

# Study on the Relevance of Internal Legal System Environment, Format Guidelines and Carbon Information Disclosure -- Empirical Data from Shanghai A-share Industrial Enterprises

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**Abstract.** This paper empirically investigates the relationship between the internal legal system environment, disclosure format guidelines issued by China Securities Regulatory Commission (CSRC) and carbon information disclosure, using Shanghai A-share industrial enterprises from 2018 to 2021 as the research samples. The results of the study show that the overall level of carbon information disclosure is low and varies greatly among enterprises, that a sound internal legal system environment can improve the level of carbon information disclosure, and that there is a significant positive relationship between the extent to which the disclosure format guidelines issued by the SFC are complete and the level of carbon information disclosure. The study confirms the importance of the internal and external systems of companies, and provides reference for the study of the factors influencing the level of carbon information disclosure.

**Keywords:** legal system environment, format guidelines, carbon information disclosure, carbon peaking and carbon neutrality.

## 1. Introduction

In recent years, as countries all over the world pay closer attention to ecological and environmental issues, low carbon has gradually become a global hot topic. However, the serious impact of the Covid-19 outbreak on economic development has led to the misconception that "green development should take a back seat to economic recovery". In response, Zheng Xinzhu et al. (2021) found that a green recovery program based on the development of clean energy and the digital economy had an equivalent or even greater impact on economic volume than a traditional economic stimulus program based on fossil energy and heavy industry. This study inspires people to break free from the shackles of inertia and develop innovative paths for energy efficiency and new energy transformation. On 22 September 2020, President Xi Jinping announced at the 75th session of the United Nations General Assembly that China would strive to peak its carbon dioxide emissions by 2030 and work towards achieving the goal of carbon neutrality by 2060. On 26 May 2021, the first plenary meeting of the Carbon Neutral Working Group was held in Beijing. On 16 July, the national carbon market was officially opened. Against such backdrop, "double carbon" has undoubtedly become the buzzword of our time.

As the main body of economic activities and carbon emissions, enterprises are responsible for environmental protection, energy saving and emission reduction, and are facing different pressure from the government, society and multiple stakeholders, so it is urgent to disclose carbon information. Most of the domestic scholars' studies on the factors influencing carbon information disclosure focus on two aspects: first, the influence of internal corporate governance characteristics on the level of carbon information disclosure. Zhao Xuanmin and Zhang Yiqiong (2016) found that company size and financial leverage were significantly and positively related to the level of carbon information disclosure, and profitability was significantly and negatively related to the level of carbon information disclosure. Secondly, the impact of public pressure on the level of carbon information disclosure. Li Huiyun et al. (2018) found that among public pressure, government pressure, creditor pressure, and shareholder pressure had a significant positive effect on corporate carbon information disclosure, with the effect of government pressure being more significant in state-owned enterprises and the effect of creditor pressure and shareholder pressure being more significant in non-state-owned enterprises.

In summary, due to the late and incomplete research on carbon information disclosure in China, there are few studies on the impact of specific internal and external systems on the level of corporate carbon information disclosure. The main research elements of this paper are: (1) to investigate the overall carbon information disclosure level of listed companies; (2) to analyse the relationship between the internal legal environment of companies, the format guidelines set by CSRC on annual report disclosure and the level of carbon information disclosure by companies. The significance of the study is to provide a research basis for improving the level of carbon information disclosure, to reveal the important role of the legal system and departmental regulations in the process of achieving the "double carbon" goal, and to promote the early formulation of a sound system to facilitate the sustainable development of a low-carbon economy.

## **2. Theoretical Analysis and Research Hypothesis**

### **2.1 Internal legal system environment and carbon information disclosure**

The rules and regulations of a company are the extension and concrete deepening of the legal system. Legal and complete rules and regulations are the law of the enterprise itself, which is the premise and foundation for the orderly development of all activities of the company. In today's society of diversified economic development, focusing only on the speed of short-term economic development and neglecting the construction of the internal legal system of the company will inevitably lead to unbalanced and unsustainable development. Among the existing studies on the influencing factors of carbon information disclosure, some scholars have suggested that a perfect legal system environment has a positive guiding effect on carbon information disclosure, which means that under the constraints of the system, enterprises will choose to disclose more carbon information. Yuan Zeming and Wang Jinyue (2015) found that the improvement of carbon emission system helps to improve the level of carbon information disclosure of enterprises and the characteristics of heavy pollution industry can enhance this promotion effect. Tang Yongjun et al. (2018) showed that the better the legal system of a company, the higher the level of carbon information disclosure. According to cost-benefit theory, companies weigh the gains and losses of economic actions and will only act when the additional benefits outweigh the additional costs. It can be deduced that when a company has an internal legal system in place regarding carbon reduction, it is more inclined to disclose carbon information in full to reduce administrative and other hidden costs, and to reveal more environmental information to stakeholders that is conducive to enhancing the company's image. This paper therefore proposes the following hypothesis.

Hypothesis 1: There is a positive relationship between the degree of perfection of the legal system environment for carbon within the company and the level of carbon information disclosure by the company.

### **2.2 Format guidelines and carbon information disclosure**

China Securities Regulatory Commission (CSRC) is responsible for researching and formulating policies, development plans, rules and regulations for the securities and futures market, establishing a unified securities and futures regulatory system and playing a regulatory role over listed companies. On 28 June 2021, CSRC issued Announcement No. 15, announcing the "No. 2 Guideline on the Content and Format of Information Disclosure for Companies that Issue Public Securities -Content and Format of Annual Reports (Revised 2021)" came into effect from the date of publication. The new standard adds a new section on environmental and social responsibility, consolidating the provisions related to environmental protection and social responsibility in the main text of periodic reports into the new "Section 5 Environmental and Social Responsibility", and adding a new section on disclosure of administrative penalties imposed on companies for environmental issues during the reporting period. Companies are encouraged to voluntarily disclose the measures they have taken to reduce carbon emissions during the reporting period and their effectiveness. The new standard places the environmental responsibility of companies on a higher level than usual, and is intended to

encourage companies to do their best to reduce carbon emissions, actively disclose carbon information and contribute to the achievement of the "double carbon" goal. This leads to the following hypothesis.

Hypothesis 2: Under the given conditions, the better CSRC's guidelines on the disclosure format of companies' annual reports, the higher the level of carbon information disclosure by companies.

### 3. Research design

#### 3.1 Sample selection and data sources

The statistical results of relevant data show that carbon dioxide emissions from the secondary industry always occupy a larger proportion of the total carbon emissions. The industrial carbon dioxide emissions in 2018 were about 762,320,000 tons, accounting for 65.93% of the total emissions, of which manufacturing, power and heat carbon emissions accounted for about 94%. In addition, Zhang Yang et al. (2010) found that the overall level of environmental information disclosure of A-share listed companies on the Shanghai Stock Exchange was better than that of the Shenzhen Stock Exchange. Therefore, in this paper, the data of Shanghai A-share industrial companies (including mining, manufacturing, electricity, heat, gas and water production and supply) from 2018 to 2021 are used, with a total of 138 companies and 552 research samples were screened out after excluding ST and \*ST companies and companies with incomplete data. The annual reports, social responsibility reports and sustainable development reports of companies used to evaluate the level of carbon information disclosure were all obtained from the Shanghai Stock Exchange and Juchao Information Website, and the carbon information disclosure indices were calculated by manual collation. Information on the internal legal system environment of companies was obtained by collecting internal company reports and annual reports, and the rest of the financial data was obtained from the Guotaian database. This paper uses Excel 2019 and Stata 15.0 for data processing.

#### 3.2 Definition of variables

##### 3.2.1 Explained variables.

**Table 1.** Evaluation indicators of carbon information disclosure level

1st level indicators	2nd level indicators	Scoring rules
Low carbon development strategy selection	Low carbon issues are integrated into corporate development strategies	1. Extraversion (E): 0 points for no disclosure in annual report, social responsibility report, sustainability report and environmental report; 1 point for annual report disclosure; 2 points for social responsibility report, sustainability report or environmental report disclosure
	Establishment of an independent carbon monitoring body	
	Risks and opportunities regarding carbon emissions	
Accounting for carbon emissions	Corporate targets and budgets for energy saving and emission reduction	2. Quantitative (Q): 0 points for no disclosure; 1 point for descriptive carbon information; 2 points for quantitative or monetary carbon information
	Guidelines and methods for carbon emissions	
Carbon emission reduction management and performance	Types of carbon emissions and carbon footprint	3. Temporality (T): 0 points for no disclosure; 1 point for disclosure of carbon information for the current year only; 2 points for comparison with the past or projection of the future
	Development of appropriate rewards and punishment mechanism for employees	
	Innovative investments (publicity, technology development, etc.) and day-to-day costs associated with carbon reduction	
	Government support or subsidies for carbon reduction	
	Carbon reduction performance	

On the basis of adopting the content analysis method commonly used in carbon information disclosure research and drawing on the CDP project and the carbon information disclosure index scoring table produced by Zhao Xuanmin and Zhang Yiqiong (2016), this paper refines and improves it by dividing the content related to carbon information into ten indicators in three dimensions, and then assigning values to each indicator in terms of extraversion, quantification and temporality, with the specific scoring details shown in Table 1. In order to reduce the influence of subjectivity, the ratio of the actual score of the *i*-th sample company to the best score of 60 is called the Carbon Disclosure Index  $CDI_i$ , with a minimum value of 0 and a maximum value of 1. The closer the  $CDI_i$  is to 1, the higher the level of carbon information disclosure.

### 3.2.2 Explaining variables.

The explaining variables in this paper are the internal legal system environment and the format guidelines. The legal system environment refers to whether a company has clear rules and regulations regarding carbon emissions reduction and disclosure, and takes a value of 1 if so, otherwise it takes a value of 0. The format guidelines refer to the CSRC's guidelines on the content and format of company disclosures. In 2021 the CSRC issued a new format standard and it became effective in that year, whereas prior to 2021 companies were using the old format standard. Therefore, the data for the format standard variable for each sample company takes the value of 1 in 2021 and 0 in 2018-2020.

### 3.2.3 Control variables.

With reference to existing studies, this paper selects company size, profitability, financial leverage, shareholding ratio of controlling shareholders and ratio of independent directors as control variables to control the impact of corporate governance characteristics on carbon information disclosure.

The specific variable names, codes and definitions are shown in Table 2.

**Table 2.** Variable definition table

Types of variables	Names of variables	Code	Definition of variables
Explained variables	Carbon Disclosure Index	CDI	$CDI_i$ =actual score of the <i>i</i> -th company's carbon disclosure / best score of the company's carbon disclosure
Explaining variables	Legal system environment	LAW	Whether the company has clear rules and regulations on carbon reduction
	Format guidelines	FORMAT	CSRC issued new format standard on annual report disclosure in 2021
Control variables	Company size	SIZE	Logarithm of the company's total assets at the end of the period
	Profitability	ROE	Net profit/net assets
	Financial leverage	LEV	Total liabilities/total assets
	Shareholding ratio of controlling shareholders	TOP	Shareholding of the largest shareholder/total shares
	Ratio of independent directors	IDR	Number of independent directors/number of directors

### 3.3 Model setting

According to the previous hypothesis and analysis, This paper constructs the following multiple regression model:

$$CDI_{it} = \alpha + \beta_1 LAW_{it} + \beta_2 FORMAT_{it} + \beta_3 SIZE_{it} + \beta_4 ROE_{it} + \beta_5 LEV_{it} + \beta_6 TOP_{it} + \beta_7 IDR_{it} + \varepsilon_{it}$$

$\alpha$  is a constant term,  $\beta_i$  ( $i=1,2,3,\dots,7$ ) denotes the regression coefficients of the explaining and control variables, and the variable subscript  $it$  denotes the value of the *i*-th sample company in year *t*.  $\varepsilon$  is a random error term.

## 4. Empirical Analysis

### 4.1 Descriptive statistics

This paper presents descriptive statistical analysis of the main research variables and the results are shown in Table 3. The maximum value of CDI of the sample companies is 0.833, the minimum value is 0, the mean value is 0.202 and the standard deviation is 0.199, reflecting that the overall level of carbon information disclosure of industrial enterprises in China is low and varies widely among enterprises. The transparency of carbon information disclosure is not high, and information asymmetry phenomenon exists between companies and stakeholders. It can be inferred that the awareness of social responsibility and environmental protection among listed companies in China is weak, and a complete carbon information disclosure system has not yet been formed. From the carbon information disclosed in the annual reports, social responsibility reports and sustainability reports issued by listed companies from 2018 to 2021, it can be seen that most companies only disclose information in accordance with the disclosure format prescribed by CSRC, and lack carbon information disclosure at the strategic level and technical level according to the specific conditions of the company, with little involvement in carbon information that stakeholders really care about. The information disclosed is mostly qualitative rather than quantitative, which is of low reference value to investors.

The mean value of LAW is 0.292 and the standard deviation is 0.455, indicating that the legal environment of carbon information disclosure in the sample companies varies greatly, with most companies not having a sound internal legal system, and only about 30% of the companies having a clear internal regulation on low carbon development in addition to complying with the relevant national environmental protection laws and regulations.

**Table 3.** Descriptive statistics of relevant variables

Variables	N	Mean	Std. Dev.	Min	Max
CDI	552	0.202	0.199	0	0.833
LAW	552	0.292	0.455	0	1
FORMAT	552	0.250	0.433	0	1
SIZE	552	22.25	1.375	19.81	27.55
ROE	552	0.0169	0.770	-13.51	1.171
LEV	552	0.395	0.173	0.0143	1.150
TOP	552	0.349	0.156	0.0693	0.810
IDR	552	0.388	0.0680	0.143	0.800

**Table 4.** Descriptive statistics grouped by variable legal system environment

Variables	N	LAW 0				LAW 1				
		mean	Std. Dev.	min	max	N	mean	Std. Dev.	min	max
CDI	391	0.108	0.103	0	0.450	161	0.431	0.191	0.0500	0.833
FORMAT	391	0.220	0.415	0	1	161	0.323	0.469	0	1
SIZE	391	21.83	1.035	19.81	25.75	161	23.28	1.544	21.07	27.55
ROE	391	-0.00871	0.913	-13.51	1.171	161	0.0792	0.0823	-0.336	0.330
LEV	391	0.380	0.171	0.0625	1.150	161	0.432	0.173	0.0143	0.775
TOP	391	0.323	0.150	0.0693	0.810	161	0.410	0.152	0.161	0.774
IDR	391	0.387	0.0612	0.143	0.600	161	0.388	0.0823	0.333	0.800

In order to further investigate the influence of legal system environment and format guidelines on the main research variables, this paper conducts descriptive statistical analysis on the legal system environment and format guidelines in groups, and the results are shown in Tables 4 and 5, respectively. The mean value of carbon disclosure index of sample companies without clear internal legal system is 0.108, and the maximum and minimum values are 0.450 and 0, respectively, while the mean value of carbon disclosure index of sample companies with clear internal legal system is 0.431, and the maximum and minimum values are 0.833 and 0.05, respectively, which are significantly higher than

the former. A similar conclusion can be obtained by performing the above analysis for the group of format guidelines. The correlation study and regression analysis will be conducted in depth in the following section.

**Table 5.** Descriptive statistical analysis grouped by variable format guidelines

Variables	N	FORMAT 0				FORMAT 1				
		mean	Std. Dev.	min	max	N	mean	Std. Dev.	min	max
CDI	414	0.183	0.193	0	0.767	138	0.259	0.206	0	0.833
LAW	414	0.263	0.441	0	1	138	0.377	0.486	0	1
SIZE	414	22.19	1.371	19.81	27.55	138	22.43	1.374	20.06	27.54
ROE	414	0.0355	0.584	-11.49	1.171	138	-0.0387	1.163	-13.51	0.330
LEV	414	0.388	0.173	0.0143	1.150	138	0.418	0.171	0.0489	0.897
TOP	414	0.353	0.157	0.0693	0.810	138	0.337	0.153	0.0696	0.810
IDR	414	0.387	0.0669	0.200	0.800	138	0.388	0.0712	0.143	0.800

## 4.2 Correlation analysis

The Pearson correlation test of the main variables is shown in Table 6. It can be found that legal system environment, format guidelines, company size, financial leverage and shareholding ratio of controlling shareholders are significantly correlated with carbon information disclosure at 1% level, and profitability and independent directors' ratio are not significantly correlated with carbon information disclosure level. Since the correlation between legal system environment and carbon information disclosure level is 0.738, in order to verify whether there is a case of multicollinearity, variance inflation factor (VIF) and tolerance (1/VIF) analysis are conducted for each variable, and it is calculated that VIF is less than 2 and tolerance is greater than 0.1, which means there is no multicollinearity problem among variables.

**Table 6.** Pearson correlation test for variables

	CDI	LAW	FORMAT	SIZE	ROE	LEV	TOP	IDR
CDI	1.000							
LAW	0.738***	1.000						
FORM	0.166***	0.108**	1.000					
SIZE	0.650***	0.482***	0.075*	1.000				
ROE	-0.008	0.052	-0.042	0.043	1.000			
LEV	0.295***	0.135***	0.075*	0.530***	-0.211***	1.000		
TOP	0.251***	0.255***	-0.044	0.276***	0.059	0.152***	1.000	
IDR	-0.007	0.005	0.004	0.054	0.004	0.109**	0.035	1.000

Note: \*\*\*, \*\*, and \* indicate significant correlation at the 1%, 5%, and 10% levels, respectively.

## 4.3 Regression analysis

In this paper, firstly, Hausman test is conducted on the panel data of the listed company sample, and the result shows that the p-value is 0.0000, which is much less than 0.05, so the fixed effect model is selected. Regression tests were performed on the empirical model and the results are presented in Table 7. From the regression results, it can be seen that the correlation coefficient between the legal system environment and the carbon information disclosure level is 0.134, which is in line with the expectation and passes the test at 1% significant level in terms of statistical significance, so the hypothesis 1 is valid, that is, a sound legal environment for carbon disclosure can improve the level of carbon information disclosure to some extent. The coefficient of correlation between format standard and carbon information disclosure level is 0.055, which is also consistent with the expectation and passes the test at 1% significant level in statistical significance. Hypothesis 2 is valid, which indicates that the CSRC's formulation of perfect guidelines on reporting disclosure format has a positive effect on the level of corporate carbon disclosure.

The coefficient of the company size is 0.032, which reaches the 5% level of significance, indicating that the larger the company size is, the higher the level of corporate carbon information disclosure is

likely to be. The correlation between the remaining control variables and the level of carbon information disclosure is not significant, so these variables' effect on the level of corporate carbon information disclosure cannot be determined.

**Table 7.** Regression results

Explaining variables	Coefficient	T
LAW	0.134***	4.40
FORMAT	0.055***	7.63
SIZE	0.032**	2.15
ROE	-0.010	-1.16
LEV	-0.087	-1.16
TOP	-0.003	-0.03
IDR	-0.042	-0.47
Constant	-0.519	-1.60
N	552	
Adjusted R-squared	0.425	
F	14.03	

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

#### 4.4 Robustness test

Since the selection of methods used to measure the company's financial indicators may have an impact on the robustness of the conclusions, this paper changes the calculation of certain indicators of the control variables, replacing ROE with EPS to measure the company's profitability, using total debt/net assets to calculate the company's financial leverage ratio. After that, this paper reselects data from the Guotaian database to calculate the ratios, and conducts regression tests again. It shows that the regression results are still consistent with previous study, which means that the results of the previous empirical tests and the conclusions obtained are robust.

## 5. Conclusions and recommendations

This paper constructs a carbon information disclosure evaluation system with a total of 552 sample data of industrial enterprises in Shanghai A-share market from 2018-2021, and empirically tests the influence of the legal system environment and format standard of companies on the level of carbon information disclosure. The research draws the following conclusions: First, the overall level of carbon information disclosure of industrial enterprises in China is low and varies greatly. The awareness of voluntary disclosure is not strong and the attention of enterprises is not high. The carbon information disclosure is not comprehensive, with most disclosure is qualitative description rather than quantitative analysis. Secondly, there is a significant positive relationship between the degree of perfection of the legal system environment on carbon and the level of carbon information disclosure of companies. Companies with clear rules and regulations on carbon information disclosure are more likely to disclose complete carbon information to reduce the cost of various parties and enhance the company's image and social influence. Last but not least, there is a significant positive relationship between the degree of perfection of the standard on the format of annual report disclosure and the level of carbon information disclosure of the company. When the CSRC announced the new annual report disclosure format guidelines, which stipulate that the information related to environmental protection in the body of the report is unified and integrated into a new section, giving sufficient attention to environmental protection, the level of carbon information disclosure of companies significantly improved.

In response to the above study, this paper makes the following recommendations: from the government level, relevant laws and regulations should be improved, reasonable carbon information disclosure format guidelines should be formulated as soon as possible, and the content and format of carbon information disclosure of listed companies should be standardized. The research results show that most companies choose to reduce or even ignore the disclosure of carbon information under the

voluntary disclosure policy. Therefore, the completely voluntary disclosure policy should be changed, and certain mandatory requirements should be imposed to provide financial support and tax incentives for enterprises that disclose carbon information completely as required, and to severely punish enterprises that violate national carbon emission regulations or do not disclose carbon information as required. From the enterprise level, they should grasp the overall situation, develop internal systems regarding carbon emission reduction, disclose carbon information in detail, and meet the needs of the company's stakeholders. In the post-epidemic era, companies should realize that economic recovery and green development are not contradictory and antagonistic, but mutually beneficial. Adhering to the principle of environmental protection while rapidly developing the economy and sticking to the path of green and sustainable development is an inevitable requirement for companies to obtain long-term benefits and realize social values.

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