Effect of Female Directors on Executive Pay Reduction Due to Ecologically Polluting Behavior: Evidence from Pollution-intensive Enterprises

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Abstract: Based on the critical quality theory, this paper discusses the impact of female directors on executive pay reduction punishment due to environmental pollution. Taking 25079 data of A-share non-financial listed companies in Shanghai and Shenzhen stock exchanges in China from 2010 to 2020 as samples, based on the OLS multiple regression model, the empirical findings show that executives in pollution-intensive enterprises would be punished by a certain amount of pay reduction due to polluting the ecological environment, and female directors who reach a mass level would weaken such a punishment in executive pay by reducing polluting behavior and enhancing environment protection expenditures. The reliability of the conclusion is verified by robustness test and independent sample t-test. The conclusion of this paper highlights the enrichment of green finance literature, expands the research horizon of female directors, also provides a certain reference significance for enterprises to protect the environment and undertake social responsibility.

1. Introduction

China has promised to peak its carbon dioxide emissions by 2030 and achieve carbon neutrality by 2060, which is of great significance in coping with global climate change. Under this background, the carbon emissions and pollution behaviors of China's heavily polluting enterprises will be subject to stricter government regulation. Theorists are concerned about whether executive pay arrangement, as a critical governance mechanism, can reflect the effective punishment to enterprises for polluting the environment[1].

At present, there are two opposing views on this issue. Some scholars believe that executives in highly polluting enterprises will be punished in terms of pay because of polluting the environment[2-3], while some other scholars believe that executives in highly polluting enterprises will even get extra pay because of enduring extra psychology and physiological pressure[4-5]. Hence, it is necessary to test whether there is really a executive pay reduction as the punishment for enterprises' environmental pollution behavior in China.

In addition, as female directors play an increasingly important role in corporate governance, a surging number of studies have confirmed that female directors have a substantial positive role in curbing corporate pollution, promoting environmental investment, and assuming social responsibility. Hence, it is reasonable to expect that in polluting enterprises with high participation of female directors, because of the effective prevention of possible pollution behaviors by female directors, the pay reduction punishment of their executives will be reduced due to improved pollution behavior.

Based on the above discussion, this paper intends to take Chinese listed companies as research samples to explore the following two issues: (1) Will executives of heavily polluting enterprises be punished for pollution in their pay? (2) How female directors change the intensity of this punishment?

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2. Literature and hypotheses

In the existing green finance research literature, there are two completely opposite views on whether there is pollution punishment in executive pay.

One view is that executives in heavily polluting enterprises are physically potentially endangered because they work in an unsafe and unclean physical environment and even need to directly contact with pollutants[2,6]; Besides, executives in such enterprises would criticized by the external public, the media and the government because of their behavior of polluting the ecological environment, and they will endure additional psychological pressure. In addition, the future employment prospects and opportunities of executives working in heavily polluting enterprises will be negatively affected due to the loss of reputation. In this case, there should be additional "pressure compensation" and "reputation compensation" in their pay composition.

Another view is that though highly polluting enterprises create value and profits by using multiple social and natural resources. The economic profits of enterprise operation are mainly enjoyed by enterprises themselves, while the costs of environmental pollution are shared by the whole society, resulting in the negative "external economies". It is reasonable that such external economies should be reflected in executive pay in the form of pay reduction [4,5]. Therefore, there is the following hypothesis.

H1: Compared with other types of enterprises, executives of heavily polluting enterprises will be punished by pay reduction due to ecological environment pollution.

It has been widely proved that female directors can promote enterprises' green governance practices such as increasing environmental protection investment and performing more social responsibility. According to the critical mass theory[7], we expect that when the proportion of female directors reaches 1/3 in the board of directors, or the number of female directors reaches 3 or more, female directors will enjoy sufficient discretion to realize their "green preferences". Accordingly, the following research hypothesis can be proposed:

H2: When female directors of pollution-intensive enterprises reach the critical mass, executives' pay reduction punishment due to environmental pollution would be significantly weakened.

3. Methodology

3.1. Sample and data

All the non-financial A-share listed companies in Shanghai and Shenzhen Stock Exchange of China from 2010 to 2020 are selected as the sample framework. The following steps are executed to screen the final research sample: (1) to exclude ST and PT listed companies; (2) to exclude listed companies with abnormal/incorrect data in the responding sampling year; (3) to exclude listed companies with missing data of key variables investigated in this study; (4) to exclude listed companies with significant changes of top executives (CEO change, or a change more than 1/3) in the responding sampling year.

Accordingly, an unbalanced panel sample consisting of 25079 firm-year observations have been finally obtained. All the data required by the study are drawn from CSMAR. In addition, all continuous variables are subject to 1% tailing treatment according to Winsorize Rule.

3.2. Measures

Explanatory variable: Pollution-intensive nature (PIN). The identification of heavily polluting enterprises is based on Guidelines for Environmental Information Disclosure of Listed Companies published by the Ministry of Environmental Protection of China in 2010 and Guidelines for Industry Classification of Listed Companies revised by the China Securities Regulatory Commission in 2012. A total of 16 polluting industries, which include Steel Industry, Chemical Industry and Electrolytic Aluminum Industry, etc., are regarded as pollution-intensive industries. For listed companies belonging to these 16 industries, PIN is defined as 1, otherwise it is 0.

Explained variable: Average of Executive pay (LNAEP). Referring to the ideas of Shuangli Yu et

al.[3], LNAEP, calculated by "ln (the total pay of the top executive teams/the number of the top executives)", is adopted as the explained variable. In addition, Average of Top Three Executives' Pay (LNAEP_Top3), calculated by "ln (the average of the total pay of top three executives)", is adopted as the alternative variable for robustness test.

Moderating variable: FEM_3. Referring to Liang Ruobing et al. [8], the proportion of female directors' number in the total number of directors on the board is used to measure female directors' participation degree. A dummy variable FEM_3 is constructed to capture the actual status of female directors' participation. When the number of female directors is greater than or equal to 3, FEM_3 is 1; otherwise, it is coded as 0.

Control variables. Referring to literature on the determination mechanisms of executive pay [9-13]: LNGDP (Logarithm of per capita GDP of all provinces and municipalities), LNFSIZE (Logarithm of total assets at the end of the year), SOE (a dummy variable, which is 1 when the sample firm is state-owned; otherwise, is 0), DUAL (a dummy variable, which is 1 when CEO also takes the position of Chairman; otherwise, is 0), IND (Number of independent directors size), ROA (return on assets), LEV (Total debt at the end of the year/Total assets at the end of the year),CEOGEDER (a dummy variable, which is 1 when CEO is a female, otherwise, is 0), CEOEDU (a dummy variable, which is 1 when CEO has a master degree or above, otherwise, is 0), CEOAGE (CEO age) and CEOTNE (CEO tenure by years). In addition, INDUSTRY dummy variables and YEAR dummy variables are considered.

3.3. Empirical model

In order to test H1, Model (1) is built based on OLS by taking LNAEP as the explanatory variable and PIN as the explained variable.

$$LNAEP_{it} = \beta_0 + \beta_1 \mathrm{PIN}_{\mathrm{it}} + \beta_2 CONTROLS_{\mathrm{it}} + \sum Industry + \sum Year + \varepsilon_{it} \qquad \text{Model (1)}$$

In Model (1), "i" refers to a specific sample firm, "t" refers to a specific sample year, and ϵ is the random error term. According to H1, it is expected that, in the regression results of MODEL1, β_1 is significantly negative. In addition, in order to explore the moderating role of female directors, H2 would be tested by adopting Grouping Regression Method. When FEM_3 is 1, the paper builds a sub-sample of female directors mass (MFEM_Sample); and when FEM_3 is 0, a sub-sample of fewer female directors (FFEM_Sample) is built. By respectively fitting Model (1) with the two sub-samples, the two results would be compared with the purpose of testing H2.

4. Results

4.1. Descriptive statistics and correlation analysis

Table 1 Descriptive statistics and correlation analysis results.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 PIN	1													
2 LNAEP	-.094**	1												
3 LNGDP	-.161**	.327**	1											
4 LNFSIZE	.040**	.480**	.052**	1										
5 SOE	.061**	.070**	-.199**	.385**	1									
6 FSHARE	.033**	-.004	-.019**	.184**	.186**	1								
7 DUAL	-.045**	-.053**	.119**	-.203**	-.313**	-.045**	1							
8 IDP	-.051**	-.015*	.048**	.014*	-.060**	.053**	.111**	1						
9 ROA	.050**	.145**	.016**	-.062**	-.099**	.111**	.054**	-.010	1					
10 LEV	-.039**	.156**	-.084**	.564**	.343**	.069**	-.167**	-.004	-.331**	1				
11 CEOGEN	-.020**	-.011	.012*	-.034**	-.070**	.004	-.032**	.048**	.002	-.021**	1			
12 CEOEDU	-.031**	.120**	.035**	.118**	.106**	.002	-.007	.017**	-.015*	.061**	-.001	1		
13 CEOTEN	.026**	.066**	.052**	.039**	-.051**	-.100**	.140**	.015*	.023**	-.004	.002	.001	1	
14 CEOAGE	.048**	.113**	.086**	.102**	.076**	.016**	.175**	.011	.012	.021**	-.031**	-.059**	.230**	1
Mean	.346	12.702	11.133	22.173	.390	34.927	.290	.374	.043	.412	.060	.530	4.470	49.8
S.D.	.476	.644	.457	1.276	.489	14.838	.452	.053	.059	.204	.242	.499	3.230	6.58

Listwise N=25079; *P<0.05; **<0.01.

Descriptive statistics and correlation analysis of the research variables are reported in Table 1.

The descriptive statistical results of the research variables are within the reasonable range, implicating that the data quality of this paper is reliable. The correlations between variables basically conform to the theoretical expectations. VIF values of all variables in the subsequent regressions are less than 10, indicating that there is no serious multicollinearity problem.

4.2. Test of H1

Column (1) of Table 2 reports the regression results of model (1) with the whole sample. Considering rich control variables and the fixed effects of industry and year, the coefficient of PIN on LNAEP is -0.081 (P<0.001). H1 holds.

4.3. Test of H2

Column (2) of Table 2 reports the regression results of Model (1) with the MFEM-Sample. The coefficient of PIN on LNAEP is -0.060 (P<0.01). Column (3) of Table 2 reports the regression results of Model (1) with the FFEM-Sample. The coefficient of PIN on LNAEP is -0.088 (P<0.001). H2 holds.

4.4. Robustness test

First, LNAEP_Top3 is adopted to replace LNAEP in Model (1). Columns (4)-(6) report the robustness regression results. H1 and H2 still hold.

Second, according to the ratio of female directors (FEM_Ratio), two sub-samples, i.e., MFEM_Ratio_Sample (with a ratio greater than 1/3) and FEM_Ratio_Sample (with a ratio less than 1/3), are designed. The regression results of Model (1) with the two sum-samples are reported in Column (7) and (8), which prove H1 and H2 once more.

Third, FEM_Ratio and the interaction item (FEM_Ratio*PIN) are introduced into Model (1), and Model (2) is built. Regression results of Model (2) are reported in Column (9), which show that the regression coefficient of FEM_Ratio*PIN is significantly positive (B=0.007, P<0.05). It indicates that the ratio of female executives (FEM_Ratio) would weaken the negative effect of pollution-intensive nature (PIN) on executive pay (LNAEP).

4.5. Further exploration

The method of Independent Sample T-test is adopted to compare the average pay of executives between pollution-intensive enterprises (PIN=1) and other enterprises (PIN=0) respectively with the whole sample, MFEM_Sample and FFEM_Sample. The results in Table 3 not only verify H1 and H2 again, but also quantify the punishment intensity of executive pay reduction for enterprises' environmental pollution behavior to a certain extent.

Table 3 Results of Independent Sample T-test.

	Sample	PIN	N	Mean	Levene test of variance equation	T-test of mean equation	
					F(Sig.)	Sig.	Mean difference
Average pay of all executives (YUAN)	Whole sample	>=1	8672	375612.377	98.435(.000)	.000	-58734.006
		=0	16407	434346.383		.000	
	MFEM_ Sample	>=1	1205	385742.519	.317(.573)	.314	-13155.052
		=0	1956	398897.572		.327	
	FFEM_Sample	>=1	7467	373977.608	113.900(.000)	.000	-65166.912
		=0	14451	439144.520		.000	

In addition, we further explore the effect of FEM_3 on Executive Pay-Environmental Protection Expenditure Sensitivity and Executive Pay-R&D Expenditure Sensitivity in pollution-intensive enterprises, concluding that female directors exceeding the mass level in pollution-intensive enterprises would reduce pollution behavior and weaken the negative “external economies” effectively by enhancing the two. And it is proved that FEM_3 would directly increase Environmental Protection Expenditure and R&D Expenditure in pollution-intensive enterprises. Due to the limitation of paper length, this result is available on request.

5. Conclusion

The paper enriches green finance literature by concluding that (1) executives in pollution-intensive enterprises would be punished by a certain amount of pay reduction due to polluting the ecological environment, and (2) female directors who reach a mass level would weaken such a punishment in executive pay by reducing polluting behavior and enhancing environment protection expenditures. The findings are of practical implications. The existing executive pay, as a corporate governance mechanism, is relatively effective in punishing environmental pollution behavior. However, the punishment intensity is to be further enhanced.

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Table 2 Empirical test results.

Sample	Whole Sample	MFEM_Sample	FFEM_Sample	Whole Sample	MFEM_Sample	FFEM_Sample	MFEM_Ratio_Sample	FFEM_Ratio_Sample	Whole Sample
Explanatory variable	LNAEP	LNAEP	LNAEP	LNAEP_Top3	LNAEP_Top3	LNAEP_Top3	LNAEP	LNAEP	LNAEP
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PIN	-.078*** (-10.436)	-.060*** (-2.870)	-.088*** (-9.825)	-.069*** (-7.985)	-.058** (-2.650)	-.074*** (-.8.338)	-.047** (-2.109)	-.072*** (-8.441)	-.079*** (-10.199)
FEM_Ratio									-.155*** (-5.985)
*FEM_Ratio*PIN*									.007** (2.379)
CONTROLS	YES								
Year/Ind	YES								
F	499.269	57.867	449.198	437.634	54.617	389.126	50.111	393.150	475.245
R^2	.418	.400	.425	.386	.386	.390	.372	.392	.419
Adj R^2	.417	.393	.424	.386	.379	.389	.365	.291	.418
N	25079	3161	21918	25079	3161	21918	3082	21997	25079