Factors Motivate the Increasing Carbon Trade among Chinese Corporations: Evidence from CSMAR

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Abstract: With the tendency of the awareness of carbon disclosure and environmental protection, finding out the reasons behind the carbon-neutral disclosure is necessary. This research shows that the inter-relationships of different factors that increase the actions of carbon trades vary over the years. Both external and internal factors that facilitate the incentives for carbon exchange are discussed and analyzed. The existing carbon accounting research papers emphasize on the social pressure that makes companies disclose carbon data using stakeholder or shareholder theories. Nevertheless, this research dissects geographical and intrinsic factors to show a new perspective on the carbon trades' managerial accounting and corporate finance. The main theory is signal theory to assist the procedure of analyzing the data layer by layer to avoid the interference factors. The empirical results show that the main factors are Carbon Emission Right Exchange, Province, Employee Scale, and Insured Employees. This paper also contributes to the advice of re-establishing the tax system to consider the human happiness better.

Keywords: Carbon Trade, Carbon Accounting, Taxation, Well-being

1   Introduction

Carbon trade and environmental taxation issues have drawn attention from academics domestically and internationally. Carbon neutrality is the hottest research topic in China now, and the number of books and journal articles has dramatically enhanced during 2020-2022. However, most use quantitative or qualitative methods based on international evidence. Only some of them provide feasible plans with details for reducing carbon emission volume for a specific region or country. This research uses Stata software to analyze company information behind the carbon trade market. There are some differences between the taxation categories and planning of China and other countries. This research emphasizes the divergence, proportional taxation, and corporations' choices when disclosing carbon trade information. There is no holistic carbon taxation system in China, but it is beneficial if comparable business analytical results are given for further development of the carbon taxation system. It is also the aim of this study.

Edmans et al. summarized that the noisier signals are, the more rewards that investors need and the more likely the choices of the investor will skew [1]. The Decision-making process of investors is essential when trading carbon-related goods. The primary step is identifying the factors that facilitate carbon information disclosure. The innovative green policies in China are unstable and with many uncertainties. Gao et al. expressed that green policy promotes innovation in companies in var-

ious ways and significantly impacts the corporate behaviour of state-owned corporations [2]. Luo et al. also suggested that social pressure plays an essential role when promoting the disclosure behaviour of large companies [3]. Perkiss et al. illustrated the importance of interaction between different companies' board members to mitigate the social press of environmental accounting disclosure [4]. There are still some research gaps for filling in the carbon accounting area to show the influence between large and small companies when the managing boards disclose carbon information (Liao & Khan) [5]. The control and management of creative green approaches lack democratization, such as mandatory vehicle restrictions in Beijing. For instance, Inhye found that representative governance (such as policy communities' debates and projects) ignores the bottom-level demands of citizens, raising the query of true democracy [6].

On the one hand, the policies create a greener environment. On the other hand, the freedom of citizens becomes less and less. Arjomandi et al. found that stricter environmental policies and governmental-level environmental expenditures slow down the green GDP and productivity in the long run. In contrast, the impact of policy stringencies is weaker in the OECD region [7]. No direct evidence or detailed research shows how policies influence carbon trading behaviours. It is crucial to link innovative approaches with corporate strategies in business decisions relating to carbon neutrality (CICC Global Institute) [8].

2   Research Methodology

Data is from CSMAR, China's leading economic and finance database, and policies from various channels, such as governments, media, etc. Research methodology is the meanly quantitative method using factors analysis and regression models based on the factors. The sample is from CSMAR-listed carbon-neutral disclosure companies, but it is vital to delete financial companies and missing values for the accuracy of results. There are some qualitative information. Therefore, the qualitative data is numbered by different types. For example, locations are numbered by different provinces, company types are labeled by different types. After the pre-processing, all the qualitative data is transferred into quantitative data. Together with other quantitative data, the variable list is produced as table 1 showed.

Table 1: Variable list.

symbol	variable	symbol	variable
var_1	Year	var_5	Company Type
var_2	Industry	var_6	Province
var_3	Carbon Emission Right Exchange	var_7	Employ Scale
var_4	Registered Capital	var_8	Insured Employees

This methodology is similar to Tang and Luo's carbon management systems and mitigation factored test in 2013 [9]. The beginning year of Chinese carbon disclosure information is 2012, which also compiles with the surge year of publishing carbon accounting-related academic journal articles based on the systematic review results from Rong et al. [10]. The last step is the empirical test. The research shows the potential gaps between the current situation of carbon disclosure factors and policies, which provides evidence and possible theoretical assistance for policymakers to develop more democratic policies. The first empirical part of this study is the multivariate descriptive statistics since the factors influence each other. In some research, the multivariate cross-tabulation or elaboration uses the third variable to show the relationship between the independent variable and dependent variable, which is also the primary research method that Professor Alex Edmans introduced in the recent TED talk in Manchester when Edmans analyzed the ESG (environmental, social, and

governmental) aspects of enterprises with industrial factors. Hence, paying attention to the third influence is necessary before building the multiple linear regression model. There needs to be a more precise linear relationship between industry and carbon emission rights exchange. The signals are unclear in this data stream. The best way to explain complex relationships is to do a factor analysis. Firstly, using KMO and Bartlett test to judge if the factor test is feasible. Secondly, using principal component analysis to determine the main factors. Thirdly, providing a positive solution for the future tax planning of China. Cheng et al. found that Chinese environmental taxation reduces external investment, while technical innovation substitutes the investing behaviours [11] . Therefore, along with the higher environmental taxation, innovative activities are improved accordingly.

3 Multivariate Descriptive Analysis

Descriptive statistics is below as table 2, including year, carbon exchange, Registered Capital, company type, Industry, Province, Employ Scale, Insured Employees.

Table 2: Information of key emission enterprises in national carbon emission trading.

	Mean	Median	Mode	Variance	Kurtosis	Skewness
var_1	2,016.13	2,017	2014	4.9	-1.13	-0.46
var_2	45.01	44.00	44	213.99	-0.29	0.36
var_3	2.07	1	1	3.09	0.52	1.36
var_4	1.7×10^5	2.8×10^4	5×10^4	1.1×10^{12}	1.2×10^3	32.42
var_5	13.06	12	4	107.99	1.36	0.95
var_6	2.03	1	1	6.06	30.05	4.71
var_7	4.59	5.00	5	1.67	0.22	-0.24
var_8	1,188.06	329	40	2.5×10^7	449.26	18.24

The beginning year of carbon data disclosure is 2012, which is the beginning year of the first Chinese Scholarship Council funded phd scholar Le Luo published the article named 'Corporate Incentives to Disclose Carbon Information: Evidence from the CDP Global 500 Report', the Chinese indigenous carbon database within CSMAR was built. From a political accounting perspective, this action shows the importance of anti-trust and knowledge invasion from the UK (where the CDP carbon database was built). The database competition began in 2012. Chinese funding has become more local instead of international since then. The mean year of carbon information is 2016. This information not only reveals the emotion of drawing on advantages and avoiding disadvantages of academics and entrepreneurs who used and disclosed carbon details but also metaphors for the beginning of using accounting as a 'tool' to earn more profits and welfare, which is unethical and disobeys the free market hypothesis. According to the free market hypothesis, money and goods are traded only by personal willingness. However, it seems that the surge of Chinese carbon information is followed by market demands instead of individual readiness. The disrupted balance of environmental accounting funding caused severe academic competition among Chinese scholars who are located overseas. Although data do not disclose the underneath dark part, the indirect effect is hard to ignore. The kurtosis of year is in the status of platy-kurtosis, and it is in the negative skewness. The kurtosis of carbon emission right exchange is close to the normal distribution, which means that each class of trading carbon commodities has equal amounts of corporate clients. The range of Registered Capital is around 4 million, which is considerable. This is another evidence that proved the fact that companies at all levels participate in carbon disclosure.

Moreover, the sample variance is relatively slight, which is around 1. This is a positive sign because different sizes of companies are given the same opportunities to share carbon information,

which shows the successful action of climate justice. This is also proved by the sample variance of Company Type, which is over 100. However, large-scale enterprises undertake more corporate responsibility through the lens of carbon disclosure since the skewness of Registered Capital is positive. The sample variance of Industry is even over 200. Different industries disclose carbon relating information randomly, which is free from the suspicion of market control. Different codes mark the industries. The median and mode of Industry are 44, which is the electricity, heat production and supply Industry. This evidence reflects this industry utilizes the most carbon volume when every Industry gains an equal chance to disclose carbon trading information.

Different names of provinces are numbered accordingly. The median is equal to mode number 1 (Shanghai City). The positive skewness and leptokurtic mean carbon emission appear as industrial aggregation. Employ The different number of employees numbers scale. The median is the same as the mode, which is 5 (100 – 499 people), and the standard variation and sample variance are very stable, close to 1.

In comparison, the sample variance of Insured Employees is incredibly high. It reveals a labour income and guarantees an inequality problem. Corporations take more responsibility for trading carbon but less for caring for employees.

Therefore, it is necessary to do further factor analysis to show the inter-relationships between var1 to var8.

4   Factor Analysis

Because the relationships between var1 to var8 are nonlinear on the surface, the R^2 of the original linear regression is below 10%, so it is vital to do the data dimension reduction processing. In this study, the factors analysis is chosen to identify the noise and signals influencing managers' decision-making to disclose carbon emission information.

Therefore, step 1 is to determine whether the database is suitable to do the factor analysis or not. In the step, Kaiser-Meyer-Olkin Measure of Sampling Adequacy is used to compare the correlation coefficient and partial correlation coefficient index among different variables. The KMO value varies from 0 to 1. Only when it is more significant than 0.5 is a relationship within these variables. Since KMO > 0.5, and the p-value of Bartlett test of sphericity is 0, so it is feasible to do the principal component analysis. The null hypothesis of Bartlett test of sphericity is the variables are not intercorrelated. If the p value < 0.05, reject the null hypothesis, and vice versa.

Table 3: Principal component analysis (pca) from var1 to var8.

Component	Eigenvalue	Difference	Proportion	Cumulative
f_1	2.05	0.26	0.26	0.26
f_2	1.79	0.74	0.22	0.48
f_3	1.04	0.03	0.13	0.61
f_4	1.01	0.12	0.13	0.74

Table 4: Principal components (eigenvectors).

f_1	0.1	-0.17	0.39	-0.51	0.17	0.37	0.3	-0.5
f_2	0.15	0.01	0.53	0.35	0.22	0.56	-0.3	0.39
f_3	-0.83	0.09	0.11	0.2	0.09	0.11	0.48	0.07
f_4	-0.01	0.79	-0.1	-0.16	0.56	-0.04	-0.2	-0.1

From the result of pca test, take f_1-f_4 to do the further factor analysis, since their eigenvalues are larger than 1. Some eigenvectors are positive, and others are negative, which represent the moving

directions of the components. From the empirical result of table 4, only var_5 (Company type) moves towards the same direction with f_1-f_4. Hence, company type does not impact on the incentive of carbon information disclosure so much. This result is not in consistent with previous researchers who conduct the comparison studies of large and small sized corporations. However, the result reveals the principles of climate equity at the UN (United Nations) Climate Conference.
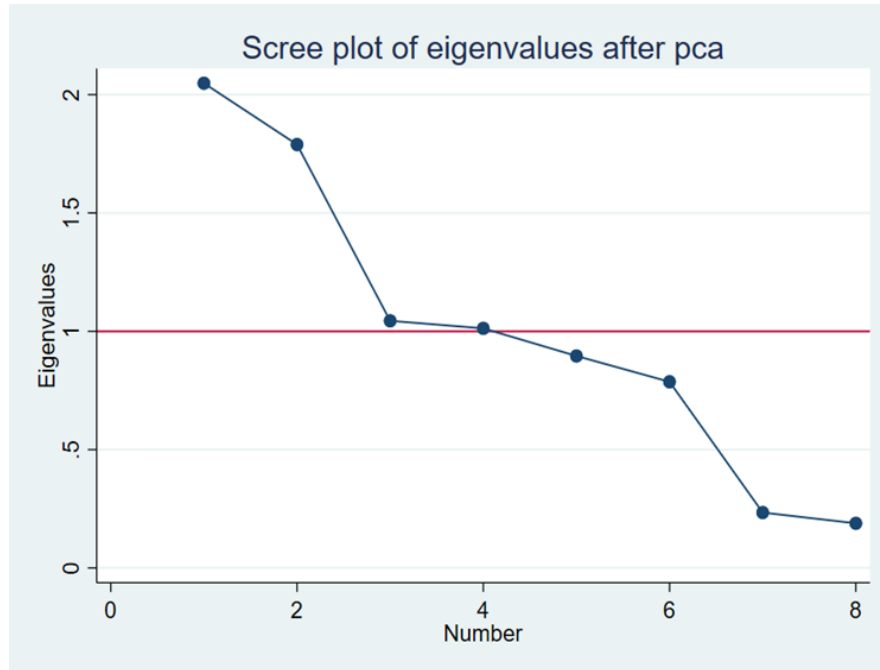

Figure 1: Scree plot of f1-f8 of pca for var_1-var_8.

Scree Plot also shows the same result, f_1-f_4 are the principal components. This is because the inflexion is 1. The eigenvalues of f_3 and f_4 are similar as showed in Figure 1, but the eigenvectors are different as showed in Table 4. Among the various variables, the different level of eigenvectors of var_1 and var_2 are the largest. Hence, var_1 and var_2 are noisy factors which distract the judgment of users. From the initial multiple regression test result, there is a linear relationship between var_1 and var_2, which are year and industry. But when the data dimension reduction processing is utilized to analyse the superficial phenomenon, the var_1 and var_2 are not important influences.

Table 5: Calculate the principle component scores.

Variable	Factor₁	Factor₂	Factor₃	Factor₄
var_1	-0.01	0.03	-0.17	-0.10
var_2	0.03	0.00	-0.05	0.15
var_3	-0.23	0.38	0.09	-0.09
var_4	0.30	0.17	0.44	-0.05
var_5	-0.03	0.04	-0.05	0.15
var_6	-0.21	0.42	-0.04	0.07
var_7	-0.06	-0.04	0.32	0.02

From the table 5, the moving directions of different variables are distinctive. According to the strength of moving, var_3 (Carbon Emission Right Exchange), var_4 (Registered Capital), var_6 (Province) and var_7 (Employ Scale) are the main influences. The differential registered capital indicates the fact that the stamp duties are different. Stamp duty levels influence the turnover of carbon busi-

nesses. It is in consistent with the common but differentiated responsibility that Kyoto Protocol ruled in 1997.

Therefore, paying less taxation is a kind of motivation for carbon trading behaviors.

Table 6: Regression model for $factor_1$ and $factor_2$.

Variable	Coef.f1	Coef.f2
var_1	0.00	0.02
var_2	0.00	0.00
var_3	-0.13	0.22
var_4	0.00	0.00
var_5	0.00	0.00
var_6	-0.09	0.17
var_7	-0.05	-0.05
var_8	0.00	-0.03
cons	6.91	-31.07

Both the two regression models are perfect since the R^2 equals to 1, and the MSE is 0. Therefore, the factor analysis is correct. From the two regression models above, var_3 is the most potent aspect motivating carbon emission trading. From the regression model of f_1 and f_2, it is found that var_3, var_6 and var_7 are the main variables: Carbon Emission Right Exchange, Province, Employee Scale, and Insured Employees. The distance from the Carbon Emission Right Exchange and the locations of companies (provinces) impacts the success rates of carbon trades. Employee scale and insured employees are two factors that are contained in corporate social responsibility. The welfare and well-being of employees are essential for some corporations which care more about human rights. However, other companies show their awareness of protecting the environment but do not respect the needs of employees equally. The action of carbon trading enhances the branding effects of enterprises, but the intrinsic employee feelings and productivity are highly dependent on how employees are treated.

From 01 June 2010, The Ministry of Finance and the State Administration of Taxation formulated the "Provisions on Several Issues concerning the Reform of Resource Tax on Crude Oil and Natural Gas in Xinjiang". Since the differential treatment of environmental taxation in Xinjiang, for compensating the discrepancies of capital expenses, the companies in Xinjiang pay lower salaries to the workers and enhance the working hours freely. The beginning of overusing human resources started with the control of taxation. The high-intensity workforce workloads can be reduced by reducing carbon taxation and enhancing the personal income tax paid by companies to their employees. Human capital variation and the cost of protecting workers' safety raise the intention of announcing the carbon reduction information to attract users, making people reckon the level of corporate social responsibility is high. For example, NIKE uses the advertising of business sustainability to hire employees. In comparison, sweatshop issues happened in the factories of NIKE. Therefore, although equal payment and healthy working hours are difficult to achieve in some companies, it is crucial for corporations to partially disclose the workload and potential salary in the recruiting advertisements.

5   Conclusion

There are complex and complementary relationships among the variables that influence the carbon trading scheme of China. Due to the policies, the carbon trading exchange places are mainly in Shanghai, so corporations' location influences the carbon exchange significantly. This is because

the transportation fees and taxation policies are different in routes. The larger companies are, the more employees they have and the more carbon trades they start. However, the more money the companies invest in employees' insurance, the less they spend on carbon trades.

To some extent, carbon accounting is a tool to cover the working overload scheme of Chinese companies and factories. Even in the universities, doing carbon accounting research faces two problems. The first obstacle is the local and international database competition. The second difficulty is the unawareness of enough break time for doctor of philosophy candidates and lecturers. It is suggested to raise attention to improving employee happiness. For example, reduce medical and security risks of an employee and deduct workload of them. Most importantly, stop using carbon accounting information disclosure as an advertisement for attracting talents to work in insecure places. Human capital is suggested to be taxed in the processing of carbon trading. Higher human capital taxation facilitates managers to choose more suitable people to work in the companies. Moreover, company may choose purchase robots to improve the working efficiency and reduce the inequalities of working hours between companies engaged in carbon trades and those not. Unlike previous journal articles, this research uses data to support the opinion that company type is not a decisive factor. No matter the size of the companies, large or small, because of the market economy and robust political control, they all engage in carbon trades. Firstly, this reveals the distinctive characteristic of the Chinese carbon economy. Secondly, the belief of complying with the climate equity principle that UN announced from the deep in the willing of the Chinese people and government is showed by the evidence.

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