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Environmental Social Responsibility, Local Environmental Protection Strategy and Corporate Financial Performance — Empirical Evidence from Heavy Pollution Industry

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Abstract: This paper empirically examines the "responsibility-performance" interaction in the process of environmental social responsibility decision making by enterprises, using the listed companies in the heavy pollution industry in Shanghai and Shenzhen A-shares in China from 2010 to 2020 as the research sample. It finds that for environmental social responsibility, a company's expected performance surplus is more likely to promote a positive interaction between responsibility and performance than a gap; for regions with relatively negative environmental strategies, environmental social responsibility provides more efficient reputation transformation and motivates companies to invest in it; more competitive industries and enterprises with forward-looking environmental strategies tend to put performance feedback into the undertaking of environmental social responsibility. Therefore, the government and regulatory authorities to supervise the implementation of environmental responsibility of heavy polluting enterprises, so that enterprises to realize that emissions reduction and growth both, in the promotion of corporate financial performance and environmental responsibility to promote a positive at the same time, the formation of ecological level and corporate social level of the win-win situation.

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1.Introduction

Since the 21st century, with the continuous improvement of people's living standards, ecological and environmental issues have become a major concern, and for the first time, China's social and economic development is facing the double constraints of emission reduction and growth. China's environmental pollution problem and ecological civilization construction have reached an unprecedented height, and the relevant construction advice has now been incorporated into the overall layout of the "five-in-one" socialist cause with Chinese characteristics. Enterprises, as micro subjects of market economy, are important landing points of the overall layout of ecological civilization construction. While fully understanding the importance and urgency of ecological civilization construction, proactively carrying out environmental protection, implementing forward-looking environmental strategies, increasing environmental protection investment, carrying out green innovation and other environmental social responsibility behaviors are important measures for enterprises to respond to national policies and implement environmental strategies. However, the core goal of enterprises is to pursue profit maximization and steadily improve the value of enterprises. As a consumptive behavior, environmental social responsibility will increase the operating cost of enterprises and the uncertainty of future development. Then, can enterprises obtain stable financial performance compensation when they undertake environmental social responsibility? Can environmental social responsibility and corporate financial performance interact well? Is environmental social responsibility a positive "strategic innovation tool" or a selective "cover up tool" for enterprises? The solution of the above problems is directly related to the initiative, effectiveness and sustainability of enterprise environmental strategy.

This paper will solve the above problems based on the following two aspects of work: first, empirically test whether expected performance feedback, the antecedent variable of environmental social responsibility, has a clear promoting effect on enterprises' undertaking environmental social responsibility, and whether enterprises can get financial performance feedback in the lagging business cycle of undertaking environmental social responsibility? On the other hand, it empirically tests the regulatory effect of local government's environmental protection strategies, enterprises' forward-looking environmental strategies, industrial competitiveness and the nature of enterprises' property rights on the "responsibility performance" relationship.

The contributions of this paper are mainly reflected in the following four aspects: first, in combination with the background of double constraints of emission reduction and growth, the relationship between corporate environmental social responsibility and expected performance feedback is explored pertinently, and the role and characteristics of environmental responsibility in corporate social responsibility research are further explained while enriching the Research on social responsibility related scenarios; Second, by investigating the cross period interaction between corporate environmental responsibility and expected performance feedback, we further deepen our understanding of the relationship between them, and strive to obtain the theoretical support and empirical evidence of the enterprise internal circulation system of "expected performance feedback - environmental social responsibility - enterprise financial performance - expected performance feedback", so as to improve the feasibility of environmental protection policies of regulatory departments and provide micro theoretical support for corresponding policy formulation; Third, on the basis of the previous research on the relationship between the two, and to further enrich the research on the regulation mechanism, this paper examines the regulatory role of local government environmental protection strategies (environmental protection attitudes, environmental regulation intensity), industry competitiveness, enterprise forward-looking environmental strategies, and the nature of property rights in the interaction between corporate environmental responsibility and financial performance. It has certain practical and policy implications for the internal managers and external regulators of enterprises to realize the development mode of mutual promotion between corporate environmental responsibility and financial performance.

2. Literature review and theoretical analysis

2.1 Environmental social responsibility and corporate financial performance

The environmental social responsibility strategy of enterprises refers to a strategic choice that enterprises follow the requirements of government regulation or actively undertake social responsibility to protect the natural environment in order to reduce the adverse impact of enterprise activities on the natural environment. In recent years, many enterprises have taken the initiative to assume environmental social responsibility in the process of operation and realized positive feedback of financial performance. Its internal transmission mechanism mainly involves the following aspects: (1) the assumption of environmental responsibility has a signal transmission mechanism. There is information asymmetry between enterprises and stakeholders. Enterprises' undertaking environmental social responsibility is a kind of continuous altruistic behavior. Compared with social responsibility activities such as charitable donations and providing jobs, it can better reflect the consistency of enterprises' undertaking social responsibility and win the trust and support of all stakeholders (Zhou Hong et al., 2018; Li Qian et al., 2022); (2) Undertaking environmental responsibility can help enterprises gain legitimacy. Undertaking environmental social responsibility by enterprises is an

important response path to the government's environmental regulation, and it is also conducive to gaining the recognition and support of all stakeholders in the horizontal competition. It has become an important strategic resource of enterprises, helping enterprises to improve transaction efficiency, reduce transaction costs and gain competitive advantages (Zimmerman and Zeitz, 2002; Blackman, 2012); (3) Undertaking environmental responsibility by enterprises is a process of "strengthening internal strength" and an important way to achieve sustainable development strategy. Through the improvement of existing production techniques and equipment in the process of undertaking environmental responsibility, it is beneficial to save energy, turn waste into profit (Xu Zhiwei and Li Ruihan, 2019), reduce the legal litigation risk of enterprises, improve brand reputation, expand production and sales, and finally improve the financial performance of enterprises (Li Chuang, 2016; Tian et al., 2016; Xu Zhaocheng and Hou Jingchuan, 2019).

The positive impact of corporate environmental responsibility on financial performance tends to have a certain lag in terms of the transmission process by which responsibility affects performance. The reasons for this involve two aspects: first, because the real market is not a perfect market, many irrational factors can make it difficult for various stakeholders to have timely and complete information related to the environmental responsibility of the company (Kunieda and Nishimura, 2019), and the information takes some time in the process of transmission and identification; on the other hand, both the establishment of green word of mouth and reputation, or the development and introduction of green technologies need to go through a certain process and spend a certain cost. Therefore, the impact of corporate environmental responsibility on financial performance feedback often has a certain lag.

Financial performance is an important indicator to back feed the operating cash flow of an enterprise. Good performance acquisition ability means that an enterprise can expect stable cash flow and greater future development space. The theoretical support of financial performance for social responsibility mainly comes from the capital supply hypothesis. Good performance acquisition ability is the financial basis for enterprises to undertake social responsibility. Therefore, enterprises must have sufficient financial strength to undertake social responsibility on the basis of meeting their normal operation and development (Lee and Bannon, 1997). It is hard to imagine that a company struggling to maintain normal operations would be able to afford social responsibilities such as supporting the development of industry innovation, improving the community environment, enhancing employee welfare, and actively making charitable donations, not to mention environmental social responsibilities that are capital intensive, long-lasting, and may have technological spillover effects. Therefore, from the decision-making level of leaders, the feedback level of expected performance of enterprises will have an important impact on the behavior of enterprises to fulfill environmental social responsibility. To sum up, the following research assumptions are proposed in this paper:

H1: environmental social responsibility can promote the improvement of financial performance of enterprises, and good financial performance can positively affect the expected performance feedback of enterprises, thus promoting the level of environmental social responsibility commitment of enterprises. The above effects may be lagging, and the relationship between the two presents a cross period mutual promotion effect.

2.2 Influence mechanism of expected performance feedback

Expected performance feedback is an important factor affecting the strategic decision of enterprises. In a business cycle, when the actual financial performance of an enterprise is lower than the expected performance, the gap feedback of the expected performance will be generated. When the actual

financial performance is higher than the expected performance, we call it the expected performance surplus feedback here. The conclusions of previous studies on the relationship between expected performance feedback and corporate social responsibility decision-making are relatively complex, and the research on the relationship between them also has inconsistent conclusions. One type of research shows that when there is a gap in performance expectation feedback, enterprise decision-makers will show higher risk tolerance and tend to respond to performance problems by adjusting enterprise strategies, such as increasing enterprises' investment in certain risk strategies (Shinkle, 2012). Another type of research believes that the behavior of the gap enterprises will be relatively conservative, and they tend to reduce the strategic investment of enterprises in order to avoid uncertain risk losses. The threat rigidity hypothesis also provides theoretical support for this kind of phenomenon. The performance expectation gap can be interpreted here as an organizational threat, which will cause psychological pressure and anxiety of decision-makers, and the business behavior of enterprises at this time will be relatively conservative (Staw et al., 1981; He Xiaogang et al., 2017; Duanmu, 2018).

On the other hand, when the expected performance of an enterprise has a surplus, it indicates that the current operating level of the enterprise exceeds the expectation, and often shows a high level of social responsibility. The reason is that under the framework of the capital supply hypothesis, enterprises must have sufficient capital strength to undertake social responsibility on the basis of meeting their normal operation and development (Lee and Bannon, 1997). Good business performance makes enterprises have stronger capital capacity to undertake social responsibility; More importantly, enterprises with good performance will often receive the attention of competitors in the same industry and government regulators, and bear greater public opinion pressure and social supervision. Empirical evidence shows that many leading enterprises rushed into the hot search due to their negative performance in social responsibility, resulting in a decline in enterprise valuation. For example, Vanke during the Wenchuan earthquake, because the donation of 2.2 million yuan was far below the expectations of the industry and the public, resulting in a short-term sell-off of its shares by investors and a drop of nearly 10% in two trading days; During the period of COVID-19, after Xiaomi donated only 300000 yuan of medical protective materials for the first time, its donation behavior was widely questioned on social platforms such as Wechat and Zhihu. In order to alleviate negative public opinion, Xiaomi made an additional donation of 10 million yuan. Based on the above analysis, this paper makes the following assumptions about the impact mechanism of expected performance feedback:

H2: when there is a gap in expected performance of enterprises, it will promote decision makers to "burn the boat", which is manifested in that the commitment of environmental social responsibility is at a high level, and the feedback of expected performance is negatively related to the commitment of environmental social responsibility; At the same time, the expected performance gap has a positive regulatory effect on the responsibility performance relationship.

H3: when the enterprise has a surplus of expected performance, the decision-maker will take the initiative to assume social responsibility due to external pressure, which shows that the commitment of environmental social responsibility is at a high level, and the feedback of expected performance is positively related to the commitment of environmental social responsibility; At the same time, the expected performance surplus has a positive regulatory effect on the responsibility performance relationship.

2.3 Adjustment mechanism of local environmental protection strategies

The externality theory of environmental economics holds that in environmental governance, enterprises,

as passive subjects, need the government to formulate environmental policies, integrate economic constraints or value constraints into the organizational structure and business activities of enterprises, change the motivation and decision preference of enterprises to engage in certain behaviors (such as environmental violations or environmental pollution behaviors), and ultimately maintain the consistency between enterprises and external systems to achieve the goal of improving the environment. Some scholars have incorporated social responsibility into the framework of institutional theory and found that economic level and corporate social responsibility behavior will be regulated by policies (John, 2007). Environmental policies will affect the performance of environmental social responsibility by enterprises and the investment of enterprises in environmental social responsibility (Li Bin et al., 2011). In the relevant research on the absence of traditional social responsibility, scholars found that only through government environmental regulation can enterprises fulfill their social responsibility and achieve the effect of reducing resource waste and environmental pollution.

With the continuous strengthening of the concept of sustainable development, the consumer market, investment market and government departments have also strengthened their supervision and support for enterprise environmental governance. The more active environmental protection strategy of the government is manifested in the continuous promotion of environmental protection concept and higher local environmental regulation level. The above changes are conducive to the formation of good subjective initiative of enterprises in the region in environmental protection, So as to enable enterprises to invest resources in the construction of environmental social responsibility to a greater extent and achieve strong support for local government environmental protection policies. The two-way interaction between the government and enterprises on environmental protection strategies has also become an internal and external incentive tool, creating the possibility for enterprises undertaking environmental social responsibility to obtain good economic benefits. Based on the above, we propose the following assumptions:

H4: the environmental protection strategies of local governments have a positive regulatory effect on the "performance responsibility" relationship of enterprises.

Other studies have shown that the government's high-intensity environmental regulation will increase the operating costs of enterprises, thereby inhibiting the technological innovation of enterprises (Conrad and Wastle, 1995; Greenstone et al., 2012). At the same time, it may also add new constraints to the production decisions of enterprises, resulting in increased difficulties in management, production and sales, Resulting in the decline of total factor productivity of enterprises (Christiansen and Haveman, 1981; Gray and Shadbegian, 1993). Therefore, the excessively high environmental protection requirements of local governments will make some enterprises tired of coping, weaken enterprises' commitment to invest more funds in social responsibility to a certain extent, especially for the environmental social responsibility with long investment cycle and large capital consumption, its inhibitory effect on technological innovation may also weaken the level of commitment to environmental social responsibility. Based on the above, we propose another hypothesis:

H5: the environmental protection strategies of local governments have a negative regulatory effect on the "performance responsibility" relationship of enterprises.

2.4 Other adjustment mechanisms of internal and external environment of enterprises

In examining the impact of expected performance feedback on environmental social responsibility, in addition to local environmental protection strategies, this paper also pays attention to adjustment variables such as industry competitiveness, forward-looking environmental strategy of enterprises, and

ownership nature of enterprises, which have been widely concerned in previous studies on social responsibility related scenarios. In examining the impact of environmental social responsibility on financial performance, we take expected performance feedback as a regulating variable, and pay attention to the impact of the nature of enterprise ownership on the relationship between the two, so as to deeply explore the internal and external impact mechanisms of the two paths of "performance responsibility" and "responsibility performance".

3. Research design

3.1 Variable definition

1. Expected performance feedback (EPF). In the past, most scholars chose the net profit rate of total assets or the annual return on net assets as the proxy index when studying financial performance. Referring to the practice of Wu Jianzu (2020), this paper adopts a more perceptible operating profit margin as the proxy variable of enterprise financial performance. According to the enterprise behavior theory and performance feedback theory, bounded rational decision makers will set "satisfaction points" in advance rather than "maximum profit goals". They regard the gap between actual performance and expected goals as an important indicator for enterprises to measure their own "good" and "bad" performance, and also a key factor affecting decision-making. Expectations can be divided into historical expectations and industry expectations. The former is compared with the previous performance of enterprises, and the latter is compared with the performance level of peers. Expected performance is a comprehensive index set based on the linear combination of the past historical performance of the enterprise and the expected performance of the industry. The calculation formula is as follows:

$$A_{it-1} = (1 - \alpha_1)SA_{it-1} + \alpha_1HA_{it-1} \quad (1)$$

Where, SA_{it-1} is the average of the actual performance of all enterprises except the enterprise itself in the industry where the enterprise i is located in the $t-1$ year; HA_{it-1} represents the historical expected performance of enterprise i in the $t-1$ year, which is the actual performance measurement of enterprise i in the $t-1$ year and represents the weight. Referring to the study of Wang Jing et al. (2014), this study reports the regression results of α_1 equal to 0.5. When the expected performance feedback (P-A) is greater than 0, that is, when the actual performance is greater than the expected performance, it is called the expected performance surplus; When the expected performance feedback (P-A) is less than 0, that is, when the actual performance is less than the expected performance, it is called the expected performance gap.

2. Environmental social responsibility (CER). This paper uses the practices of Shen Hongtao (2017) and Zhang Zhaoguo (2019) for reference, and adopts the operating income pollution discharge rate as the proxy indicator of corporate environmental social responsibility. The reasons are as follows: first, the collection of pollutant discharge fees is intended to remind enterprises to reduce ecological damage, promote technological upgrading and environmental management within enterprises to reduce pollutant discharge, which is also a process of actively assuming environmental social responsibility; Second, the collection standard of sewage charges is divided according to the discharge of various types of pollutants, which can comprehensively reflect the overall sewage discharge situation of enterprises, and is comprehensive and scientific. Third, the sewage charge data is disclosed in the annual report details of each company, which can ensure the availability of data and the integrity of the overall sample. At

the same time, this indicator is a reverse indicator. The smaller the value, the less the pollutant discharge fee the enterprise needs to pay for its operating income, and the higher the enterprise's commitment to environmental responsibility.

3. Financial performance (UnEBIT). In previous studies, most of them used the rate of return on total assets or the rate of return on net assets as the financial performance measurement indicators, ignoring the possible "earnings management noise", which led to the deviation of their financial indicators from the reality and affected the reliability of the results. In order to reduce the interference of "earnings management noise" to the regression conclusion, the paper selects the EBIT rate of total assets after excluding earnings management as the proxy variable of financial performance indicators. The specific steps are as follows: first, the normal accrued profit margin is estimated based on Jones model (2); Then, the manipulated accrued profit rate DA is obtained by subtracting the normal accrued profit rate from the actual accrued profit rate, as shown in model (3); Finally, through the difference between the EBIT rate of total assets and the accrued profit rate of manipulation, the EBIT rate of total assets excluding earnings management is obtained, as shown in model (4).

$$\frac{TA_{i,t}}{Assets_{i,t-1}} = \alpha_0 \frac{1}{Assets_{i,t-1}} + \beta_1 \frac{\Delta Sales_{i,t}}{Assets_{i,t-1}} + \beta_2 \frac{PPE_{i,t}}{Assets_{i,t-1}} \quad (2)$$

$$DA = \frac{TA_{i,t}}{Assets_{i,t-1}} - (\hat{\alpha}_0 \frac{1}{Assets_{i,t-1}} + \hat{\beta}_1 \frac{\Delta Sales_{i,t}}{Assets_{i,t-1}} + \hat{\beta}_2 \frac{PPE_{i,t}}{Assets_{i,t-1}}) \quad (3)$$

$$UnEBIT_{i,t} = \frac{EBIT_{i,t}}{Assets_{i,t}} - DA \quad (4)$$

4. Local environmental protection strategy

This paper reflects the local government's environmental protection strategy from two aspects of guiding and mandatory indicators, that is, the local government's attitude towards environmental protection and the government's level of environmental regulation.

(1) Environmental attitude (EA). In recent years, information extraction from a large number of unstructured texts through computer-aided text analysis (CATA) has become an important text quantitative means for many scholars to measure the environmental strategies and practices of governments and enterprises. This method can effectively make up for the limitations of questionnaire survey, interview and other methods, such as strong subjectivity, low response rate and non replication. This paper refers to the research of Wang, Ruxi and Wijen, Frank (2018), and uses the CATA method to measure the environmental protection policies of local governments. Through the statistics of the frequency of environmental protection words in the reports of the provincial, prefectural and municipal governments, the government's attitude towards the environmental protection work in the jurisdiction is measured, that is, the government's environmental protection guidance strategies faced by enterprises.

(2) Environmental regulation (ER). Refers to the practice of Ye Qin et al. (2018), and calculates the comprehensive index ER of environmental regulation intensity by calculating the industrial wastewater discharge per unit output value, the industrial SO₂ discharge per unit output value, and the industrial smoke and dust discharge per unit output value. The larger the ER, the more pollution emissions, the weaker the environmental regulation intensity. This index is a reverse index. The specific measurement methods of environmental regulation are as follows:

First, the industrial wastewater discharge per unit output value, the industrial SO₂ discharge per unit output value and the industrial smoke and dust discharge per unit output value of each province are standardized, as shown in formula (5).

$$UE_{ij}^s = [UE_{ij} - \min(UE_j)] / [\max(UE_j) - \min(UE_j)] \quad (5)$$

Where, UE_{ij} is the emission per unit of output value of pollutant of category j in province i , and UE_{ij}^s is the standardized result of the index. $\max(UE_j)$ denotes the maximum value of emission per unit of output value of pollutant of category j in all provinces, and $\min(UE_j)$ denotes the minimum value of emission per unit of output value of pollutant of category j in all provinces. Calculate the weights of each type of pollutant.

$$W_j = UE / \overline{UE_{ij}} \quad (6)$$

UE_{ij} denotes the average level of unit output emissions of pollutant j for each year and province.

The composite index of environmental regulation for province i is:

$$ER_i = \frac{1}{3} \sum_{j=1}^3 W_j UE_{ij}^s \quad (7)$$

5. Industry competition (Compete). In previous studies, the reciprocal of the standard deviation of the profit margin of the main business or the number of enterprises in the same industry were mostly selected as the proxy indicators of industry competition. Compared with the two, the main business profit margin better reflects the degree of monopoly in the product market, so this paper uses the inverse of the standard deviation of the main business profit margin to measure the degree of industry competition.

6. Forward looking environmental strategy (PES). The source of this indicator data is highly consistent. Previous studies have judged whether an enterprise adopts a forward-looking environmental strategy by examining whether the enterprise has passed the ISO14001 environmental management system certification. Enterprises that have passed the certification indicate that the enterprise has adopted a forward-looking environmental strategy. The value of this variable is 1; Otherwise, the value is 0.

The definitions and measurement methods of each variable are detailed in Table 1.

Table 1 Variable Definition

Variable Type	Variable Name	Variable Symbols	Variable Metrics
Investigation Variable	Expected Performance Feedback	<i>EPF</i>	$P_{it}-A_{it}$
	Environmental Social Responsibility	<i>CER</i>	Sewage charges / operating income
	Financial Performance	<i>UnEBIT</i>	EBIT margin after excluding earnings management behavior
Regulating Variable	Nature of ownership	<i>OWNER</i>	State-owned or state-controlled enterprises take 1, otherwise take 0
	Environmental Protection Attitude	<i>EA</i>	The frequency of environmental protection words in the reports of prefecture-level municipal governments
	Industry Competition	<i>Compete</i>	Reciprocal of the standard deviation of the profit margin of the enterprise's main business

	Environmental Regulation	<i>ER</i>	Comprehensive Index of Environmental Regulation
	Forward-looking Environmental Strategy	<i>PES</i>	ISO14001 certification takes the value of 1, otherwise it is 0
Control Variables	Financial leverage	<i>LEV</i>	Total liabilities/total assets
	Enterprise Growth	<i>Growth</i>	Growth rate of operating revenue
	Shareholding Concentration	<i>TOP10</i>	Shareholding proportion of top ten shareholders
	Board Size	<i>Aboard</i>	Natural logarithm of the number of directors
	Proportion of independent directors	<i>IBD</i>	Number of independent directors / total number of directors
	Two jobs in one	<i>Duality</i>	When the chairman of the company and the general manager are the same person, it is 1, otherwise it is 0
	Enterprise Age	<i>Age</i>	The natural logarithm of the company's establishment year plus 1
	Redundant Resources	<i>slack</i>	The average value of current ratio, asset liability ratio and expense income ratio represents the degree of redundant resources of the company
	Return on total assets	<i>ROA</i>	Net profit / average total assets
	Enterprise Size	<i>Size</i>	Natural logarithm of total assets at the end of the year
	Total Assets	<i>Assets</i>	Total assets

3.2 Descriptive statistics of data sources and variables

In this paper, the listed companies in the heavy pollution industry monitored by the state of Shanghai and Shenzhen A-shares from 2010 to 2020 are selected as the research samples. After excluding the listed companies with missing data, the unbalanced panel data consisting of 1255 observations from 196 companies in 11 years is obtained. The data of the enterprise's pollutant discharge fee is manually sorted out from the management fee details in the annual report of the enterprise. The data of industrial wastewater discharge, industrial SO₂ discharge and industrial smoke and dust discharge are from the China urban statistical yearbook. Other data are directly or indirectly calculated and obtained through the CSMAR database and the annual report of the enterprise. The descriptive statistical results of each variable are shown in Table 2.

Table 2 Descriptive statistics of variables

Variable name	mean	standard deviation	minimum	maximum
EPF	0.0154	0.2586	-3.6829	4.1075
UnEBIT	0.0831	0.4223	-1.6998	10.0887
CER	0.0018	0.0031	-0.0016	0.0360
OWNER	0.7234	0.4475	0.0000	1.0000

EA	0.0036	0.0008	0.0015	0.0063
ER	0.7700	0.6237	0.0000	2.5853
Compete	12.2780	6.9095	0.1714	70.4886
Assets	1.9367e+10	3.5911e+10	2.1755e+08	2.9135e+11
ROA	0.0265	0.1178	-0.7652	2.6772
LEV	0.5608	0.2490	0.0156	4.1137
Growth	1.1241	21.4155	-0.9673	665.5401
IBD	0.3690	0.0526	0.2500	0.6000
Size	22.7719	1.3324	19.1979	26.3978
TOP10	54.7122	15.8839	15.1000	93.4100
Duality	0.1648	0.3711	0.0000	1.0000
Aboard	2.2055	0.2075	1.3863	2.8904
slack	0.6863	0.8257	0.2789	23.0155
Age	2.8939	0.2641	1.6094	3.7377

3.3 Model setting

In order to test the interaction between "responsibility performance", this paper builds model 1 and model 2 based on the research of Lioui and Sharma (2012) and Zhang Yingkui et al. (2019). Among them, UnEBIT represents the financial performance of the enterprise, CER represents the environmental and social responsibility of the enterprise, and EPF represents the expected performance feedback. Controls_{i,t} represents the set of control variables that affect financial performance and corporate environmental social responsibility. The specific model is as follows:

$$UnEBIT_{i,t} = a_0 + a_1 \times CER_{i,t-1} + \sum_2^m a_m Controls_{i,t} + \mu_i + \nu_t + \varepsilon_{i,t} \quad (1)$$

$$CER_{i,t} = a_0 + a_1 \times EPF_{i,t-1} + \sum_2^m a_m Controls_{i,t} + \mu_i + \nu_t + \varepsilon_{i,t} \quad (2)$$

Where subscripts i and t represent enterprise and time respectively, μ_i is individual fixed effect and ν_t is time fixed effect.

4. Analysis of empirical research results

4.1 Group test of environmental social responsibility influencing factors and analysis of relevant adjustment mechanism

From the regression results in Tables 3 and 4, it can be obtained that the regression coefficients of expected performance feedback and environmental social responsibility considering the lagged period are negatively significant, and environmental social responsibility is an inverse indicator, so a good level of expected performance feedback of enterprises can promote the assumption of environmental social responsibility. Since the use of the cross term adjustment mechanism test greatly limits the investigation of the control variables, this paper uses group regression to empirically analyze the possible relevant adjustment mechanism between the two, while reserving the possibility of further refining the control variables to investigate the relevant influencing factors of environmental social responsibility.

This paper groups expected performance feedback, local environmental protection strategies (environmental protection attitudes, environmental regulations) and industrial competitiveness based on the median sample. Expected performance feedback is divided into expected performance surplus

and expected performance gap groups according to whether it is greater than or equal to 0 and less than 0. The property right nature and the enterprise environment strategy adopt 0-1 grouping. The regression results show that the regression coefficient of the expected performance surplus is negative. Considering that environmental social responsibility is a reverse indicator, it shows that the expected performance surplus can promote the environmental social responsibility of enterprises. Hypothesis 3 has been verified, which is different from the conclusions of existing studies. Studies including Shinkle (2012), Wu Jianzu and Yuan Haichun (2020) believe that enterprises are often more inclined to respond to the doubts of stakeholders about performance by adjusting their development strategies when facing the drop in performance expectations, such as increasing the investment of enterprises in certain risk strategies. However, its research samples mainly examine the overall level of corporate social responsibility. This study discusses the environmental social responsibility of enterprises, which is fundamentally different from small, short-term, one-time investments such as charitable donation responsibility, social employment responsibility, and information disclosure responsibility, etc. Environmental social responsibility is a continuous investment that consumes more capital and takes longer, such as the failure of research and development or transformation of results in the process of technological investment in upgrading environmental protection equipment, sudden changes in environmental protection policies. Changes in regulatory standards can cause high sunk costs for enterprises. Therefore, the sustainable cash flow brought by the expected performance surplus is decisive for the enterprise's commitment to environmental social responsibility. Decision makers will not think of change when they are poor because of the short-term business downturn. The ability to obtain good financial performance and the expected performance surplus are the key factors to ensure the level of environmental social responsibility commitment.

In terms of environmental protection strategies of local governments, environmental protection attitudes and environmental regulations have shown a negative regulatory effect on the performance responsibility relationship, and Hypothesis 5 has been verified. Specifically, in areas with more active environmental protection strategies, most enterprises in the jurisdiction respond to the government's call and avoid punishment in undertaking environmental social responsibility, which weakens the marginal contribution of corporate environmental responsibility investment. In areas with relatively negative environmental protection strategies, taking the initiative to assume environmental social responsibility will bring immediate effects to enterprises, which can enable enterprises to quickly establish a good image among local governments, investors, regulatory departments and other social groups, more efficiently realize the transformation from responsibility to reputation, and make enterprises more willing to actively invest in environmental social responsibility with better financial performance.

In addition, the industry competitiveness in the regression results shows a positive regulatory effect on the relationship between the two. It shows that in the highly competitive industry, enterprises are more willing to make themselves go out of the group through social responsibility, and gain the recognition of stakeholders through positive environmental social responsibility investment. The forward-looking environmental strategy of the enterprise has a significant positive regulatory effect on the relationship between them, which is consistent with the research conclusions of many mathematicians in the past. Enterprises implementing forward-looking environmental strategies will pay more active attention to environmental problems, take environmental protection measures, actively assume environmental responsibilities, and use financial resources for environmental protection to a greater extent (Aragon and Sharma, 2003; Zhang Chi et al., 2020).

In addition, the property rights of enterprises do not have a moderating effect on the relationship between the two. According to the regression results of the control variables, the survival time and growth of enterprises have a significant positive impact on CSR undertaking, which is in line with our conventional expectations and economic logic.

Table 3 regression results

variable	Full sample regression	Expected performance feedback		Environmental protection attitude		Environmental regulation	
		Expected performance surplus	Expected performance gap	positive	negative	strong	weak
	<i>CER</i>	<i>CER</i>	<i>CER</i>	<i>CER</i>	<i>CER</i>	<i>CER</i>	<i>CER</i>
<i>EPF_{t-1}</i>	-0.0495* (0.0273)	-0.1263** (0.0564)	-0.0582 (0.0374)	-0.0048 (0.0342)	-0.1625*** (0.0418)	0.0047 (0.0461)	-0.0634* (0.0371)
<i>Growth</i>	-0.9790** (0.4383)	0.3598 (1.2660)	-0.9923** (0.4192)	-2.9852* ** (1.1140)	-0.5295 (0.4065)	-1.3551 (1.0582)	-0.8222 (0.5012)
<i>ROA</i>	0.0031 (0.0191)	0.0868 (0.0646)	0.0076 (0.0190)	-0.0528 (0.0435)	0.0042 (0.0198)	0.0274 (0.0351)	0.0077 (0.0247)
<i>Aboard</i>	-0.0168 (0.0449)	-0.0085 (0.1030)	-0.0505 (0.0478)	0.0070 (0.0585)	-0.0493 (0.0687)	-0.0872 (0.0695)	0.0342 (0.0674)
<i>Duality</i>	-0.0200 (0.0768)	0.2236 (0.1880)	-0.0382 (0.0794)	0.0003 (0.1133)	-0.1156 (0.1032)	0.0123 (0.1180)	-0.0718 (0.1068)
<i>slack</i>	0.0350* (0.0211)	0.2444** (0.1235)	0.0216 (0.0186)	0.0203 (0.0202)	0.2285* (0.1208)	0.4730** * (0.1200)	0.0206 (0.0220)
<i>Age</i>	-0.1473 (0.1725)	-0.8382* (0.4389)	0.2192 (0.1760)	-0.1462 (0.2229)	-0.3715 (0.2619)	-0.1988 (0.2260)	0.1104 (0.2921)
<i>IBD</i>	-0.0020 (0.0319)	0.0914 (0.0843)	-0.0289 (0.0313)	-0.0212 (0.0394)	-0.0204 (0.0464)	-0.0168 (0.0487)	-0.0149 (0.0457)
<i>cons</i>	-0.0992 (0.1413)	-0.4978 (0.3422)	0.1113 (0.1492)	-0.2313 (0.2099)	-0.1578 (0.1868)	-0.1903 (0.2079)	0.1714 (0.2175)
<i>N</i>	988	404	584	524	464	497	491
<i>r²</i>	0.0641	0.1253	0.1130	0.0773	0.1886	0.1355	0.0880
Individual effect	YES	YES	YES	YES	YES	YES	YES
Year effect	YES	YES	YES	YES	YES	YES	YES

Note: standard error is in parentheses, *, **, *** are significant at 10%, 5% and 1% levels respectively

Table 4 Results of internal and external factors of the company to moderate financial performance affecting corporate environmental responsibility

variable	Industry competition		Environmental strategy		Nature of ownership	
	strong	weak	Forward looking	Non forward looking	state-owned enterprise	Non state owned enterprises
	<i>CER</i>	<i>CER</i>	<i>CER</i>	<i>CER</i>	<i>CER</i>	<i>CER</i>
<i>EPF_{t-1}</i>	-0.0716** (0.0345)	-0.0815 (0.0548)	-0.1575*** (0.0555)	-0.0297 (0.0372)	0.0156 (0.0357)	-0.0690 (0.0518)
<i>Growth</i>	-4.1710*** (1.2368)	-0.5300 (0.5122)	-3.8850** (1.5012)	-0.7664 (0.4889)	-0.9203** (0.4267)	0.2182 (1.3956)
<i>ROA</i>	0.0128 (0.0207)	-0.0234 (0.0512)	0.0755 (0.0761)	-0.0000 (0.0229)	-0.0791** (0.0382)	0.0298 (0.0290)
<i>Aboard</i>	0.0195 (0.0627)	-0.0116 (0.0832)	0.0576 (0.0919)	-0.0494 (0.0598)	0.0123 (0.0435)	-0.1105 (0.1425)
<i>Duality</i>	-0.0614 (0.1175)	-0.0399 (0.1274)	-0.0492 (0.1435)	-0.0636 (0.0976)	-0.1002 (0.0840)	0.2831 (0.1735)
<i>slack</i>	0.0233 (0.0244)	0.0855 (0.0537)	0.2010 (0.2183)	0.0325 (0.0225)	0.0193 (0.0187)	0.4762*** (0.1649)
<i>Age</i>	-0.5008 (0.3126)	0.1175 (0.2408)	-0.4888 (0.3920)	-0.0601 (0.2165)	-0.1196 (0.1802)	-0.2761 (0.4192)
<i>IBD</i>	0.0270 (0.0460)	-0.0100 (0.0525)	-0.0279 (0.0735)	-0.0123 (0.0397)	-0.0131 (0.0332)	0.0271 (0.0857)
<i>cons</i>	-0.4914** (0.2354)	0.1300 (0.2108)	-0.4929 (0.3377)	-0.0441 (0.1738)	-0.0661 (0.1394)	-0.3395 (0.4014)
<i>N</i>	522	466	266	722	712	272
<i>r²</i>	0.0792	0.1049	0.1234	0.0813	0.0791	0.1309
Individual effect	YES	YES	YES	YES	YES	YES
Year effect	YES	YES	YES	YES	YES	YES

Note: standard error is in parentheses, *, **, *** are significant at 10%, 5% and 1% levels respectively

4.2 The influence of corporate environmental social responsibility on financial performance

Table 5 reports the empirical test results of corporate environmental social responsibility on financial performance considering the lag of one period. The regression results show that corporate environmental social responsibility can promote the improvement of financial performance, which is consistent with previous research conclusions. In combination with the empirical conclusions in tables 3 and 4, hypothesis 1 proposed in this paper is verified. At the same time, in order to further investigate the regulatory effect of internal and external factors on the promotion of corporate financial performance by environmental social responsibility. This paper uses expected performance feedback as a moderating variable to conduct group regression, focusing on the impact of expected performance feedback on the relationship between environmental social responsibility and corporate financial performance. It can be seen from the results that among the groups with expected performance surplus, the environmental social responsibility that lags behind for one period has obtained significant regression results, which shows that the surplus performance feedback of enterprises can effectively

promote the positive impact of environmental social responsibility on financial performance. Combined with the empirical conclusions in tables 3 and 4, We can conclude that the benign mutual promotion system of "expected performance feedback - environmental social responsibility - financial performance - expected performance feedback" is achievable. In addition, we also examined the regulatory effect of the nature of property rights on the responsibility performance relationship. The results show that the relationship can be positively promoted in the group of non-state-owned enterprises. The reason is that compared with state-owned enterprises, non-state-owned enterprises need to improve their social reputation to obtain financing channels and development opportunities. Bearing social responsibility is an important means for them to obtain positive evaluation from stakeholders and obtain development resources. Therefore, non-state-owned enterprises can better improve their financial performance by assuming environmental social responsibility.

In the regression results of the control variables, the return on total assets and financial leverage of the enterprise have a significant promoting effect on the financial performance of the enterprise, which is in line with our conventional expectations. In the regression results, the ownership concentration of enterprises is significantly positively correlated with financial performance as a whole. The reason is that enterprises with high ownership concentration can more centrally reflect the overall objectives of stakeholders, which is conducive to enterprises to clarify the development direction, implement development strategies and improve financial performance.

Table 5 regression results

variable	Full sample regression	Expected performance feedback		Nature of ownership	
		Expected performance surplus	Expected performance gap	State-owned enterprises	Non state owned enterprises
	<i>UnEBIT</i>	<i>UnEBIT</i>	<i>UnEBIT</i>	<i>UnEBIT</i>	<i>UnEBIT</i>
<i>CER_{t-1}</i>	-0.0860* (0.0500)	-0.0760** (0.0301)	-0.0773 (0.1137)	-0.0590 (0.0736)	-0.0814* (0.0413)
<i>LEV</i>	0.0921* (0.0530)	-0.0266 (0.0613)	0.2231*** (0.0795)	0.5748*** (0.0876)	0.0596 (0.0548)
<i>Size</i>	-0.7968*** (0.1065)	0.0133 (0.0786)	-1.5473*** (0.1765)	-1.3341*** (0.1390)	-0.4585** * (0.1384)
<i>TOP10</i>	0.2273*** (0.0658)	-0.1026** (0.0453)	0.5136*** (0.1072)	0.3413*** (0.0847)	0.1400** (0.0672)
<i>ROA</i>	0.1825*** (0.0285)	0.1588*** (0.0291)	0.2828*** (0.0453)	0.8319*** (0.0719)	0.0389** (0.0186)
<i>Age</i>	-0.0269 (0.2567)	-0.0576 (0.1998)	-0.0594 (0.4115)	-0.2641 (0.3167)	0.1526 (0.2756)
<i>Aboard</i>	-0.0207 (0.0555)	0.0596 (0.0374)	-0.0159 (0.0906)	-0.0164 (0.0645)	0.0616 (0.0752)
<i>slack</i>	-0.0247 (0.0299)	-0.0354 (0.0454)	0.0195 (0.0415)	0.0199 (0.0318)	-0.0221 (0.0922)

<i>Assets</i>	0.1534 (0.1123)	0.1337 (0.1019)	0.2492 (0.1682)	0.1914 (0.1217)	2.4744*** (0.4433)
<i>cons</i>	-0.3655* (0.2072)	-0.2727* (0.1529)	-0.4071 (0.3455)	-0.5118** (0.2468)	0.5836** (0.2783)
N	1047	428	619	756	287
r2	0.1438	0.3158	0.2668	0.3000	0.2376
Individual effect	YES	YES	YES	YES	YES
Year effect	YES	YES	YES	YES	YES

Note: standard error is in parentheses, *, **, *** are significant at 10%, 5% and 1% levels respectively

5. Conclusions and Policy Recommendations

This paper takes the listed companies in the heavy pollution industry in Shanghai and Shenzhen A-shares from 2010 to 2020 as the research samples, and uses the two-way fixed effect model to empirically test the "responsibility performance" interaction in the process of enterprises' decision-making on environmental social responsibility, taking into account the local government's environmental protection strategy and expected performance feedback. The research finds that: (1) for environmental social responsibility, the stable cash flow brought by the expected performance surplus of enterprises is an important guarantee to promote the virtuous cycle of environmental social responsibility and financial performance, and the expected performance gap is not enough to stimulate the willingness of decision makers to take risks in the undertaking of environmental social responsibility; (2) The environmental protection strategies of local governments have a negative regulatory effect on the performance responsibility relationship. In areas with relatively negative environmental protection strategies, environmental social responsibility can more efficiently achieve reputation transformation and promote enterprises to invest in environmental social responsibility; (3) Industries with more fierce competition and enterprises with forward-looking environmental strategies are more inclined to put performance feedback into the undertaking of environmental social responsibility; It is easier for non-state-owned enterprises to improve their financial performance by assuming environmental social responsibility.

Based on this study, the following theoretical enlightenment and policy recommendations can be obtained: first, enterprise decision makers should make full use of the potential interaction mechanism between environmental social responsibility and financial performance, promote the improvement of financial performance by actively undertaking environmental social responsibility, and drive the long-term stable development of enterprises and the growth of social public interests; Second, in areas with relatively backward awareness of environmental protection, the government and regulatory departments should urge heavily polluting enterprises to implement their environmental responsibilities. Through publicity and guidance, enterprises can fully realize that emission reduction and growth can be achieved simultaneously, and promote more enterprises to seek their own development while protecting the ecological environment; Third, we should encourage heavily polluting enterprises to implement forward-looking environmental strategies, realize the coordinated development of government environmental protection strategies and enterprise environmental strategies, promote the mutual promotion of corporate financial performance and environmental responsibility, and form a win-win situation at the ecological level and the corporate social level.

Data Sharing Agreement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of Conflicting Interests

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