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Empirical Study for Influencing Factors on Environmental Accounting Information Disclosure in Chemical Industry

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In the cyclic and low-carbon economic environment, it is of great significance for the sustainable development of the whole society to strengthen the study for environmental accounting (EA) information disclosure. Now, the number of enterprises for EA information disclosure among Chinese chemical enterprises presents the continuously increasing trend, But, as a whole, the enterprises have lower EA information disclosure level, and the large gap still exists between these enterprises in terms of EA information disclosure level. By the empirical analysis of multiple linear regression (MLR), it can be found that the enterprise size, Rate of Return on Common Stockholders' Equity, debt level, state-owned holding nature of the enterprise have positive correlation with EC information disclosure level. The proportion of independent directors in enterprise and EC information disclosure have positive correlation, but without passing the test of significance, mainly because of the incomplete system of independent directors in China.

1. Introduction

Nowadays, with the continuous economic development, the environmental pollution has been intensified, and more attention of the public has been paid to the relationship between the enterprise business activity and ecology environment. To make systematic and fully disclosure of EA information has become the important means for the enterprise to emphasize on the environmental protection (Indjejikian, 2007). Carry on the EA information disclosure can fully reflect the resource utilization and environmental pollution management of the enterprise (Rodrigue, 2014). Following the continuous development of scientific information, the enterprise stakeholder shall need comprehensive EA information for decision making; in order to improve its social image and realize sustainable development, it has become the trend for the enterprise to disclose the comprehensive and systematic EA information (Ana and Jesús, 2010). In the cyclic and low-carbon economic environment, by continuously promoting the enterprise level of EA information disclosure, it has positive effect on the sound and sustainable development of the whole economic society (Wang et al., 2014)

About EA study, many scholars and experts at home and abroad have carried on lots of analysis, and developed lots of research results. The existing literatures are mainly focused on the different aspects of EA information disclosure in terms of disclosure content (Trueman, 1987; Lenter et al., 2003), disclosure method (Maines et al., 2003), evaluation method of disclosure quality (Arnold, 1998; Mauldin and Richtermeyer, 2004) and disclosure situation and influencing factor (Ro, 1980; Iatridis, 2008), mainly for normative study, but lack of the empirical study for EA information disclosure, esp. there was no study for one certain industry. Therefore, based on the chemical industry, this paper makes empirical analysis of the influencing factors on EA information disclosure, which has certain practical and innovative meaning.

2. Multiple linear regression (MLR) analysis method

Regression analysis is the mathematical statistics method treating the statistical correlation of the variables, with the basic thought to find the mathematical expression form representing the relationship between independent variable and dependent variable (Wessel and Jurs, 1994). The regression analysis with two or more independent variables is called multiple regression (Bersten, 1998).

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Given the linear regression model of random y and general variables X_1, X_2 , …, X_k:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_k X_k + \varepsilon \quad (1)$$

Where, y is dependent variable, X_i independent variable, β_i regression parameter, and ε random error.
The linear regression model aims to divide Y into two parts: certainty part and uncertainty part (Clouser and Jurs, 1996). In actual analysis, multi-observations were made to obtain *n* groups of sample data (y_i; x_{i1} , x_{i2}, …, x_{ip}). The MLR model can be shown as:

$$\begin{cases} y_1 = \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \cdots \beta_k X_{1p} + \varepsilon_1 \\ y_2 = \beta_0 + \beta_1 X_{21} + \beta_2 X_{22} + \cdots \beta_k X_{2p} + \varepsilon_2 \\ \cdots \\ y_n = \beta_0 + \beta_1 X_{n1} + \beta_2 X_{n2} + \cdots \beta_k X_{np} + \varepsilon_n \end{cases} \quad (2)$$

Formula (2) can be simplified as:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots \beta_k X_{ip} + \varepsilon_i \quad (3)$$

In MLR analysis, it was necessary to test the fitting degree of the model, and also determine the significance level of every variable parameter in the regression equation (Lin and Wu, 1999). Normally the multi-coefficient of determination should be mainly adopted testing the fitting degree of MLR equation; refer to the formula as follows:

$$R^2 = \frac{\mathrm{SSR}}{\mathrm{SST}} = 1 - \frac{\mathrm{SSE}}{\mathrm{SST}} = 1 - \frac{\sum(y-\hat{y})^2}{\sum(y-\bar{y})^2} \quad (4)$$

Where, SSR means the regression sum of square; SSE the residual sum of square; SST the sum of square for total.
The value range R^2 of was [0, 1]; the lower R^2 meant the less fitting degree of regression equation, while the higher R^2 meant the more fitting degree (Shimada et al., 2000). Considering that R^2 was easily influenced by the number of independent variables, it needed to be adjusted normally, specifically speaking, multiplying the SSE and SST by its degree of freedom respectively, to effectively reduce the effect of number of independent variables on fitting degree (And and Jurs, 1995). Refer to the formula as follows:

$$\overline{R^2} = 1 - \frac{\frac{\mathrm{SSE}}{\mathrm{n-k-1}}}{\frac{SST}{n-1}} = 1 - (1 - R^2)\frac{n-1}{n-k-1} \quad (5)$$

The formula (5) shows, the higher R^2, the better.
F is generally used to test the significance of multiple regression equation. The formula is as follows:

$$\mathrm{F} = \frac{\mathrm{SSR/k}}{SSE/(n-k-1)} \quad (6)$$

The higher F means that the dependent variable (DV) change caused by the independent variable (IV) change is greater than that of independent variables caused by random variable. Also, F-statistics can reflect the fitting degree of regression equation. Make certain changes to formula (4) and (6), to obtain:

$$\mathrm{F} = \frac{R^2/k}{(1-R^2)/(n-k-1)} \quad (7)$$

Formula (7) shows, with higher fitting degree, F-statistics shall be more significant; with more significant F-statistics, the fitting degree shall be higher (Bakker et al., 2004).

3. Empirical analysis for environmental accounting information disclosure

3.1 General situation of EA information disclosure in chemical industry

The chemical industry mainly includes the enterprises for chemical production and development, which easily leads to a mass of “Three Wastes” (industrial wastewater, waste gases and residues), and pollutes the environment greatly, because of the heavy use of raw chemical materials. Until now, there have been 293 listed enterprises in chemical industry altogether, mainly composed of three major types of enterprises: petrochemical enterprise, basic chemical enterprise, and chemical fiber enterprise; refer to Figure 1 for the proportion of these three types.

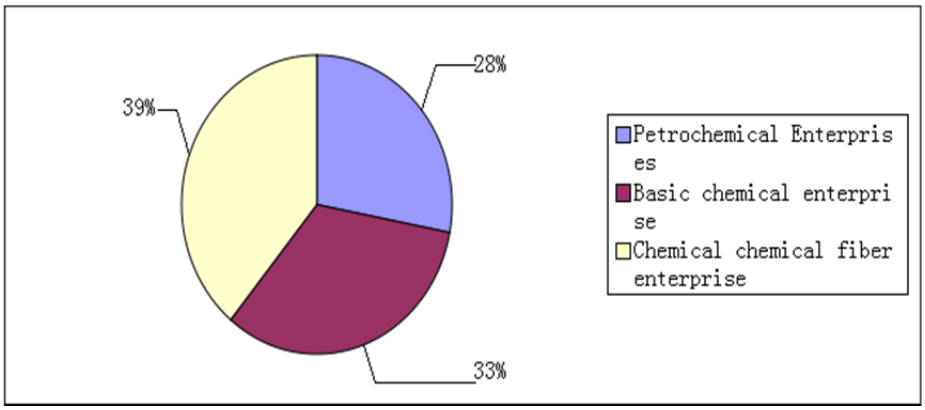

Figure 1: Classification of enterprises in chemical industry

With the environmental requirements promoted continuously, the number of enterprises for EA information disclosure in chemical enterprise has been increasing. Refer to Figure 2 for details.

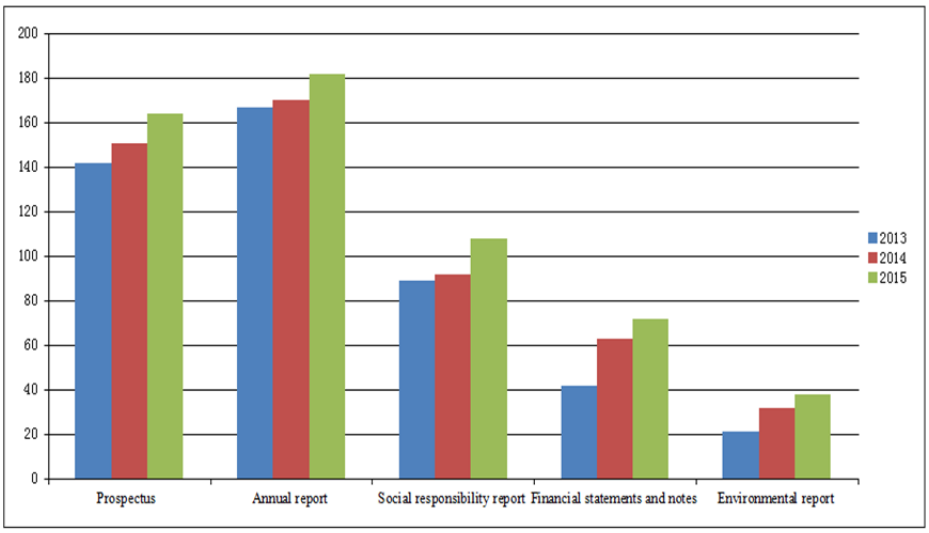

Figure 2: Comparison chart of environmental accounting information disclosure carrier in chemical enterprises

The EA information disclosure in chemical industry is mainly shown in text description and digital description, where the text description includes the overall situation of environmental protection, environmental risks, research and development project of environmental protection, and environmental achievements of the enterprise etc.; the digital description includes inputs, expenditure and research & development fee of the environmental protection in the enterprises. But now, as a whole, the enterprises have lower EA information disclosure level, and the large gap still exists between these enterprises in terms of EA information disclosure level.

3.2 Model construction

By selecting the chemical fiber enterprises, resulting in more pollution in chemical industry, as the study samples in the time range 2013-2015 (92 enterprises in total), this paper makes empirical analysis of the influencing factors on the EA information disclosure, and construct the multiple regression model as follows:

$$\mathrm{EDI}_i = \beta_0 + \beta_1 \mathrm{SIZE} + \beta_2 ROE + \beta_3 \mathrm{DEBT} + \beta_4 NSH + \beta_5 RINDPR + \varepsilon \quad (8)$$

Where, EDI is the environmental accounting information index, as dependent variable; β_1 and β_9 mean regression coefficient, β_0 constant term, and ε random error. See Table 1 for other independent variables.

Table 1: Independent variables definition table

Variable symbol	Variable name
SIZE	Enterprise total assets scale
ROE	Net asset yield
DEBT	Asset liability ratio
NSH	The nature of the actual controlling shareholders
RINDPR	Proportion of independent directors

The descriptive statistics is made for every variable in the model. See table 2 for detail.

Table 2: Descriptive statistics of variables

Variable	N	Minimum	Maximum	Mean	Std.Deviation
EDI	276	0.00000	0.60000	0.20945	0.14493
SIZE	276	18.73265	23.99843	20.67359	0.899627
ROE	276	-0.45572	0.49827	0.06994	0.127438
DEBT	276	0.17993	0.81125	0.48732	0.16843
NSH	276	0	1	0.75	0.436
RINDPR	276	0.34452	0.89975	0.54438	0.10341

3.3 Correlation analysis

Considering that many variables are used in the model, and independent variables and dependent variables have positive correlation, the correlation test for the variables should be conducted before empirical analysis shown in Table 3. Generally, between the independent variables, the high correlation coefficient means there exists the multicollinearity, which shall influence the results of empirical analysis; the data in Table 3 shows that basically all correlation coefficients are rather small, therefore, the multicollinearity doesn't exist in the independent variables of the model.

Table 3: Correlation analysis of variables

	Insize	Roe	Debt	Nsh	Rindpr
SIZE	1.0000				
ROE	0.0652	1.0000			
DEBT	0.5458	-0.1528	1.0000		
NSH	0.2149	-0.0051	0.2664	1.0000	
RINDPR	-0.0347	-0.0163	0.0408	-0.2152	1.0000

3.4 Multiple regression analysis

In this paper, the regression analysis was made for the model by SPSS17.0. See Table 4 for details.

Table 4: Results of linear regression analysis

Variable	Coefficient	Std.Error	T-statistic	Prob.
β_0	-0.75528	0.191123	-4.19427	0.0000
SIZE	0.08326	0.019263	4.39753	0.0000
ROE	0.18525	0.073256	2.40153	0.0169
DEBT	0.13983	0.045824	3.10034	0.0023
NSH	0.09284	0.016542	6.59984	0.0000
RINDPR	0.09834	0.142475	0.72384	0.4698
R-squared	0.49923	Mean dependent var		0.2695
Adjusted R-squared	0.48932	S.D. dependent var		0.14253
Log Likelihood	182.5823	F-statistic		29.7326
Dubin-Watson state	1.984245	Prob(F- statistic)		0.0000

In Table 4, at F=30.8208, well above $F_{0.05}$ (5.324), and P=0, lower than 0.05, it means the significance of the model. But P value of the proportion of independent director (RINDPR) was 0.4698, greater than 0.05, indicating the failure in test of significance. Deducting the variable RINDPR, re-make regression analysis of the model to obtain Table 5.

Table 5 shows R^2=0.500428, and amended determination coefficient $\overline{R^2}$ =0.496283, indicating that the independent variable has greater effect on the dependent variable. At DW=1.988652, very close to 2, it means

that the residual errors are mutual independent, without auto-correlation. Above all, the enterprise size (SIZE) and EA information disclosure level have positive correlation, presenting high significance level at 1% (P=0.0000), because with larger enterprise size, it can more easily draw the attention of the society and the public, and the pressure by all parties for information disclosure shall be greater. Besides, in order to get the support of the government and public, the enterprise has been motivated to disclose more EA information to some extent.

Table 5: Results of linear regression analysis

Variable	Coefficient	Std.Error	T-statistic	Prob.
β_0	-0.724563	0.171634	-4.192553	0.0000
SIZE	0.086463	0.019623	4.392742	0.0000
ROE	0.193243	0.077345	2.400531	0.0169
DEBT	0.149882	0.047821	3.187492	0.0017
NSH	0.112673	0.019234	2.155628	0.0341
R-squared	0.500428	Mean dependent var		0.271963
Adjusted R-squared	0.496283	S.D. dependent var		0.133274
Log Likelihood	182.3754	F-statistic		37.92734
Dubin-Watson state	1.988652	Prob(F- statistic)		0.000000

Table 6: Multiple collinearity test statistics

Dependent variable	coefficient	beta	R-squared	Tolerance	VIF
SIZE	0.08642	0.2854	0.302943	0.674338	1.448238
ROE	0.18548	0.1239	0.058372	0.958332	1.048723
DEBT	0.14376	0.1936	0.337259	0.649985	1.554294
NSH	0.10729	0.3221	0.167233	0.834472	1.198352

Based on the data in Table 5 and 6, the final regression equation is calculated:

$$\mathrm{EDI} = -0.724563 + 0.08642\mathrm{SIZE} + 0.18548\mathrm{ROE} + 0.14376\mathrm{DEBT} + 0.10729\mathrm{NS} \quad (9)$$

Rate of Return on Common Stockholders' Equity (ROE) and EA information disclosure level have positive correlation, presenting high significance level at 5% (P=0.0169). The profitable enterprise, with more resources available, can make better use of resources to reduce the cost and gain the competitive advantage.
The enterprise debt (DEBT) and EA information disclosure level have positive correlation, presenting high significance level at 1% (P=0.0017), which means the enterprise starts to focus on the investment and financing risks in the EA information disclosure process. Also, the creditors attach great importance to the EA information when financing the enterprise. State-owned holding nature (NSH) and EA information disclosure level have positive correlation, presenting high significance level at 1% (P=0.0341). Compared with the private holding enterprises, the state-owned holding enterprises have stronger awareness of social responsibility, being more willing to disclose high-level EA information to the society.
The proportion of independent directors (RINDPR) and EA information disclosure level have positive correlation, but without passing the test of significance (P=0.4698), mainly because of the incomplete system of independent director: most directors, nominated by the Chairman of Board and Board of supervisors, and then elected by general meeting of stakeholders, haven't played their real roles.

4. Conclusion

With the environmental requirements promoted continuously, the number of enterprises for EA information disclosure in chemical enterprise has been increasing. But now, as a whole, the enterprises have lower EA information disclosure level, and the large gap still exists between these enterprises in terms of EA information disclosure level. By the empirical analysis of multiple linear regression (MLR), it can be found that the enterprise size (SIZE), Rate of Return on Common Stockholders' Equity (ROE), debt level (DEBT), state-owned holding nature (NSH) are the key influencing factors on enterprise EA information disclosure, and they have positive correlation with EC information disclosure. The proportion of independent directors (RINDPR) in enterprise and EC information disclosure have positive correlation, but without passing the test of significance, mainly because of the incomplete system of independent directors in China.

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