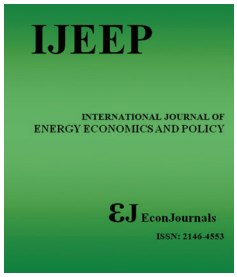

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2022, 12(3), 460-469.

Environmental Performance, Corporate Governance and Financial Performance of Chinese Heavy Polluted Industries

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Received: 13 February 2022 **Accepted:** 06 May 2022 **DOI:** https://doi.org/10.32479/ijeep.13002

ABSTRACT

Heavy polluted industries are the primary source of environmental pollution. In the case of the decline of ecological carrying capacity, how to ensure the necessary protection of the environment and the development of financial benefits, and whether corporate governance can regulate environmental performance and financial performance will be explored. This paper uses IBM SPSS Statistics 26.0 to conduct factor analysis to process dimensionality reduction on aggregate environmental performance based on statistics from heavy polluted industry companies listed on Shenzhen and Shanghai stock markets from 2015 to 2019. Then stata16.0 was used for regression analysis. It is found that a company's aggregate environmental performance has a beneficial influence on its financial performance. Financial performance is also influenced by the size of the company and the rate at which revenues rise. Furthermore, the ratio of female board members has a beneficial effect on the link between a company's aggregate environmental and financial performance, and the total number of committees has a strong negative impact on the relation between aggregate environmental and financial performance. These findings back up the agency, stakeholder, and resource-based theories, and they have significant consequences for the company's management, legislators, and regulators.

Keywords: Heavy Polluted Industry, Aggregate Environmental Performance, Corporate Governance, Financial Performance
JEL Classifications: M41; Q56

1. INTRODUCTION

It was proposed to build an ecologically harmonious civilization system, promote all-round green transformation and upgrading of economic and social development, and promote the green development of heavy polluted companies at the fifth plenary session of the Communist Party of China (CPC) held in Beijing in October 2020. With the continuous improvement of China's economic system and the gradual deterioration of the environment, the Chinese government has introduced a series of environmental regulation policies.

In 2015, the latest improved Environmental Protection Law took effect, attention paid to environmental protection topics such as air pollution control, water resource protection, energy conservation and emission reduction during the National People's Congress and the Chinese Political Consultative Conference (NPC and CPPCC) in recent years show that the whole society attaches increasing importance to environmental protection and ecological civilization. Which requires companies to adopt environment-friendly management measures, improve the environmental management level, reduce pollution and assume environmental responsibility (Bazerman and Hoffman, 2000).

The link between environmental and financial performance has long been a central theme in academic study and corporate governance, as well as one of the government's primary concerns. Porter (1996) proposed the "Porter Hypothesis", claiming that a

company's environmental and financial success are inextricably linked. The government made companies with low energy consumption efficiency increase technological innovation, improve environmental protection awareness and reduce pollution through compulsory measures. In the long run, green innovation can improve product competitiveness, improve production efficiency, create energy-saving benefits, minimize the cost of environmental governance and protection, and even make environmental benefits far more remarkable than environmental protection costs (Porter, 1996). Alexopoulos et al. (2018) collected the data of Greek manufacturing factories with more than ten employees from 1993 to 2007 and finally found that the company's environmental performance would positively impact financial performance.

Over the period of 18 years, Eccles et al. (2014) discovered that companies with a high degree of sustainability were impacted greatly by their peers in terms of financial and stock market performance. Escobar-Perez and Miras-Rodrguez (2020) used high-tech listed companies as examples to investigate the link between corporate governance and financial performance. It is found that board structure and supervisory function measures are significantly positively correlated with return on assets (ROA). Tosun (2021) took American listed companies from 1998 to 2009 as samples and concluded that board independence would promote the financial performance of a company. Meanwhile, Aguilera et al. (2021) discovered that combining corporate governance with a sustainable strategic plan improves financial performance significantly.

Existing research has looked at the link between a company's environmental and financial performance, as well as the link between corporate governance and financial performance. Although rich research achievements have been made, there are still some deficiencies. Hence, this study divides the aggregate environmental performance into four dimensions (environmental consumption, environmental damage, environmental governance, and external communication) from the company's operational process of "input–damage–output" to get more convincing results. At the same time, this study uses corporate governance as a moderating variable between a company's environmental and financial performance in order to investigate the influence of corporate governance on the link between the two, filling a research blank in the area.

2. HYPOTHESIS DEVELOPMENT

Albertini (2013) conducted a 35-year meta-analysis of 52 trials and found a favorable relationship between environmental and financial performance. Potential moderators include environmental and financial performance indicators, regional differences, industry differences, and study duration (Albertini, 2013). Ong et al. (2019) used structural equations to analyze response data collected from 124 ISO14001EMS certified manufacturers in Malaysia and found that environmental innovation has the ability to seamlessly translate the advantages of environmental performance into financial performance. In researching the relation between financial performance and environmental performance in various industries, Awaysheh et al. (2020) adopted ROA to quantify corporate financial performance. They believe that ROA is the most important metric for assessing a company's profitability, and that the greater its value, the better the company's financial performance. Nguyen et al. (2020) used return on equity (ROE) and ROA to evaluate the financial performance of companies in the study of the interaction between financial and environmental performance. They believe that our current capital market is weak, and accounting indicators can better reflect the overall business status of one company than market indicators. As a result, this paper proposes the following hypothesis.

H_1: There is a significant correlation between aggregate environmental performance and financial performance.

Corporate governance provides an environmental guarantee for companies to fulfil their obligations. Kasbun et al (2016), Kurnia et al. (2020), Pekovic and Vogt (2021), Soelton et al. (2020) have proved that corporate governance has a favorable association with a company's environmental stewardship, which will enhance the company's financial performance and long-term development. Good corporate governance can produce good operating efficiency, help companies better allocate resources to fulfil environmental responsibility, and further improve their financial performance. As a result, the following hypothesis is proposed in this study.

H_2: Corporate governance has a positive moderating relationship between aggregate environmental performance and financial performance.

The size of the board of directors, from the standpoint of the business scope assumption, indicates the complexity of the company's business (Ciftci et al., 2019), and increasing the number of board members is critical for the company's business development (Pillai and Al-Malkawi, 2018). The larger the board size is, the more resources a company can obtain. Furthermore, a larger board size will bring more social resources and financing channels (Mohan and Chandramohan, 2018). These are essential resources for companies looking to improve their environmental management and performance. The following hypothesis is offered based on this.

H_{2a}: Board size positively promotes the impact of a company's aggregate environmental performance and financial performance.

The independent-director system is intended to increase the board of directors' independence, strengthen the board of directors' oversight of management, and defend shareholders' rights and interests (Balagobei, 2018). Because of China's "about face" culture, the public and media believe that independent directors are frequently used as "eye candy". In recent years, numerous Chinese listed companies have shown that as the system improves, independent directors get rid of their "eye candy" position gradually. Also, start overseeing management and defending stakeholders' rights and interests, which will help firms improve their environmental and financial performance (Molnar, Wang, and Chen, 2017; Adedeji et al., 2020). When the business complexity of a company increases, more independent directors are needed to supervise the behaviour of the management. Relevant studies show that independent directors can better supervise senior executives (Kammoun et al., 2020; Rasheed and Nisar, 2018). The

existing scholars also found that compared with male executives, the characteristics of female executives enable to bring positive impacts to companies as diversified human resources (Ciftci, 2019). The existence of female executives in the management team can provide a diversified vision and improve the decision-making ability and efficiency of the team (Mathew et al., 2017). Based on it, this study proposes the following hypotheses.

H_{2b}: The relation between the company's aggregate environmental performance and financial performance is positively influenced by board independence.

H_{2c}: The ratio of female board members has a favorable stimulating influence on the aggregate environmental and financial performance of the company.

In most companies, there are four special committees (audit committee, strategy committee, risk control committee, and compensation and nomination committee). Each special committee reports to the board of directors and operates with the approval of the board of directors (Brown and Caylor, 2004). They have a clear division of labour, clear rights and responsibilities, and effective operation. They offer proposals and opinions for the board of directors' decision-making, and play a significant part in one company's crucial decisions (Bowen et al., 2008). The audit committee is charged with monitoring financial reports to improve audit quality, and their activity is usually measured by the number of meetings held during the reporting period (Agrawal and Knoeber, 2012). The increasing times of meetings could increase the number of matters discussed. As the number of meetings increases, the number of matters discussed among members increases significantly (Mishra et al., 2021). Members of the audit committee expend energy to attend the meeting, which results in a large rise in enthusiasm for addressing economic concerns at their companies, which can reflect the audit committee's performance (Haj-Salem et al., 2020). As a result, the following hypotheses are proposed.

H_{2d}: The total number of committees has a favorable impact on the aggregate environmental and financial performance of the company.

H_{2e}: The number of audit committee meetings helps to strengthen the relation between the company's aggregate environmental and financial performance.

3. RESEARCH METHOD

3.1. Sample Selection and Data Description

Data from the Shanghai and Shenzhen stock exchanges from 2015 to 2019 for listed firms in heavy polluted industries were chosen as the primary sample based on the Ministry of Environmental Protection of China's (MEP) Guidelines on Environmental Information Disclosure of Listed Companies issued in 2010, and considering the impact of the COVID-19 outbreak on the global economy at the end of 2019. The following processing is performed on the company sample in order to confirm the validity and credibility of chosen data.

1. The samples of listed companies with delisting warnings and special treatment are excluded
2. The samples of listed companies listed after January 1, 2015, or delisted before December 31, 2019, are excluded.

Finally, the collected data are from 373 companies and covers 16 industries. Among the sample companies, 35.88% are from the chemical industry, 19.66% are from the pharmaceutical industry, 10.31% are from the textile industry, 8.40% are from the building materials industry, 7.54% are from the mining industry. Electrolytic aluminium, thermal power, papermaking, iron and steel, fermentation, cement, coal, petrochemical, brewing, metallurgy, and leather are the remaining industries. The sample as a whole is well represented.

The data in this paper were obtained through the following ways:

1. The data relating to the company's financial performance come from the Wind database;
2. The aggregate environmental performance data are obtained from corporate social responsibility reports and CSMAR database through the manual collection, sorting and summary
3. The corporate governance and other relevant data of companies come from the CSMAR database.

Table 1 displays the description and measures of selected variables.

3.2. Factor Analysis

In the evaluation index system, factor analysis is a critical tool for dealing with data from multiple variables. Its essence is dimensionality reduction. That is, a small number of independent factors are used to express the main information provided in the original variable. In this study, the independent variable is divided into four dimensions and then subdivided into 16 indicators. Therefore, IBM SPSS Statistics 26.0 software is required for factor analysis before regression analysis. Before starting factor analysis, the correlation between variables should be tested to determine whether they are suitable for extracting common factors. Kaiser-Meyer-Olkin (KMO) test and Bartlett Test of Sphericity are selected in this study. The KMO value is generally between 0 and 1. When there is a high connection, the partial correlation coefficient is substantially less than the simple correlation coefficient, and the KMO value is around 1. When the KMO value is <0.5, factor analysis is not recommended. This study's KMO value is 0.683, with a significance of 0.00<0.05. Reject the hypothesis that variables are independent and consider variables are correlated, factor analysis can be carried out. The experimental results are as follows in Table 2.

Table 3 yields the variance of the common factor of the original variable, with the value "extraction" in the result representing the variance of the common factor of the variable. The common factor variance of coal consumption (tons of standard coal) per unit of revenue is 0.936, indicating that the factor after dimensionality reduction can explain 93.6% of the variance of coal consumption (tons of standard coal) per unit of revenue. All else follows.

The "% of variance" represents how much this component explains the aggregate environmental performance. As shown in Table 4, component 1 can explain 43.142% of the aggregate variance. The "cumulative %" means that the explanatory degree of the four components to the whole is 86.295%>70%, which is in the acceptable range.

Table 1: Variable description and indicators

Variable	Variable		Acronym	Indicators
Independent variable	Aggregate environmental performance		Env	ROA, ROE
Moderator	Corporate governance	Female board members ratio	Rat_Fem	Number of female board members/number of total board members
		Board size	Num_Boa	ln (Number of total board members)
		Board independence	Rat_InDir	Number of independent directors/total number of directors
		Total number of committees	Num_Com	ln (Number of committees)
		Audit committee meeting	Num_Mee	ln (Number of audit committee meetings)
Dependent variables	Return on assets		ROA	Net profit/total assets
	Return on equity		ROE	Net profit/gross equity
Control variables	Firm size		Size	ln (the total assets)
	Growth rate of sales		Growth	ln ($SALE_t/SALE_{t-1}$)*100%
	Financial leverage		Lev	Debt to equity ratio

Table 2: KMO and Bartlet's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.683
Bartlett's Test of Sphericity	
Approx. Chi-square	3880.258
df	36
Sig.	0

Table 3: Communalities

	Initial	Extraction
Greenhouse gas emissions (tons carbon dioxide emission) per unit of revenue	1.000	0.824
Solid emissions (tons) per unit of revenue	1.000	0.364
Liquid emissions (tons) per unit of revenue	1.000	0.800
Coal consumption (tons of standard coal) per unit of revenue	1.000	0.936
Water consumption (tons) per unit of revenue	1.000	1.000
Electricity consumption (10,000 KWH) per unit of revenue	1.000	0.946
Fuel consumption (tons) per unit of revenue	1.000	1.000
Environmental Investment (million RMB)	1.000	0.960
Social Donation (million RMB)	1.000	0.938

After rotation (Table 5), the component matrix can be divided into four components. Fuel consumption (tons) per unit of revenue, water consumption (tons) per unit of revenue, electricity consumption (10,000 KWH) per unit of revenue, and coal consumption (tons of standard coal) per unit of revenue are component 1. Greenhouse gas emissions (tons carbon dioxide emission) per unit of revenue, Liquid emissions (tons) per unit of revenue, and Solid emissions (tons) per unit of revenue are component 2. Environmental Investment (million RMB) is component 3. Social Donation (million RMB) is component 4.

Assume ×1 is Greenhouse gas emissions (tons carbon dioxide emission) per unit of revenue, ×2 is Solid emissions (tons) per unit of revenue, ×3 is Liquid emissions (tons) per unit of revenue, ×4 is Coal consumption (tons of standard coal) per unit of revenue, ×5 is Water consumption (tons) per unit of revenue, ×6 is Electricity consumption (10,000 KWH) per unit of revenue, ×7 is Fuel consumption (tons) per unit of revenue, ×8 is Environmental Investment (million RMB), and x9 is Social Donation (million RMB). Using the component score coefficient matrix, we obtain the rotated variables. That is,

F1=0.000*×1+0.10*×2−0.002*×3+0.249*×4+0.258*×5+0.251*×6+0.258*×7−0.023*×8−0.002*×9

F2=0.485*×1+0.27*×2+0.475*×3+0.000*×4+0.002*×5+0.003*×6+0.002*×7−0.036*×8+0.021*×9

F3=0.025*×1−0.209*×2+0.075*×3−0.001*×4−0.013*×5−0.023*×6−0.013*×7+0.974*×8+0.027*×9

F4=−0.053*×1+0.195*×2−0.063×3−0.002*×4−0.001*×5+0.000*×6−0.001*×7+0.027*×8+0.974*×9

The weight for the principle component synthesis model was then calculated as the proportion of the four principal components' contribution percentage to the cumulative percentage of extracted principal components. The principle component synthesis model may be used to obtain the total principal component value (Table 6). Namely,

F = F1*(43.871/86.295)+F2*(20.832/86.295)+F3*(11.376/86.295)+ F4*(10.216/86.295)

3.3. Descriptive Analysis

The result of descriptive statistics (Table 7) shows the standard deviation of company size is large. That is, the firm scale of different selected companies has great volatility. Secondly, the standard deviation of ROA is also large, which is 7.06, revealing a significant variation in the ROA of the chosen sample companies. The difference between the maximum and minimum values of aggregate environmental performance, firm size, financial leverage, ROA, ROE and other variables is large. That is, for these variables, the sample companies are seriously polarized.

The influence of aggregate environmental performance on corporate profitability factor ROA, as well as moderating effect

Table 4: Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.948	43.871	43.871	3.948	43.871	43.871	3.883	43.142	43.142
2	1.875	20.832	64.703	1.875	20.832	64.703	1.872	20.805	63.947
3	1.024	11.376	76.080	1.024	11.376	76.080	1.011	11.228	75.175
4	0.919	10.216	86.295	0.919	10.216	86.295	1.001	11.120	86.295
5	0.838	9.314	95.609						
6	0.277	3.079	98.689						
7	0.118	1.311	100.000						
8	1.883E-05	0.000	100.000						
9	4.500E-06	5.000E-05	100.000						

Table 5: Rotated component matrix[a]

	Component			
	1	2	3	4
Fuel consumption (tons) per unit of revenue	0.997	−0.007	0.009	0.071
Water consumption (tons) per unit of revenue	0.997	−0.007	0.009	0.073
Electricity consumption (10,000 KWH) per unit of revenue	0.972	−0.005	0.009	0.039
Coal consumption (tons of standard coal) per unit of revenue	0.962	−0.010	0.008	0.105
Greenhouse gas emissions (tons carbon dioxide emission) per unit of revenue	−0.014	0.905	−0.060	0.028
Liquid emissions (tons) per unit of revenue	−0.016	0.890	−0.073	0.051
Solid emissions (tons) per unit of revenue	0.012	0.509	0.254	−0.199
Social Donation (million RMB)	0.013	0.009	0.967	0.054
Environmental Investment (million RMB)	0.154	−0.041	0.047	0.966

Table 6: Component score coefficient matrix

	Component			
	1	2	3	4
Greenhouse gas emissions (tons carbon dioxide emission) per unit of revenue	0.000	0.485	0.025	−0.053
Solid emissions (tons) per unit of revenue	0.010	0.270	−0.209	0.195
Liquid emissions (tons) per unit of revenue	−0.002	0.475	0.075	−0.063
Coal consumption (tons of standard coal) per unit of revenue	0.249	0.000	−0.001	−0.002
Water consumption (tons) per unit of revenue	0.258	0.002	−0.013	−0.001
Electricity consumption (10,000 KWH) per unit of revenue	0.251	0.003	−0.023	0.000
Fuel consumption (tons) per unit of revenue	0.258	0.002	−0.013	−0.001
Environmental Investment (million RMB)	−0.023	−0.036	0.974	0.027
Social Donation (million RMB)	−0.002	0.021	0.027	0.974

Table 7: Descriptive analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Env	986	0.054	0.072	−0.373	0.411
Rat_Fem	986	9.068	1.794	5	17
Num_Boa	986	2.186	0.193	1.609	2.833
Rat_InDir	986	0.37	0.051	0.3	0.667
Num_Com	986	1.393	0.123	0	1.792
Num_Mee	986	1.573	0.393	0	2.708
Size	986	23.05	1.405	19.198	28.098
Growth	814	0.097	0.22	−1.458	0.983
Lev	986	0.429	0.196	0.037	1.345
ROA	985	0.129	0.814	−2.351	13.442
ROE	986	0.087	0.344	−1.609	9.821

of corporate governance on this impact, are investigated using a panel model in this study. The model is as follows.

$$ROA_{it} = \beta_1 Env_{it} + \beta_2 Lev_{it} + \beta_3 Growth_{it} + \beta_4 Size_{it} + \beta_5 Env_{it} * Rat\_Fem_{it} + \beta_6 Env_{it} * Num\_Boa_{it} + \beta_7 Env_{it} * Rat\_InDir_{it} + \beta_8 Env_{it} * Num\_Com_{it} + \beta_9 Env_{it} * Num\_Mee_{it} + \mu_{it} + \varepsilon_{it}$$

3.4. Regression Analysis

Mixed regression, random effect model, and fixed effect model are the three types of panel models. In a mixed effect model, the intercept is the same for both individuals and sections when it is constant. When it is a random variable and has a correlation with the independent variable, the data of different cross-sections have a different intercept of regression, it is a fixed-effect model. When a random disturbing term does not change with time and is a random disturbing term that changes with time and individuals, it is a random effect model. The regression results of the fixed effect model are shown in Table 8, the P = 0.00, and the F-test value is 6.42. There is a substantial linear association between the company's aggregate environmental and financial performance at the statistical level of 5%. R-squared is 0.243. The company's aggregate environmental variable can explain 24.3% of the variation of its financial performance, showing poor goodness of fit. The F-statistic in F-test is F(162, 180) = 3.67 and P-value is 0.0000. The null hypothesis was shown to be non-constant and was rejected at a statistical level of 5%. In other words, the fixed effect model outperformed the mixed effect model.

The aggregate environmental performance coefficient is 0.177, with a P = 0.00, based on the regression coefficient. The company's

aggregate environmental performance has a significant positive effect on financial performance at the statistical level of 5%. At a statistical level of 5%, an company's aggregate environmental performance has a strong positive influence on its financial performance. The interaction term between female board members' percentage and overall environmental performance is favorable. The t-test P = 0.03, indicating a positive moderating impact at the 5% level of significance. The proportion of female board members has a favorable effect on an company's aggregate environmental performance. The relation between the logarithm of aggregate environmental performance and the total number of committees is negative; P-value of the t-test is 0.051, indicating that the coefficient is significant at the 5% level of significance; the moderating effect is positive. The total number of committees has a considerable adverse impact on the aggregate environmental and financial performance of companies. Other moderating interactions are not statistically significant at a 5% level of confidence. The coefficient of the growth rate of sales among the control variables is 5.973, with a P = 0.00. At a 5% level of confidence, the growth rate of sales capability has a considerable beneficial influence on company performance. Similarly, the financial leverage coefficient is −23.777, with a P = 0.00, indicating that financial leverage has a statistically significant negative influence on company performance at the 5% level.

Overall R-squared value is 0.276 in the random effect model (Table 9), which indicates companies aggregate environmental could explain 27.6% of the variation of its financial performance. Chi-square is 116.698, and the P = 0. At the 5% level, the model's linear hypothesis is established. The coefficient of aggregate environmental performance is 0.179, P-value in the t-test is 0. At a confidence level of 5%, a company's aggregate environmental performance has a considerable beneficial influence on financial performance. The interaction term between female board members and aggregate environmental performance is positive, with a P = 0.088 in the T-test. Therefore, the moderating effect is positive at the statistical level of 10%. This suggests that having a higher percentage of female board members has a beneficial impact on company's overall environmental and financial performance.

The interaction term between the logarithm of the total number of committees and aggregate environmental performance is negative, P-value in the t-test is 0.075, the coefficient can be regarded as significant at the statistical level of 10%, the moderating effect is positive. The relation between logarithm of a total number of committees and aggregate environmental performance is negative; P-value in the t-test is 0.075; coefficient is significant at the 10% level of statistical significance; and the moderating impact is positive. The total number of committees' logarithm has

Table 8: Fixed effect model

Roa	Coef.	St.Err.	t-value	P-value	95% Conf	Interval	Sig
Env	0.177	0.053	3.340	0.000	−0.003	0.354	***
c_Rat_Fem*Env	11.088	5.07	2.19	0.030	1.083	21.092	**
c_Num_boa*Env	5.784	4.059	1.42	0.156	−2.226	13.794	
c_Rat_InDir*Env	5.772	14.027	0.41	0.681	−21.906	33.451	
c_Num_Com*Env	−10.688	5.449	−1.96	0.051	−21.44	0.063	*
c_Num_Mee*Env	0.706	1.11	0.64	0.525	−1.484	2.897	
ln_Size	0.922	1.204	0.77	0.445	−1.453	3.297	
Growth	5.973	1.304	4.58	0	3.399	8.546	***
Lev	−23.777	4.555	−5.22	0	−32.764	−14.79	***
Constant	−5.951	27.429	−0.22	0.828	−60.074	48.173	
Mean dependent var		6.104		SD dependent var		6.117	
R-squared		0.243		Number of obs		352.000	
F-test		6.420		Prob>F		0.000	
Akaike crit. (AIC)		1659.300		Bayesian crit. (BIC)		1697.937	

***P<0.01, **P<0.05, *P<0.1

F test that all u_i=0: F (162, 180)=3.67 Prob>F = 0.0000

Table 9: Random effect model

Roa	Coef.	St. Err.	t-value	P-value	95% Conf	Interval	Sig
Env	0.179	0.022	8.136	0.000	0.000	0.358	***
c_Rat_Fem*Env	4.754	2.789	1.70	0.088	−0.713	10.221	*
c_Num_boa*Env	2.434	2.193	1.11	0.267	−1.864	6.733	
c_Rat_InDir*Env	6.556	7.798	0.84	0.401	−8.728	21.839	
c_Num_Com*Env	−6.11	3.428	−1.78	0.075	−12.828	0.608	*
c_Num_Mee*Env	−0.289	0.775	−0.37	0.71	−1.808	1.231	
Size	1.198	0.337	3.55	0	0.536	1.859	***
Growth	7.675	1.177	6.52	0	5.367	9.982	***
Lev	−19.213	2.41	−7.97	0	−23.936	−14.489	***
Constant	−14.421	7.301	−1.98	0.048	−28.731	−0.111	**
Mean dependent var		6.104		SD dependent var		6.117	
Overall r-squared		0.276		Number of obs		352.000	
Chi-square		116.698		Prob>chi2		0.000	
R-squared within		0.218		R-squared between		0.296	
sigma_u=4.2709511		sigma_e=3.472761		Rho=0 0.60199218			

***P<0.01, **P<0.05, *P<0.1

a considerable detrimental impact on the company's aggregate environmental and financial performance. Further moderating interactions are not significant at the confidence level of 10%. Among the control variables, the coefficient of the growth rate of sales is 7.675, P-value is 0.00. At a confidence level of 5%, sales growth has a considerable beneficial impact on company's financial performance. Similarly, coefficient of financial leverage is −19.213, P = 0.00, and at the statistical threshold of 5%, financial performance of a company is significantly hindered by financial leverage. At the statistical level of 1%, the coefficient of the logarithm of firm size is 1.198, P-value is 0, and the company's sales growth rate has a substantial positive influence on financial performance.

The BP test is used to determine the superiority of random effect model over mixed effect model, e is random disturbance while u is perturbations of individual random effects. The following are the findings (Table 10). The findings indicate that Chi-square value is 40.81 and P-value is 0, showing that the null hypothesis is false, implying that the variance Var(u)=0 of random perturbation term u is invalid. In comparison to the mixed effect model, the random effect model is preferable.

Hausman test is used to determine the superiority of fixed effect model over random effect model (Table 11). The Chi-square value is 17.17, whereas the P-value is 0.0492. At a 5% level of significance, the null hypothesis is deemed invalid. Fixed effect model outperform random effect model.

3.5. Robustness Test

The dependent variable in this study is ROE, and robustness test is carried out using a fixed-effect model. The result in Table 12 shows that R-squared is 0.249, which is close to the original regression model. The coefficient of aggregate environmental performance is 0.273, P-value is 0.000. The company's aggregate environmental performance positively impacts its financial performance at the statistical level of 1%, which is consistent with the original model.

Table 10: BP test

	Var	sd=sqrt (Var)
Roa	37.41311	6.116626
e	12.06007	3.472762
u	18.24102	4.270951
Test: Var (u) = 0		
chibar2 (01) = 40.81		
Prob>chibar2=0.0000		

Table 11: Hausman test

Variables	Coefficients			
	(b)	(B)	(b-B)	sqrt (diag (V_b-V_B))
	fe	re	Difference	S.E.
Env	−0.177226	−0.1763652	−0.0008611	0.0618348
c_Rat_Fem	11.0876	4.754293	6.333304	4.233829
c_Num_boa	5.784022	2.434293	3.349729	3.415687
c_Rat_InDir	5.772489	6.555504	−0.7830147	11.65954
c_Num_Com	−10.68821	−6.109744	−4.578468	4.235476
c_Num_Mee	0.7064007	−0.2885419	0.9949426	0.7947069
Size	0.9222925	1.197597	−0.2753044	1.155367
Growth	5.972733	7.674634	−1.701901	0.5605985
Lev	−23.77704	−19.21252	−4.564516	3.864868

b=consistent under Ho and Ha; obtained from xtreg

B=inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: Difference in coefficients not systematic

Chi2 (9)=(b-B)'[(V_b-V_B)^(-1)](b-B)=17.17

Prob>chi2=0.0462

4. DISCUSSION

This study discusses the relationship between a company's aggregate environmental performance, financial performance, and corporate governance through panel data regression analysis. With panel data regression analysis, this study examines the relation between a company's aggregate environmental performance, corporate performance, and financial performance. It was discovered that if a company only pays attention to its financial performance and ignores environmental behaviors, it will eventually damage financial performance. China has been pursuing rapid economic growth in the early decades. Many companies chase their financial benefits unilaterally while ignoring environmental governance during the developing process (Li, 2011). Within near term, this extended development approach may help companies enhance their financial performance. Still, uncontrolled consumption of resources causes frequent environmental pollution problems in the long run, which brings irreversible damage to the financial performance of the companies (Tung and Cho, 2001).

Horváthová (2010) found that financial performance could provide material support to the development of environmental governance, for example, buying ecological protection equipment and green innovation investment. Companies can use resources more efficiently and discharge less waste through environmental management. The improvement of environmental performance reflects the transformation of companies' development model, from extensive growth model to intensive growth model, this is in line with this study's findings. Companies could apply the achievements of environmental governance to their production and operation, realize leading technology, improve production efficiency, save resource costs, and bring more profits to the companies. The financial performance after the environmental investment is a kind of financial performance, including green sustainable development (Alshehhi et al., 2018). China's production standards for energy conservation and environmental protection are increasingly strict, and the environmental protection requirements for energy development are constantly improving. Under China's increasingly restrictive environment, heavy polluted companies should strengthen their ecological awareness, further reduce pollutant emissions, and promote its transformation from environmental performance to financial performance to achieve green and sustainable development.

Total number of committees has a considerable negative influence on the relation when analyzing the moderating impact of corporate governance between company's financial and aggregate environmental performance. Number of audit committee meetings has no obvious moderating effect. The committee system has not been fully popularized in China, and the real-time performance is poor. At present, the internal control defects of Listed companies

Table 12: Robustness test

ROE	Coef.	St. Err.	t-value	P-value	95% Conf	Interval	Sig
Env	0.273	0.037	7.374	0.000	0.000	0.546	***
c_Rat_Fem*Env	0.131	0.084	1.55	0.123	−0.036	0.297	
c_Num_boa*Env	0.074	0.066	1.12	0.262	−0.056	0.205	
c_Rat_InDir*Env	0.129	0.228	0.57	0.57	−0.32	0.579	
c_ln_Num_Com*Env	−0.172	0.09	−1.91	0.058	−0.349	0.006	*
c_Num_Mee*Env	0.025	0.018	1.36	0.175	−0.011	0.061	
ln_Size	0.012	0.02	0.61	0.54	−0.027	0.051	
Growth	0.116	0.021	5.39	0	0.073	0.158	***
Lev	−0.322	0.075	-4.30	0	−0.469	−0.174	***
Constant	−0.052	0.45	-0.12	0.908	−0.941	0.837	
Mean dependent var		0.103		SD dependent var		0.100	
R-squared		0.249		Number of obs		352.000	
F-test		6.619		Prob>F		0.000	
Akaike crit. (AIC)		−1233.861		Bayesian crit. (BIC)		-1195.225	

***P<0.01, **P<0.05, *P<0.1

F test that all u_i=0: F (162, 180)=4.24 Prob > F = 0.0000

in China are still severe. The establishment of committees in many companies is still a formality, with a vague division of labour; whitewashing financial data also occurs from time to time (Liao et al., 2019). Therefore, companies should strengthen the awareness and construction of the committees and let them play their natural function. Hold regular meetings according to the company's situation, discuss internal management policies, improve the functional performance ability of the committees fundamentally, and improve the company's internal management. It is also recommended to enhance the professionalism of audit committee members. Employ experienced and professional personnel to manage the audit committee members so that everyone can perform their respective duties well without wasting time on meetings, to let the audit committee have rules to follow.

Furthermore, due to the natural characteristics of the female, the participation of female executives in corporate governance is conducive to the fulfillment of corporate environmental responsibilities (Adeabah et al., 2018). In the context of social development and the improvement of the education level of the masses, female's employment, education, and promotion space have been improved in recent years. However, "sex discrimination" is still severe in the workplace (Ullah et al., 2019). There is still a big gap between the proportion of females in senior management and men. Therefore, it is necessary to completely eradicate China's outdated ideas of "males are superior to females". To support gender-differentiated executive teams actively and use females' unique environmental ethics to influence management decisions related to environmental activities, to improve corporate environmental governance, and it is more conducive to improving the company's environmental performance and financial performance.

5. CONCLUSION

This study examines the connection between aggregate environmental performance, corporate governance, and financial performance using panel data from 373 publicly traded companies in heavy polluted sectors from 2015 to 2019. The following conclusions are drawn.

First, a positive association between aggregate environmental financial performance of publicly traded companies engaged in heavy polluted sectors. A company doing well in environmental protection will form a good social image, have more consumer preferences, and attract more capital investment (Ong et al., 2016; Hussain et al., 2018). The irreplicable competitive advantage promotes financial performance improvement. After improving financial performance, the company could invest more in environmental management to promote environmental performance improvement. Therefore, aggregate environmental performance and financial performance can achieve a win-win situation. Second, among corporate governance related criteria, diversity of gender on the board of directors does have an effect on the relation between aggregate performance and financial performance. This study's findings are congruent with the manner in which corporate governance structure reform is now proceeding in a number of European nations. That is, increasing the representation of women on corporate boards benefits corporate performance (Daz et al., 2017).

The results show a positive correlation between companies aggregate environmental performance and financial performance with the ratio of female board members. The findings indicate that there is a favorable association between company's aggregate environmental and financial performance, and its female board member ratio. Other variables, on the other hand, have little bearing on the relation between a company's aggregate environmental and financial performance.

Due to limitation of time and author's capacity, there are limitations in sample selection and indicator setting. The current business environment is complex and volatile, and the data for this study is not the latest because the COVID-19 pandemic has severely affected the global economy. The time and quantity of samples would affect the study results. Second, because there is no uniform format and standards of environmental-related information disclosure, manual filtering and data processing can also lead to differences in outcomes. With the gradual deepening of environmental performance research, the author suggests that companies should improve the disclosure of environmental data in the future. The measurement of performance can be more accurate,

and the research object can cover all the companies from heavy polluted industries. At the same time, the research period can also be more extended, making the future research results more robust and comprehensive.

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