

An empirical study on the relationship between the internal control effectiveness and the quality of environmental information disclosure: public data from listed companies in China's oil and gas industry

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Abstract: As China pays more attention to environmental pollution and environmental protection issues, corporate environmental accounting information disclosure has also received attention from researchers. The oil and gas industry, as the lifeblood of the national economy and at the same time an unavoidably heavy polluting industry, should be more vigorous in environmental protection and the regulatory requirements should be more stringent. Among the factors that affect the quality of corporate environmental information disclosure, internal control has certain research value as an institutional system that regulates corporate behavior. This paper explores the impact of internal control effectiveness on the quality of environmental accounting information disclosure by establishing a multiple linear regression model for empirical analysis, using listed companies in the oil and gas industry from 2016 to 2020 as the research object.

Keywords: Internal Control Effectiveness; Quality of Environmental Information Disclosure; Oil and Gas Industry.

1. Introduction

With the increased emphasis on environmental protection issues in China, how companies can improve their environmental protection efforts has become a hot topic of research. In addition to policy factors, many scholars' studies show that improving the quality of corporate environmental information disclosure has a positive effect on promoting environmental protection.

Most of the early related literature studied the factors affecting environmental information disclosure in terms of external pressure and corporate governance. Wang (2008) found that the external regulatory regime significantly influenced the transparency of environmental information disclosure through an empirical study of listed companies in Shanghai[1]. In other empirical studies, environmental protection departments and public pressure (Wang et al., 2013), public opinion supervision and local government regulation (Shen and Feng, 2012) and other external pressures also show significant effects on the level of environmental information disclosure. In studies of related issues in different industries, researchers generally agree that pressure from external institutions can significantly improve the quality of environmental information disclosure. In order to strengthen the institutional construction of corporate environmental information disclosure, a series of laws and regulations were introduced in China in early years, such as the Measures on Environmental Information Disclosure (for Trial Implementation) in 2007, the Guidelines on Environmental Information Disclosure of Listed Companies in Shanghai Stock Exchange in 2008, and the Guidelines on Environmental Information Disclosure of Listed Companies in 2010, all of which made a series of specific requirements on corporate environmental information disclosure. With further research, scholars have found that the effect of environmental information disclosure relying on external pressure has not met expectations. The results of Shen and Li

(2010) show that after strengthening external pressure, the number of enterprises disclosing environmental information and the number of environmental-related items disclosed, although increasing, have decreased in quality, and are mostly positive information and descriptive information that is difficult to verify, while potentially negative information is less disclosed. The number of companies and the number of environmental-related items disclosed are increasing, but the quality is decreasing. It is evident that even with increased external pressure, the incentive for enterprises to proactively perform environmental information disclosure is still insufficient. Under such circumstances, some scholars suggest that strengthening institutional pressure and establishing a unified environmental disclosure system for listed companies can play a positive role in institutionalizing environmental information disclosure of listed companies by establishing mandatory homomorphic mechanism, imitative homomorphic mechanism and normative homomorphic mechanism (Xiao et al., 2013).

Then, how can we reflect the extent to which companies are implementing environmental policies and regulations? From the perspective of both regulators and enterprises, regulating the disclosure of environmental information through an enterprise's internal control system is a direct and effective way. The academic research on the correlation between internal control and environmental information disclosure started late. An empirical study by Li and Zhang (2017) on listed companies in Shanghai and Shenzhen from 2009 to 2012 shows that internal control has a significant positive impact on the disclosure of social responsibility information[6]. In an empirical study of listed companies in the heavy pollution industry from 2011-2017, Zhou (2019) stated that there is a mediating effect in the influence of internal control on the environmental information voluntarily disclosed by enterprises under the pressure of government regulation, and the higher the degree of government regulation, the more likely enterprises are to voluntarily disclose relevant environmental information. Similar

conclusions were reached in related studies on different industries. Empirical studies by other scholars also indicate that the implementation and improvement of the internal control system has a significant positive contribution effect on the improvement of the quality of corporate accounting information disclosure (Yao and Leng, 2016; Zhang and Li, 2017). It has also been found in some English studies that internal control, while playing an important role in corporate governance, does have a significant impact on corporate environmental information disclosure (Johnstone and Labonne, 2009). A study by Cohen and Simentt (2015) also shows that a sound and well-developed internal control system can improve the reliability of environmental information disclosure reports. Thus, it is clear that internal control systems, as a complement to external systems, can effectively contribute to the improvement of corporate related governance activities, including environmental information disclosure.

As the lifeblood of the national economy and a heavily polluting chemical industry in the manufacturing sector, the oil and gas industry inevitably produces a large amount of pollutants in all aspects, which is extremely harmful to the environment. Therefore, the requirements for environmental information disclosure in the oil and gas industry should be more stringent. At present, the literature studies related to internal control and environmental information disclosure have been analyzed with the whole manufacturing industry as a sample, and there are also separate studies on industries such as metal industry and paper industry, but there is no literature record of separate studies on oil and gas industry, which provides space for this paper's research. Based on this, this paper selects the data of 13 listed companies in China's A-share oil and gas industry from 2016-2020 as the research object for empirical analysis to explore the impact of internal control effectiveness on the quality of environmental information disclosure in the oil and gas industry, enrich the relevant research literature in this industry, and provide internal control for the oil and gas industry to optimize and improve the environmental information disclosure system and enhance the quality of environmental information disclosure. It is also a useful reference for the oil and gas industry to optimize and improve the environmental information disclosure system and enhance the quality of environmental information disclosure.

2. Theoretical analysis and research hypothesis

From the perspective of stakeholder theory proposed by Freeman, the interests or constraints of stakeholders, including the natural environment, are part of what companies must consider when making business decisions. Therefore, it is logical for companies to pay attention to the disclosure of environmental information when seeking to grow. However, the business goal of enterprises to chase profits often conflicts with the public interest of the society, leading to the tendency of enterprises to avoid, conceal, and report the good news but not the bad when disclosing environmental information. The connotation of internal control as a systematic normative system and self-regulatory system of enterprises and its institutional norms determines that internal control has a series of spillover effects such as social responsibility effect (Li and You, 2013) and this social responsibility effect can reduce or circumvent the negative impact of enterprises in

fulfilling their social responsibility (Guan and Liu, 2013), promoting CSR internal control information including environmental information disclosure can effectively control CSR risks (Ding and Wang, 2016), indicating that internal control is a good platform for improving the quality of corporate environmental information disclosure. With the introduction and implementation of a series of laws and regulations, internal control has gradually become an indispensable platform and means to implement corporate social responsibility, environmental protection, and information disclosure. The general conclusion obtained by combining a large number of relevant literature studies shows that an effective internal control system can play a role in promoting the quality of corporate environmental information disclosure. As a traditional heavy polluting manufacturing industry, the oil and gas industry should all the more strictly comply with the information disclosure system and improve the internal control system. Based on this, this paper puts forward the following hypotheses:

H: Internal control effectiveness has a positive effect on the quality of environmental information disclosure of listed companies in the oil and gas industry.

3. Model Design

3.1. Sample selection and data sources

This paper selects data related to the oil and gas extraction industry and petrochemical industry from 2016-2020 for 13 listed companies based on the results of the industry classification of listed companies by the Securities and Futures Commission for empirical analysis.

Among the research variables in this paper, the data involved in calculating the Environmental Disclosure Index (EDI) are obtained from the publicly available annual reports, social responsibility reports and sustainability reports of listed companies collected by hand. For the effectiveness of internal control, the internal control index published by Shenzhen Diebold was used. The data of other control variables were downloaded from China Stock Market & Accounting Research Database (CSMAR). The data screening and organizing part was done using Excel, and the empirical analysis part was done using STATA 16.0 software.

3.2. Variable Definition

3.2.1. Quality of environmental information disclosure

This paper uses content analysis to define the environmental information disclosure index (EDI) as the explanatory variable, and assigns sixteen items to environmental information disclosure in terms of significance, comparability, and adequacy in accordance with accounting information quality requirements, as detailed in Table 1. To ensure the reliability of the empirical results, the raw data were standardized according to the following formula to obtain the final environmental information disclosure index (EDI).

$$EDI_i = \frac{\sum EDI_i}{\sum MEDI} \times 100$$

where $\sum EDI_i$ is the sum of the scores of the i th listed company; $\sum MEDI$ is the sum of the best scores of all items in the definition table, which is 30 points; EDI_i The range of values of is [1,100].

3.2.2. Internal Control Effectiveness

The explanatory variable in this paper is internal control effectiveness. uses the internal control index library from the

DIB internal control and risk management database internal control.
developed by Shenzhen DIB to measure the effectiveness of

Table 1. Definition table of environmental information disclosure index

| Classification | Projects | | Assignment method |
|---|---|---|--|
| Significance | Disclosure vehicle (availability of social responsibility reports/sustainability reports, etc.) | | Yes, 1 point; |
| Comparability | Availability of comparable information | | None, 0 points. |
| Adequacy | Non-Financial Information | Environmental Protection Goals | 1 point for disclosure of qualitative information only; 1 point for disclosure of quantitative information only; 2 points for disclosure of qualitative and quantitative information; No disclosure, recorded 0 points. |
| | | Environmental protection organizations | |
| | | Environmental Education and Training | |
| | | Environmental Management System Certification | |
| | | Types and quantities of pollutant emissions | |
| | Financial Information | Compliance status of pollutant emissions | |
| | | Amount of environmental investment | |
| | | Occurrence of major environmental problems | |
| | | Benefits of reducing environmental pollution | |
| | | Environmental taxation situation | |
| | | Sewage Expenditure | |
| | | Waste recycling situation | |
| | | Environmental grants and subsidies | |
| Construction and operation of environmental protection facilities | | | |

3.2.3. Control variables

According to previous studies and the previous analysis, the company's operating conditions and structure also have some influence on the quality of environmental information

disclosure. Based on this, this paper selects company equity concentration, financial leverage, profitability, company size, and enterprise value as control variables, and the meanings of the specific variables are shown in Table 2.

Table 2. Variable Definition Table

| Variable Type | Name | Symbols | Connotation |
|-----------------------|---|---------|---|
| Explained variables | Quality of environmental information disclosure | EDI | Environmental Information Disclosure Index, the ratio of environmental information disclosure item scores based on the content analysis method and the sum of the best scores normalized to the value taken |
| Explanatory variables | Internal Control Effectiveness | ICI | Internal control index values for Diebold's internal control index library |
| Control variables | Shareholding Concentration | OC | Percentage of shareholding of the largest shareholder |
| | Financial leverage | LEV | Gearing ratio, i.e. the ratio of a company's liabilities to its total assets for the year |
| | Profitability | ROE | Return on net assets, i.e. the ratio of net income to net assets |
| | Company Size | SIZE | Natural logarithm of year-end market capitalization of listed companies |
| | Enterprise Value | TBQ | Tobin's Q value |

3.3. Model Setting

To test the hypothesis, the following model is constructed in this paper:

$$EDI = \alpha + \beta_1 ICI + \beta_2 OC + \beta_3 LEV + \beta_4 ROE + \beta_5 SIZE + \beta_6 TBQ + \varepsilon$$

Where EDI is the explanatory variable environmental information disclosure index, and ICI are the explanatory variables internal control effectiveness, the OC, LEV, ROE, SIZE and TBQ are the control variables. $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ and β_6 are the coefficients of each variable, and ε are the random perturbation terms.

4. Empirical Results and Analysis

4.1. Descriptive Statistics

The results of descriptive statistics are shown in Table 3. The great value of environmental information disclosure index is 73.33, the very small value is 30, the mean value is 47.94, and the standard deviation is 13.33, indicating that the quality of environmental information disclosure of the sample

enterprises has a large difference and the general disclosure quality is low. The great value of internal control index is 881.8, the very small value is 180.2, and the difference is large, the mean value is 642.2, and the standard deviation is 133.7, which indicates that the effectiveness of internal control of the sample enterprises varies greatly, but generally can reach a high level.

Table 3. Descriptive statistics

| Variables | Average value | Standard deviation | Minimal value | Maximum value |
|-----------|---------------|--------------------|---------------|---------------|
| EDI | 47.94 | 13.33 | 30 | 73.33 |
| ICI | 642.2 | 133.7 | 180.2 | 881.8 |
| OC | 37.57 | 19.56 | 6.390 | 86.01 |
| LEV | 0.409 | 0.188 | 0.103 | 0.700 |
| ROE | 0.0603 | 0.0740 | -0.214 | 0.238 |
| SIZE | 23.87 | 2.245 | 21.02 | 28.54 |
| TBQ | 1.5272 | 1.099 | 0.784 | 8.321 |

4.2. Correlation Analysis

As can be seen from Table 4, the correlation coefficient

between the quality of environmental information disclosure and the effectiveness of internal control of the sample companies is 0.431 and significant at the 0.01 level, indicating a significant positive correlation between the two. Both shareholding concentration and company size show a significant positive correlation on the quality of

environmental information disclosure and the effectiveness of internal control. Gearing, on the other hand, shows a negative correlation but is insignificant for environmental disclosure quality and significant at the 0.05 level for internal control effectiveness. The correlation analysis results of return on net assets and Tobin's Q were not significant.

Table 4. Correlation Analysis

| | EDI | ICI | OC | LEV | ROE | SIZE | TBQ |
|------|----------|----------|-----------|-----------|---------|-----------|-----|
| EDI | 1 | | | | | | |
| ICI | 0.431*** | 1 | | | | | |
| OC | 0.768*** | 0.387*** | 1 | | | | |
| LEV | -0.0280 | -0.300** | 0.144 | 1 | | | |
| ROE | 0.128 | 0.191 | 0.183 | -0.101 | 1 | | |
| SIZE | 0.591*** | 0.294** | 0.806*** | 0.422*** | 0.00500 | 1 | |
| TBQ | 0.0920 | 0.0130 | -0.328*** | -0.769*** | 0.156 | -0.662*** | 1 |

*** indicates significant at the 0.01 level; ** indicates significant at the 0.05 level; * indicates significant at the 0.1 level

4.3. Regression analysis

4.3.1. Regression results

According to the Hausman test, the p-value of the model is 0.000428, which is less than 0.05, and the original hypothesis is rejected, indicating that the model is suitable for fixed effects regression.

From the fixed effects regression results (Table 5), it can be seen that the regression coefficient of internal control effectiveness and environmental information disclosure quality is 0.143465, which is significant at the 1% level, indicating that hypothesis H holds. The relationship between firm size and environmental information disclosure quality is significant at the 1% level, showing a strong positive influence relationship, indicating that the larger the size, the more inclined the firm is to disclose high quality environmental information. Corporate value shows a significant negative effect at the 5% level in the regression results with environmental information disclosure quality,

which may be due to the fact that companies with larger corporate value are more cautious in disclosing environmental information, especially in the oil and gas industry where environmental problems inevitably arise, but when disclosing environmental information, companies will be more cautious in considering the impact on their own value, resulting in the larger the corporate value, the more the disclosed the more conservative the quality of environmental information disclosed. The relationship between shareholding concentration and environmental information quality shows a significant positive effect at the 10% level, which means that companies with highly concentrated shareholdings tend to disclose higher quality environmental information, which indicates that the higher the shareholding concentration of the sample companies, the more shareholders care about the public image, especially in the oil and gas industry. The relationship between financial leverage and profitability and the quality of environmental information disclosure failed to pass the significance test.

Table 5. Regression results

| Variables | Coefficient | Standard Error | T-value | P-value |
|---------------------|-------------|----------------|----------|---------|
| ICI | 0.143465 | 0.0042316 | 3.39 | 0.001 |
| OC | 0.297121 | 0.1415736 | 1.14 | 0.098 |
| LEV | -4.38894 | 5.502544 | 0.80 | 0.429 |
| ROE | -4.944863 | 3.955239 | -1.25 | 0.218 |
| SIZE | 2.472429 | 3.33415 | 4.12 | 0.000 |
| TBQ | -1.962512 | 0.8013633 | -2.45 | 0.018 |
| Constant term | 156.7775 | 34.77326 | 4.51 | 0.000 |
| F | | | 51.73*** | |
| Adj. R ² | | | 0.1775 | |
| N | | | 63 | |

*** indicates significant at the 0.01 level; ** indicates significant at the 0.05 level; * indicates significant at the 0.1 level

4.3.2. Model Testing

As can be seen from Table 5, the F-test shows that the model is significant at the 0.01 level, indicating that the regression results are significantly valid. As can be seen from Table 6, the VIF values of the explanatory variables and each control variable are significantly less than 10, indicating that there is no multicollinearity among the variables of the model.

4.4. Sensitivity Testing

To test the robustness of the regression results, this paper groups the samples based on the mean value of internal control effectiveness, those greater than the mean value (642.2) as the high internal control effectiveness (ICI) group, and those less than and equal to the mean value as the low

internal control effectiveness (ICI) group, and regresses the model in groups for the original hypothesis, and the results are shown in Table 7.

Table 6. Covariance test

| Variables | VIF | 1/VIF |
|-----------|-------|-------|
| SIZE | 5.190 | 0.193 |
| TBQ | 3.980 | 0.252 |
| OC | 3.490 | 0.286 |
| LEV | 3.270 | 0.306 |
| ICI | 1.670 | 0.600 |
| ROE | 1.150 | 0.870 |
| Mean | VIF | 3.120 |

Table 7. Sensitivity test results

| Variabes | ICI High Group | ICI low group |
|----------------|-----------------------------|----------------------------|
| ICI | 0.0566573*** (0.0195703) | 0.0059614** (0.0028204) |
| OC | 0.2093266* (0.1070507) | 0.1824273* (0.1591703) |
| LEV | -0.7379385 (11.02915) | -4.210075 (5.2651) |
| ROE | -10.01998 (13.27127) | 11.08011 (9.323033) |
| SIZE | 0.7225692** (1.095275) | 1.160022 (1.384266) |
| TBQ | -1.25198* (2.565269) | 1.064857 (0.8454497) |
| _cons | 9.361176*** (24.78439) | 61.94411** (28.1432) |
| R ² | 0.7958 | 0.4310 |
| F | 44.12 | 13.07 |
| N | 35 | 28 |

*** indicates significant at the 0.01 level; ** indicates significant at the 0.05 level; * indicates significant at the 0.1 level

Analysis of Table 7 shows that the regression results of both the high and low internal control effectiveness groups show a significant positive effect of internal control effectiveness on the quality of environmental information disclosure of the sample companies, but both regression coefficients have decreased. Comparing the significance and coefficient values of the two groups shows that the effect of internal control effectiveness on the quality of environmental information disclosure is stronger and more pronounced in the sample with higher internal control index. The sensitivity test findings are not materially different from the previous full-sample regression results, further supporting the original hypothesis and indicating that the results of this paper's empirical test of internal control effectiveness on listed companies in the oil and gas industry are robust.

5. Conclusions and Recommendations

This paper investigates the impact of internal control effectiveness on the quality of environmental information disclosure of listed enterprises in the oil and gas industry, using listed companies in the oil and gas industry from 2016 to 2020 as the research object. After empirical analysis, this paper draws the following conclusions: i) among listed enterprises in the oil and gas industry, the quality of corporate environmental information disclosure varies widely, with generally low disclosure quality, and the effectiveness of internal control varies widely but can generally reach a high level; ii) internal control effectiveness has a significant positive effect on the quality of environmental information disclosure among listed companies in the oil and gas industry; iii) in the oil and gas industry, the internal control effectiveness on the quality of environmental information disclosure is stronger and more pronounced in companies with higher internal control index.

The research in this paper provides empirical evidence of internal control and environmental information disclosure related research in the oil and gas industry and enriches the research literature in related fields; from the conclusion, this paper provides theoretical support of internal control system perspective for optimizing the environmental information disclosure system in the oil and gas industry. However, this

paper only selected a small number of listed companies in the oil and gas industry when selecting the research sample, and further research can be conducted in future studies by expanding the scope of the study.

As the country pays more and more attention to the ecological environment, the issue of environmental information disclosure has gradually become a research hotspot in related fields. The oil and gas industry, as the lifeblood of the national economy and at the same time an unavoidably heavy polluting industry, should be more vigorous in environmental protection and the regulatory requirements should be more stringent. From the research of this paper, the quality of disclosure of environmental information in the public information disclosed by listed companies in the oil and gas industry is still generally low, and the use of environmental accounting is not yet in place. Internal control, as a self-monitoring and self-regulatory system of enterprises, has a significant positive impact on the quality of environmental information disclosure. Accordingly, this paper argues that enterprises in the oil and gas industry should establish a more sound and effective internal control system, especially to reasonably optimize and implement the disclosure methods and contents of environmental information, and at the same time appropriately increase the disclosure of financial information related to environmental protection, institutionalize, standardize and specify the disclosure of environmental information, and also strengthen the self-monitoring of environmental information disclosure in order to improve the quality of environmental information disclosure. We should also strengthen the self-monitoring of environmental information disclosure to improve the quality of environmental information disclosure and to meet the different needs of more different types of corporate stakeholders for environmental information disclosure.

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