

Article

Does Increased Representation of Female Executives Improve Corporate Environmental Investment? Evidence from China

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Abstract: Based on the upper echelon theory and theory of feminist care ethics, this paper uses the data of 359 Chinese listed companies between 2008–2016 to investigate the influence of female executives on corporate environmental investment. The results of the pooled OLS (Ordinary Least Square) regression reveals that both having a female as CEO or Chair as well as increased representation of female directors on the board committees significantly increases corporate environmental investment. Moreover, this phenomenon is not only evident in polluting enterprises but also exists in non-polluting enterprises. Further, we examine whether female executives' environmental investment is driven by the motive of availing government subsidies or to comply with the environmental regulations. The empirical testing reveals that the environmental investment by female executives is not associated with the acquisition of government subsidies. Moreover, female executives' environmental investment remains significant in China's eastern regions despite having less stringent government regulations. The study also found that contrary to the result in the male sample, environmental investment by the female executives significantly reduces pollutant emissions. The present study adds a new perspective to the CSR literature and suggests that an increase in environmental investment by the women executives lies primarily in their innate commitment towards social responsibility. Against the backdrop of a greater emphasis on environmental protection in China, it is concluded that increased representation of female executives in enterprises can contribute to a significant improvement in environmental quality.

Keywords: female executives; environmental investment; corporate social responsibility

1. Introduction

Since the first Earth Day in 1970, environmental issues have received greater attention from countries around the world and have aroused widespread public awareness about environmental policy [1]. As the largest emerging economy in the world, China has witnessed remarkable economic progress in the last few decades partly at the expense of environmental degradation. Environmental problems have become an important issue affecting the quality of people's life and now receive significant attention from the Chinese society [2]. Companies on one hand receives vital resources from the environment and on the other hand emit waste and air pollutants back to the environment which is one of the key reason for rising environmental pollution. The Chinese Government attaches high importance to the preservation and management of the ecological environment, and has promulgated a series of policies to promote the protection of ecological environment [3]. However, government

is not solely responsible for environment protection, corporate investment in environment friendly activities is also an important tool to reduce environmental pollution. The aim of the enterprise is to use the limited resources to achieve maximum productivity. The literature generally holds that the primary motive of a firm is to pursue economic benefits [4]. However, the environmental investment requires the corporations to inject funds continuously to buy facilities and advanced technologies so as to ensure environmental protection [5]. Moreover, environmental investment does not bring the direct economic benefits, hence it is contrary to the profit maximization principle of an enterprise. Therefore, if based on the cost–benefit principle, firm’s environmental investment often lacks initiative [6].

The principal-agent theory holds that the separation of ownership and management in modern form of corporation give the company’s decision-making power in the hands of its executives. Hence, the values and personal preferences of the executives profoundly influence the decision-making process of the firm [7]. According to the upper echelon theory, the values and behavioral preferences of corporate executives are reflected by their demographic characteristics [8]. Presently, women are playing a considerable role in yet a male dominated business world. They can rely on their knowledge and expertise to participate in the company’s decision-making process. Female executives are also assuming a greater role in management. Hafsi and Turgut [9] found that board diversity enhances social performance of the firm. Higher representation of females on the board significantly improves the social responsiveness of arts sector firms in Australia [10]. Gender differences can lead to significant variation in the investment decisions between men and women [11]. Females are usually more compassionate, pay more attention to ethics, caring for others, and social responsibility [12]. According to the theory of Feminist Care Ethics, the female executives push the companies to pay more attention to the issues related to corporate social responsibility. In the face of increasingly serious environmental dilemmas, women may take decisions that differ from the mainstream behavior [13]. As a cost-based undertaking, the environmental investment decision of firms’ management explains their attitude towards corporate social responsibility to a large extent. Li et al. [14] found that gender diversity on corporate boards can act as a stimulus in the development of an environment policy for firms. Can this unique value orientation of women serve as an impetus for corporate environmental investment decisions?

Taking the Shanghai and Shenzhen A share listed firms in 2008–2016 as a sample, this paper analyzes the association between female executives and corporate environmental investment and reveals the underlying logic behind this phenomenon. The study found that women executives (CEO or Chair) make significantly higher investment in environment protection. Additionally, an increase in the proportion of female directors on board committees also contributed to an increase in corporate environmental investment. Further investigation reveals that this phenomenon exists not only in firms from the polluting industries, but also in firms from non-polluting industries. Women executives of companies from non-polluting industries significantly increased investment for environmental protection despite the fact that such firms face less regulatory pressure relative to their polluting industries counterparts. This implies that the key reason for female executives to increase corporate environmental investment lies in their sense of commitment to social responsibility rather than economic or regulatory considerations. To substantiate this fact, the paper focuses on the role of external factors such as economic benefits of female executives’ investment for environmental protection and the pressure to comply with government regulations [15]. We find that environmental investment by female executives is not driven by government subsidies. In addition, women executives also increase investment towards environmental protection in the eastern regions of China where the environmental regulations are quite lax. We further investigate the effectiveness of female executives’ investment in curtailing pollutant emissions and find that environmental investment by female executives significantly reduces the SO₂ emission, while these results are insignificant in the firms run by the male executives. It proposes that the investment by female executives is well-directed to reduce the environmental pollution. These findings present a strong case that the environmental investment of female executives significantly contribute to the reduction of pollutants thus it can serve

as a mean to improve environmental quality. This paper clarifies the influence of gender in Chinese listed companies on environmental investment and postulates that firms can promote the corporate social responsibility consciousness through a more inclusive management team structure.

The innovation of this paper is, first, the past research has focused more on the relationship of gender and social responsibility such as donation expenditures [16], care for the underclass [17], firm performance [18,19], cash holding [20], and Innovation [21,22]. Although the environmental investment belongs to the category of corporate social responsibility, there is a dearth of literature on gender and social responsibility of senior executives. Wei, Ding, and Kong [23] investigated the influence of women on the board and corporate environmental investment in China but their work is confined to the impact of female directors on firm's environmental investment. However, Usually CEO and Chair have a far more influential role in the decision making than the Board members [24]. Therefore, it is imperative to explore the impact of female as CEO or Chair besides their representation on board committees. Second, this paper makes use of extensive empirical analysis to examine various possible motives other than the perceived social responsibility consciousness of female executives that can influence the environmental investment decisions of an enterprise. Third, the study draws a comparison on the effectiveness of environmental investment by both genders and reveals that contrary to the environmental investment outcome of male executives, the investment activities carried out by the female executives significantly reduces the emission of pollutants. The principal conclusion of this research is that female executives do not merely take environmental related investment as a strategic means of enterprise development, but primarily out of their innate sense of social responsibility to protect the environment, hence they can play an instrumental role in improving the environmental quality.

The rest of the paper is organized as follows: Section 2 entails institutional background and regulatory environment of China. This section also provides the theoretical foundation and the context of the study, which stipulate the basis for hypotheses development; Section 3 constitutes research design, we introduce the sample selection, data sources, model setting, and variable definition under this section; Section 4 furnish results of empirical analysis; and Section 5 concludes the study.

2. Institutional Background and Hypotheses Development

2.1. Institutional Background

Environmental issues are now given serious consideration by the Chinese government as they have aroused a wide range of social concerns in China. Environmental investment is a crucial embodiment of corporate social responsibility that can serve as an important tool to alleviate the current environmental pollution problems. Despite the fact that greater emphasis has been put on environmental protection and the development of a healthy ecosystem by the government, the pollution still remains a serious challenge for China. China is the largest contributor towards CO₂ and SO₂ emission in the world [25] and, besides health issues, environmental pollution shaves off 3.5–8% of China's GDP each year [26]. As per the air quality report released by the Ministry for Environmental Protection for 2016, the air quality of only 25% of the prefecture-level cities was up to the standards. Meanwhile, the rest of the 75% cities does not meet the air quality standards. Enterprises are the main source of environmental pollution and energy consumption in China with 80% of the environmental pollutants originating from the industries [27]. Corporate social responsibility has received enormous attention in China in recent years mainly due to the growing number of incidents of product safety and environmental pollution such as poisonous milk by the Sanlu group and sewage discharge by Harbin Pharma [28]. China has experienced rapid economic growth over the past 40 years and is on the verge of becoming the world's largest economy. However, this economic growth is mainly driven by several government interventions. One reason for the continuous fast paced growth of the Chinese economy is the top-down competitive promotion policy of the local government figures. The promotion of local government officials in China is decided by the central government, which judges the performance of

local government officials according to an established assessment criteria. The primary criterion is the economic performance of local government officials during their tenure. This has led local government officials to compete for economic growth [29]. Hence, as long as a project can bring economic growth, it is likely to be introduced immediately, without contemplating much on the environmental impact and moral hazards of the project. This practice led to economic growth at the expense of environmental pollution. In addition, under the political system of China, local governments control the distribution of most of the economic resources and the rent-seeking activities carried out by enterprises to acquire economic gains are common [30]. In this particular institutional context, it is more likely for both the firms and local governments to forgo environmental protection for higher economic growth, and firms may carry out extensive rent-seeking activities to obtain economic benefits.

2.2. Theoretical Analysis and Research Assumptions

The existing literature on enterprise environmental investment is divided into two main parts: state driven environmental policy and corporate policy for environment protection [31]. The research shows that in the face of a regressive environmental protection policy, the internal stakeholders and management have no incentive and enthusiasm to carry out a positive environmental investment behavior [32]. While environmental investment is a long-term strategy for corporate value, the majority of companies are still passive in this regard as it requires a steady stream of investment [33]. Scholarly work on the influential factors for environmental investment is conducted at the corporate level and suggests that the shareholders may restrain the environmental investment activities of enterprises [7]. However, there is less research on the impact of specific executive characteristics on corporate environmental investment. Feminist care ethics theory points out that gender is a prominent feature which can define the decision making behavior of senior executives. Gender differences will lead to significant variations in ethical motive between men and women. Females, generally, pay more attention to moral ethics, care for others, and value social responsibility. Thus, female executives will push public companies to pay more attention to corporate social responsibility [34,35]. A higher proportion of women on board leads to improvement in CSR practices in Chinese companies [36].

The social role theory maintains that men are usually more self-orientated having such attributes as strength, dominance, and ambition. Whereas, women are more society-oriented with qualities such as being concerned, loving, and helpful [12]. Hence, there are significant difference in the thinking pattern of both genders. Studies have shown that when women are part of the board, the company has a higher level of participation in social responsibility-related activities as female directors have a stronger social responsibility orientation [37]. While male directors are more concerned about the economic performance of the firm [38]. Female executives also reflect a positive attitude towards charitable donations and the ecological environment to enhance the social image of the company. This is because women have a unique perspective towards solving social problems. Women are more inclined to consider specific moral issues and the environment [39]. Women executives now enjoy a relatively improved social status, thus having higher say in corporate decision-making [40]. Research reveals that female executives can help companies better understand the complexity of their surroundings based on their social consciousness [41]. These studies assert that female executives are more socially responsible than their male counterparts. Moreover, female executives are equally as influential as male executives in corporate decision-making. Teams with female executives tend to pay more attention to social returns, environmental investment, and corporate culture than teams without female executives [42].

Environmental investment seems contrary to the primary principle that firms are essentially in pursuit of economic gains yet, more importantly, it reflects the sense of social responsibility of enterprises [6]. The study of feminist care ethics contends that women will be more interested in social responsibility and environmental protection is an important part of corporate social responsibility. In a recent study from Chinese context, Wei et al. [23] found that the presence of more female directors on the board significantly increases corporate environmental investment. However, in

China's corporate culture, board members have a fairly limited influence on the corporate investment policies as compared to the CEO or Chair. Besides having a female as a director, the present study takes having a female as CEO or Chairperson of the board as the key variable of interest. Based on the above discussion, we expect that the presence of a female executive can significantly increase the amount of investment in environmental protection thus reducing the pollution levels. Hence, the following hypotheses emerge:

Hypothesis 1. *The presence of a female executive significantly increases the amount of investment in environmental protection by the enterprise.*

Hypothesis 2. *Investment by female executives significantly reduces environmental pollution.*

3. Research Design

3.1. Sample Selection and Data Sources

The study sample consists of Shanghai and Shenzhen A shares listed companies for the period of 2008–2016. The total environmental protection investment data is collected manually from the “social responsibility report” and “sustainable development report” of the respective firm. The rest of the data is obtained from the China Stock Market and Accounting Research (CSMAR) database. The raw data is processed as per the following rules: (1) we excluded firms with an environmental investment of 0 or with gaps in the environmental investments data, (2) the financial firms are excluded from the sample, (3) the continuous variable are winsorized on the 1% and 99% quantile. This leads to a final sample of 359 companies with an unbalanced panel of 2521 firm year observations.

3.2. Model Setting and Variable Definition

The study makes use of Pooled OLS regression estimation procedure with standard errors adjusted as per Driscoll and Kraay [43] to ascertain the results of our proposed model. The following regression model is employed to empirically test the impact of the presence of female executives on the corporate environmental investment:

$$\begin{aligned} \text{Environment} = & \beta_0 + \beta_1 \text{Female} + \beta_2 \text{Size} + \beta_3 \text{Roe} + \beta_4 \text{Lev} + \beta_5 \text{Growth} + \beta_6 \text{Cash} \\ & + \beta_7 \text{Ocf} + \beta_8 \text{Expen} + \beta_9 \text{Fa}_r + \beta_{10} \text{First} + \beta_{11} \text{Dual} + \beta_{12} \text{Ddrate} + \beta_{13} \text{Stime} \\ & + \beta_{14} \text{State} + \sum \text{IND} + \sum \text{YEAR} + \sum \text{PROVINCE} \end{aligned} \quad (1)$$

In model (1), Environment is a measure of a firm's environmental investment, taken as a ratio of total amount of environmental investment and the initial operating income. The environmental protection investment data is manually collected from each firm's “Social Responsibility Report” and “Sustainable Development report”. Female represents female executives whereas Female1, Female2, and Female3 are used as independent variables to determine the various roles of females in Chinese companies. If the CEO of the company is a female, Female1 is assigned the value of 1, otherwise 0; if the company's chairman or CEO is female, then Female2 is assigned the value of 1, otherwise 0; Female3 indicates the proportion of the company's female directors as board members, supervisory board members, and representatives on other corporate committees. In line with the previous studies [33,44], firm size, profitability, asset–liability ratio, enterprise growth, cash holding ratio, operating cash flow ratio, sales cost rate, the first major shareholder shareholding ratio, the duality of chairman and CEO, independent director ratio, the number of years that a company goes public, property rights, and other variables that may affect the environmental investment behavior of the enterprise—such as industry, year, and province—are used as the control variables. The specific variable definition is shown in Table 1.

Table 1. Variable definitions.

Variable Name	Symbol	Definition
Dependent Variable		
Environmental Investment	Environment	$100 \times \text{Total environmental investment}/\text{initial operating income}$
Independent Variables		
Female as CEO	Female1	If the CEO of the company is female, assign to 1, otherwise 0
Female as CEO & Chair	Female2	If the CEO or chairman of the company is female, assign to 1, otherwise 0
Proportion of Females on executive teams	Female3	The number of women in the corporate executive team divided by the total number of executive team
Control Variables		
Size	Size	The natural logarithm of the total assets
ROE	Roe	Net profit/net assets
Leverage	Lev	Total Assets/total Liabilities
Growth	Growth	Current operating income/(current operating income-previous operating Income)
Cash	Cash	Cash holding amount/total assets
OCF	Ocf	Operating cash Flow/total assets
Expense Ratio	Expen	Sales cost/operating Income
Fixed Assets Ratio	Fa_r	Fixed assets/total assets
Majority Shareholder	First	Percentage of shares held by the largest shareholder
CEO Duality	Dual	1 if the chairman and CEO are the same person, 0 otherwise
Independent	Ddrate	Percentage of independent directors on the board
Inception time	Stime	Years elapsed since the firm was listed
State	State	1 if the company is state-owned, otherwise 0.
Industry	Indus	Industry dummy variables
Year Dummy	Year	Year dummy variables
Province Dummy	Province	Province dummy variables

4. Empirical Results

4.1. Descriptive Statistics of Variables

Table 2 provides descriptive statistical results for the variables in this article. As can be seen from the table, the average value of enterprise environmental investment index is 4.302, indicating that the proportion of Chinese listed companies' environmental investment accounted for 4.302% of the operating income, the standard deviation of the index is relatively large, reflecting substantial differences in environmental protection investment between enterprises. However, it remains to be seen that whether female executives influence this phenomenon. The statistics of Female1 and Female2 indicates that the proportion of the listed companies with a woman CEO is 4%, and the proportion of the listed companies with woman as chairman or CEO is 5.7%. It shows that there is quite meager representation of females on key positions in Chinese enterprises. Moreover, females are more likely to be a CEO than holding the key position of chairman. The descriptive statistics of the Female3 variable reveals that, on average, female directors in the sample firms accounts for 14.1% of the total, while the maximum value is 52.9%. It indicates that the male directors still dominate the board committees in the Chinese listed firms. The values of control variables are generally consistent with the previous literature.

Table 2. Descriptive statistics.

Variable	N	Mean	Std.dev	Min.	Max.
Environment	2521	4.302	10.491	0.002	73.677
Female1	2521	0.040	0.197	0.000	1.000
Female2	2521	0.057	0.232	0.000	1.000
Female3	2521	0.141	0.097	0.000	0.529
Size	2521	22.441	1.243	18.942	25.622
Roe	2521	0.063	0.130	−0.815	0.475
Lev	2521	0.513	0.194	0.055	1.210
Growth	2521	0.293	1.072	−0.830	11.464
Cash	2521	0.143	0.093	0.006	0.611
Ocf	2521	0.048	0.069	−0.202	0.264
Expen	2521	0.046	0.054	0.000	0.423
Fa_r	2521	0.317	0.177	0.001	0.860
First	2521	0.369	0.152	0.090	0.750
Dual	2521	0.179	0.383	0.000	1.000
Ddrate	2521	0.367	0.053	0.231	0.667
Stime	2521	11.273	5.532	2.003	26.052
State	2521	0.620	0.485	0.000	1.000

4.2. Regression Analysis

In order to investigate the influence of female executives of listed companies on their environmental investment behavior, the Pooled OLS Regression analysis is performed based on model (1). The standard errors are robust to very general forms of cross-sectional and temporal dependence. The regression results are presented in Table 3. It can be seen from Table 3 that women CEO (Female1) and corporate environmental investment (Environment) are positively correlated at 1% significance level. This shows that when the CEO in a company is a female, the company is more likely to make more investment for environmental protection. The CEO is responsible for the routine affairs in an enterprise and is answerable to the board of directors for holding the highest executive power in the company, and oversees the daily activities of the company. Women are usually more sensitive to social responsibility than men [45]. Thus, the existence of female CEOs can incorporate the sense of social responsibility in the company's decision-making process. Therefore, environmental investment as an essential part of social responsibility, will naturally be taken into account. Consequently, the existence of female CEO is likely to increase the enterprise environmental investment in line with the expectations. Having a female as a CEO or Chair (Female2) is found to be positively related to environmental investment (environment) at a 1% level, which means that when the chairman or CEO in a company is woman, the company is also more likely to do environmental investment. The chairman holds significant authority in a company and plays a vital role in framing the strategy and direction of the company on behalf of the board of directors. Under the feminist theory, women pay more attention to social responsibility so a female being the chairman of the company will be more conducive for enterprise investment in environmental protection. The regression results are consistent with these expectations. In addition, the proportion of female directors on the board committees (Female3) and the environmental investment (environment) is also positively associated at the 1% level, which implies that the higher the proportion of female directors as board members, the greater the amount of environmental investment of the company and these results are in line with the previous research [23]. The executive team here includes the corporate board, supervisory board, and senior level board committees. Hence, the higher the proportion of female executives in the enterprise, the more significantly the female's voice will reflect in corporate decision-making. As a result, the corporate economic decision-making will demonstrate female's preference for social responsibility. Hypothesis 1 is thus supported by this empirical outcome.

Table 3. Female executive and corporate environmental investment.

Variable	Environment	Environment	Environment
Female1	3.288 ***		
	(3.33)		
Female2		1.959 ***	
		(3.54)	
Female3			7.002 ***
			(3.36)
Size	0.025	0.027	0.085
	(0.49)	(0.53)	(1.44)
Roe	2.324 ***	2.199 **	1.987 **
	(2.60)	(2.31)	(2.08)
Lev	−0.929	−0.993	−0.959
	(−1.27)	(−1.37)	(−1.33)
Growth	−0.126	−0.106	−0.087
	(−1.21)	(−1.12)	(−0.95)
Cash	3.459	3.673	3.573
	(1.20)	(1.30)	(1.21)
Ocf	−14.339 ***	−14.402 ***	−13.703 ***
	(−3.13)	(−3.10)	(−2.92)
Expen	−19.174 ***	−19.261 ***	−19.270 ***
	(−8.53)	(−8.47)	(−9.35)
Fa_r	7.977 **	7.869 **	7.742 **
	(2.47)	(2.38)	(2.36)
First	1.417	1.336	1.330
	(1.48)	(1.40)	(1.41)
Dual	2.750 ***	2.762 ***	2.551 ***
	(13.35)	(13.32)	(10.07)
Ddrate	1.208	1.500	1.787 *
	(1.01)	(1.30)	(1.69)
Stime	−0.059	−0.062	−0.067
	(−1.25)	(−1.38)	(−1.59)
State	−3.118 ***	−3.112 ***	−2.963 ***
	(−9.13)	(−8.84)	(−8.87)
Cons	−1.768	−1.774	−3.986 ***
	(−0.89)	(−0.90)	(−2.99)
Year	YES	YES	YES
Ind	YES	YES	YES
Province	YES	YES	YES
N	2521.000	2521.000	2521.000
R ²	0.144	0.142	0.143
F	192.882	200.891	180.572

* Represents significance at the 10% level. ** Represent significance at the 5% level. *** Represent significance at the 1% level.

4.3. The Influence of External Factors on Female Executives' Environmental Investment

4.3.1. Female Executives and Corporate Environmental Investment: An Investigation on the Heterogeneity of Industry Attributes

As the industry characteristics play an important role in determining the strategic decisions of the firm, the enterprise decision-making behavior will inevitably be affected by the industry

environment and industry characteristics such as influencing the investment decision and behavior of the enterprise [46]. Tang and Li [33] found that Chinese firms from non-polluting industries pay less attention to environmental investment. One possible reason is, for companies emitting more pollutants in the production process, the environmental investment for pollution control should be higher, but firms in non-polluting industries may not find it important to invest in environmental protection. However, considering the favorable sense of social responsibility of female executives, they may also allocate investment in environmental protection for non-polluting industries so as to maintain the regional ecosystem. If found, such results could strengthen the ethical logic behind the women executives' corporate environmental investment. In this section, we have carried out the empirical analysis by taking the enterprise environmental investment as the dependent variable. The sample has been divided into the polluting industries and non-polluting industries to perform the regression analysis. Following the industrial classification proposed by Shu [47], the companies are divided into eight different categories: mining, food and beverage, paper and printing, textile and garment fur, petrochemical and plastic industries, metal and non-metallic industries, the pharmaceutical and biological products industry, and the hydroelectric gas industry.

The regression results from the industry sub-samples are shown in Table 4. The values depict that in the polluting industries, the female CEO variable (Female1) and the proportion of female directors in the executive committees (Female3) are still significantly related with corporate environmental investment at 5% and 1% respectively. These results are quite obvious for firms in the polluting industry. However, the results of non-polluting industries show that, the female executive variables (Female1 and Female2), and the proportion of female directors in the board committees (Female3) are positively linked with the corporate environmental investment at 1% significance level. This shows that the environmental investment behavior of female executives is not only favorable in the industries that need environmental governance, but also in industries which are not under strong environmental surveillance by the government. The result reflects that the basic logic behind female executives investing in environmental protection stems from the deep rooted sense of social responsibility in the inherent perception of females, rather than as a consequence of external environment.

Table 4. Regression results under Industry heterogeneity.

Variable	Polluting Industries			Non-Polluting Industries		
	Environment			Environment		
Female1	1.311 **			4.045 **		
	(2.29)			(2.40)		
Female2		0.381			3.355 ***	
		(1.07)			(2.88)	
Female3			2.658 ***			10.483 **
			(2.59)			(2.15)
Size	−0.313 *	−0.310 *	−0.281	1.426 ***	1.458 ***	1.504 ***
	(−1.68)	(−1.66)	(−1.51)	(5.16)	(5.53)	(6.69)
Roe	5.713 ***	5.613 ***	5.619 ***	−1.512	−1.577	−2.220
	(4.21)	(4.23)	(4.31)	(−1.12)	(−1.12)	(−1.48)
Lev	2.098	2.144	2.140	−2.763	−2.986	−3.108 *
	(1.23)	(1.27)	(1.27)	(−1.46)	(−1.61)	(−1.77)
Growth	−0.073	−0.067	−0.063	−0.044	−0.014	0.018
	(−0.92)	(−0.86)	(−0.81)	(−0.29)	(−0.11)	(0.12)
Cash	9.757 ***	9.997 ***	10.104 ***	−4.324 *	−4.274 *	−4.952 *
	(3.29)	(3.36)	(3.31)	(−1.93)	(−1.94)	(−1.88)
Ocf	−10.578 ***	−10.540 ***	−10.262 ***	−14.308 ***	−14.490 ***	−13.526 ***
	(−2.72)	(−2.70)	(−2.64)	(−3.67)	(−3.70)	(−3.37)
Expen	−5.920 ***	−6.105 ***	−6.157 ***	−27.683 ***	−28.362 ***	−27.348 ***

Table 4. Cont.

Variable	Polluting Industries			Non-Polluting Industries		
	Environment			Environment		
	(−3.97)	(−4.03)	(−4.14)	(−7.00)	(−7.53)	(−6.52)
Fa_r	3.110 **	3.039 *	3.102 *	19.122 ***	19.000 ***	18.335 ***
	(1.99)	(1.91)	(1.95)	(3.25)	(3.21)	(3.05)
First	1.234	1.177	1.047	2.028 **	2.050 ***	2.307 **
	(0.74)	(0.71)	(0.63)	(2.57)	(2.62)	(2.53)
Dual	0.779 *	0.752 *	0.710 *	4.533 ***	4.573 ***	4.233 ***
	(1.87)	(1.78)	(1.73)	(12.80)	(12.65)	(10.36)
Ddtrate	−1.144	−1.046	−1.013	−1.574	−1.396	−0.587
	(−0.63)	(−0.56)	(−0.56)	(−0.69)	(−0.57)	(−0.21)
Stime	−0.110 **	−0.115 **	−0.114 **	−0.024	−0.024	−0.037
	(−1.97)	(−2.07)	(−2.03)	(−0.63)	(−0.61)	(−1.00)
State	−1.693 ***	−1.686 ***	−1.649 ***	−4.565 ***	−4.660 ***	−4.265 ***
	(−4.28)	(−4.22)	(−3.92)	(−15.38)	(−13.92)	(−15.98)
Cons	5.246 ***	5.172 ***	4.191 ***	−32.759 ***	−33.254 ***	−35.179 ***
	(6.44)	(6.41)	(4.42)	(−5.09)	(−5.43)	(−6.98)
Year	YES	YES	YES	YES	YES	YES
Ind	YES	YES	YES	YES	YES	YES
Province	YES	YES	YES	YES	YES	YES
N	1428.000	1428.000	1428.000	1093.000	1093.000	1093.000
R ²	0.123	0.122	0.123	0.223	0.222	0.223
F	165.952	156.712	151.341	341.271	314.448	912.734

* Represents significance at the 10% level. ** Represent significance at the 5% level. *** Represent significance at the 1% level.

4.3.2. Female Executives and Corporate Environmental Investment: The Impact of Economic Motive for Resource Acquisition

The above analysis found that women executives can significantly improve corporate environmental investment due to their inherent sense of social responsibility. However, according to the existing literature, enterprises may undertake social responsibility with a motive to obtain governmental subsidies in order to improve their financial position. Torugsa et al. [48] found that Chinese companies with an active corporate social responsibility have better financial performance. So under this economic consideration, regardless of whether the female executives have a good sense of social responsibility, firms will undertake environmental investment as an important mean to acquire some economic gains. From this perspective, the relationship between female executives and corporate environmental investment may be influenced by the economic factors rather due to a desire for social responsibility. We do some further investigation in Table 5 to uncover this possibility. The government subsidy obtained by the enterprise in the next period is taken as the dependent variable and the enterprise environmental investment as independent variable. Regression models were used to examine the impact of governmental subsidies on the environmental investment in the overall sample as well as female and non-female sub-samples. The grouping was based on whether the chairman or CEO was a female. As can be seen, the corporate environmental investment helps to obtain future government subsidies in the whole sample firms. But the group regression results indicate that this phenomenon is significant only for the non-female executive group, and for the female executive group, environmental investment even weakens with the access to future government subsidies. These results rule out the possibility that the female executives' intent to invest in environmental protection is driven by the government subsidies, reflecting that their eagerness to invest in environmental protection lies in the concern for social responsibility.

Table 5. Regression results of the resource acquisition motive under gender heterogeneity.

	Full Sample	Female Sample	Non-Female Sample
Variable	Sub	Sub	Sub
Environment	0.007 ** (2.36)	−0.025 *** (−3.55)	0.008 ** (1.97)
Size	−0.113 *** (−9.56)	−0.330 * (−1.75)	−0.101 *** (−4.58)
Roe	0.487 *** (6.90)	0.852 (1.32)	0.312 *** (2.75)
Lev	0.194 ** (2.51)	−0.444 (−0.46)	0.219 (1.57)
Growth	−0.022 *** (−3.37)	0.029 (0.39)	−0.012 (−1.15)
Cash	0.028 (0.29)	0.879 (1.54)	−0.090 (−0.51)
Ocf	0.678 *** (6.33)	8.072 (1.41)	0.493 ** (2.20)
Expen	0.124 (0.56)	−1.903 (−1.50)	0.377 ** (2.36)
Fa_r	−0.165 ** (−2.03)	−2.715 *** (−2.77)	−0.207 (−1.45)
First	0.097 * (1.88)	0.437 (0.38)	−0.022 (−0.32)
Dual	−0.017 (−0.39)	−0.791 *** (−3.52)	−0.008 (−0.16)
Ddrate	0.172 (1.27)	7.446 * (1.70)	−0.093 (−0.39)
Stime	0.010 *** (6.19)	0.076 *** (2.79)	0.008 *** (3.12)
State	0.016 (0.39)	−0.472 (−1.43)	−0.016 (−0.30)
Cons	2.525 *** (12.31)	2.973 (0.56)	2.491 *** (7.59)
Year	YES	YES	YES
Ind	YES	YES	YES
Province	YES	YES	YES
N	2443.000	138.000	2305.000
R ²	0.100	0.474	0.120
F	38.947	3.201	2.820

* Represents significance at the 10% level. ** Represent significance at the 5% level. *** Represent significance at the 1% level.

4.3.3. Female Executives and Corporate Environmental Investment: The Role of Government Intervention

Meng et al. [49] contends that in the context of China, strong governmental regulations are essential in order to direct firms to take environment protection more seriously. Governmental regulations and industry characteristics are important factors that define Chinese enterprise's environmental investment [44]. Usually, women are more susceptible to external pressure. Under the backdrop of Chinese government's increased emphasis towards environmental responsibility, local government's regulatory intervention in enterprises is gradually strengthened. Therefore, it is important to examine that whether a favorable attitude of female director towards environmental investment is influenced by the governmental regulations. The region effect is applied in the following regression models to understand this phenomenon. China has a vast territory where different regions have different degree of marketization. The eastern regions have a higher degree of marketization and less government intervention. Thus, a lower investment in the eastern regions will imply that female

executives' environmental investment decisions are driven by the governmental regulations rather than the intrinsic social responsibility values of women executives.

The regression results from Table 6 show that in the eastern regions, both the female executive variables (Female1 and Female2) and the proportion of female directors in the board committees (Female3) are positively related with the corporate environmental investment at 1% significant level, indicating that in the eastern regions where local government intervention is relatively weak, female executives still significantly increased corporate investment in environmental protection. Whereas, the co-efficient for Female2 variable is significant at 5%. These results ruled out the impression that increased investment in environmental protection is caused by the local government intervention.

Table 6. Female executives and corporate environmental investment: The role of the government intervention.

Variable	Eastern Region			Non-Eastern Region		
	Environment			Environment		
Female1	2.921 ***			1.714 ***		
	(3.11)			(4.18)		
Female2		1.802 ***			0.971 **	
		(4.03)			(2.32)	
Female3			10.274 ***			−0.935
			(3.54)			(−1.03)
Size	−0.041	−0.044	0.078	−0.119	−0.122	−0.143
	(−0.60)	(−0.71)	(0.75)	(−1.11)	(−1.13)	(−1.26)
Roe	3.989 ***	3.998 ***	3.913 ***	−0.268	−0.389	−0.398
	(4.70)	(4.68)	(4.21)	(−0.23)	(−0.32)	(−0.32)
Lev	−0.546	−0.619	−0.642	−1.083	−1.065	−1.010
	(−0.63)	(−0.72)	(−0.73)	(−1.08)	(−1.08)	(−1.05)
Growth	−0.172	−0.158	−0.150	−0.139 ***	−0.126 **	−0.111 **
	(−1.02)	(−0.99)	(−0.81)	(−2.63)	(−2.49)	(−2.15)
Cash	3.885	3.858	3.650	4.057	4.410 *	4.744 **
	(1.55)	(1.52)	(1.37)	(1.64)	(1.84)	(1.97)
Ocf	−26.926 ***	−27.053 ***	−26.475 ***	−0.943	−0.956	−1.067
	(−5.22)	(−5.14)	(−5.32)	(−0.24)	(−0.24)	(−0.26)
Expen	−23.589 ***	−23.521 ***	−23.880 ***	−13.746 ***	−13.816 ***	−13.457 ***
	(−11.72)	(−11.12)	(−12.93)	(−9.64)	(−9.99)	(−10.24)
Fa_r	15.262 ***	15.301 ***	15.366 ***	−0.641	−0.771	−0.712
	(5.72)	(5.64)	(6.09)	(−0.18)	(−0.22)	(−0.20)
First	3.201	3.206	3.194	−0.039	−0.121	−0.061
	(1.45)	(1.48)	(1.52)	(−0.03)	(−0.11)	(−0.05)
Dual	2.939 ***	2.965 ***	2.718 ***	1.286	1.251	1.158
	(11.16)	(11.22)	(9.73)	(1.39)	(1.39)	(1.24)
Ddrate	0.746	0.930	1.558	−3.004 **	−2.731 **	−2.343
	(0.56)	(0.68)	(1.00)	(−2.17)	(−2.03)	(−1.57)
Stime	−0.201 ***	−0.203 ***	−0.196 ***	0.090 **	0.086 **	0.085 **
	(−3.74)	(−3.87)	(−3.66)	(2.59)	(2.53)	(2.57)
State	−2.243 ***	−2.192 ***	−1.961 ***	−4.349 ***	−4.394 ***	−4.487 ***
	(−5.67)	(−5.42)	(−4.82)	(−4.64)	(−4.76)	(−4.80)
Cons	8.138 ***	8.120 ***	3.224	7.768 ***	7.887 ***	8.381 ***
	(3.11)	(3.00)	(1.46)	(3.89)	(4.15)	(4.01)
Year	YES	YES	YES	YES	YES	YES
Ind	YES	YES	YES	YES	YES	YES
Province	YES	YES	YES	YES	YES	YES
N	1475.000	1475.000	1475.000	1046.000	1046.000	1046.000
R ²	0.161	0.160	0.165	0.203	0.202	0.202
F	104.013	117.846	188.497	1864.212	2041.320	1693.422

* Represents significance at the 10% level. ** Represent significance at the 5% level. *** Represent significance at the 1% level.

4.4. The Effectiveness of Female Executive's Environmental Investment: A Perspective Based on Pollutant Emission Reduction

The existing studies reveal that the environmental investment based on rent-seeking motives does not necessarily leads to an improvement in environmental quality [50]. The question then arises as to whether the increase in corporate environmental investment that stems from the female executives' awareness of social responsibility can effectively improve environmental quality? To test our second hypothesis, we use the provincial SO₂ emission reduction data to answer this question. In particular, based on the natural logarithm of the provincial SO₂ emission reduction as the dependent variable and the enterprise environmental protection investment as independent variable, a regression analysis was carried out on the overall sample and the sub-samples based on the gender category. The results are reported in Table 7. In the full sample regression model, the environmental investment of Chinese listed companies generally does not improve the pollutant emission reduction significantly. It conjectures that on an overall basis, the environmental investment of sample firms is not well-directed to reduce pollution, perhaps due to lack of managerial intent for environmental protection. However, the results for the female executives sub-sample indicates that the environmental investment of such companies does significantly reduce the SO₂ emission. This outcome maintains that the environmental investment by the female executives is effectively targeted at reducing the environmental pollutants due to being conscious of social responsibility. Hence it can lead to better environmental protection. Contrarily, the impact of environmental investment on pollutant emission control is insignificant in the non-female executive sub-sample.

Table 7. Corporate environmental investment and reduction in pollutant emission.

Variable	Full Sample	Female Sample	Non-Female Sample
	SO ₂ Reduction	SO ₂ Reduction	SO ₂ Reduction
Environment	0.001 (0.72)	0.008 ** (2.61)	0.001 (0.86)
Size	0.011 (1.44)	0.015 (0.19)	0.009 (1.02)
Roe	0.035 (0.26)	0.155 (0.51)	−0.002 (−0.01)
Lev	0.153 * (1.68)	−0.119 (−0.58)	0.186 * (1.72)
Growth	0.030 *** (2.96)	−0.047 ** (−2.02)	0.029 *** (2.87)
Cash	0.242 * (1.71)	0.846 * (1.80)	0.208 * (1.74)
Ocf	−0.386 * (−1.69)	−1.639 ** (−2.59)	−0.275 (−1.04)
Expen	−0.268 ** (−2.08)	2.769 *** (3.23)	−0.234 (−1.37)
Fa_r	0.092 (1.12)	2.369 *** (4.87)	−0.028 (−0.27)
First	0.114 (1.24)	0.523 (1.60)	0.095 (1.08)
Dual	−0.020 ** (−2.49)	−0.227 (−1.65)	−0.010 (−1.07)
Ddrate	0.829 ***	1.935 ***	0.781 ***

Table 7. Cont.

Variable	Full Sample	Female Sample	Non-Female Sample
	SO ₂ Reduction	SO ₂ Reduction	SO ₂ Reduction
	(2.66)	(3.07)	(2.64)
Stime	0.004	−0.008	0.004
	(1.25)	(−0.42)	(1.26)
State	0.068 *	0.658 ***	0.072 *
	(1.78)	(2.98)	(1.68)
Cons	12.890 ***	10.529 ***	13.023 ***
	(64.01)	(7.88)	(96.87)
Year	YES	YES	YES
Ind	YES	YES	YES
Province	YES	YES	YES
N	2521.000	144.000	2377.000
R ²	0.987	0.995	0.987
F	9.977	51.697	88.224

* Represents significance at the 10% level. ** Represent significance at the 5% level. *** Represent significance at the 1% level.

4.5. Robustness Testing

In order to ensure the robustness of the above results, we use the ratio of total environmental investment to total assets as dependent variable, and rerun model (1). The regression results are listed in Table 8. The following conclusions can be drawn from the results below: after replacing the core variable environmental investment, the three independent variables representing the female executives still have a significant positive relationship with the enterprise's environmental investment thus validating that the results of our regression analysis are quite robust.

Table 8. Robustness test: An alternate measure of dependent variable.

Variable	Environment	Environment	Environment
Female1	0.698 ***		
	(3.00)		
Female2		0.344 **	
		(2.25)	
Female3			2.156 ***
			(2.66)
Size	−0.066 **	−0.067 **	−0.044
	(−2.40)	(−2.43)	(−1.23)
Roe	1.478 ***	1.451 **	1.387 **
	(2.59)	(2.48)	(2.33)
Lev	0.254	0.242	0.246
	(0.55)	(0.53)	(0.54)
Growth	−0.056	−0.051	−0.047
	(−1.58)	(−1.53)	(−1.46)
Cash	1.847 *	1.897 *	1.852 *
	(1.72)	(1.79)	(1.67)
Ocf	−4.829 ***	−4.838 ***	−4.638 ***
	(−3.78)	(−3.75)	(−3.52)

Table 8. Cont.

Variable	Environment	Environment	Environment
Expen	−7.157 *** (−16.21)	−7.170 *** (−16.06)	−7.192 *** (−17.28)
Fa_r	2.344 *** (2.60)	2.316 ** (2.52)	2.294 ** (2.53)
First	0.845 * (1.70)	0.829 * (1.68)	0.823 * (1.66)
Dual	0.934 *** (10.15)	0.933 *** (9.98)	0.879 *** (7.81)
Ddrate	1.122 * (1.68)	1.196 * (1.80)	1.242 ** (2.04)
Stime	−0.031 ** (−2.28)	−0.032 ** (−2.40)	−0.033 *** (−2.59)
State	−1.079 *** (−8.30)	−1.076 *** (−8.19)	−1.035 *** (−8.23)
Cons	0.938 * (1.79)	0.960 * (1.83)	0.195 (0.64)
Year	YES	YES	YES
Ind	YES	YES	YES
Province	YES	YES	YES
N	2521.000	2521.000	2521.000
R ²	0.123	0.123	0.124
F	171.345	157.923	231.032

* Represents significance at the 10% level. ** Represent significance at the 5% level. *** Represent significance at the 1% level.

Similarly, we have tested the impact of female executives in industry sub-samples using an alternate measure of environmental investment in Table 9. It is evident that in the polluting industry sub-sample, the Female1 variable and the Female2 variable are positively related with the enterprise environmental investment. Likewise, the Female1 and Female2 variables also show a positive association with the firm's environmental investment in the non-polluting industry sub-sample, hence the conclusions above have not changed fundamentally.

Table 9. Robustness test: An alternate measure of dependent variable in industry sub-samples.

Variable	Polluting Industries			Non-Polluting Industries		
	Environment			Environment		
Female1	0.532 *** (3.38)			0.595 ** (2.01)		
Female2		0.207 * (1.68)			0.495 ** (2.01)	
Female3			0.530 (1.57)			3.181 (1.50)
Size	−0.143 ** (−2.03)	−0.142 ** (−2.00)	−0.136 ** (−2.00)	0.250 *** (3.52)	0.255 *** (3.70)	0.287 *** (5.73)
Roe	3.127 ***	3.088 ***	3.087 ***	−0.706	−0.716	−0.936

Table 9. Cont.

Variable	Polluting Industries			Non-Polluting Industries		
	Environment			Environment		
	(5.89)	(5.83)	(5.90)	(−0.73)	(−0.72)	(−0.84)
Lev	1.088	1.104	1.108	0.089	0.056	0.039
	(1.47)	(1.49)	(1.52)	(0.60)	(0.38)	(0.25)
Growth	−0.025	−0.023	−0.021	−0.020	−0.016	−0.012
	(−0.76)	(−0.69)	(−0.64)	(−0.27)	(−0.22)	(−0.16)
Cash	3.492 ***	3.581 ***	3.622 ***	−0.127	−0.120	−0.319
	(3.26)	(3.34)	(3.37)	(−0.13)	(−0.12)	(−0.28)
Ocf	−4.928 ***	−4.917 ***	−4.851 ***	−3.680 ***	−3.707 ***	−3.470 ***
	(−3.90)	(−3.87)	(−3.86)	(−5.12)	(−5.18)	(−4.36)
Expen	−3.859 ***	−3.930 ***	−3.949 ***	−9.018 ***	−9.118 ***	−8.941 ***
	(−4.61)	(−4.67)	(−4.60)	(−6.45)	(−6.61)	(−5.94)
Fa_r	1.011 ***	0.987 ***	0.987 ***	4.846 **	4.828 **	4.615 *
	(3.62)	(3.49)	(3.37)	(2.16)	(2.14)	(1.96)
First	1.310 *	1.288 *	1.261 *	0.331	0.335	0.441
	(1.78)	(1.75)	(1.73)	(0.76)	(0.77)	(1.14)
Dual	0.393 ***	0.385 **	0.369 **	1.392 ***	1.398 ***	1.303 ***
	(2.61)	(2.57)	(2.47)	(11.25)	(11.34)	(7.40)
Ddrate	−1.744 **	−1.709 **	−1.691 **	3.483 ***	3.509 ***	3.650 ***
	(−2.46)	(−2.37)	(−2.37)	(4.52)	(4.47)	(4.46)
Stime	−0.049 ***	−0.051 ***	−0.051 ***	−0.013	−0.013	−0.017
	(−3.47)	(−3.58)	(−3.64)	(−0.87)	(−0.87)	(−1.20)
State	−0.508 ***	−0.503 ***	−0.500 ***	−1.745 ***	−1.759 ***	−1.671 ***
	(−3.27)	(−3.23)	(−3.08)	(−9.97)	(−9.79)	(−8.96)
Cons	3.472 ***	3.438 ***	3.252 ***	−7.484 ***	−7.557 ***	−8.465 ***
	(8.88)	(8.78)	(9.11)	(−3.80)	(−3.96)	(−6.69)
Year	YES	YES	YES	YES	YES	YES
Ind	YES	YES	YES	YES	YES	YES
Province	YES	YES	YES	YES	YES	YES
N	1428.000	1428.000	1428.000	1093.000	1093.000	1093.000
R ²	0.126	0.125	0.125	0.179	0.179	0.182
F	18.156	37.539	50.992	99.638	98.315	84.162

* Represents significance at the 10% level. ** Represent significance at the 5% level. *** Represent significance at the 1% level.

5. Conclusions

The aim of this study was to examine that whether increased representation of female executives improves environmental investment in Chinese listed companies. Nowadays, with the rise in social status and the level of education of females, the number of female executives in enterprises has increased. Several studies have now been conducted on the gender differences of executives that leads to the difference in decision-making approaches in firms. The empirical results support our first hypothesis and assert that the presence of female executives can indeed promote environmental

investment in enterprises. Moreover, the impact of female executives on environmental investment is not influenced by the industry attributes. It suggests that female executives not only make significant environmental investment in the polluting industries but also in the non-polluting industries. These findings maintain that women executives invest in environmental protection based on their inherent sense of social responsibility which is not affected by the industry attributes. We further investigate that whether the female executives favorable attitude towards environmental investment is driven by external factors such as government subsidies or regulatory pressure. The findings refute the conjecture that environmental investment of female executives may be caused to acquire government subsidies. In addition, female executives persist with environmental investment in eastern China where environmental regulations are not very stringent. The previous research contends that environmental investment by the corporate executives may be aimed at availing the economic incentives or to comply with the governmental regulations, thus it may not significantly improve the environment. Hence, our second hypothesis tests the effectiveness of female executive's investment compare to their male counterparts. The results indicate that contrary to male executives, environmental investment activities carried out by female executives lead to a significant reduction in the emission of pollutants. These findings validate the female executive's natural inclination towards environmental protection and affirmative attitude to improve the quality of the ecological environment. This paper elucidates the influence of executives' gender on environmental investment of listed companies in China. Given the increased pressure for environment protection from the government and society, it is imperative to emphasize the role of leadership characteristics and management composition on the corporate social responsibility practices of an enterprise. Hence, the study provides new insights for optimizing management team structure and establishes that increased representation of female executives can significantly improve the environmental quality in China. The study has practical significance for the corporations and the society at large as it not only suggests a way out to improve the environmental quality, but also reaffirm the important role of females in an enterprise. Hence, this evidence can pave the way to eradicate the 'ceiling effect' in the promotion process of female executives. However, the findings of this study are limited to the Chinese context. Future studies in this area can examine how the presence of a female executive influences the management and behavioral aspects of an enterprise and corporate risk taking. Moreover, female executives' willingness to invest in environmental protection activities should also be tested to corroborate these findings in other emerging and advanced economies.

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