

An Empirical Study on Impacts of Environmental Regulation on Environmental Information Disclosure of Listed Companies of China: Based on Researches on Listed Companies in Nonferrous Metal Industry

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Abstract

With rapid development of economy, environmental pollution becomes increasingly serious, which not only affects quality of our life but also threatens our living conditions. Since the 1990s, the percentage that Chinese listed companies' voluntary environmental information disclosure has increased to a larger extent and the content disclosed by many enterprises has gone beyond scope required by laws. Under this background, this paper combines with current status of environment information disclosure of Chinese listed companies, takes listed companies of non-ferrous metal industry in Shanghai and Shenzhen from 2006 to 2011 as samples, and studies impacts of environmental information disclosure system and environmental regulation intensity on environmental information disclosure. In addition, it carries out empirical tests on sample data of companies and implements robustness tests on regression results to exclude influence of differences between new and old criterion on comparability of accounting data. By virtue of positive analysis, it is found that corporate features like scale of company, financial risk, growth ability and profitability have great influence on environment information disclosure, and implementation of environment information disclosure and environmental regulation intensity have significant impacts on environment information disclosure.

Key words: Environment; Accounting; Information disclosure; System; Intensity of environmental regulation

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INTRODUCTION

Since Reform and Opening-up, Chinese economy has greatly developed. However, pollution is getting worse and worse as industrialization proceeds continuously. In recent years, environmental pollution accidents have occurred frequently. Related leaders of Ministry of Environmental protection and experts from the field of environmental protection have indicated that "China is entering the period when environmental pollution accidents happen frequently" on many occasions. There have been many environmental pollution accidents, such as environmental protection accidents of listed companies like Zijin Mining and Zhongjin Linnan Nonferrous Metal Company, oil leakage accidents of CNOOC and CNPC, and cadmium contamination in Longjiang, Guangxi Province. Besides, there are numerous small environmental pollution problems, which damage people's living environment. It is no doubt that environmental pollution accidents have serious influence on people's health, environment and social security. The environmental information disclosure of companies plays an important role in assisting the government in understanding status of enterprises' environmental protection, strengthening pollution control and establishing mutual trust between enterprises and the public. In 2003, State Environmental Protection Administration issued *An Announcement on Environmental Information Disclosure of Companies* (HF [2003] Doc# 156), which clearly specified that companies included in the list must periodically disclose

environmental information, including enterprises' environmental policies, total amount of pollutant emission, environmental pollution control, environmental compliance and environmental management etc. In 2010, Ministry of Environmental Protection issued *Guideline for Environmental Information Disclosure of Listed Companies* (exposure draft), requiring listed companies in heavy-polluting industries should publish an annual environmental reports. Such reports should disclose information, such as business name, address and legal representative; names of major pollutants, discharge mode, emission concentration and total amount, exceeding standards, and situations beyond total amount; construction and operating situations of enterprises' environmentally protective facilities; and plans dealing with emergencies related to environmental pollution. In doing so, they aimed at encouraging companies to disclose resource consumption, reduce emissions and improve actions of resource efficiency and actual effect and decrease potential influence on global climate.

1. LITERATURE REVIEW

1.1 Domestic and Foreign Literature Review

Studies of Tinker (1991) not only hold that environmental information disclosure helps enterprises to form good relationships with community groups but also deem coordination of their own information disclosure by external response and access to information has influence on their public image. In a certain period, enterprises should disclose the process in which they perform their responsibilities for environment and related results to the society in a certain form in order to finish responsibilities that the society offers to them. Gray (1995) profoundly reviewed disclosure of social responsibilities and deemed that previous studies were mainly confined to influence of social disclose responsibility on companies' features and externality. Ullman (1985) held that previous studies were mainly confined to influence of social disclose responsibility on companies' features and externality, proposed corporate environmental accounting system using non-monetary measurement instruments to reflect environment-related inputs and outputs. Guethrie and Paker (1990) studied discontinuous human resources and information disclosure of community involvement of the largest company in Australia and highlighted human resources as well as the relationship between the degree of social participation and environmental information disclosure. Brenton (1995) believed that environmental information should be disclosed to the public in order that people could come into contact with such information, companies serving as social members should be responsible for considering environmental factors and provide environmental accounting information for other members when they made decisions. Jerry (1996)

further pointed out that concept of fiduciary duty from a broad perspective made enterprises have a responsibility to report environmental information more completely, i.e., enterprises was responsible for providing corporate information including environmental information. Robert (1992) believed that companies were obliged to provide all of the information about operating conditions and results in order to ensure that investors could make judgment and decision correctly, and his study pointed out that other companies would form certain pressure undoubtedly while more advanced enterprise disclosed environmental information were awarded. Pattern (1991) proposed that a company's size and industry could be interpreted as effective public pressure, which indicated that large companies in environmentally sensitive industry would be more willing to disclose environmental information. It was in the 1990s that China's environmental accounting began to develop and *A New Ideological Trend of Western Accounting Theory in the 1990s - Green Accounting* published by Professor Ge Shu et al. was considered to be an important indicator representing researches on environmental accounting of China were started. Wang et al. (1998) conducted a survey on environmental management and accounting practices of Chinese enterprises, finding that most of companies' environmental management work was not satisfying. Xiao and Hu (2004) targeted annual reports of about 1,000 publicly traded companies in Shanghai and Shenzhen in 2002 and 2003, carried out statistical surveys on their environmental information disclosure and gave comments and suggestions on how to improve companies' environmental information disclosure system in our country. Shi (2006) conducted researches on stocks of listed companies with environmental information disclosure from 2002 to 2005 to examine the correlation of changes in stock price and environmental information disclosure and investigate reaction of our current stock market to environmental information, and concluded that China's capital market could not react to environmental information disclosure basically. Tang (2010) believes that environmental information disclosure of companies has the following two aspects: the main reason why companies carry out environmental information disclosure is that they are under external pressure; and environmental information disclosure is a corporate responsibility for stakeholders. Yuan (2010) thinks that there are external pressure theory and voluntary disclosure theory in addition to except fiduciary duty theory, decision-making useful theory and motivation which are similar to the ones under traditional accounting information.

1.2 Comment on Research Literatures

Empirical researches on factors affecting environmental information disclosure in foreign countries have been quite mature. Scale of company, industry factor and media exposure are recognized main factors affecting

environmental information disclosure. These research achievements play a positive role in driving enterprises to improve reporting procedures and establishing good information disclosure mechanism. Since different countries have different economic development level, laws and regulations and environmental awareness, the foregoing conclusions are not appropriate for China such a developing country. However, China's researches on environmental accounting started late and most of researches on environmental information disclosure are normative achievements. Overall, researches on technique methods like theoretical framework and environmental information measurement of environmental information disclosure are not profound or systematic enough. Empirical researches are rather weak and rarely involve performance evaluation system and methods of enterprises' environmental responsibility information. Researches that are carried out from the perspective of environmental regulation are rarely involved and all of them are not systematic. In addition, staged division of implementation course is laced in countermeasure researches. Therefore, this research will analyze impacts on level of environmental information disclosure in the two aspects, i.e., implementation of environmental information disclosure system and intensity of environmental regulation, and study whether level of companies' internal governance has promoting effect on environmental information disclosure system. Considering the situation that difference industries have obvious difference in level of environmental information disclosure, this research selects an industry from heavy-polluting industries of China randomly, i.e., the non-ferrous metal industry, uses relevant data from 2006 to 2011 and carries out an empirical analysis of the influence of environmental regulation on the level of environmental information disclosure.

2. MECHANISM ABOUT INFLUENCE OF ENVIRONMENTAL REGULATION ON ENVIRONMENT INFORMATION DISCLOSURE OF CHINESE ENTERPRISES

With growing concern for environmental issues, our government has issued a number of environmental regulations and policies to ease the contradiction between economic development and environmental pollution in order to achieve sustainable economic development. The environmental information disclosure of companies plays an important role in assisting the government in understanding status of enterprises' environmental protection, strengthening pollution control and establishing mutual trust between enterprises and the public. Therefore, analysis of the impact of environmental

regulation on enterprises' environmental information disclosure has much promoting effect on perfection of our environmental policies and regulations and improvement in the level of environmental information disclosure in China. This study will consult performance evaluation index system about listed companies' environmental information disclosure, which is made by the project team of *A Research on Environmental Responsibility Information Disclosure System of Chinese Enterprises* a national social science fund of College of Economics and Management, Southwestern University, to analyze the mechanism about impacts of environmental regulation on three parts in the performance evaluation index system about environmental information disclosure specifically, i.e., operation of the system itself, the system promotes effects listed companies' environmental protection and the system enhances effect of environment improvement. In doing so, it obtains main factors of environmental regulation, which affect environmental information disclosure, to provide basis for the empirical part in Chapter 5.

2.1 The Impact of Environmental Regulation on Operation of the System Itself in Enterprises' Environmental Information Disclosure

The operation of the system itself is a basic situation of environmental information disclosure, which mainly includes rate of disclosure, ways of disclosure, carriers of disclosure and level of disclosure. According to analyses of basic situations of environmental information disclosure of Chinese listed companies in heavy-polluting industries from 2006 to 2011, it is found that the rate of disclosure of disclosed environmental information in 2006 was only 38.98%, while it had breakthrough and reached 64.67% in 2008, which had close relationship with *Guidance of Shanghai Stock Exchange for Environmental Information Disclosure of Listed Companies* (JG [2008] Doc# 18) a corporate environmental information disclosure norm issued by Shanghai Stock Exchange in 2008. With respect to ways of disclosure and carriers of disclosure, different ways and carriers of disclosure appear because China does not have specific regulations to restrain them at present. In another word, different companies have different ways and carriers of disclosure, and the same company also has different ways and carriers of disclosure in different years. It can be said that disclosure lacks consistency and comparability, which is also a part that Chinese environmental regulation must improve urgently. In 2010, Ministry of Environmental Protection of China issued *Guideline for Listed Companies' Environmental Information Disclosure* (exposure draft in 2010, HF [2010] Doc#78), specifying that environmental information disclosure of listed companies should include regular disclosure and temporary disclosure and information that should be disclosed by annual environmental reports included occurrence of major environmental problems, assessment on environmental impacts, implementation

of 'three simultaneous' system, pollutant discharge under certain standards and completion of overall reduction tasks etc., which greatly improved the level of Chinese listed companies' environmental information disclosure, especially the level of environmental information disclosure of listed companies in heavy-polluting industry. Therefore, it can be said that environmental regulations has significant promoting effect on operation of the system itself in environmental information disclosure of Chinese listed companies.

2.2 The Impact of Environmental Regulation on the Situation that the System in Enterprises' Environmental Information Disclosure Promotes Effect of Listed Companies' Environmental Protection

The part with respect to the situation that the system promotes effect of listed companies' environmental protection mainly includes 5 modules, i.e., environmental management, environmental cost, environmental liabilities, environmental investment and environmental governance. In 2008, *Guidance for Environmental Information Disclosure of Listed Companies* issued by Shanghai Stock Exchange specifies that listed companies may disclose or solely disclose environmental information like corporate environmental policies, annual objectives and achievements of environmental protection, annual total resource consumption, investment in environmental protection, development of environmental technology, types, quantity, concentration and whereabouts of emission pollutants, as well as treatment, disposal, recycling and comprehensive utilization of waste products etc. In 2010, Ministry of Environmental Protection issued *Guideline for Environmental Information Disclosure of Listed Companies* (exposure draft), and particularly proposed listed companies in 16 types of heavy-polluting industries like thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, chemical, petrochemical, building materials, papermaking, brewing, pharmacy, fermentation, textile, leather and mining should issue annual environmental reports in the current year, and disclose environmental information related to pollutant emission, environmental compliance and environmental management regularly. This shows that issuance of the two documents will promote effect of Chinese listed companies' environmental protection to a large extent. This study suggests that environmental regulation intensity will also have impacts on the situation that the system in enterprises' environmental information disclosure promotes effect of listed companies' environmental protection to a large extent and in a large scope in addition to the fact that implementation of environmental information disclosure system has promoting effect on effect of Chinese listed companies' environmental protection. Environmental regulation intensity is mainly reflected by effect of environmental

regulation. In accordance with relevant researches, it is found that most domestic and foreign researches on the effect of environmental regulation center on impacts of environmental regulation on the three aspects, i.e., technological innovation, industrial performance and international direct investment. Researches on impact of environmental regulation on technological innovation think that environmental regulation can drive enterprises to carry out technological innovation; researches on impacts of environmental regulation on industry performance suggest that results of such impacts are uncertain; and influence of environmental regulation on international direct investment is not certain either. Technological innovation means an unprecedented 'new combination' about production factors is introduced to production system, including new products, new technologies and new markets etc.

As a technology innovation, environmental technological innovation refers to product innovation and process innovation that direct at reducing pollution emission in the production process, which mainly includes replacement of production factors, production and use of products with low contamination, installation of equipment and utilization of end processing technology to reduce pollutant discharge in the production process. Thus, this study will consider using the proportion of pollution regulation expenditure to total assets to measure intensity of environmental regulation, and then analyze the degree to which environmental regulation intensity affects Chinese listed companies' environmental information disclosure.

2.3 Impacts of Environmental Regulation on the Situation that the System in Enterprises' Environmental Information Disclosure Promotes Effect of Environmental Improvement

The situation that the system promotes effect of environmental improvement is mainly reflected by perspective of governmental supervision and the public's regulation. However, it is difficult to have a specific evaluation standard for the public's regulation. Thus, this research will not consider this one. As the subject making system and regulations as well as supervising implementation of them, government plays a great promoting role in the process of listed companies' environmental information disclosure. Moreover, formulation and implementation of environmental information disclosure system and norms have decisive effect. In detail, environmental marks and enterprises' environmental management system certification (ISO14000) are mainly implemented. Environmental marks are signs that governmental administrative departments issue to some goods according to related laws, regulations and standards and are posted on products to identify the products in the whole process from production to use accord with specified requirements of environmental protection.

2.4 Influence of Different Types of Regulation Tools on Environmental Information Disclosure

Generally, there are three types of environmental regulation tools, i.e., command and control type or environmental regulation tools via administrative regulatory policy; market-based regulatory policy or environmental regulation tools via economic incentives;

environmental regulation tools using information disclosure as well as participation mechanism and policy. The first two types are usually used, i.e., command and control-type environmental regulation tool (CCERT) and market-based environmental regulation tool (MBERT). Differences and connections between the two instruments are shown in Table 1.

Table 1
Comparison Between CCERT and MBERT

Type of environmental regulation tools	Classification	Level of implementation	Innovation of environmental technology
CCERTs	Environmental standards and management standards, etc	High	Low
MBERTs	Environmental fee, sewage discharge permission, tax permit system, caution money for operation of management facilities, and the 'three simultaneous' caution money etc.	High	High

According to the table, it can be found that the degree of implementation of both tools is high. With respect to innovation of environmental technology, market-based environmental regulation tools are superior to command and control-type environmental regulation tools. Command and control-type environmental regulation tools mainly regulate environmental information disclosure of listed companies by setting standards and regulations, whose influence scope primarily involves the first and the third parts of the foregoing performance evaluation index system of environmental information disclosure. Market-based environmental regulation tools mainly promotes the level of listed companies' environmental information disclosure by some pollution discharge and governance costs, whose influence scope primarily involves the second part of the performance evaluation index system.

Therefore, this research concludes command and control-type environmental regulation tools and market-based environmental regulation tools as environmental information disclosure system and intensity of environmental regulation, respectively, which completely coincides with the mechanism (that has been analyzed above) about impacts of environmental regulation on Chinese listed companies' environmental information disclosure.

3. EMPIRICAL STUDY

After summarizing and analyzing domestic and foreign research literatures, implementation of environmental information disclosure and environmental regulation intensity will affect the level of the listed companies' environmental information disclosure, and corporate internal governance will have some influence on effect of environmental information disclosure system on environmental information disclosure. At present,

Chinese listed companies' will to disclose environmental information is low, and the overall level at which they disclose environmental information voluntarily is also low. Based on domestic and foreign research methods and conclusions, this research will target listed companies in the nonferrous industry from heavy-polluting industries in China to study the level at which implementation of environmental information disclosure system and environmental regulation intensity on the level of environmental information disclosure.

3.1 Research Hypothesis

3.1.1 Implementation of Environmental Information Disclosure System and Environmental Information Disclosure

Environmental information disclosure system is a kind of system in which listed companies must report their environmental information and materials to security management departments and stock exchanges as well as disclose or announce them to the society according to provisions of laws in order to guarantee investors' interests, accept the public's supervision and make investors learn situations sufficiently.

Since 2003, Chinese government has promulgated a series of environmental laws and regulations and standardized enterprises' environmental information disclosure to different degrees. However, there is the problem that the environmental information disclosure system is neither systematic nor standard. Thus, it has difficulty in satisfying of our government, the public and enterprises' interest subjects for environmental information. In 2008, Shanghai Stock Exchange issued *Guidance of Shanghai Stock Exchange for Environmental Information Disclosure of Listed Companies*. The guidance not only clearly specifies that the environmental

information that must be disclosed by the method of temporary announcement, the environmental information that companies may disclose voluntarily and scope of the information that enterprises which environmental protection administration considers to be heavy-polluting ones must disclose but also defines related procedural requirements of environmental information disclosure, such as methods of announcement and documents for records etc. The provision requires that listed companies should disclose situations of events and possible impacts on companies' operation and stakeholders within two days after occurrence of such events if there such companies encounter major events related to environmental protection and there may be significant impacts on their stocks and transaction price of derived varieties. Shanghai Stock Exchange also requires listed companies that environmental protection administration includes them in the list of heavy-polluting enterprises should disclose the following information within two days after the environmental protection administration has announced the list: names of major pollutants, discharge mode, emission concentration and total amount, exceeding standards, and situations beyond total amount; construction and operating situations of enterprises' environmentally protective facilities; plans dealing with emergencies related to environmental pollution; and measures that companies take to reduce pollutant discharge and future work arrangement.

The higher the pressure that listed companies can feel is, the higher the level at which they disclose environmental information voluntarily will be. This pressure mainly comes from the government, the public and the media. Specifically, the government guides enterprises to disclose environmental information by a series of laws and regulations, and the public and the media mainly apply pressure via public opinions and market behaviors of enterprises. As various legal norms are issued, the government increases strength of policy enforcement. Thus, the public pressure that enterprise face with, which is related to problems of environmental protection, mainly derives from the government. Thus, this research proposes the first hypothesis:

H1: *The implementation of environmental information disclosure system can improve the level of listed companies' environmental information disclosure.*

3.1.2 Environmental Regulation Intensity and Environmental Information Disclosure

In addition to the fact that the government formulates laws and regulations to intervene with environment information disclosure of enterprises, another important tool is economic means, such as taxation, mineral resource tax and compensation fee, "three simultaneous" caution money, SO₂ charge and sewage discharge permission etc. When enterprises face with powerful environmental regulation, they will input more funds into pollution abatement, which may result in "crowding out". However,

from the dynamic perspective, enterprises may cope with the increased cost resulted from by improvement in standards for environmental regulation via technological innovation. As we all know, technological innovation can improve effect of enterprises' environmental protection to a large extent and in a large scope. In another word, environmental regulation intensity will have positive effect on Chinese listed companies' environmental information disclosure to a large extent and in a large scope.

H2: *Environmental regulation intensity has significant positive correlation with the level of listed companies' environmental information disclosure.*

3.2 Sample Selection and Data Source

3.2.1 Sample Selection

In 2010, Ministry of Environmental Protection consulted the public's opinions on *Guideline on Environmental Information Disclosure of Listed Companies*. The *Guideline* is appropriate for A-share companies listed at Shenzhen Stock Exchange and Shanghai Stock Exchange, and specifies that environmental information disclosure of listed companies should include regular disclosure and temporary disclosure and information that should be disclosed by annual environmental reports includes occurrence of major environmental problems, assessment on environmental impacts, implementation of 'three simultaneous' system, pollutant discharge under certain standards and completion of overall reduction tasks etc. The *Guideline* particularly proposes listed companies in 16 types of heavy-polluting industries like thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, chemical, petrochemical, building materials, papermaking, brewing, pharmacy, fermentation, textile, leather and mining should issue annual environmental reports in the current year, and disclose environmental information related to pollutant emission, environmental compliance and environmental management regularly. However, related researches show that different industries have significantly different level and quality of environmental information disclosure. Thus, this research selects one industry from the 16 types of industries randomly, i.e., the nonferrous industry, and regards its A-share listed enterprises at Shenzhen Stock Exchange and Shanghai Stock Exchange as objects.

3.2.2 Data Source

Sample data of the research, including level of environmental information disclosure, shareholding ratio of controlling shareholders, proportion of independent directors, audit committee, type of listed companies and scale of board of supervisors, are obtained by manually collecting and settling annual reports that A-share listed enterprises of Shenzhen Stock Exchange and Shanghai Stock Exchange publish at the two exchanges. Financial data mainly derive from Guotai financial and economic information database (CSMAR) and Ruisi database (RESSET).

3.3 Definition of Variables and Model Selection

3.3.1 Explanatory Variable

Level of environmental information disclosure (EID): There has been no fixed code standard for evaluation on level of environmental information quality up to now. At present, there are mainly three methods measuring level of environmental information disclosure. The first one uses external database or authorities' evaluation on companies' information disclosure as companies' information disclosure indexes. The second one adopts earning quality of companies' reports to measure quality of accounting information disclosed by companies. The third one is a scientific research method which utilizes "content analysis" to carry out objective, systematic and quantitative analysis of literature content. Among the three methods, results obtained by the first one are relatively objective and tend to be accepted by others. However, there is no database about companies' environmental information in China currently. The second method mainly directs at financial information, so it is not appropriate for environmental information. The third method is a major way to determine social responsibility information and level of environmental information disclosure.

After comprehensive consideration, this research will use "content analysis" to evaluate and score listed companies' environmental information. Only in way can qualitative description be quantified. This research divides environmental information disclosure of listed companies into 3 parts, 9 modules and 27 indexes to give them marks. At last, the index final score / optimal score used is as an index measuring the level of environmental information disclosure in this research.

3.3.2 Explanatory Variable

Implementation of environmental information disclosure requirement (EIDS): a dummy variable. 2008 is used as the starting point of the implementation of environmental

information disclosure system. In detail, the variable will be 0 and 1 before and after 2008, respectively.

Environmental regulation intensity (ERI): proportion of investment in pollution control to total assets of a company.

3.3.3 Control Variable

Domestic and international researches not only show impacts of environmental regulation on companies' environmental information disclosure but also indicate that corporate features have significant influence on enterprises' environmental information disclosure. Thus, this research selects the following control variables.

Size of company (SIZE): By consulting practice of most domestic and foreign scholars, this research uses natural logarithm of listed companies' total assets at the end of a term as an alternative variable of SIZE.

Level of liabilities (LEV): Domestic and foreign scholars generally use the two indexes asset-liability ratio and equity ratio to measure listed companies' level of liabilities. The two indexes have the same economic connotation. This research selects asset-liability ratio as an alternative variable of listed companies' LEV.

Growth ability (GROWTH): Growth ability is an important basis judging companies' cash flow in future. Thus, growth ability affects companies' behaviors about environmental information disclosure to a large extent. This research selects increase rate of business revenue as a growth index of listed companies.

Profitability (ROE): Return on equity is the ratio between net income and shareholders' equity of a company in a certain period, which highlights and reflects the relationship between investment and return and acts as a critical index reflecting profitability of listed companies and a financial index with the most comprehensiveness. This research uses the index as a variable to measure the profitability of listed companies.

Table 2
Summary of Research Variables

Variable name	Variable symbol	Variable definition	Expected symbol
Explained variable:			
Level of environmental information disclosure	EID	Environmental information disclosure index= Total disclosure score / The optimal disclosure score	
Explanatory variable:			
Implementation of the environmental information disclosure system	EIDS	Dummy variable. It is after and in 2008. Otherwise, it is 0.	+
Environmental Regulation Intensity	ERI	Pollution control investment / Total assets	+
Control variable:			
Size of company	SIZE	Natural logarithm of the total assets	+
Financial risk	LEV	Total liabilities at the end of year / Total assets at the end of year	+
Growth ability	GROWTH	Increase rate of business revenue	+
Profitability	ROE	Return on equity	+

3.3.4 Model Selection

Based on the existing literatures and after comprehensive consideration, this research will take the following models to verify the hypotheses.

Model one

$$EID=c+\beta_1*EIDS+\beta_2*SIZE+\beta_3*LEV+\beta_4*GROWTH+\beta_5*ROE+\varepsilon$$

Model two

$$EID=c+\beta_1*ERI+\beta_2*SIZE+\beta_3*LEV+\beta_4*GROWTH+\beta_5*ROE+\varepsilon$$

The two models mainly test whether implementation of environmental information disclosure system and environmental regulation intensity have impacts on the level of environmental information disclosure or not and how much such impacts are. At the same time, they

test impacts of corporate features including scale of company, financial risk, growth ability and profitability on environmental information disclosure.

3.4 Empirical Test and Analysis of Results

3.4.1 Descriptive Statistical Analysis

According to the descriptive statistical analysis of regression variable in Table 3, it can be found that mean value of listed companies' EID index is 14.22, and its median is 12.82. In case the total value is 100, this will indicate that level of companies' environmental information disclosure is generally low. The maximum is 48.72 and the minimum is 0, which implies there is significant difference. Other variables also show some differences.

Table 3
Descriptive Statistical Analysis of Main Variables

	EID	EIDS	SIZE	LEV	GROWTH	ROE	ERI
Mean	14.22	0.67	21.96	0.57	0.37	0.07	0.001
Median	12.82	1	22.04	0.58	0.3	0.10	0
Maximum	48.72	1	24.94	1.65	3.7	1.11	0.02
Minimum	0	0	18.81	0.11	-2.37	-3.28	0
Standard deviation	12.93	0.47	1.21	0.22	0.69	0.38	0.01
Sample size	240	240	240	240	240	240	240

Table 4
Related Coefficients of Variables

	EID	EIDS	SIZE	LEV	GROWTH	ROE	ERI
EID	1.00						
EIDS	0.38	1.00					
SIZE	0.14	0.21	1.00				
LEV	0.05	0.03	-0.16	1.00			
GROWTH	0.06	0.22	0.30	-0.38	1.00		
ROE	0.01	0.18	0.12	-0.24	0.22	1.00	
ERI	0.09	0.04	0.01	0.08	-0.06	-0.01	1.00

According to Table 4, it is shown that correlation coefficient among all variables is small and basically smaller than 0.3, which indicates that the correlation among explanatory variables is weak. Thus, it can be basically decided that there is no influence of multicollinearity. At the same time, we can see that there is a significant correlation between the explanatory variables EID and major explanatory variable.

3.4.2 Multiple Linear Regression and Analysis of Results

This research uses panel data model, which reduces the degree of co-linearity between variables to some extent. In addition, it compares fixed effect model and mixed regression model and selects redundant variables of fixed effects to perform likelihood ratio test. As a result, it finds that probability value of F statistic is small, indicating that effect of the fixed effects model is better. Therefore, the fixed effect model is used.

In accordance with regression analysis of impacts of implementation of environmental information disclosure system and corporate characteristics on companies' environmental information disclosure in Table 5, we find that implementation of environmental information disclosure system has significant influence on environmental information disclosure in Panel 1 and Panel 6. According to regression model of Model 1, it is found that R^2 is 0.718878, which indicates that overall fitting of Panel 6 is significant. Meanwhile, we can see that scale of company, financial risk, growth ability and profitability are significantly positive at 1%, 1%, 5%, and 10%, respectively, which implies that scale of company, financial risk, growth ability and profitability have significant impacts on companies' environmental information disclosure. Thus, it can verify that H1 (i.e., The implementation of environmental information disclosure system can improve the level of listed companies' environmental information disclosure) is valid.

Table 5
Impacts of Implementation of Environmental Information Disclosure System and Corporate Characteristics on Companies' Environmental Information Disclosure

Variable	Panel 1 EID	Panel 2 EID	Panel 3 EID	Panel 4 EID	Panel 5 EID	Panel 6 EID
Constant	7.147 435*** (5.350 158)	-113.032 9*** (-8.899 913)	4.208 295** (2.292 178)	5.3493 88*** (3.615 858)	6.189 021*** (6.954 565)	-156.736 5*** (-7.7856 23)
EIDS	10.608 97*** (6.484 017)					5.105 608*** (4.821 044)
SIZE		5.795 645*** (10.034 88)				7.486 947*** (8.163 365)
LEV			6.084 094** (2.245 637)			6.353 681*** (3.041 864)
GROWTH				3.018 126** (2.682 546)		3.519 513** (2.782 448)
ROE					3.959 283** (2.092 526)	2.668 839* (1.907 864)
Sample size	240	240	240	240	240	240
R ²	0.583 848	0.574 550	0.668 153	0.583 930	0.584 880	0.770 633
Adj R ²	0.500 200	0.489 033	0.599 437	0.497 774	0.498 921	0.718 878
P(F)	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000

***, ** and * mean value is significant at 1%, 5% and 10%, respectively, and t values are shown in brackets.

Table 6
Impacts of Environmental Regulation Intensity and Corporate Characteristics on Companies' Environmental Information Disclosure

Variable	Panel 1 EID	Panel 2 EID	Panel 3 EID	Panel 4 EID	Panel 5 EID	Panel 6 EID
Constant	7.147 435*** (34.024 15)	-113.032 9*** (-8.899 913)	4.208 295** (2.292 178)	5.349 388*** (3.615 858)	6.189 021*** (6.954 565)	-207.665 8*** (-10.965 87)
ERI	385.026 2*** (6.551 939)					89.888 76*** (5.439 272)
SIZE		5.795 645*** (10.034 88)				10.016 23*** (11.951 60)
LEV			6.084 094** (2.245 637)			5.272 322** (2.250 894)
GROWTH				3.018 126** (2.682 546)		3.350 123*** (4.249 487)
ROE					3.959 283** (2.092 526)	3.162 856** (2.600 849)
Sample size	240	240	240	240	240	240
R ²	0.666 094	0.574 550	0.668 153	0.583 930	0.584 880	0.803 365
Adj R ²	0.598 977	0.489 033	0.599 437	0.497 774	0.498 921	0.758 996
P(F)	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000

***, ** and * mean value is significant at 1%, 5% and 10%, respectively, and t values are shown in brackets.

According to the regression analysis of impacts of environmental regulation intensity and corporate characteristics on companies' environmental information disclosure in Table 6, it is found that the environmental regulation intensity in Panel 1 and Panel has significant impacts on environmental information disclosure at the level of 1%, which indicates that environmental regulation intensity has significant influence on environmental information disclosure. Based on regression results of Model 2, we find that Adj R² is 0.758996, which implies

that overall fitting of Panel 6 is significant. At the same time, it is shown that scale of company, financial risk, growth ability and profitability are significantly positive at 1%, 5%, 1%, and 5%, respectively, which further verifies that scale of company, financial risk, growth ability and profitability have significant impacts on companies' environmental information disclosure. Thus, it can verify that H2 (i.e., Environmental regulation intensity has significant positive correlation with the level of listed companies' environmental information disclosure) is valid.

3.4.3 Robustness Test

Since new accounting standards were issued in 2006 and began to be implemented in 2007, this might affect the comparability of data. In order to test robustness of models, we use data during the five years from 2007 to 2011 to do a regression analysis of impacts of implementation of environmental information disclosure system and corporate features on companies' environmental information disclosure and influence

of corporate internal governance on exertion of implementation effect of environmental information disclosure system. At the same time, considering implementation of environmental information disclosure system may affect environmental regulation intensity and environmental information disclosure, a regression analysis of data during the four years from 2008 to 2011 is applied to Model 2 to compare it with results of the foregoing two models and test their robustness.

Table 7
Robustness Test Related to Impacts of Implementation of Environmental Information Disclosure System and Corporate Features on Companies' Environmental Information Disclosure

Variable	Panel 1 EID	Panel 2 EID	Panel 3 EID	Panel 4 EID	Panel 5 EID	Panel 6 EID
Constant	9.870 412*** (10.419 47)	-174.285 0*** (-8.082 943)	15.833 50*** (10.123 17)	17.497 21*** (34.359 35)	16.107 78*** (36.398 03)	-165.893 3*** (-7.213 494)
EIDS	7.482 498*** (7.064 835)					2.858 749** (2.611 668)
SIZE		8.610 294*** (8.819 603)				8.036 227*** (7.756 803)
LEV			5.041 946** (2.015 117)			6.009 360** (2.180 436)
GROWTH				4.702 954*** (4.798 058)		3.736 586*** (3.730 586)
ROE					3.393 080** (2.078 238)	3.277 170** (2.148 051)
Sample size	250	250	250	250	250	250
R ²	0.702 621	0.743 649	0.692 747	0.735 250	0.646 485	0.801 612
Adj R ²	0.627 902	0.679 240	0.615 548	0.668 729	0.557 662	0.746 674
P(F)	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000	0.000 000

***, ** and * mean value is significant at 1%, 5% and 10%, respectively, and t values are shown in brackets.

According to the foregoing table, it is found that impacts of implementation of environmental information disclosure system on environmental information disclosure are significant at the level of 1%, which indicates that implementation of environmental information disclosure system has significant influence on environmental information disclosure. This conforms to results of Table 5-5. Thus, robustness is good.

Table 8
Robustness Test Related to Impacts of Environmental Regulation Intensity and Corporate Features on Companies' Environmental Information Disclosure

Variable	Panel 1 EID	Panel 2 EID
Constant	17.728 14*** (34.186 76)	-183.680 3*** (-8.509 265)
ERI	24.276 65*** (3.090 164)	270.454 0*** (4.998 968)
SIZE		8.724 387*** (9.495 867)
LEV		14.715 91*** (4.015 591)
GROWTH		4.637 802*** (3.378 478)

To be continued

Continued

Variable	Panel 1 EID	Panel 2 EID
ROE		3.313 733** (2.236 290 9)
Sample size	160	160
R ²	0.828 928	0.891 655
Adj R ²	0.771 425	0.850 201
P(F)	0.000 000	0.000 000

***, ** and * mean value is significant at 1%, 5% and 10%, respectively, and t values are shown in brackets.

According to the foregoing table, it is found that impacts of environmental regulation intensity on environmental information disclosure are significant at the level of 1%, which indicates that environmental regulation intensity has significant influence on environmental information disclosure. This conforms to results of Table 5-6 and robustness is tested favorably.

CONCLUSION

This study analyzes current status environmental information disclosure system and standards in China

at present. In addition, based on theoretical analysis and literatures review, it constructs a related multiple linear regression model, uses listed companies of the nonferrous industry in Shenzhen and Shanghai from 2006 to 2011 as samples and empirically analyzes influence of environmental regulation on enterprises' environmental information disclosure and promoting function of corporate internal governance level on implementation effect of environmental regulations. In doing so, it draws the following conclusions.

a. Overall, the level of Chinese listed companies' environmental information disclosure is low, which is mainly reflected by quantity and quality of disclosed information. Enterprises only disclose a little environmental information and environmental information disclosure mainly focuses on mandatorily disclosed content. Disclosure of information with integrity and comprehensiveness in the aspects of environmental governance and environmental management system is lacked. However, the level of environmental information disclosure shows an improving trend as economy develops.

b. Implementation of environmental information disclosure system and environmental regulation intensity have significant impacts on environmental information disclosure. Laws and regulations of our country, for instance, Environmental Protection Act, specify content of environmental information disclosure, which is reflected in Chinese listed companies' rules and regulations about their supervision to some extent. In order to reduce unnecessary spending expenditures in the aspects of political costs, fine and compensation, enterprises must disclose corresponding environmental information in accordance with provisions of laws and regulations.

c. In corporate features, scale of company, financial risk, growth ability and profitability significant have significant impacts on enterprises' environmental information disclosure.

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