This is despite 'protecting the environment' being China's basic national policy. The 19th National Congress of the Communist Party of China indicated that it is necessary to build an environmental governance system with the government in the lead role, enterprises as the main body, and social organizations and the public as participants. Establishing and perfecting the environmental information disclosure system is an important measure to strengthen the leading role of the government and an effective means to encourage enterprises to implement the main responsibility of environmental protection. Since 2003, China's securities regulatory authority has required listed companies in heavily polluting industries to disclose environmental information. However, the results of this system based on external pressure were unsatisfactory. The constraints from state governance, media opinion, industry competition and public supervision disallowed companies' senior management from voluntarily fulfilling their disclosure obligations [1–3]. Since the 2008 publication of the Guidelines for Environmental Information Disclosure of Listed Companies and the required contents and methods of environmental information disclosure (EID) of enterprises being improved, the disclosure contents are selective and self-serving, with more positive and difficult-to-verify descriptive information and less negative information about resource consumption and pollutant control [4].

However, the continuous optimization of corporate EID behaviour has been observed. The Evaluation Report on Environmental Responsibility Information Disclosure of Listed Companies in China (2021) indicates that the level of EID among listed companies has gradually improved, and the disclosure index in 2021 is approximately 40 points, a 10-year high. Mandatory laws and regulations are important but are not the only determinant of firms' responsibility-related environmental expenditures [5]. From a weak external system background [6], the question is 'What is the motivation for enterprises to disclose environmental information?'.

Behavioural motivation involves the internal dynamics used to motivate individuals to conduct an activity. The existing research on the motivation of enterprise EID is mainly based on signalling theory and legitimacy management theory, from the perspective of environmental performance, and draws the opposite conclusion. According to signalling theory, there is a serious information asymmetry in environmental information inside and outside enterprises. When the external evaluation of the environmental performance of enterprises affects its value, enterprises can be different from those with a poor environmental performance by disclosing environmental information [7]. Currently, environmental performance is positively correlated with EID [8]. Legitimacy motivation upholds that enterprises disclose environmental information in order to meet the requirements and expectations of regulatory authorities and stakeholders [9] and manage the public's understanding of corporate environmental performance through EID, and environmental performance is negatively correlated with EID [10,11]. Compared with signalling theory, EID in legitimacy management theory is more similar to a tool for enterprises to disguise and guide the outside world to understand their own environmental performance, that is, to believe that enterprises bear environmental responsibility and disclose environmental information is a manifestation of "opportunistic" motivation.

At present, few studies examine the motivation of EID from the perspective of earnings management (EM). EM is the result of enterprise managers manipulating financial reports by accounting means or arranging transactions to mislead stakeholders regarding enterprise performance or affect contracts based on reported data. Its root lies in the moral hazard generated by enterprises in the information asymmetry environment [12]. EID helps improve the transparency of enterprises, and EM depends on reducing information asymmetry and continuously improving the information environment. Corporate environmental responsibility is a subitem of social responsibility, but it is different from social responsibility. From the perspective of EM, the academic community's conceptualisation of corporate social responsibility (CSR) motivation has developed into two opposite conclusions: the 'moral view' and the 'opportunistic view' [13,14], which provides a new perspective and feasibility for the study of EID motivation. Therefore, this study intends to discuss the impact of corporate EID on EM and considers it the external representation of either 'ethical behaviour' or 'opportunism' motivations of corporate EID. Regarding the current 'weak external system' EID situation in China, this study further considers the situational characteristics from two aspects: the abilities of internal management and fluctuations of operating environments.

The possible contributions of this paper include the following: Firstly, it investigates the impact of EID on EM, and classifies it into two types of environmental information 'soft disclosure' and 'hard disclosure', which enriches the study of the content and economic consequences of EID. Secondly, it explores the attitudes of enterprises related to the disclosure of environmental information. Existing empirical research on the motivation of CSR generally presents two opposing hypotheses, most of which are considered empirical issues. Starting from the segmentation dimension of CSR, this study is the first to explore the motivation of corporate EID using both theoretical analysis and empirical testing. It is helpful for stakeholders to better understand the essence of corporate EID and provide useful information for their own decision-making. Thirdly, from the perspective of corporate governance, it examines the moderating effect of internal management competency and operating environment uncertainty on the relationship between EID and

EM, which makes up for the deficiency of institutional constraints on corporate EID and has important theoretical guiding significance for enterprises to improve management competency and stabilize the operating environment. Fourthly, a comprehensive range of heterogeneous factors of EID is examined, including the enterprise life cycle, the nature of property rights, the geographical location, and the public environmental attention where the enterprise is located, which helps regulators to fully consider the different performance of enterprises with different characteristics in disclosing environmental information when further improving relevant laws and policies on EID.

2. Theoretical Analysis and Research Hypothesis

2.1. Environmental Information Disclosure and Earnings Management

Environmental responsibility originates from social responsibility and is an important branch derived from it. Previous EID research has been mostly combined with CSR research. Currently, the academic community generally agrees with the concept of CSR proposed by Carroll (1979) [15], believing that in addition to generating economic profits and complying with the law, enterprises should also comply with social ethics in their behaviour. Yang Ping (2009) [16] indicated that enterprises are not only economic entities, but also moral entities, and should, therefore, conduct economic activities in a manner consistent with regulations and ethical integrity, thereby achieving economic benefits. EM is an external intervention imposed by managers on accounting data. This type of intervention interferes with stakeholders' evaluation of the company and affects the results of contracts based on financial reports, which is regarded as immoral and irresponsible. Will enterprises committed to disclosing high-quality environmental information reduce the irresponsible behaviour of EM? The answer to this question remains to be analysed in combination with social responsibility. Previous research has formed two views on the influence of social responsibility on EM: 'ethical behaviour' and 'opportunism'. Specific to the mechanism of corporate EID on EM, this paper also begins with this analysis and considers the differences between EID and social responsibility.

The view of 'ethical behaviour' holds that enterprises, as an important part of social and economic activities, abide by social morality as their inherent requirement and that their behavioural essence conforms to social public order and good customs. In addition to reducing the problem of information asymmetry, CSR also includes moral responsibility, honesty, and trustworthiness. A study by Hong et al., (2011) [17] based on KLD data in the United States shows that enterprises that perform their social responsibilities well have less manipulation of real EM activities and higher quality accounting information. Scholtens et al., (2013) [18] took Asian enterprises as a sample and showed that enterprises with good CSR participated significantly less with EM. Almahrog et al., (2018) [19] found that companies that publish high levels of CSR information can reduce information asymmetries and strengthen relationships with stakeholders, rather than simply focusing on increasing profits. CSR activities are motivated by managers' incentives to be honest, trustworthy, and ethical [20]. Specific to research by Chinese scholars, Zhu Song (2011) [21] suggested that investors will expect enterprises with good social responsibility to have stable and optimistic future profit expectations. Therefore, enterprises can increase stakeholder trust and have more sustainable future profitability, and the informational value of their reported accounting earnings will increase. Chen Guohui et al., (2018) [13] showed that social responsibility shows an inhibitory effect on EM, whether it is regulatory disclosure or voluntary disclosure, and enterprises voluntarily fulfil social responsibility for ethical motives. Additionally, from a reputational perspective, enterprises earn better reputations for disclosing their social responsibilities, which mainly stems from media supervision. The reputation mechanism under media supervision is an important non-legal means of supervising corporate behaviour [22]. Under the reputation supervision generated by external public opinion, enterprises may pay more attention to social responsibilities in future decisions [4], which may help improve earnings quality.

'Opportunism' holds that voluntary CSR is a strategy to gain stakeholders' support and reduce the risks of EM. Enterprises incorporate multilateral contractual relationships which include stakeholders. Once stakeholders find negative signs of EM, they will take various measures to punish the management. This includes the loss of customers and reduced loyalty, potential administrative punishments by the government, loan restrictions by creditors, etc., which will eventually lead to reduced enterprise value. To avoid this situation and reduce pressure from stakeholders, enterprises will send positive signals to stakeholders by taking socially responsible actions and striving to meet their requirements. These positive effects can conceal the EM behaviour of enterprises or buffer the negative EM signals of enterprises. Mc Williams et al.'s (2006) [23] research showed that the good social image established by enterprise managers through social responsibility can reduce the supervision of stakeholders related to their EM behaviour, and thus maximize their interests. Prior et al., (2008) [24] also found that to reduce the vigilance of stakeholders regarding EM behaviour, management can win the support of stakeholders by actively undertaking CSR and buffering the aggressive punishment behaviour of stakeholders on their EM. Firms that engage in CSR are also more likely to engage in EM [14]. The conclusion of Li Shu et al., (2019) [25], with listed Chinese companies as samples, also supports the view of 'opportunistic motivation' of CSR. Similarly, from the perspective of reputation, enterprises that must disclose social responsibility reports may conduct more EM under the guise of a good reputation, which is equivalent to a layer of 'Insurance' for the company. When negative information related to the company appears, the public has a higher tolerance for a company with a good reputation, and a good reputation reduces the negative impact brought about by improper behaviour [26]. Therefore, CSR will function as a shield and concealment tool for corporate managers who conduct EM.

CSR is broad-ranging, and most scholars do not subdivide the subcategories of it. Zyglidopoulos et al., (2012) [27] put forward two ways for enterprises to participate in social responsibility: CSR 'strengths' and 'weaknesses'. The 'strengths' of CSR refer to the additional benefits provided by the enterprise to its stakeholders beyond the legal and narrow economic benefits, while the 'weakness' refers to the negative impact of enterprise management on its stakeholders after the cessation of CSR activities. The most significant difference between them lies in the flexibility and cost of implementation. Additionally, enterprises have greater freedom to enhance their 'strengths' than to reduce their 'weaknesses'. For example, in the process of enhancing CSR 'strengths', enterprises can choose to donate to any one of a long list of charities, increase any aspect of employee welfare, or participate in various other activities to benefit various stakeholders which are not limited to the basic legal authorizations of enterprises. In contrast, to reduce the 'weaknesses' of CSR, companies have no choice but to focus on specific aspects of their business that negatively impact society. For example, a company that pollutes the environment with a specific toxic waste can increase its CSR 'strengths' in a variety of ways but can only reduce its CSR 'weaknesses' by reducing the discharge of the specific toxic substance. Zyglidopoulos et al., (2012) [27] believed that, compared with the 'strengths' of CSR, the 'weaknesses' of CSR lack flexibility and the implementation costs are greater. Therefore, managers prefer to choose social responsibility 'strengths' with high flexibility and low implementation costs to conceal or implement opportunistic behaviours, rather than social responsibility 'weaknesses' with low freedom and high costs. The environmental responsibility belongs to the 'weakness' of social responsibility. Therefore, the possibility of corporate environmental responsibility and EID out of opportunistic motivation is low. Similarly, Li Shu et al., (2019) [25] divided the content of CSR into basic CSR and high-level CSR (including donations, charities, public welfare, etc.) according to a different emphasis. In this classification method, bearing environmental responsibility and disclosing environmental information belong to basic CSR. The research conclusion shows that the 'opportunistic motivation' that focuses on undertaking basic CSR is weak.

In summary, this paper suggests that enterprises arrange EID behaviour out of ethical consideration, which can effectively play the governance role in EM. Accordingly, this paper proposes the following hypothesis:

Hypothesis (1): *The better the EID, the lower the EM.*

2.2. Types of EID and EM

The environmental information disclosed by enterprises is not homogeneous. Clarkson et al., (2007) [7] called descriptive environmental information that is easy for enterprises to imitate from others as 'soft disclosure of environmental information (EIDs)', while they referred to quantified and verifiable environmental information that is not easy to be imitated by other enterprises as 'hard disclosure of environmental information (EIDh)'. They also suggested that EIDh has greater credibility because enterprises will face legal pressure if they are discovered to have lied about EIDh.

For Chinese heavy pollution industries, the state orders the relevant enterprises to disclose environmental information regularly, but there is no standardized unified disclosure format. This results in the widespread phenomenon of 'too much expression of strategic planning' and 'too little actual practice information'. This hidden mode of EID amounts to 'cheap talk' (mismatches between environmental strategy and action) which is both a low-cost reputation-building mechanism and a language strategy to coordinate the role conflicts between the company and regulatory authorities [28]. Especially in China, with its cultural background highly dependent on context, it is easier for management to influence the understanding of language audiences through induced language expression [29].

The practice of corporate EID is essentially a real or strategic reflection of environmental performance. From the perspective of the disclosure method, economic quantitative data are relatively objective and accurate and can better reflect the input and cost of an enterprise's environmental management, while vague qualitative information is often used by enterprises as a strategy to cope with external pressure [30]. According to voluntary disclosure theory and signal transmission theory, enterprises with good environmental performance tend to disclose verifiable and difficult-to-imitate environmental information to distinguish themselves from those with poor environmental performance and to improve the credibility and accuracy of the information. In turn, the level of EIDs will be improved accordingly. In contrast, enterprises with poor environmental performance are more inclined to disclose vague information that cannot be easily verified, especially when their legitimacy is threatened. They are also more likely to report low-quality environmental information that cannot be easily verified to compensate for or conceal their unreasonable behaviour. Thus, EIDh tends to be an objective description of the environmental management practices of enterprises and has higher informational content, reflects the responsible attitude of enterprises towards the environment, and reflects quasi-ethical performance. EIDs tend to become a kind of language strategy used by enterprises to build their reputations and divert the attention of stakeholders to meet their legitimacy requirements. Therefore, the following hypothesis is proposed:

Hypothesis (2): *Compared with EIDs, EIDh can reduce EM more effectively.*

2.3. Management Competency, EID, and EM

Management competency is a comprehensive reflection of managers' background characteristics and reflects their unique values and ethics, thus determining their attitudes towards decision-making processes. This includes information disclosure, which includes corporate EID decisions. Non-financial information such as corporate environmental responsibility is both a legal and moral category, and its essence is that management is dealing with social issues related to enterprises [31]. Regarding the governance effect of corporate EID on EM, the regulatory effect of management competency is manifested in two aspects: the influence on whether and how to fulfil environmental responsibilities and

the impact on how to convey the environmental responsibility-related practice information to the general public.

Based on Maslow's hierarchy of needs theory, management gradually realizes its own needs to achieve the goal of self-realization. Additionally, with less skilled management, the likelihood of internal power struggles increases [32]. Currently, management generally pays more attention to immediate interests, but with the increased ability, they will increasingly consider their long-term interests of self-realization for themselves and the company. Competent management tends to increase long-term benefits, avoid short-sighted effects, and has a greater risk-taking ability [33,34]. Even if environmental responsibility negatively impacts business performance in the short term, it can lead to rational decisions and identify the long-term value effect contained in immediate risks. It can also have a positive impact on whether enterprises choose to undertake and the level of environmental responsibility [35]. Welch et al., (2022) [36] utilised employees' ratings of their management as a signal of the manager's ability and proposed that more capable managers allocate resources to ESG in ways that improve shareholder value.

From the perspective of reputation theory, a good reputation will have a positive impact on the future of an enterprise, and enterprises can establish a good reputation through EID, which is beneficial to their long-term performance and value. The greater the ability of managers, the more they monitor their reputation to improve their competitiveness and gain competitive rewards [37]. Under the incentive and constraint of a good reputation, managers with strong abilities also pay more attention to their careers [38]. Competent management tends to change the business objectives of the enterprise from 'profit first' which was more common in the past, to 'people-oriented' in the present. Their leadership style also gradually moves toward ethical leadership and truthfully reports the environmental protection efforts made by the enterprise to its stakeholders with a responsible attitude, reducing the tendency toward opportunism.

Accordingly, this paper proposes the following hypothesis:

Hypothesis (3): *Management competency has a positive moderating effect on the relationship between EID and EM.*

2.4. Environmental Uncertainty, EID, and EM

Environmental uncertainty refers to the state in which it is difficult for enterprises to accurately perceive and judge future developments and changes. These can include the political, economic, social, and cultural environments. Environments impose constraints on enterprises and increase the systemic risks they face. Therefore, managers must include environmental factors as a category in the decision-making process of operation and management.

When the environmental uncertainty faced by an enterprise is high, its free cash flow will be reduced due to the greater operating risk, poor financial situation, and poor operating performance. Simultaneously, to reduce their risks, financial institutions tend to demand higher returns on capital as compensation for this risk or they raise the threshold for loan approval [39]. This further aggravates the financial constraints affecting enterprises. Under the double attack of internal and external unfavourable factors, management must urgently improve its operating conditions to avoid adverse effects on the implementation of its strategic objectives, and the salary levels and professional image of its managers. To quickly reduce risks and stabilize profits, enterprises must reduce expenses. As a non-core business of most enterprises, environmental responsibility is considered relatively unprofitable, and management will prioritize reducing environmental protection investment. Additionally, the possibility and degree of EM will increase along with increasing environmental uncertainty [40].

In summary, when environmental uncertainty is high, enterprises will have a higher degree of EM and poor environmental performance. If enterprises are still trying to fulfil their environmental responsibilities and maintain good EID at this time, it is reasonable to suspect that they may be motivated by opportunism. Thus, a good level of EID conceals

the motivations and behaviour associated with EM and further conceals losses and other negative information. Based on these factors, this paper proposes the following hypothesis:

Hypothesis (4): *Environmental uncertainty has a negative moderating effect on the relationship between EID and EM.*

3. Data and Methodology

3.1. Sample and Data Collection

The environmental information disclosed by enterprises is mostly concentrated in the social responsibility report, environmental report, and annual report. China's capital market first began implementation of new mandatory social responsibility information disclosure regulations in 2009, and the heavily polluting industries have strong environmental sensitivity. Therefore, this study selected heavily polluting industries A-share listed companies in Shanghai and Shenzhen Stock Exchange from 2009 to 2020 as the initial research samples. The identification of heavily polluting industries is mainly based on the Catalogue of Industries for Environmental Protection Verification and Classification of Listed Companies issued by the Ministry of Environmental Protection in June 2008, the Guidance on Environmental Information Disclosure of Listed Companies and the Guidance on Industry Classification of Listed Companies revised by the China Securities Regulatory Commission in 2012. The industry codes referring to firms in heavily polluting industries are B06, B07, B08, B09, B10, C15, C17, C18, C19, C22, C25, C26, C27, C28, C29, C30, C31, C32, C33, D44, and D45. The final sample size was 7725 after excluding companies with abnormal listings (ST, *ST, PT) and missing variable data during the study period. To reduce the interference of outliers on the results of the study, all continuous variables were reduced by 1% on both sides. The data used in the study were all from the China Stock Market & Accounting Research Database (CSMAR), and the empirical study was processed using the STATA version 15.0 statistical software (StataCorp LLC, College Station, TX, USA).

3.2. Model construction and variable description

According to the described theoretical analysis, this paper constructs Model 1 to verify Hypothesis (1), Model 2 to verify Hypothesis (2), and Models 3 and 4 to verify Hypotheses (3) and (4), respectively, to investigate the impact of corporate EID on EM. The specific models are set as follows:

$$EM_{i,t}/REM_{i,t}(AEM_{i,t}) = \beta_0 + \beta_1 EID_{i,t}(+\beta_2 REM_{i,t}) + \sum \beta_j \times Control_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$EM_{i,t}/REM_{i,t}(AEM_{i,t}) = \beta_0 + \beta_1 EIDh_{i,t}/EIDs_{i,t}(+\beta_2 REM_{i,t}) + \sum \beta_j \times Control_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$\begin{aligned} EM_{i,t}/REM_{i,t}(AEM_{i,t}) &= \beta_0 + \beta_1 EID_{i,t} + \beta_2 MC_{i,t} + \beta_3 EID_{i,t} \times MC_{i,t}(+\beta_4 REM_{i,t}) \\ &+ \sum \beta_j \times Control_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (3)$$

$$\begin{aligned} EM_{i,t}/REM_{i,t}(AEM_{i,t}) &= \beta_0 + \beta_1 EID_{i,t} + \beta_2 EU_{i,t} + \beta_3 EID_{i,t} \times EU_{i,t}(+\beta_4 REM_{i,t}) \\ &+ \sum \beta_j \times Control_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (4)$$

The main variables involved in the model are described as follows:

1. Dependent Variable: Earnings Management

(1) Accrual Earnings Management

This paper utilises the modified Jones model [41] to calculate accrued earnings management.

$$\frac{TA_{i,t}}{A_{i,t-1}} = \beta_0 \frac{1}{A_{i,t-1}} + \beta_1 \frac{\Delta REV_{i,t}}{A_{i,t-1}} + \beta_2 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) + \varepsilon_{i,t} \quad (5)$$

$$NDA_{i,t} = \hat{\beta}_0 \frac{1}{A_{i,t-1}} + \hat{\beta}_1 \frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} + \hat{\beta}_2 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) \quad (6)$$

$$DA_{i,t} = \frac{TA_{i,t}}{A_{i,t-1}} - NDA_{i,t} \quad (7)$$

In the above formula, TA refers to total accrued profit, which is equal to operating profits minus net cash flow from operating activities, and NDA refers to non-operating accrued profit. ΔREV_t is the change in operating income, ΔREC_t is the change in accounts receivable, PPE_t is the net fixed assets of period t, and A_{t-1} is the total assets at the end of year $t-1$ which is used to eliminate the scale effect. Industry-by-industry and year-by-year regressions were conducted using Formula (5) to obtain a regression coefficient which is used in Formula (6) to obtain a non-controllable accrued profit NDA, and then in Formula (7) to obtain a modified controllable accrued profit (DA). The absolute value of DA was utilised to obtain the accrued earnings management (AEM) value. The larger the absolute value, the larger the earnings management space and the lower the information quality.

(2) Real Earnings Management

This paper utilises the model of Dechow (1998) and Roychowdhury (2006) [42] to measure the real earnings management level of enterprises.

$$\frac{CFO_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \frac{1}{A_{i,t-1}} + \alpha_2 \frac{REV_{i,t}}{A_{i,t-1}} + \alpha_3 \frac{\Delta REV_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (8)$$

$$\frac{PROD_{i,t}}{A_{i,t-1}} = b_0 + b_1 \frac{1}{A_{i,t-1}} + b_2 \frac{REV_{i,t}}{A_{i,t-1}} + b_3 \frac{\Delta REV_{i,t}}{A_{i,t-1}} + b_4 \frac{\Delta REV_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (9)$$

$$\frac{DISEXP_{i,t}}{A_{i,t-1}} = c_0 + c_1 \frac{1}{A_{i,t-1}} + c_2 \frac{REV_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (10)$$

$$REM_{i,t} = |(-1)A\_CFO_{i,t} + A\_PROD_{i,t} + (-1)A\_DISEXP_{i,t}| \quad (11)$$

In the above formula, $CFO_{i,t}$ is the net operating cash flow of enterprise i in the year of t, $PROD_{i,t}$ is the production cost, which is equal to the sum of the current operating cost of the enterprise and changes in inventories, $DISEXP_{i,t}$ is the operating expenses, which is equal to the sum of sales expenses and management expenses. $REV_{i,t,}$ is the operating income of enterprise i in the year of t, and $\Delta REV_{i,t}$ is the change in business income of enterprise i in t year. $\Delta REV_{i,t-1}$ is the change in business income of enterprise i in t-1 year, and $A_{i,t-1}$ is the total assets at the end of the $t-1$ period, which is used to eliminate the scale effect. Regression residuals of each model are obtained by industry and annual regression, which include abnormal values of each index, cash flow of abnormal business activities A_CFO, abnormal production cost A_PROD, and abnormal discretionary expenses A_DISEXP. Real earnings management (REM) is calculated using Formula (11). The greater the REM value, the higher the degree of real EM of the company.

(3) Earnings Management

As AEM and REM reflect their respective EM levels, respectively, in practice, the company management will integrate or substitute these two methods based on their characteristics [43]. To fully reflect the overall level of enterprise EM, this study draws lessons from the research of Feng Liyan et al., (2016) [44] and defines the overall level of EM as the sum of AEM and REM.

2. Independent Variable

(1) Environmental Information Disclosure

Regarding the measurement of EID, most previous studies collected relevant environmental information manually from the carriers of listed companies' annual reports, social responsibility reports and environmental reports according to their needs and have used the text analysis method to construct corresponding indexes. This paper also utilises this method and combines the contents of the CSMAR environmental research database, using five first-level indicators and thirty second-level indicators. These include environmental liability disclosure, environmental management disclosure, environmental supervision

and certification disclosure, EID carrier, and environmental performance and governance disclosure to comprehensively reflect the EID of enterprises. For environmental liabilities and environmental performance and governance, if the qualitative description was '1', the quantitative description is '2', and the undisclosed value is '0'. If the remaining indicators are disclosed, the value is '1', otherwise, the value is '0'. These scores were then summed and divided by the maximum possible score of 42 to obtain the EID values.

Furthermore, according to the characteristics of environmental information, it is divided into two categories: 'hard disclosure' and 'soft disclosure'. Intuitively speaking, 'hard disclosure' information refers to that objective and specific information that is not easily imitated, including environmental liabilities and environmental performance and governance. The actual score of 'hard disclosure' information is divided by 42 to obtain the hard disclosure of environmental information (EIDh) value. 'Soft disclosure' information refers to information with empty content and no substantive significance, including environmental management disclosure, environmental supervision and certification disclosure, and EID carrier. Dividing the actual score of 'soft disclosure' information by 42 provides the soft disclosure of environmental information (EIDs) value.

(2) Management Competency

Using Demerjian's (2012) [45] concepts as a reference, data envelopment analysis (DEA) and Tobit regression were used to measure management competence. First, six variables including net fixed assets (PPE), Intangible assets (Intangible assets), Goodwill (Goodwill), R&D expenditure (R&D), operating costs (COGS) and selling and administrative expenses (SG&A) were used as inputs. Revenues (REV) were used as the sole output variable. DEA was used to estimate the production efficiency (θ) of the listed company, and the θ value was between 0 and 1. The closer the value was to 1, the higher the production efficiency of the company would be. The estimation model is shown in Model 12.

$$\max_{v}\theta = \frac{\text{REV}}{\nu_1\text{PPE} + \nu_2\text{Intangible} + \nu_3\text{Goodwill} + \nu_4\text{R\&D} + \nu_5\text{COGS} + \nu_6\text{SG\&A}} \quad (12)$$

Furthermore, to exclude the influence of factors such as company characteristics other than management ability among the determinants of production efficiency of listed companies, the Tobit model was utilised to remove company size (natural logarithm of the company's total assets at the end of the year), listing years, and degree of diversification (i.e., the number of industries involved in business operations), market share, nature of ownership, free cash flow (dummy variable) and other fixed effect factors of the company affecting its production capacity. The residual obtained reflects the ability of the management. The change in residuals from small to large indicates the change in management ability from weak to strong. A positive value indicates that an enterprise's management has a strong ability, i.e., the management can effectively use its established resources to create more output or expend fewer resources under the established output and generate higher productivity rates. A negative value indicates that management is less capable and consumes more resources for a given output.

(3) Environmental Uncertainty

Using Shen Huihui et al., (2012) [46] as a reference, this study uses the industry-adjusted coefficient of variation of abnormal income during the past five years to measure the environmental uncertainty faced by enterprises.

(4) Control Variables

Referring to the previous literature on earnings management [13,47], the following control variables are set: company size (Size), asset-liability ratio (Lev), return on total assets (Roa), growth (Growth), audit quality (Big4), audit opinion type (Audit), equity concentration (Top1), management compensation (Magpay), and annual fixed effect (Year) and industry fixed effect (Industry).

Table 1 shows the names, symbols, and definitions of variables utilized in Model 1–Model 4.

Table 1. Definitions and measures of major variables.

Nature of Variables	Variable Name	Variable Symbols	Variable Description
Dependent Variables	Accrual Earning Management	AEM	|DA| from Modified Jones model
	Real Earnings Management	REM	$REM_{i,t} = \|(-1)A\_CFO_{i,t} + A\_PROD_{i,t} + (-1)A\_DISEXP_{i,t}\|$
	Earnings Management	EM	EM = AEM + REM
Independent Variables	Environmental Information Disclosure	EID	Total score of all environmental information disclosure indicator systems/maximum possible score 42
	Hard disclosure of environmental information	EIDh	Total score of soft disclosure part of environmental information disclosure indicator system/42
	Soft disclosure of environmental information	EIDs	Total score of hard disclosure part of environmental information disclosure indicator system/42
	Management Competency	MC	Refer to the detailed description above
	Environmental Uncertainty	EU	Industry-adjusted coefficient of variation for abnormal income over the past five years
Control Variables	Company size	Size	Natural logarithm of total assets
	Asset-liability ratio	Lev	Total liabilities/total assets
	Return on total assets	Roa	Net profit/total assets
	Growth	Growth	Operating income for the current period/the corresponding period of last year − 1
	Audit quality	Big4	The auditor is from the four largest international companies = 1; Otherwise = 0
	Audit opinion type	Audit	If the type of audit opinion is a standard unqualified opinion = 1; Otherwise = 0
	Equity concentration	Top1	The largest shareholder's shareholding ratio
	Management compensation	Magpay	The natural logarithm of total compensation for the top three executives
	Annual fixed effect	Year	Year dummy variable
	Industry fixed effect	Industry	Industry dummy variable

4. Empirical Results and Discussion

4.1. Descriptive Statistic

The descriptive statistical results of the sample are shown in Table 2. The average value of the sample companies' overall EM was 0.194 and the standard deviation was 0.155. The average REM was 0.129, of which the maximum value was 0.725 and the standard deviation was 0.131. This indicates that there were great differences in the degree of REM among different enterprises, and some enterprises have conducted significant REM. It is of great practical significance to explore the influencing factors of REM. The EID is quite different, with a maximum value of 0.738, a minimum value of 0, an average value of 0.204, and a standard deviation of 0.195. This reveals that the level of EID among listed companies in heavily polluting industries was uneven, with an average disclosure of one-fifth of all designated indicators. The EID in heavily polluting industries was generally poor. Specifically, examining the EIDh and EIDs separately, the average value of EIDh was 0.103, which reveals an average of 18% ($0.103 \times 42/24 = 0.180$) in all designated indicators, and the average value of EIDs was 0.101, which reveals an average value of 23.6% ($0.101 \times 42/18 = 0.236$) in all designated indicators. Enterprises were more inclined to disclose textual descriptive information. Finally, the statistical results of the control variables were generally consistent with the existing research and are not analysed individually here.

Table 2. Descriptive statistical results.

Variable	N	Mean	Median	Min	Max	Std. Dev.
EM	7725	0.194	0.155	0.016	0.902	0.155
REM	7725	0.129	0.091	0.002	0.725	0.131
AEM	7725	0.064	0.047	0.001	0.294	0.059
EID	7725	0.204	0.143	0	0.738	0.195
EIDh	7725	0.103	0.048	0	0.452	0.125
EIDs	7725	0.101	0.095	0	0.333	0.
EU	7725	1.259	0.968	0.144	6.446	1.076
Size	7725	22.46	22.26	20.07	26.22	1.278
Lev	7725	0.450	0.449	0.063	0.901	0.200
Roa	7725	0.041	0.034	−0.172	0.234	0.063
Growth	7725	0.137	0.078	−0.466	2.473	0.376
Big4	7725	0.068	0	0	1	0.251
Audit	7725	0.970	1	0	1	0.171
Top1	7725	0.352	0.332	0.091	0.767	0.151
Magpay	7725	14.37	14.35	12.56	16.33	0.729

4.2. Multiple Regression Analysis

1. Multiple Regression Analysis of EID and EM

Model 1 was used to test the correlation between EID and EM. Hausman test results indicated that the fixed effect model was more effective than the random effect model. The test results are reported in Table 3, in which the explained variables in columns (1), (2) and (3) are EM, AEM and REM, respectively. Columns (4) and (5) take REM as explained variables and group regression in the direction of REM.

Table 3. Regression results of EID and EM.

Variable	(1) EM	(2) AEM	(3) REM
EID	−0.0263 **	0.0017	−0.0242 **
	(−2.160)	(0.294)	(−2.488)
REM		0.0878 ***	
		(12.295)	
Size	−0.0204 ***	−0.0063 ***	−0.0117 ***
	(−4.431)	(−2.946)	(−3.163)
Lev	0.0720 ***	0.0225 ***	0.0399 ***
	(4.234)	(2.841)	(2.928)
Roa	0.4052 ***	−0.0095	0.3613 ***
	(11.327)	(−0.566)	(12.623)
Growth	0.0615 ***	0.0126 ***	0.0438 ***
	(13.869)	(6.062)	(12.348)
Big4	0.0205	0.0049	0.0140
	(1.344)	(0.689)	(1.148)
Audit	−0.0365 ***	−0.0135 ***	−0.0215 ***
	(−3.606)	(−2.856)	(−2.654)
Top1	0.0005 *	0.0001	0.0004 *
	(1.806)	(0.492)	(1.877)
Magpay	0.0029	0.0007	0.0032
	(0.633)	(0.343)	(0.897)
Constant	0.5829 ***	0.1972 ***	0.3139 ***
	(5.166)	(3.753)	(3.476)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	7725	7725	7725
R^2	0.0929	0.0592	0.0810

Note: *t* statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Column (1) in Table 3 shows that the EID coefficient was significantly negative at 5%, indicating that the higher the level of EID, the lower the overall EM level. This supports the 'ethical behaviour' hypothesis and Hypothesis (1) is verified. This indicates that the disclosure of environmental information by enterprises is a type of moral behaviour and is not an EM activity under the cover of EID, but a genuine activity serving society.

The results of examining the different effects of EID on both EM are presented in columns (2) and (3) of Table 3. EID and AEM are positively correlated, and not significant. EID and REM are negatively correlated at a 5% significance level. Compared with AEM, EID had a more significant inhibitory effect on REM. The possible reason is that the AEM only changes the accounting period of corporate profits, which has less distortion to performance, while the REM adjusts current profits by arranging real and unreasonable economic activities. Compared with AEM, REM has a more serious negative impact on the enterprise's operation and stakeholders' decision-making, which is more harmful to stakeholders. Once it is found, it will cause more damage to the enterprise's reputation and value, and its 'immorality' is more obvious. In addition, as no significant impact of EID on AEM was observed in the regression analysis of Model 1, only EM and REM were used as explanatory variables in the regression analysis of Model 2–4 in the following.

2. Multiple regression analysis of EID types

Table 4 reports the types of EID and EM, which are the test results of Model 2. Column (1) and column (2) use overall EM as the explanatory variable, the coefficient of EIDh was significantly negative, and the coefficient of EIDs was not significant. Columns (3) and (4) used the REM as the explanatory variable, and the EIDh coefficient was significantly negative at the level of 1%, while the EIDs coefficient was −0.0388 but did not pass the significance test. Therefore, Hypothesis (2) is verified. Compared with the 'soft disclosure' of environmental information, the governance effect of 'hard disclosure' on EM/REM is more obvious. EIDh tends to be an objective description of the environmental management practices of enterprises, with higher informational content, reflecting the responsible attitude of enterprises towards the environment, which is a quasi-ethical performance and can effectively reduce the enterprise's EM (especially REM). EIDs tend to become a kind of language strategy used by enterprises to build their reputations and divert the attention of stakeholders to meet their legitimacy requirements.

3. The Moderating Effect of Management Competency

Table 5 reports the Model 3 test results of MC, EID, and EM. Whether the total EM or the REM is taken as the explanatory variable, the coefficient of the cross-term of MC and EID (EID × MC) was significantly negative, indicating that strong MC promoted the 'moralism' of EID. Competent management tends to change the business objectives of the enterprise from 'profit first' which was more common in the past, to 'people-oriented' in the present. Their leadership style also gradually moves toward ethical leadership and truthfully reports the environmental protection efforts made by the enterprise to its stakeholders with a responsible attitude, increasing the tendency toward moralism, thus helping to suppress the degree of EM. Therefore, Hypothesis (3) is verified.

4. The Moderating Effect of Environmental Uncertainty

Table 6 reports the Model 4 regression results of EU, EID, and EM. Whether taking overall EM or REM as the explanatory variable, the EID coefficient was significantly negative, and the coefficient of EID × EU (the multiplier of EID and EU) was significantly positive, indicating that EU weakens the effect of EID on reducing corporate EM. When enterprises were facing greater external environmental pressure and if environmental performance and economic performance cannot be parallel, they may seek to develop their primary business at the expense of environmental protection. Currently, if good environmental performance remains, there is good reason to attribute it to opportunistic motivation. Thus, Hypothesis (4) can be verified.

Table 4. Regression results of EID types.

Variable	(1) EM	(2) EM	(3) REM	(4) REM
EIDh	−0.0373 **		−0.0361 ***	
	(−2.151)		(−2.601)	
EIDs		−0.0476		−0.0388
		(−1.606)		(−1.637)
Size	−0.0206 ***	−0.0203 ***	−0.0118 ***	−0.0116 ***
	(−4.469)	(−4.401)	(−3.206)	(−3.139)
Lev	0.0720 ***	0.0718 ***	0.0398 ***	0.0397 ***
	(4.231)	(4.222)	(2.927)	(2.913)
Roa	0.4053 ***	0.4055 ***	0.3614 ***	0.3616 ***
	(11.330)	(11.333)	(12.626)	(12.631)
Growth	0.0615 ***	0.0614 ***	0.0439 ***	0.0438 ***
	(13.881)	(13.852)	(12.362)	(12.330)
Big4	0.0207	0.0199	0.0142	0.0134
	(1.354)	(1.302)	(1.164)	(1.097)
Audit	−0.0367 ***	−0.0364 ***	−0.0216 ***	−0.0215 ***
	(−3.619)	(−3.596)	(−2.669)	(−2.645)
Top1	0.0005 *	0.0005 *	0.0004 *	0.0004 *
	(1.808)	(1.812)	(1.879)	(1.885)
Magpay	0.0029	0.0026	0.0033	0.0030
	(0.654)	(0.581)	(0.925)	(0.836)
Constant	0.5851 ***	0.5838 ***	0.3157 ***	0.3154 ***
	(5.186)	(5.172)	(3.497)	(3.492)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	7725	7725	7725	7725
R^2	0.0929	0.0926	0.0810	0.0805

Note: *t* statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. Regression results of managerial competence moderating effect.

Variable	(1) EM	(2) REM
EID	−0.0474 ***	−0.0430 ***
	(−2.853)	(−3.223)
MC	0.1734 ***	0.1376 ***
	(5.472)	(5.409)
EID × MC	−0.1551 *	−0.1626 **
	(−1.829)	(−2.388)
Size	−0.0085	−0.0041
	(−1.307)	(−0.794)
Lev	0.0886 ***	0.0507 ***
	(3.920)	(2.794)
Roa	0.2913 ***	0.2671 ***
	(6.027)	(6.883)
Growth	0.0668 ***	0.0519 ***
	(11.505)	(11.151)
Big4	0.0263	0.0181
	(1.333)	(1.143)
Audit	−0.0440 ***	−0.0164
	(−3.223)	(−1.496)
Top1	−0.0003	−0.0002
	(−0.829)	(−0.686)
Magpay	0.0074	0.0071
	(1.244)	(1.489)
Constant	0.2353	0.0888
	(1.509)	(0.709)
Year	Yes	Yes
Industry	Yes	Yes
N	5024	5024
R^2	0.1058	0.0971

Note: *t* statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Regression results of environmental uncertainty moderating effect.

Variable	(1) EM	(2) REM
EID	−0.0446 ***	−0.0413 ***
	(−2.828)	(−3.265)
EU	0.0066 ***	0.0025
	(2.706)	(1.299)
EID × EU	0.0163 *	0.0151 **
	(1.836)	(2.123)
Size	−0.0224 ***	−0.0128 ***
	(−4.849)	(−3.457)
Lev	0.0783 ***	0.0438 ***
	(4.601)	(3.210)
Roa	0.4201 ***	0.3698 ***
	(11.727)	(12.890)
Growth	0.0517 ***	0.0384 ***
	(10.703)	(9.922)
Big4	0.0195	0.0133
	(1.277)	(1.092)
Audit	−0.0337 ***	−0.0201 **
	(−3.326)	(−2.477)
Top1	0.0003	0.0003
	(1.180)	(1.408)
Magpay	0.0023	0.0029
	(0.504)	(0.797)
Constant	0.6237 ***	0.3386 ***
	(5.525)	(3.745)
Year	Yes	Yes
Industry	Yes	Yes
N	7725	7725
R^2	0.0967	0.0831

Note: *t* statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.3. Robustness Test

1. Using Instrumental Variable

This paper primarily examines the relationship between enterprise EID and EM, but the possibility of reverse causality also exists. That is, EM will affect the decision of enterprises to disclose environmental information. To solve the possible endogenous problem, this study used the instrumental variable method to test the robustness of the main conclusions. Considering the requirements of instrumental variables in terms of correlation and externality, referring to Zhu Wei et al., (2019) [2], the lagged two-period variables of EID were used as instrumental variables for two-stage least squares (2SLS) regression to solve the endogenous problems caused by reverse causality and missing variables. The sample volume was, therefore, reduced to 5592, and the corresponding regression results are reported in Table 7. During the first stage, the current EID was regressed by lagging two periods of EID and using the regression coefficient of L2. EID was found to be significantly positive, indicating that the instrumental variables have good explanatory power on the explanatory variables. During the second stage, the fitting value of EID (EIDi) was regressed with EM, and the EIDi coefficient was −0.092, which passed the verification to a 1% significance level. The higher the level of EID, the lower the degree of EM, and the higher the quality of earnings. The Kleibergen-Paap rk LM statistic was 2192.904, with $p < 0.01$. This significantly rejects the original hypothesis of 'insufficient identification of instrumental variables. The F value of the Cragg-Donald Wald weak instrumental variable test was 3281.7, indicating that there was no weak instrumental variable problem. Thus, after the use of instrumental variables to alleviate endogeny, the research conclusion is validated.

Table 7. Regression results of the instrumental variable.

Variable	(1) First Stage EID	(2) Second Stage EM
Size	0.022 ***	−0.017 ***
	(9.80)	(−7.17)
Lev	−0.004	0.083 ***
	(−0.31)	(6.60)
Roa	−0.004	0.469 ***
	(−0.09)	(12.68)
Growth	−0.009	0.066 ***
	(−1.58)	(11.83)
Big4	0.029 ***	0.026 ***
	(3.77)	(3.38)
Audit	0.006	−0.052 ***
	(0.58)	(−4.73)
top1	0.000 ***	0.001 ***
	(3.47)	(4.25)
Magpay	0.016 ***	0.010 ***
	(4.87)	(3.01)
L2.EID	0.535 ***	
	(45.57)	
EIDi		−0.092 ***
		(−4.25)
Constant	−0.585 ***	0.387 ***
	(−10.42)	(6.48)
Year	Yes	Yes
Industry	Yes	Yes
N	5592	5592
R^2	0.540	0.183

Note: *t* statistics in parentheses. *** $p < 0.01$.

2. Heckman's Two-stage Regression

This study also utilised Heckman's two-stage method to address the problem of sample selection bias. In the first stage, probit regression was conducted with whether the sample disclosed environmental information (ifEID) as the explanatory variable. Simultaneously, the average EID (m_EID) of other listed companies in the same year and industry was used as the exclusive constraint variable of the virtual variable of EID. Thus, due to the impact of the same industry supervision and cultural atmosphere, the results of EID in the same industry were similar, but the EID of others in the same industry did not directly affect the company's EM. Additionally, the model control factors may affect the EID. These include Size, Lev, Roa, and Growth. During the second stage, the Inverse Mills Ratio (IMR) was added to Model 1 for regression. Table 8 shows the results. In column (1), the regression coefficient of the exclusionary constraint variable (m_EID) was significantly positive at the 1% level, indicating that the EID of other listed companies in the same industry and year would have a positive impact on the company's EID decisions. This meets the selection conditions of the exclusionary constraint variable. In column (2), the IMR was not significant, indicating that there was no obvious selective bias in the selection of samples in this paper. The regression coefficient of EID was still significantly negative, which once again confirms the robustness of this study's conclusions.

Table 8. Regression results of Heckman's two-stage correction.

Variable	(1) ifEID	(2) EM
EID		−0.024 **
		(−1.971)
IMR		0.001
		(0.040)
Size	0.398 ***	−0.019 ***
	(22.828)	(−3.366)
Lev	−0.152	0.072 ***
	(−1.408)	(4.184)
Roa	0.671 **	0.407 ***
	(2.126)	(11.211)
Growth	−0.183 ***	0.061 ***
	(−4.001)	(12.948)
Big4		0.020
		(1.325)
Audit		−0.036 ***
		(−3.504)
Top1		0.001 **
		(2.002)
Magpay		0.003
		(0.712)
Constant	−10.969 ***	0.506 ***
	(−26.154)	(3.289)
m_EID	6.005 ***	
	(9.941)	
Year	Yes	Yes
Industry	Yes	Yes
N	7725	7725
R^2	0.242	0.098

Note: *t* statistics in parentheses. ** $p < 0.05$, *** $p < 0.01$.

3. Substitute Variable Measurement Method

Referring to Qi Huaijin and Liu Ruhan (2013) [48], the social responsibility rating score (RKScsr) in the rating report issued by Runling Global is used as an alternative variable for EID. Runling Global is a third-party authoritative agency for CSR information rating in China. Zhang Haoer, the founder of the agency, indicated that 'ratings do not evaluate the performance of enterprises in fulfilling social responsibility, but focus on investigating the quality and transparency of social responsibility information disclosure of listed companies. As shown in column (1) of Table 9, the coefficient of RKScsr was significantly negative, and the conclusions of this study remain unchanged.

4. Considering Policy Interference

On 1 January 2015, the new edition of the 'People's Republic of China Environmental Protection Law' came into force, explicitly requiring heavily polluting enterprises to disclose environmental information. This has been called 'the strictest environmental protection law in history'. Considering this exogenous shock, the sample is divided into two sub-samples using this as the time node and was then regressed. The results are shown in columns (2) and (3) of Table 9, and the EID coefficient was significantly negative. In the sub-samples before and after the implementation of the new environmental protection law, the governance effect of EM of EID can be observed, and the research conclusions of this study remain unchanged.

Table 9. Regression results for substitution variables and policy interference.

Variable	(1) EM	(2) Year < 2015 EM	(3) Year ≥ 2015 EM
RKScsr	−0.0010 **		
	(−2.028)		
EID		−0.0362 **	−0.0570 ***
		(−2.079)	(−4.493)
Size	−0.0035	−0.0220 ***	−0.0200 ***
	(−0.332)	(−7.077)	(−8.268)
Lev	0.0157	0.0888 ***	0.0792 ***
	(0.445)	(4.975)	(5.677)
Roa	0.6000 ***	0.8077 ***	0.4316 ***
	(8.669)	(14.675)	(10.548)
Growth	0.0601 ***	0.0566 ***	0.0569 ***
	(6.648)	(7.563)	(9.591)
Big4	−0.0068	0.0290 ***	0.0188 **
	(−0.304)	(2.586)	(2.061)
Audit	−0.0850 ***	−0.0773 ***	−0.0636 ***
	(−3.633)	(−4.537)	(−5.302)
Top1	0.0000	0.0003	0.0006 ***
	(0.014)	(1.520)	(3.958)
Magpay	−0.0117	0.0028	0.0173 ***
	(−1.462)	(0.606)	(4.746)
Constant	0.4138	0.6692 ***	0.3897 ***
	(1.643)	(8.822)	(6.229)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	2256	3101	4624
R^2	0.1288	0.1825	0.1223

Note: *t* statistics in parentheses. ** $p < 0.05$, *** $p < 0.01$.

4.4. Heterogeneity Analysis

To further explore the different performances of the governance effect of EID on EM under different enterprise characteristics, this section combines the micro and macro characteristics of enterprises to test Hypothesis (1). At the micro level, the enterprise life cycle and the nature of property rights are selected; at the macro level, the geographic location and the public environmental concern of the province are selected.

1. Heterogeneity of Enterprise Life Cycle

There are three methods to divide the life cycle of an enterprise in the existing literature: univariate method (e.g., enterprise age, profit index, scale, etc.), comprehensive index method and cash flow method. As the core of the vitality of an enterprise, cash flow embodies an enterprise's business development strategy and resource allocation ability. Judging the life cycle of an enterprise based on the positive and negative net cash flows of three types of activities, namely, enterprise operation, investment, and fundraising, can fully reflect the operating risk, profitability, and growth rate of an enterprise through different life cycles. Additionally, it can not only avoid the interference of inherent differences in the industry but also avoid making subjective assumptions about the sample distribution throughout the life cycle. It, therefore, has strong operability and objectivity. As the sample used in this study consisted of listed companies with Shanghai and Shenzhen A shares, the companies that have successfully listed have generally passed the initial stage. Therefore, referring to the methods of Dickinson (2011) [49] and Liu Shiyuan (2020) [50], all the sample companies were divided into a growth period, maturity period and decline period according to the cash flow characteristics of the operation, and the investment and financing of the enterprise, thus, defining the life cycle of the enterprise. The specific division method is shown in Table 10.

Table 10. Combination of cash flow characteristics at each life cycle of an enterprise.

Cash Flows	Growth Period		Maturity Period	Decline Period				
	Initia	Growth	Maturity	Decline	Decline	Decline	Elimination	Elimination
Net operating cash flows	-	+	+	-	+	+	-	-
Net investment cash flows	-	-	-	-	+	+	+	+
Net financing cash flows	+	+	-	-	+	-	+	-

The Model 1 regression results of grouping according to the life cycle of the enterprise are shown in columns (1), (2) and (3) of Table 11. Only in the enterprise sample with the mature stage in column (2) can EID significantly inhibit REM behaviour. Enterprises in the growth phase have just begun to generate profits and gradually occupy a certain product market. The business value of an enterprise, the enhancement of its brand competitiveness and the expansion of its product market can all be achieved by taking on more environmental responsibilities and disclosing more environmental information. The good reputation and image thus established can make it easier for an enterprise to obtain support from external investors. Currently, the moderate EID of enterprises tends to become a strategic tool for management to obtain resources without affecting the capital turnover of their enterprises. Mature enterprises have occupied a considerable market share, had stable profitability and cash flow, and have greater advantages in resources and capabilities, but they still face the dilemma of reducing investment opportunities. Stakeholders often have high expectations of mature enterprises, and if they minimize disclosure of environmental information and lack substantive environmental protection behaviour they may be regarded as insincere. Additionally, according to Maslow's hierarchy of needs theory, once the needs of enterprises to achieve business objectives have been met more attention will be paid to the pursuit of moral goals. During a recession, management pays more attention to the long-term survival of the enterprise. Continuing operations is its main goal, and environmental responsibility efforts undertaken will utilise the liquid resources of the enterprise. Therefore, compared with the growth and recession periods, mature enterprises are more inclined to disclose environmental information based on moral responsibility than opportunism, that is, the EID of mature enterprises can effectively reduce EM.

2. Heterogeneity of the Nature of Property Rights

As an enterprise characteristic under the special institutional background of China, the nature of ownership has an important impact on the empirical research of related issues of listed companies in China. The results of the grouping test according to the nature of ownership are reported in columns (4) and (5) of Table 11. Only in the sub-sample of state-owned enterprises was, the EID coefficient significantly negative, revealing the governance effect on EM.

Presently, China is in a critical period of economic system reform, with the reform of state-owned enterprises advancing daily. As a result, the reform of the property rights system has become a key concern. However, in the context of economic transformation, due to imperfect systems and laws, private enterprises are still subjected to policy 'discrimination' in many ways, and non-state-owned enterprises have difficulty obtaining equal market competition status comparable to state-owned enterprises. Thus, the living environment is not optimistic. The state-owned nature of state-owned enterprises itself determines the particularity of their EID. In addition to the economic, legal, and political responsibilities that they must fulfil, state-owned enterprises must also shoulder the expectations of society and the social responsibilities of protecting the environment and disclosing environmental information. In contrast, non-state-owned enterprises generally pay more attention to their economic performance, and their opportunistic motivation for EID is stronger than that of state-owned enterprises. Simultaneously, non-state-owned enterprises are more likely to try to improve their corporate reputation through EID and establish close ties with the government to maximize political patronage. Moreover, compared with the inherent ad-

vantages of state-owned enterprises, non-state-owned enterprises disclose environmental information more out of a strong tendency toward political rent-seeking. Therefore, due to their special position in the market economy, state-owned enterprises have shown relatively positive initiative and consciousness in undertaking environmental responsibilities. However, the opportunistic motivation of EID of non-state-owned enterprises is more intense, the concealing effect of EID is stronger, and the governance effect of EM behaviour is not obvious.

Table 11. Regression results of the heterogeneity analysis [(1)].

Variable	Enterprise Life Cycle [(2)]			Nature of Property Rights		Geographic Location		Public Environmental Attention [(3)]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Growth	Maturity	Decline	Non-State-Owned	State-Owned	Western	Eastern	Low	High
EID	−0.015	−0.025 *	0.010	−0.013	−0.028 **	−0.034 **	−0.016	−0.040 ***	0.001
	(−0.869)	(−1.838)	(0.259)	(−0.801)	(−2.438)	(−2.389)	(−1.207)	(−2.974)	(0.063)
Size	0.005	−0.031 ***	0.019	−0.019 ***	−0.001	−0.020 ***	−0.003	−0.011 **	−0.011
	(0.672)	(−5.184)	(1.405)	(−3.225)	(−0.276)	(−3.740)	(−0.537)	(−2.185)	(−1.383)
Lev	0.057 **	0.030	0.110 **	0.086 ***	0.000	0.024	0.058 ***	0.017	0.061 **
	(2.308)	(1.287)	(2.565)	(4.144)	(0.020)	(1.224)	(3.020)	(0.851)	(2.353)
Roa	0.286 ***	0.623 ***	0.074	0.467 ***	0.263 ***	0.382 ***	0.344 ***	0.362 ***	0.301 ***
	(4.844)	(14.040)	(0.986)	(11.289)	(6.463)	(8.927)	(8.904)	(9.023)	(6.104)
Growth	0.043 ***	0.045 ***	0.082 ***	0.035 ***	0.058 ***	0.047 ***	0.039 ***	0.049 ***	0.044 ***
	(7.388)	(7.303)	(6.234)	(6.658)	(11.870)	(9.494)	(7.667)	(10.397)	(6.615)
Big4	−0.021	0.036 **	−0.004	0.011	0.015	0.034 *	−0.003	0.031 *	−0.011
	(−0.763)	(2.378)	(−0.094)	(0.503)	(1.028)	(1.743)	(−0.204)	(1.702)	(−0.570)
Audit	−0.014	−0.042 ***	−0.031	−0.037 ***	−0.003	−0.001	−0.044 ***	−0.006	−0.036 ***
	(−1.001)	(−2.801)	(−1.310)	(−3.240)	(−0.252)	(−0.108)	(−3.940)	(−0.536)	(−2.751)
Top1	0.000	0.001 *	0.001	0.001 ***	0.000	0.001 ***	0.000	0.001 *	−0.000
	(0.133)	(1.906)	(0.760)	(2.735)	(0.041)	(2.695)	(0.134)	(1.826)	(−0.116)
Magpay	−0.004	0.003	0.006	0.011 **	−0.006	−0.001	0.009 *	0.002	0.006
	(−0.617)	(0.609)	(0.475)	(1.988)	(−1.331)	(−0.266)	(1.804)	(0.462)	(0.945)
Constant	0.059	0.705 ***	−0.395	0.496 ***	0.171	0.524 ***	0.100	0.289 **	0.426 **
	(0.347)	(4.776)	(−1.206)	(3.406)	(1.402)	(4.095)	(0.756)	(2.251)	(2.110)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3163	3357	1183	3852	3873	3586	4139	4061	2793
R^2	0.069	0.162	0.125	0.094	0.095	0.098	0.077	0.105	0.070

Note: [(1)] *t* statistics in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. [(2)] The sample with zero net investment and financing cash flows cannot be included in any one life cycle. Additionally, the sample size is small so this sample is deleted. The total sample size was reduced to 7703, slightly less than the total sample size of 7725, which does not have a substantial impact on the study's conclusions. [(3)] In the grouping regression results of public environmental concern, the sample size is 6854, which is less than the total sample size of 7725. The data of public environmental concern started in 2011, because urban smog was only disclosed by public figures and the media in 2011, and then became a well-known environmental problem in China.

3. Heterogeneity of Geographic Location

According to the geographical location of the sample enterprises, they are divided into eastern and western regions. The so-called 'eastern region' includes Beijing, Tianjin, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Hainan and 10 other provinces and cities. For simplicity, the rest of the provinces and cities are divided into the 'western region'. Columns (6) and (7) of Table 11 report the corresponding regression results, which indicate that the coefficient of EID is significantly negative only in the western region sample.

China has a vast land area spanning a great distance from east to west, and obvious economic, political, and cultural differences. Generally, it is believed that the economy in the eastern coastal areas is developing rapidly while economic growth in the western areas is relatively delayed. However, it should also be noted that the western region is rich in resources and has great developmental potential. The national development plan for the eastern and western regions differs. In the foundation stage of the western region

development of China from 2001 to 2010, construction focused on infrastructure, science and technology education, ecology and the environment, and other infrastructure construction. It also focused on the coordinated and sound development of the natural environment and economy. Unlike the traditional system in the eastern region which began in the late 1970s with development first and governance later, the western region has more advanced environmental awareness. From another perspective, the eastern coastal areas have rapid economic development, superior market systems and mechanisms, a good information environment and high information transparency. When enterprises in the eastern region disclose environmental information, the marginal impact on EM is relatively weak. In the western region, the information barrier is greater, and the information transparency is lower; thus, the market demand for incremental EID is higher.

4. Heterogeneity of Public Environmental Attention

Under the influence of a variety of public environmental attention, the effect of EID on EM will also vary. Referring to the research of Wu Libo et al., (2022) [51], using Baidu's environmental pollution search index as a proxy indicator of public environmental concern, the median of all provinces in the country in that year was used for grouping. If it was greater than the median, the index value was '1', otherwise, it was '0'. The regression results are reported in Columns (8) and (9) of Table 11. These results indicate that only in the samples with low environmental concern was the significant governance effect of EID on EM observed.

The public plays an important role in environmental governance. Public environmental demands theoretically affect the environmental strategy choices of the central government, local governments, and enterprises, and supplement the formal environmental regulation system. Environmental attention is an important manifestation of public environmental preferences. Additionally, enterprises located in areas with high demand for environmental protection from the public have low levels of managerial slack, and their EID have a small marginal impact on their EM. In contrast, based on the legitimacy theory, when faced with attention pressures from the external public, enterprises tend to conduct legitimacy management through EID. Currently, disclosing environmental information is a 'justification' made by enterprises for survival, and the effect of EID on EM remains limited.

5. Research Conclusions and Implications

This study uses the heavily polluting A shares listed companies in Shanghai and Shenzhen Stock Exchange as a sample to examine the impact of corporate EID on EM and uses this as an external representation of corporate EID motivation. The moderating effect of management competency and environmental uncertainty is further discussed. The primary conclusions are as follows: (1) The improvement of corporate EID is helpful to restrain EM behaviour, especially REM, supporting the 'ethical behaviour' motivation of corporate EID. (2) The nature of different types of environmental information varies. Compared with the descriptive 'soft disclosure information', the quantitative and verifiable 'hard disclosure information' that is difficult for other enterprises to imitate is more helpful to reduce EM. (3) Management competence has a positive moderating effect on the relationship between EID and EM, while environmental uncertainty has a negative moderating effect on it. (4) EID is more helpful to reduce EM in enterprises in a mature period, state-owned holding, western region, and low public environmental concern, compared with enterprises in growth and recession periods, non-state-owned enterprises, enterprises in the eastern region and enterprises with high public environmental concern in the province where they are located.

On the basis of the above conclusions, this paper puts forward the following policy recommendations: (1) Stakeholders should strengthen the overall cognition of corporate EID behaviour, improve the attention to corporate environmental information, effectively identify the motivation of corporate EID and the corresponding accounting information quality, and reasonably judge corporate value, so as to provide effective guidance for their own behavioural decision-making. (2) When the government and other regulatory authorities designate policies related to EID, on the one hand, they should fully recognize

the selective behaviour of enterprises in disclosing environmental information, and further promote enterprises to pay more attention to quantitative and verifiable EIDh on the basis of encouraging enterprises to improve the overall EID. On the other hand, differentiated EID policies are formulated for enterprises with different characteristics. (3) Enterprises should fully mobilize their initiative to disclose environmental information, improve the level of EID, optimize the structure of EID, and disclose as much specific and verifiable information as possible. In addition, enterprises should also effectively enhance the management competency of the enterprise, stabilize the external production and operation environment, and promote the advantages of EID in optimizing enterprise EM behaviour, to achieve a win-win situation for the environmental performance and economic performance of the enterprise.

This paper studies the motivation of enterprise EID from the perspective of EM accounting behaviour, and has made some meaningful research progress, but there are still some limitations and deficiencies, which need to be supplemented and improved by follow-up research: (1) Due to the limited data collected, this paper only focuses on the overall situation of corporate EID, as well as EIDs and EIDh, without paying attention to the emotional tone of environmental information and the consistency between environmental information and environmental practice. It is worth further discussing this issue in the background of the deepening new green development concept. (2) The research sample in this paper is only listed companies in heavily polluting industries. Under the current EID policy in China, which requires all listed companies to disclose environmental information, the future research sample can be expanded to all listed companies. (3) Apart from EM, which behaviours of enterprises can reflect the motivation of EID, which needs to be further explored. (4) After the motivation of the enterprise to disclose environmental information is verified, how the market reflects and whether investors can effectively identify can be further tested by post-event verification and other methods.

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