Research on the Relationship Between Environmental Information Disclosure Quality and Financial Performance

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Abstract. Nowadays the problem of environmental pollution has become more and more prominent. By studying the coupling and coordination between environmental information disclosure quality and financial performance, guide companies to attach importance to environmental problems, take the public companies in the pharmaceutical industry from the heavy pollution industries in China as the research object, and apply the coupling model in physics to calculate the coupling coordination degree between the environmental information disclosure quality and financial performance. The results show that in 2015–2019 the coupling coordination degree of 160 public companies in the pharmaceutical industry is not high, most companies are in a state of maladjustment, only a few companies can reach the level of junior coordination. However, this state of maladjustment has been gradually changing. By 2019, most companies has reached the level of slight maladjustment. In China Both the government and companies should think highly of the environmental information disclosure quality and the companies should pursue the coordinated development of company performance and environmental protection.

Keywords: Environmental information disclosure · Financial performance · Coupling model

1 Introduction

In the recent years the human living environment has been severely damaged, and the environmental problems have become a major bottleneck that restricts the development of all countries in the world [1], and China is also facing severe environmental problems. China's regulatory authorities have issued environmental information mandatory disclosure documents. As the main force of environmental protection, the companies should disclose the environmental information timely and clearly, which has a wide range of influence to the outside world and directly affects stakeholders' impressions of the companies and the investment decisions.

However, the current standardized environmental information disclosure system has not yet been formed. The information disclosed by companies is relatively small in

quantity and low in quality. Outsiders such as governments, investors, analysts, and the public are unable to obtain related data within the companies, and therefore unable to judge the real internal environmental performance based on the information it discloses. By studying the relationship between environmental information disclosure (hereinafter abbreviated as EID) and financial performance (hereinafter abbreviated as FP), this paper attempts to establish EID evaluation system, to study the coupling correlation between the above two through the empirical data of public companies in heavy pollution industries so as to further improve our country's EID system and to help external information users to make effective judgments on FP of the companies.

2   Literature Review

Mara et al. (2017) divided EID into five major categories: emissions, wastewater, waste, products and services and transportation, her categories are detailed [2]. Zhao Haiyan et al. (2018) divided companies' environmental information into the following aspects: disclosure form, environmental management, environmental input, environmental costs, environmental liabilities, effectiveness, government supervision, and environmental auditing, they also set scoring standards and used qualitative scoring methods to overall evaluate companies' EID [3]. Norhasimah et al. (2016) used the severe environmental issues as an entry point to study the correlation between EID and FP, and at the same time took environmental accounting as one of the important elements of companies governance [4]. Zhang Aimei et al. (2020) conducted research on public companies in our country's chemical industry and found that EID quality is positively correlated with FP [5].

Zeng Guo'an et al. (2021) selected EID index, FP data, and market performance data of 172 public companies in 16 heavy pollution industries in our country to conduct an empirical analysis on the relationship between companies' market performance and environmental performance, and their research results showed that the environmental performance of Chinese companies had positive correlation with FP [6]. Above all, most of the existing literature focus on one or several specific heavy pollution companies, and apply multiple regression as the empirical methods basically to study the relations between EID quality and FP. This article first conducts Granger causality test to obtain the causal relationship between EID quality and FP, and then uses coupling coordination degree model to conduct empirical research on the coordination level of the above two, which provides a new research method.

3   Construction of Index System and Data Processing

Firstly, establish the index system of EID quality and the index system of FP. Then, use R language software to calculate all the weights in the corresponding system.

3.1   Establishment of EID Index System

Referring to the methods of Wu Jianfeng et al. (2015), establish the monetary EID index calculated from six indicators. The non-monetary EID index calculated from seven

Table 1. EID quality index system.

Classification	Index Setting	Value Assignment		
	Pollutant Discharge Fees (Environmental Tax Instead In 2019)	**Nondis Closure**	**Qualitative Disclosure**	**Qualitative And Quantitative Disclosure**
Monetary EID Index	Emergency expenditures for major environmental problems	0	1	2
	Expenditure or loan of environmental protection investment	0	1	2
	Reduction of pollution benefits	0	1	2
	Waste utilization income	0	1	2
	Reduction and exemption of environmental protection grants or reward	0	1	2
Non-Monetary EID Index	EID System	0	1	2
	Environmental management goals	0	1	2
	Environmental protection measures and improvement	0	1	2
	Whether there is environmental protection certification and implementation status	0	1	2

Table 1. (*continued*)

Classification	Index Setting	Value Assignment		
	Pollutant Discharge Fees (Environmental Tax Instead In 2019)	**Nondis Closure**	**Qualitative Disclosure**	**Qualitative And Quantitative Disclosure**
	Energy saving measures and achievements	0	1	2
	Forms and quantities of pollutants and status on whether discharge meets the standards	0	1	2
	Whether there are EID relevant reports	2 for yes, 0 for no		
Total EID Index	Calculated from all EID indicators			

indicators and the total EID index calculated from all EID indicators constructed, as shown in Table 1.

The aggregate score of the optimal disclosure quality of the Monetary EID Index is 12 points, and the aggregate score of the optimal disclosure quality of the Non-Monetary EID Index is 14 points; With the same weight, the companies' total EID index has an aggregate score of 26 points for the best disclosure quality.

The calculation formula is shown below.

$$\text{Monetary EID Index}: \frac{\sum_{i=1}^{6} MEIDI_i}{12}$$

$$\text{Non-monetary EID Index}: \frac{\sum_{i=1}^{7} NMEIDI_i}{14}$$

$$\text{Total EID index}: \frac{\sum_{i=1}^{13} TEIDI_i}{26} \tag{1}$$

3.2   Establishment of FP Index System

Referring to the current research results, the paper takes the following four important capabilities of the companies as the first-level indicators: profitability, repayment ability, operating ability, and development ability. And then takes the following as the second-level indicators to measure profitability: the profit rate of main business, profit rate of

Table 2. FP index system.

First-level Indicators	Second-level Indicators	Attribute
Profitability	Profit Rate of Main Business (%)	Positive indicator
	Profit Rate of Total Assets (%)	Positive indicator
	Return Rate on Assets (%)	Positive indicator
Repayment Ability	Current Ratio (%)	Positive indicator
	Quick Ratio (%)	Positive indicator
	Asset Liability Ratio (%)	Moderate indicator
Operating Ability	Inventory Turnover Ratio (%)	Positive indicator
	Total Asset Turnover Ratio (%)	Positive indicator
Development Ability	Basic Earnings Per Share (Yuan)	Positive indicator
	Net Assets Per Share (Yuan)	Positive indicator
	Main Business Income (RMB100mn Yuan)	Positive indicator

total assets, return rate on assets. The second-level indicators-current ratio, quick ratio, and asset liability ratio are used to measure repayment ability. Inventory turnover rate and total asset turnover ratio are used as secondary indicators to measure operating ability, basic earnings per share, net assets per share, main business income are used as a secondary indicators to measure development ability (Table 2).

In order to eliminate the dimensional difference, the appropriate standardized formula for positive indicators is used as follows:

$$X_i^* = \frac{X_i - X_{min}}{X_{max} - X_{min}} \tag{2}$$

For the standardization of moderate indicators, firstly determine its optimal value K, the optimal value of the asset-liability ratio is 50%, that is, K = 0.5 then:

$$X_i^* = 1 - \frac{|X - K|}{max\{|X_i - K|\}} \tag{3}$$

3.3   Data Acquisition

The paper takes a-share companies in the pharmaceutical industry in heavy pollution industries listed on the Shanghai and Shenzhen stock exchanges in 2015–2019 as research samples.

In the samples selection of heavy pollution companies, follow these principles: (1) Exclude ST and *ST companies; (2) Exclude public companies in the financial industry; (3) Exclude public companies with abnormal financial data and missing data; (4) Exclude public companies of environmental protection business; (5) Exclude samples from the year of listing. In this paper, the data of EID quality mainly comes from manual collection. The data used to measure FP in this paper is from wind database.

Table 3. Weight of second-level indicators.

Second-level Indicators	Weight
Profit Rate of Main Business (%)	0.0113
Profit Rate of Total Assets (%)	0.0009
Return Rate on Assets (%)	0.0058
Current Ratio (%)	0.1329
Quick Ratio (%)	0.1511
Asset Liability Ratio (%)	0.0159
Inventory Turnover Ratio (%)	0.1776
Total Asset Turnover Ratio (%)	0.0592
Basic Earnings Per Share (Yuan)	0.0082
Net Assets Per Share (Yuan)	0.0318
Main Business Income (RMB100mn Yuan)	0.4052

3.4 Calculation of Indicator Weight

Use R language software to get the weight of secondary indicators by entropy weight method (Table 3).

Finally, the FP indicators are calculated by multiplying and adding each indicator and the corresponding weight.

4 Model Construction and Empirical Analysis

4.1 Coupling Model

Coupling degree refers to the degree of interaction between the two sides, no pros and cons; Coordination degree refers to good coupling in interaction, which shows the levels of coordination.

S represents the EID quality system and M represents the FP system, and apply the following model to measure the coupling degree C of the two index systems:

$$C = 2\sqrt{\frac{S \times M}{(S + M)^2}}$$

(4)

The scope of C is (0, 1). Based on the division criteria of coupling degree in the existing research literature, decide on the types of coupling degree (Table 4).

4.2 Coupling Coordination Degree Model

C can reflect the matching degree of the two systems, but it can not explain it is a high-level coordination or a low-level coordination, and it can not explain the quality of

Table 4. Types of coupling degree.

Scope of C	Corresponding Type
[0,0.29)	Low coupling stage between EID quality and FP
[0.29,0.49)	Antagonistic stage between the quality of EID and FP
[0.49,0.7)	Primary running-in stage of EID quality and FP
[0.7,1)	High running-in stage between the quality of EID and FP

Table 5. Types of coupling coordination degree.

Scope of D	Coordination Level
[0,0.1)	Exceeding maladjustment
[0.1,0.2)	Serious maladjustment
[0.2,0.3)	Medium maladjustment
[0.3,0.4)	Slight maladjustment
[0.4,0.5)	Verge of maladjustment
[0.5,0.6)	Reluctant coordination
[0.6,0.7)	Junior coordination
[0.7,0.8)	Medium coordination
[0.8,0.9)	Good coordination
[0.9,1.0)	High coordination

coordination. Therefore, the matching degree of the two systems needs to be measured by coupling coordination degree D.

$$D = \sqrt{C \times Z} \tag{5}$$

$$Z = \alpha S + \beta M \tag{6}$$

In the above formula, Z represents the comprehensive coordination coefficient, α and β are specific coefficients, $\alpha + \beta = 1$. Environmental protection is as important as economic development. Therefore, both α and β are taken as 0.5. The range of D is [0, 1]. Divide the coupling coordination degree into the following 10 types (Table 5).

4.3 Empirical Analysis of Coupling Model

Through the calculation of EID quality, FP, coordination degree C and comprehensive coordination coefficient Z of the two systems, we finally get D-the coupling coordination degree of EID quality and FP and get the types of coupling degree. Due to the large number of public Companies in the heavy pollution industries, the calculation results

Table 6. Coupling coordination degree of 160 listed companies in 2015-2019.

Year	Scope of D	Type of Coupling Coordination Degree	Number of Listed Companies
2015	[0,0.1)	Exceeding maladjustment	2
	[0.1,0.2)	Serious maladjustment	1
	[0.2,0.3)	Medium maladjustment	48
	[0.3,0.4)	Slight maladjustment	98
	[0.4,0.5)	Verge of maladjustment	11
	[0.5,0.6)	Reluctant coordination	0
2016	[0,0.1)	Exceeding maladjustment	1
	[0.1,0.2)	Serious maladjustment	1
	[0.2,0.3)	Medium maladjustment	31
	[0.3,0.4)	Slight maladjustment	110
	[0.4,0.5)	Verge of maladjustment	16
	[0.5,0.6)	Reluctant coordination	1
2017	[0,0.1)	Exceeding maladjustment	0
	[0.1,0.2)	Serious maladjustment	1
	[0.2,0.3)	Medium maladjustment	16
	[0.3,0.4)	Slight maladjustment	113
	[0.4,0.5)	Verge of maladjustment	29
	[0.5,0.6)	Reluctant coordination	1
2018	[0,0.1)	Exceeding maladjustment	0
	[0.1,0.2)	Serious maladjustment	0
	[0.2,0.3)	Medium maladjustment	10
	[0.3,0.4)	Slight maladjustment	101
	[0.4,0.5)	Verge of maladjustment	48
	[0.5,0.6)	Reluctant coordination	1
2019	[0,0.1)	Exceeding maladjustment	1
	[0.1,0.2)	Serious maladjustment	1
	[0.2,0.3)	Medium maladjustment	11
	[0.3,0.4)	Slight maladjustment	99
	[0.4,0.5)	Verge of maladjustment	47
	[0.5,0.6)	Reluctant coordination	1

of 160 companies in pharmaceutical manufacturing industry are selected for analysis. The calculation results of 800 empirical data of 160 public companies in 2015–2019 are shown in the Table 6.
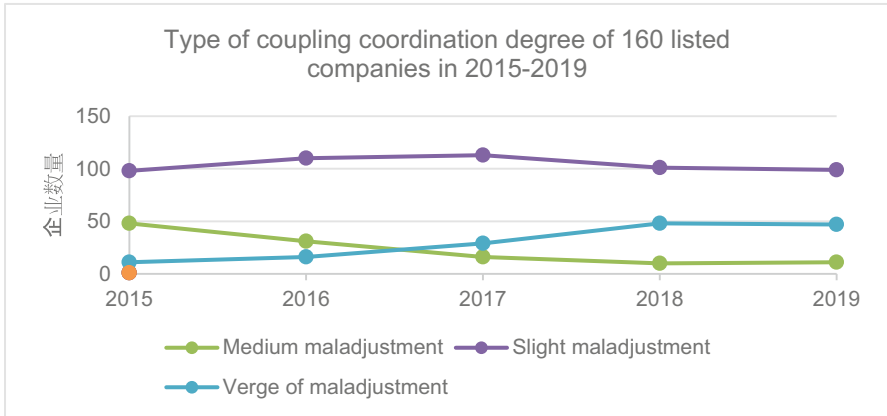
Fig. 1. Types of coupling coordination degree of 160 listed companies in 2015–2019.

From Table 6 we know that the number of companies of the exceeding maladjustment gradually changes from 2 to 0 from 2015 to 2019, indicating that after five years development, no companies of exceeding maladjustment exist any more basically. There is only 1 company of serious maladjustment per year from 2015 to 2019 and there is also 1 company of reluctant coordination per year from 2015 to 2019, indicating that occasionally 1 company reached the level of serious maladjustment or reluctant coordination. Most companies belong to the level of slight maladjustment and verge of maladjustment. The statistic data of most companies is shown in the Fig. 1.

In Fig. 1 we know that, the number of companies of medium maladjustment, slight maladjustment decreased from 2015 to 2019, especially the number of companies of medium maladjustment decreased greatly, while the number of companies of Verge of maladjustment increased greatly. It shows that in the past five years the relationship between EID quality and FP of public companies in pharmaceutical manufacturing industry has been greatly improved, and has gradually developed from medium maladjustment to no longer maladjustment.

5 Conclusion

There exists coupling correlation between EID quality and FP. However, according to the empirical data analysis results of 160 public companies in China's pharmaceutical manufacturing industry in 2015–2019, the coupling coordination between EID quality and FP of public companies is not high, most of them are in a state of maladjustment, and only a few companies can reach the level of reluctant coordination. However, this maladjustment has been gradually improving. By 2019, most companies has reached the level of slight maladjustment. While it cannot be denied that the coupling coordination degree between EID quality and FP of public Companies in heavy pollution industries in China is still very low. Both the government and companies should attach importance to EID quality. The government should further standardize the EID mechanism. And the companies should correctly understand the importance of EID, consciously undertake

corresponding environmental protection responsibilities and pursue the integration of companies performance and environmental protection.

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