

Article

The Threshold Effect of Executive Compensation on Corporate Environmental Responsibility: Based on the Moderating Effect of Industry Competition

Yang Zhang ¹ and Xinxin Zhang ^{2,*}

¹ School of Business Administration, Hunan University of Technology and Business, Changsha 410205, China; ambition.007@163.com

² Business School, Central South University, Changsha 410083, China

* Correspondence: csuzhangxinxin@163.com

Abstract: In recent years, the relationship between the executive characteristics and corporate environmental responsibility has attracted much attention from academia, especially the relationship between executive compensation and corporate environmental responsibility. Based on the panel data of China's Shanghai and Shenzhen A-share listed manufacturing companies from 2006 to 2018, this paper empirically tests the threshold effect of executive compensation on corporate environmental responsibility and explores this relationship under the moderation of industry competition. The results show the following: (1) The impact of executive compensation on corporate environmental responsibility represents a U-shaped threshold effect; that is, the promotion of corporate environmental responsibility by executive compensation only appears after reaching a certain boundary. (2) Industry competition has a positive moderating effect, which will shift the inflection point of the U-shaped curve between executive compensation and corporate environmental responsibility to the left. (3) Executive compensation of companies of different attributes, sizes, and regions has an impact on corporate environment responsibility, and industry competition has a varying impact on executive compensation and corporate environmental responsibility. This paper is based on the special situation of China and can be used for reference to other developing countries. This study not only expands the research perspective of corporate environmental responsibility and further reveals and verifies the manager effect in the field of environmental performance, but also has practical significance to further give full play to the incentive effect of compensation on corporate non-financial performance.

Keywords: corporate environmental responsibility; executive compensation; industry competition; threshold effect



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1. Introduction

In recent years, countries around the world are seeing increasingly severe ecological and environmental damage. The pursuit of rapid GDP growth has led to greenhouse effect, water pollution, and reduction in biodiversity, which seriously affect the health and well-being of all humankind. The “Global Risk Report” published by the World Economic Forum in 2019 states that environmental crisis is a looming “nightmare”. Societies have started to focus on reducing the negative impacts of rapid economic development on the environment, and environmental protection has become an indispensable part of sustainable development [1]. As the main subjects of economic activities, enterprises are not only the suppliers of products and services, but also the perpetrators of many environmental problems [2], and are regarded as the root cause of environmental degradation [3]. Enterprises play a key role in environmental governance, and their ability to assume environmental responsibilities is related to ecological safety and sustainable development. Motivating enterprises to conduct and improve environmental self-governance is a major focus in academia. With the introduction of the upper echelon theory, scholars believe

that executives make strategic choices for their companies based on their own cognition and values [4]. Therefore, executives, as decision makers for the actions and strategies of corporate social responsibility [5], are subjected to institutional and environmental pressures from the government and the public. With the increasing importance placed on environmental protection, these external pressures could impact the implementation of corporate environmental strategies.

Existing studies have explored the role of executives in corporate social responsibility and environmental responsibility management from both theoretical and empirical perspectives. Among them, the characteristics of executives are regarded as key factors that explain the different responses of companies to external pressures [6]. For example, Olthuis and Van (2020) [7] show that gender diversity within the board of directors has varying effects on corporate social responsibility and information disclosure, while Chen et al. (2020) [8] reveal that companies with executives that have military backgrounds have a lower level of environmental information disclosure. The literature shows that the characteristics of executives affect corporate environmental responsibility but research has yet to reach a unified conclusion.

Compensation, as an executive characteristic, is the main economic benefit that executives actively pursue. Management incentive can alleviate the agency problem and converge the interests of senior executives with those of the enterprise, so as to stimulate the motivation of management innovation and improve the sustainable performance of enterprises [9]. The effect of executive compensation on corporate environmental responsibility behavior remains unclear. Shareholders use compensation to motivate executives, guide and reduce self-interested behaviors, ease agency conflicts, and affect the behavioral decisions of executives in corporate environmental responsibility. However, the relationship between executive compensation and corporate environmental responsibility has not been clarified. Scholars have explored the incentive mechanisms and proposed the agency theory, stating that executives are selfish and unwilling to conduct large-scale investment in environmental protection activities without direct financial benefits [10]. Thus, companies can stimulate selfish executives to adopt environmental protection measures through high salary incentives; that is, there is a positive relationship between executive compensation and corporate environmental responsibility. However, other scholars believe that executives consider costs and benefits when making corporate social responsibility decisions. Generally, the costs of corporate social responsibility are large and the return period is long; therefore, executives with profit-linked incentives will reduce investment in corporate social responsibility; that is, there is a negative correlation between executive compensation and environmental responsibility [11,12]. In summary, the current understanding of the relationship between executive compensation and corporate environmental responsibility is unclear, with studies either showing a positive or negative linear relationship.

Furthermore, the development and survival of enterprises are closely related to investors, consumers, and other stakeholders. The relationship between companies and stakeholders is bound to be affected by the degree of competition, where corporate environmental responsibility can be used as a competitive strategy to gain stakeholder preference [13]. For example, Fernández-Kranz and Santaló (2010) [14] show that companies in a highly competitive environment have better environmental performance. Fisman et al. (2006) [15] reveal a positive correlation between market competition and corporate social responsibility.

To explore the influence of industry competition on the relationship between executive compensation and corporate environmental responsibility, this study selects China, an emerging economy, as the research subject for the following reasons. First, studies on corporate social responsibility, environmental responsibility, and their relationship with executive characteristics have mainly focused on developed countries [16–18], while largely ignoring emerging economies. The applicability of the research conclusions from developed countries to developing countries, such as China, remains to be confirmed. As the world's largest emerging economy, China is representative of developing countries. Second, China and developed countries have different economic structures and institutional settings,

which may exhibit different research results [19,20]. In developed countries, the market is highly efficient with low levels of government's intervention, and the environmental responsibility of enterprises originates from the free market. In comparison, China and other developing countries have a lower degree of marketization with higher levels of government intervention. The governments in developing countries are more likely to interfere with market competition, thereby affecting corporate environmental responsibility decisions. In short, it is worthwhile to explore the contextual effects of industry competition in developing countries (e.g., China) where market competition is not fully mature, and to examine the moderating effect of industry competition on the relationship between executive compensation and corporate environmental responsibility.

Therefore, this study introduces the ERG theory and upper echelon theory to explore the nonlinear relationship between executive compensation and corporate environmental responsibility. This paper aims to answer the following questions: (1) Will differences in executive compensation affect corporate environmental responsibility? If so, what is the mechanism? (2) Does market competition impact the threshold effect of executive compensation on corporate environmental responsibility? Do the characteristics of the company (company ownership, size, and located region) heterogeneously impact the relationship between executive compensation and corporate environmental responsibility?

To answer the above questions, this study examines listed companies in China, constructs a U-shaped relationship, and creates moderating models to explore the impact mechanism of executive compensation on corporate environmental responsibility. Next, we introduce market competition to explore its moderating effect. Then, we analyze the heterogeneity of company ownership, scale, and located region. Last, we test the robustness and reliability of the results by replacing explained variables, Tobit modeling, and Heckman modeling. The results show that executive compensation has a U-shaped threshold effect on corporate environmental responsibility and is alleviated by industry competition.

Compared to existing research, the contribution of this study is reflected in three aspects: First, this paper reveals and verify the managerial effect in the field of environmental performance, expanding and extending the applicable boundaries of the upper echelon theory. According to the upper echelon theory, the characteristics of executives affect the economic consequences of companies. In contrast to existing studies that focused on the impact of executive characteristics (such as gender, age, etc.) on financial performance [21,22], this study explores the driving factors of environmental responsibility from the perspective of executive compensation and expands the understanding of corporate environmental responsibility. The results reveal and verify the managerial effect in the field of environmental performance and aid the analysis and prediction of enterprise environmental performance from a new perspective.

Second, this paper enriches the literature on the intersection of executive compensation and corporate social responsibility, environmental responsibility, and other fields. Studies on corporate environmental responsibility and executive compensation are mostly based on developed countries with established laws and high market competition [17,18]. This study, based on China, clarifies the boundary conditions of the impact of executive compensation on corporate environmental responsibility in developing countries. It also tested the heterogeneous relationship between executive compensation and corporate environmental responsibility according to company ownership, size, and located region. The results identify the impact of executive compensation on corporate environmental responsibility, providing reference material for other developing countries.

Third, this paper constructs a model to test the nonlinear relationship between executive compensation and corporate environmental responsibility and clarifies the point of inflection, effectively extending the existing literature that verifies the linear relationship between the two [11,12,23]. In addition, this study provides practical guidance for relevant enterprises to actively assume environmental responsibilities.

The structure of this article is as follows: Section 1 is the introduction; Section 2 reviews existing studies and related theories and proposes the research hypotheses; Section 3

presents the research design; Section 4 tests the hypothesis and robustness; Section 5 summarizes the results and discusses the implications.

2. Literature Review and Research Hypothesis

To reveal the relationship between executive compensation and corporate environmental responsibility, this study employs the upper echelon perspective, ERG theory, and stakeholder theory to analyze and formulate the research hypothesis. The upper echelon theory proposes that the internal and external environments faced by executives are complex, often including incomprehensible phenomena. As decision makers of corporate actions and strategies, the executive's cognitive foundation and values limit their ability to interpret relevant information and can only selectively observe partial aspects of the organization and its environment. This restricted view is combined with personal values to provide a basis for the company's strategic decisions. In other words, the characteristics of the executive's cognitive ability, perception ability, and values will affect the organization's strategic choice and performance [24], and in turn affect the company's behavior [25]. Based on the principal-agent relationship, compensation, as an important method for shareholders to motivate managers [11,26], is used to resolve information asymmetry between the goals of managers and shareholders [27]. Executive compensation is a heterogeneous characteristic in the upper echelon theory that affects executive's strategic decision making [28].

However, the influence of executives on corporate behavior and decision making varies depending on the executive's level of self-fulfillment. The ERG theory divides human needs into three levels: existence, relatedness, and growth [29]. When the low-level needs are met, the desire for high-level needs will be triggered. From the perspective of the ERG theory, the compensation of executives determines the material life and desire satisfaction; that is, different compensation levels correspond to different levels of pursuit, which affect the behavioral decisions of executives. As the decision makers of corporate social responsibility actions and strategies [5], executives are the main participants in formulating corporate strategies, commitments, attitudes, and values [30]. The support of environmental protection is crucial for companies to respond to environmental emergencies and other environmental performances [31]. Different compensation levels have varying effects on executive's need in self-fulfillment, which in turn affect the enterprise's pursuit of environmental performance and financial performance. Companies adopt different social and environmental performance strategies based on the attitudes and values of their executives [32].

In addition, the strength and intensity of executive's enforcement of corporate environmental responsibilities are affected by the situational factors of industry competition. According to the stakeholder theory, the needs of various stakeholders, such as consumers, investors, and suppliers, are important forces that shape organization strategy [33]. With the increasing focus on environmental protection, enterprises face increased pressure from stakeholders, which require companies to formulate and implement environmental protection strategies that promote environmental protection and actively invest resources to fulfill their responsibilities [34]. Investors, suppliers, and consumers are more inclined to favor companies that respect the law and are willing to pay more for the products of environmentally friendly companies [35]. To meet the environmental needs of stakeholders, companies have begun to consider environmental responsibility as an important part of their overall performance [31], in other words, the needs of stakeholders and environmental issues are integrated into corporate strategy [36].

However, the integration of stakeholder demands into corporate strategy is greatly affected by the intensity of industry competition. In theory, market competition is a powerful control mechanism that forces executives to optimize decisions and maximize company value. It can reduce excessive investments and information asymmetry [37,38] and plays a key role in corporate decision making, forcing executives to consider the implementation of corporate environmental responsibility activities [39]. That is, industry competition is a key

factor that moderates corporate behavioral decisions under the influence of stakeholder needs and executive compensation [40].

2.1. Executive Compensation and Corporate Environmental Responsibility

Compensation is closely related to corporate social responsibility, and providing executives with direct incentives for corporate social responsibility is an effective tool to improve corporate social performance. Currently, scholars have yet to reach a consensus on the relationship between executive compensation and corporate environmental responsibility. Based on the institutional theory, mechanism theory, and environmental management research, some researchers believe that there is a positive correlation between executive compensation and corporate environmental responsibility [23]. For example, Mahoney and Thorn (2006) [41] show a positive correlation between executive compensation and corporate social performance of Canadian companies. Berrone and Gomez-Mejia (2009) [23] reveal a positive correlation between executive compensation and environmental performance in the polluting industry within U.S., although the structure of CEO compensation did not affect environmental performance. Moreover, more and more enterprises have incorporated corporate social responsibility standards into executive compensation plans, including environmental goals, such as CO₂ emission/water pollution targets, to encourage management to implement future-oriented corporate social responsibility plans [42]. Haque (2017) [43] finds a positive correlation between compensation policies based on corporate carbon emission reduction plans and carbon performance [43]. At the same time, the executive pay gap will also affect the motivation of corporate social goals, and the pay difference between the CEO and other executives urges the CEO to assume more social responsibility, so limiting the financial incentives of senior executives may damage their motivation to participate in corporate social responsibility [21,44]. However, Fabrizi et al. (2014) [11] point out that executives will consider costs and benefits when making corporate social responsibility decisions. Since the current cost of corporate social responsibility is large and the return period is long, executives tend to reduce investment in corporate social responsibility to increase the level of profit-linked incentives; that is, there is a negative correlation between executive compensation and environmental responsibility [12]. In addition, some studies have explored the impact of corporate social responsibility on CEO pay, but the conclusions are not uniform [45]. Some scholars believe that corporate social responsibility will increase CEO pay, while others regard corporate social responsibility as an agency problem and think that the relationship between corporate social responsibility and CEO pay is negative [16].

The ultimate goal of managers is to maximize the long-term value of shareholders to the company, while pursuing job stability, personal reputation, and on-the-job consumption [46]. When the goals of shareholders and managers are inconsistent, it will lead to agency problems, and incentive methods such as executive compensation are very important to the pursuit of managers' goal level. Comparatively, from the perspective of the reputation model of agency theory, some scholars propose that when executive compensation is low, they are more inclined to improve their reputation to increase future compensation. When the executive's compensation is high, it indicates that their value is fully reflected in the market. The risk and energy consumption of environmental protection investment make executives more risk averse [47] and unwilling to improve environmental performance; that is, there is an inverted U-shaped relationship between executive compensation and corporate environmental responsibility. However, we propose that, in the context of the economic man hypothesis, compared with environmental performance, the short-term salary of executives is affected by the financial performance of the company, and they care less about improving market reputation through environmental responsibility until their compensation reaches a certain level.

According to the ERG theory, when the compensation level of executives is low, their pursuit focuses on existence, or their own material needs. As rational economic units, companies often focus on maximizing economic benefits, and financial performance is the

most important criterion for measuring executive compensation [48]. Therefore, when the executive's compensation is low, they pay more attention to improving their salary through company financial performance. They pay attention to the economic potential and financial performance of the company and ignore the company's environmental responsibility. To maximize self-interest, executives are more likely to achieve short-term financial success at the expense of the environment, resulting in more pollution emissions and environmental violations [49]. At this stage, executive compensation negatively correlates with corporate environmental performance. However, when compensation reaches a certain boundary, the executive's existence desires are satisfied, and they begin to pursue high-level relatedness and growth needs. The relationship between executive includes the need to maintain important interpersonal relationships with shareholders, customers, society, and other stakeholders.

Stakeholders are increasingly valuing corporate environmental responsibility due to the increase in public awareness of environmental protection and the implementation of sustainable development strategies. The environmental performance of the company is conducive to improving the image and reputation of the company and its executives [50], reducing financing costs, and enhancing relationships with stakeholders [51]. The social expectation of firms serves as an influential factor in managers' CSR decisions [44]. Therefore, when executives pursue high-level relationships, they will begin to attach importance to environmental responsibility. Growth needs include the realization of the self-value of executives, such as promotion, gaining social reputation, etc. The fulfillment of corporate environmental responsibility can help executives attain a "celebrity effect", such as obtaining "Environmental Protection Ambassador" honorary titles. This is considered as a better method for executives to realize their self-worth and growth needs. From the perspective of the upper echelon theory, the increase in salary enables executives to manage their company from a broader perspective and attach importance to corporate environmental responsibility while pursuing corporate economic benefits. After their salaries reach a certain threshold, they will continue to strengthen the implementation of corporate environmental responsibility while pursuing the satisfaction of their own high-level needs. That is, at this stage, the executive compensation positively correlates with the company's environmental responsibility. In summary, we propose Hypothesis 1:

H1. *Executive compensation exhibits a U-shaped threshold effect on corporate environmental responsibility.*

2.2. The Moderating Role of Industry Competition

Although some scholars regard corporate social responsibility, including environmental responsibility, as an excessive investment from the perspective of agency theory, they believe that corporate social responsibility activities will generate excessive initial investment costs, and enterprises with fierce market competition face more financial constraints. Therefore, companies can gain a competitive advantage by achieving economies of scale, increasing productivity, developing new products, or creating new opportunities for new projects [52], rather than investing in corporate social responsibility activities [39]. However, other researchers believe that the focus of corporate social responsibility activities in competitive industries can create new business opportunities, improve company image, and enhance the stability and growth of future cash flow. Therefore, corporate social responsibility activities in competitive industries should become a positive factor for competitive advantage. For example, Fernandez-Kranz and Santalo (2010) [14] found that companies in highly competitive industries invest more in social responsibility activities. Some scholars have found that there are significant differences in compensation practice among different industries [12,53].

This study starts from the stakeholder theory and believes that the key resources needed for the survival and development of enterprises are in the hands of the investors, consumers, and stakeholders, and will actively maintain this relationship through corresponding means and give stakeholders an advantage over the company [54]. Fierce

competition in the industry represents similar or alternative competitors that companies face in the market, which will affect the company's financing capabilities and profitability [55]. To survive in competitive markets, companies need to rely more on stakeholders by establishing a good social and market image [30], so as to gain more market resources. However, in low competition markets, even if a company does not pay enough attention to customer needs, it will not lead to a significant decline in performance. This is because customers must use the company's products due to the lack of alternatives [56].

According to the stakeholder theory, the behavior of companies in terms of environmental responsibility is increasingly facing pressure from stakeholders, such as consumers, investors, and suppliers. When industry competition is fierce, managers will be more aware of the importance of stakeholders. To win the attention of stakeholders, companies will increase the initiative of environmental response and respond to the pressure of stakeholders, such as attaching importance to green technology research and development, green manufacturing, actively fulfilling social obligations and environmental responsibilities [57], gaining goodwill, and increasing the loyalty of consumers [58,59]. Moreover, research shows that implementing active environmental strategies can improve organizational capabilities [60,61] and enable companies to gain competitive advantages [62,63]. Therefore, the assumption of environmental responsibility is necessary for enterprises to enhance their core competitiveness in fierce industry competition. When industry competition is weak, stakeholders' advantage over companies is also weak, and companies will lack the willingness to actively carry out environmental governance and invest in environmental protection.

Environmental governance requires the company to spend valuable resources and carry out environmental protection technology innovation, which not only increases the business cost of the enterprise, but also does not bring direct economic inflow [64]. Therefore, this study believes that when industry competition is fierce, the executives of such companies need to establish a good social image by fulfilling corporate environmental responsibilities to gain a competitive advantage. That is, industry competition can reduce the threshold of the impact of executive compensation on corporate environmental responsibility. Based on this, we propose Hypothesis 2:

H2. *Industry competition eases the U-shaped threshold effect of executive compensation in promoting corporate environmental responsibility.*

The conceptual model of this article is shown in Figure 1.

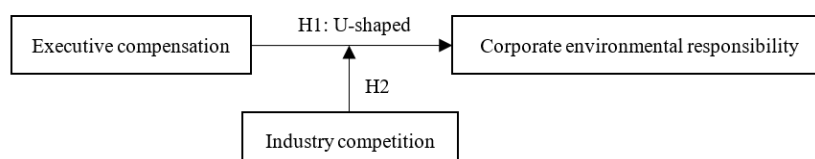


Figure 1. Conceptual model.

3. Research Design

3.1. Data Source

This study selects the data of listed manufacturing companies in China's Shanghai and Shenzhen A-share from 2006 to 2018 as the research subject, the original data are processed as follows: First, exclude companies with abnormal financial records during the study period, such as ST, *ST, etc. Second, exclude listed companies with incomplete or missing data. Third, perform logarithmic processing of continuous variables. A total of 561 listed companies are included with a total of 3667 observations.

3.2. Variable Description

3.2.1. Dependent Variable

This study employs the eight indicators of environmental responsibility from the China Research Data Service Platform (CNRDS) to measure corporate environmental responsibility. These indicators are defined as follows and coded 1 for positive and 0 for negative. (1) Environmentally beneficial products: company has developed or used innovative products, equipment, or technologies that are beneficial to the environment. (2) Measures to reduce wastes: company has adopted policies, measures, or technologies to reduce emissions of waste gas, wastewater, waste residues, and greenhouse gases. (3) Sustainable economy: company uses renewable energy or adopts the policies and measures of the sustainable economy. (4) Energy saving: company has policies or technologies to conserve energy. (5) Green office: the company has green office policies or measures. (6) Environmental certification: company has attained the ISO 14001 environmental management system certification. (7) Environmental commendation: company has received environmental commendation or other positive reviews. (8) Other environmental advantages: other environmental-related advantages that are not covered by the above indicators. The above indicators are weighted and averaged to obtain the final corporate environmental responsibility measurement indicator. The data source of CNRDS are obtained from the environmental responsibility reports and annual reports issued by the official websites of Shanghai and Shenzhen A-share listed companies. Its evaluation system is highly objective, authentic, and scientific.

3.2.2. Independent Variable

The corporate executives in this study mainly include the general manager, deputy managers, financial officers, secretary of the board of directors of the listed company, and other management personnel required by the company's articles of association. Executive compensation includes salary, bonus, long-term incentives, and other benefits. In view of the availability of data sources and drawing on the research methods of the literature [65–67], this paper selects the top three executive's total compensation and takes the logarithm as the measurement index for measuring executive compensation.

3.2.3. Moderating Variable

Industry competition represents the degree of industry agglomeration. Drawing on the research of relevant scholars [68], this study uses the sales of the top four companies in the industry to measure the proportion of total industry sales. Higher concentration of large enterprises represents lower competitiveness in the industry. With consideration for the consistency of the direction, a minus sign is added to this indicator to measure the degree of industry competition.

3.2.4. Control Variables

Drawing on the research of related scholars [4,69,70], this article adds the following control variables. (1) Corporate financial characteristic variables: including: enterprise size, age, return on total assets, debt to assets ratio, revenue growth rate. Among them, corporate size is closely related to corporate environmental responsibility and executive compensation, because large companies can pay more attention to their stakeholders [12] and pay attention to the relationship between compensation and corporate development. In each life cycle of enterprise development, the degree of attention to environmental responsibility is also different, so this paper controls the enterprise age (age). In addition, the debt to assets ratio, that is, the debt level of the enterprise, may affect the possibility of the company using CEO compensation as a tool to solve agency problems [12]. The indicators of profitability and development ability, such as return on assets and the growth rate of operating income, are also related to the selection of corporate compensation system and the awareness of environmental responsibility. (2) Characteristics of comprehensive corporate governance: business ownership. According to the existing research, there are sig-

nificant differences in agency issues between state-owned and non-state-owned enterprises, and they pay different attention to corporate environmental commitment and financial performance, so the nature of property rights is also an important factor affecting the role of executive compensation in social responsibility such as environmental responsibility [71]. (3) The characteristics of regional environmental governance: environmental investment, environmental monitoring, environmental standards, and environmental reports. China has a vast territory, and there are great differences in the degree of economic development and marketization process in different regions, and there are also differences in the level of environmental governance and the degree of attention to environmental protection in different regions, so this paper controls the relevant characteristic variables of environmental governance in different regions. In addition, it also controls for dummy variables such as year, industry, and region. For specific descriptions of variables, see Table 1.

Table 1. Variable description.

Variables	Term	Symbol	Source
Dependent variable	Corporate environmental responsibility	Envrep	The eight indicators of environmental responsibility in (CNRDS) are weighted and averaged to measure corporate environmental responsibility.
Independent variable	Executive compensation	Pay	The total salary of the top three executives and take the logarithm.
Moderating variable	Industry competition	IC	The ratio of the total sales of the top four companies in the industry to the total sales of the entire industry. To maintain consistency in direction, a minus sign is used as a measure of industry competition.
Control variables	Enterprise size	Size	Natural logarithm of total assets.
	Enterprise age	Age	The cumulative number of years from the establishment of the company to the current year.
	Return on total assets	Roa	After-tax net profit to total assets, it is used to measure net profit per unit of assets creates.
	Debt to assets ratio	Debt_a	Total debt to total assets.
	Revenue growth rate	Grow	The ratio of the increase in business income this year to the total business income of the previous year.
	Business nature	Soe	State-owned enterprise is 1, non-state-owned enterprise is 0.
	Environmental investment	Env_inv	The proportion of investment in environmental pollution control of each province (city) in local GDP.
	Environmental monitoring	Env_moni	The number of provincial (municipal) environmental monitoring agencies, plus 1 before taking the logarithm.
	Environmental standards	Env_stad	The number of local environmental protection standards issued by each province (city) that year, plus 1 before taking the logarithm.
	Environmental reports	Env_repo	The number of environmental protection reports in each province (city), plus 1 before taking the logarithm.

3.3. Model Construction

To test the nonlinear relationship between executive compensation and corporate green innovation, this study constructs the following model:

$$y_{it} = \alpha_0 + \alpha_1 x_{it} + \alpha_2 x_{it}^2 + \lambda z_{it} + year_t + industry_i + area_i + \varepsilon_{it} \quad (1)$$

where y_{it} represents the dependent variable Envrep, x_{it} represents the independent variable Pay, x_{it}^2 is the quadratic term of the independent variable Pay, α_0 is the constant term, α_1 and α_2 are respectively the coefficients of the linear and quadratic terms of the independent

variable Pay, z_{it} is the control variable, λ is the coefficient of the control variable, $year_t$ is the time variable, $industry_i$ is the industry variable, $area_i$ is the area variable, and ε_{it} is the error term. We use Haans et al. (2016) [72] to define the U-shaped threshold effect: First, α_2 is significantly positive. Second, assuming that X_H and X_L are the maximum and minimum values of compensation and the slope at X_H is positive, if the slope at X_L is negative, that is, $\alpha_1 + 2\alpha_2 X_L$ is less than 0 and $\alpha_1 + 2\alpha_2 X_H$ is greater than 0. Third, the inflection point $-\alpha_1/2\alpha_2$ of the quadratic curve according to the estimated coefficient, needs to be within the value range of the independent variable Pay.

To test the moderating effect of industry competition on executive compensation and corporate environmental responsibility, this study constructs the following model:

$$y_{it} = \alpha_0 + \alpha_1 x_{it} + \alpha_2 x_{it}^2 + \alpha_3 x_{it}^2 m_{it} + \alpha_4 m_{it} + \lambda z_{it} + year_t + industry_i + area_i + \varepsilon_{it} \quad (2)$$

where m_{it} is the moderating variable, α_3 is the cross-product of the moderating variable and the independent variable's quadratic term, α_4 is the moderating variable's coefficient. The meanings of other variables and coefficients are as described above. According to the moderating effect analysis of the U-shaped curve by Haans et al. (2016) [72], we derive x in the above formula and make it 0, the following results can be obtained: $x^* = -\alpha_1 / (2\alpha_1 + 2\alpha_3 m)$. Here, the position of the turning point depends on the moderating variable, and the derivative of the moderating variable can be obtained as follows: $\delta x^* / \delta m = 2\alpha_1 \alpha_3 / 2(\alpha_1 + \alpha_3 m)^2$. At this time, since the denominator is a number greater than 0, the position of the turning point depends on the numerator ($2\alpha_1 \alpha_3$), if greater than 0, the turning point is shifted to the right; if less than 0, the turning point is shifted to the left. With regard to the shape of the curve, whether the curve is gentle or steep depends on whether the quadratic coefficient α_3 is significant. If α_3 is significantly positive, it represents a steep curve; if α_3 is significantly negative, it represents a gentle curve.

4. Empirical Analysis

4.1. Descriptive Statistics and Correlation Analysis

Table 2 lists the descriptive statistics of each variable. The results show that: (1) The mean value of Envrep is 3.160, indicating that most manufacturing companies have not fulfilled their appropriate environment responsibility. The maximum value of Envrep is 8 and the minimum value is only 0, indicating that there are great differences in the level of environmental responsibility among Chinese enterprises. (2) The minimum Pay of executive compensation level is less than 0, indicating that there is a state of executive arrears, while there is a big difference between the maximum value and the minimum value, indicating that there is also a certain pay gap among executives of Chinese listed companies. (3) The larger the IC, the higher the degree of competition in the industry. The minimum value of IC is -7.780 and the maximum value is 0.870 , which shows that the concentration of the top four enterprises in the Chinese market is still relatively high. (4) On the control variables, the descriptive statistics of size and other enterprise financial variables are consistent with the existing research; for soe, the average value is 0.560 , indicating that about 56% of the sample enterprises are state-owned enterprises; the differences between the maximum and minimum values of environmental governance level variables in Env_inv and other regions are relatively large, which fully shows that there are differences in the level of environmental governance and the degree of attention to environmental protection in different regions.

Table 2. Descriptive statistics.

Variable	Mean	SD	Min	Max	Observations
Envrep	3.160	1.620	0	8	3667
Pay	0	1	−10.94	4.780	3667
IC	0	1	−7.780	0.870	3667
Size	22.73	1.320	20.17	26.02	3667
Age	16.96	5.230	5	31	3667
Roa	0.050	0.060	−0.160	0.220	3667
Debt_a	0.460	0.190	0.060	0.900	3667
Grow	0.150	0.290	−0.430	1.530	3667
Soe	0.560	0.500	0	1	3667
Env_inv	1.250	0.680	0.060	4.660	3667
Env_moni	5.560	1.040	2.560	7.030	3667
Env_stad	0.680	0.800	0	4.600	3667
Env_repo	8.910	1.330	0	11.56	3667

4.2. Main Regression Analysis

The generalized estimation model is used to analyze unbalanced panels or repeated measurement data. As the panel data studied in this paper are unbalanced, the generalized estimation model is used for testing. To eliminate the influence of multicollinearity, this article standardizes the independent variable and the moderating variable. The estimation results are shown in Table 3. In Model 2, the linear coefficient is -0.978 , which is significantly negative at the 1% statistical level, and the quadratic coefficient is 1.046 , which is significantly positive at the 1% statistical level, but whether there is a U-shaped threshold effect needs further testing. Following the three testing methods of U-shaped threshold effect by Haans et al. (2016) [72], using Model 2 as an example, the quadratic coefficient is significantly positive ($\alpha_2 = 1.046$). Second, the inflection point of the curve calculated based on the coefficient of the linear term and the coefficient of the quadratic term $-\alpha_1/2\alpha_2$ is within the range of the independent variable. Third, in the sample interval, $\alpha_1 + 2\alpha_2X_L$ is less than 0, and $\alpha_1 + 2\alpha_2X_H$ is greater than 0. It shows that only when executive compensation reaches a certain level will the executive promote the fulfillment of corporate environmental responsibility. When executive compensation is low, their satisfaction and self-confidence in their abilities are insufficient, and they will only pay attention to the financial performance and economic benefits of the company related to their salary. When the executive compensation crosses a certain boundary, their satisfaction and self-confidence gradually increase and they will actively pay attention to other indicators in addition to corporate financial performance. The fulfillment of corporate environmental responsibility can help executives to improve overall strength and social status, which is beneficial to achieve better development in the future. In addition, as shown in Figure 2, the left and right solid lines represent the minimum and maximum values of Pay, respectively, and the dotted line between the two solid lines represents the inflection point of the U-shaped curve, which shows that the turning point is also within the value range of Pay. Executive compensation and the performance of corporate environmental responsibility are not purely linear, but represent a U-shaped threshold effect, validating H1. In addition, consistent with the existing research, the empirical results also show that there is a positive correlation between the control variable size and corporate environmental responsibility. This shows that large-scale enterprises may pay more attention to stakeholders and take the initiative to assume environmental responsibility.

Model 4 is used to test H2. Based on Model 2, Model 4 adds industry competition and the cross-term of industry competition and executive compensation. The cross-term coefficient of the quadratic term of industry competition and executive compensation is 0.045 , and it is significantly positive at the 10% statistical level, indicating that industry competition eases the U-shaped threshold effect of executive compensation in promoting corporate environmental responsibility. To maximize the benefits and achieve sustainable development in the fierce industry competition, companies must attach importance to the

interests of their stakeholders. The active performance of environmental responsibilities by companies can help to establish good corporate image and increase recognition and satisfaction of consumers, investors, media, and the public. These can help companies maintain favorable strategies in fierce competition and realize green and sustainable development. According to the test method of the U-shaped curve by Haans et al. (2016) [72]: First, determine the position of the curve's inflection point. Secondly, judge the steepness of the curve. If α_3 significantly positive, the U-shaped curve is steeper, and if the α_3 negative direction is significant, the U-shaped curve is smoother. Taking model (4) as an example, according to the previous formula, the position of the inflection point depends on the sign of $2a_1a_3$, and the result is -0.081 ; that is, the inflection point moves to the left. For the type of curve, it depends on the sign and significance of α_3 . It can be seen from the table that α_3 is 0.045 and is significantly positive at the 10% statistical level. For the U-shaped curve, the curve is steep, and the threshold effect is valid.

Table 3. Generalized estimation results.

Variables	Model 1	Model 2	Model 3	Model 4
	Envrep	Envrep	Envrep	Envrep
Pay	0.046 (1.43)	−0.978 *** (−3.22)	−0.986 *** (−3.25)	−0.903 *** (−2.94)
Pay ²		1.046 *** (3.39)	1.054 *** (3.42)	0.971 *** (3.12)
IC			0.031 (1.02)	0.057 * (1.72)
IC×Pay ²				0.045 * (1.85)
Size	0.358 *** (12.62)	0.344 *** (11.98)	0.343 *** (11.95)	0.344 *** (12.00)
Age	0.008 (1.44)	0.008 (1.35)	0.008 (1.37)	0.008 (1.42)
Roa	0.037 (0.07)	−0.059 (−0.11)	−0.061 (−0.12)	−0.097 (−0.18)
Debt_a	0.010 (0.06)	−0.002 (−0.01)	0.014 (0.08)	0.007 (0.04)
Grow	−0.090 (−1.03)	−0.082 (−0.94)	−0.082 (−0.94)	−0.087 (−0.99)
Soe	0.047 (0.79)	0.062 (1.04)	0.061 (1.02)	0.062 (1.04)
Env_inv	0.081 (1.29)	0.085 (1.35)	0.083 (1.32)	0.085 (1.35)
Env_moni	−0.072 (−0.53)	−0.064 (−0.48)	−0.064 (−0.47)	−0.060 (−0.44)
Env_stad	0.021 (0.54)	0.020 (0.51)	0.018 (0.48)	0.018 (0.46)
Env_repo	0.049 (1.15)	0.049 (1.15)	0.050 (1.18)	0.048 (1.14)
Constant	−7.326 *** (−6.95)	−7.061 *** (−6.69)	−7.023 *** (−6.65)	−7.051 *** (−6.68)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
Observations	3667	3667	3667	3667
Stkcd	561	561	561	561

Note: t-statistics in parentheses, *** $p < 0.01$, * $p < 0.1$.

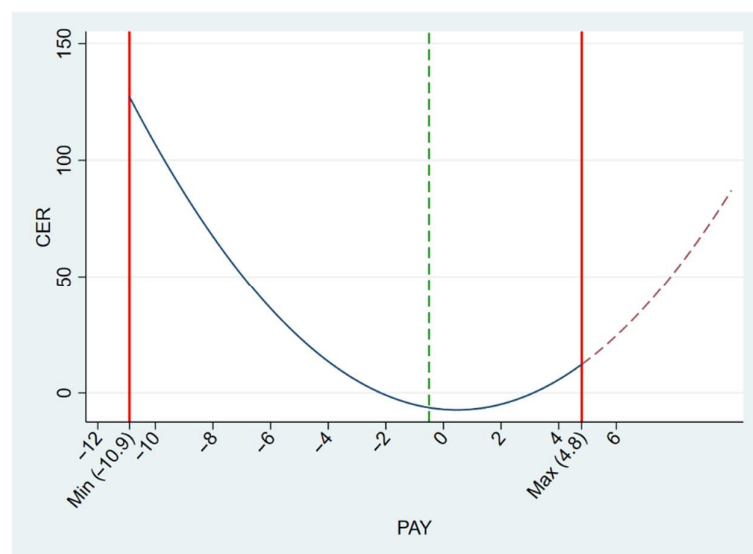


Figure 2. The relationship between executive compensation and corporate environmental responsibility. The red solid lines on the left and right sides represent the minimum and maximum values of the U-shaped curve, respectively. The green dotted line in the middle represents the inflection point of the U-shaped curve.

4.3. Robustness Test

4.3.1. Replacing Explained Variable

Here, principal component analysis is performed on the explained variable. KMO and Bartley sphere test [73] are required before principal component analysis. The value of KMO is 0.634 after testing, meeting the KMO test standard (KMO test: the standard is above 0.9, which is very suitable for factor analysis; between 0.8 and 0.9 is very suitable; between 0.7 and 0.8 is suitable; between 0.6 and 0.7 is acceptable; between 0.5 and 0.6 indicates very poor; below 0.5 should be abandoned), and the Bartley sphere test is used to examine whether the correlation matrix is a unit matrix, that is, whether the variables are independent. The Bartley sphere test statistic is 1204.075, and the corresponding probability Sig. is 0.000. Therefore, it can be considered that the correlation coefficient matrix is significantly different from the identity matrix. Therefore, the explained variable is suitable for principal component analysis. The results in Table 4 present the corporate environmental responsibility (Envrep_sub) calculated by the principal component analysis method. The agreement and significance of the main variables are consistent with the main regression analysis, showing good robustness.

4.3.2. Robustness Test Based on the Tobit Model

Taking into account that the value of the corporate environmental responsibility is 0, the dependent variable in the research and analysis shows a right-side truncated form; therefore, we adopt the panel Tobit model to test robustness (Table 5). The results are similar to the main regression results, showing good robustness.

4.3.3. Endogeneity Test with the Heckman Model

Corporate environmental responsibility belongs to company's strategic planning and is affected by the company's characteristics (corporate size, age, and return on total assets, etc.), which is prone to self-selection bias. Therefore, to solve this endogenous problem, the Heckman model is used to correct and adjusted the sample to effectively solve the self-selection bias [74]. The first step is to perform regression analysis with the Probit model to obtain the IMR [75]. The second step is to use the calculated IMR value as a control variable into the regression model that affects the corporate environmental responsibility. Table 6 presents Heckman's two-step regression model. In the first step (Panel A), the

corporate environmental responsibilities are grouped by the median, with greater than the median set as 1, and less than the median set as 0. Explanatory variables include enterprise size, age, return on total assets, asset to liability ratio, enterprise value, profit before interest and taxes, board size, and current assets ratio. Part B shows the regression results of the second stage. We found that all IMRs are significantly negative at the 5% level. Although the surface model has self-selection bias, the signs and significance levels of the main variables in the corrected regression analysis were similar to the main regression analysis results, indicating good robustness.

Table 4. Robustness test via replacing the explained variable.

Variables	Model 1	Model 2	Model 3	Model 4
	Envrep_sub	Envrep_sub	Envrep_sub	Envrep_sub
Pay	0.020 * (1.88)	−0.330 *** (−3.31)	−0.335 *** (−3.36)	−0.305 *** (−3.03)
Pay ²		0.357 *** (3.53)	0.362 *** (3.57)	0.332 *** (3.25)
IC			0.019 * (1.94)	0.029 *** (2.62)
IC×Pay ²				0.016 ** (2.04)
Size	0.116 *** (12.46)	0.111 *** (11.81)	0.111 *** (11.76)	0.111 *** (11.82)
Age	0.004 ** (2.35)	0.004 ** (2.27)	0.004 ** (2.30)	0.004 ** (2.36)
Roa	−0.017 (−0.10)	−0.050 (−0.29)	−0.051 (−0.29)	−0.064 (−0.37)
Debt_a	0.032 (0.56)	0.028 (0.49)	0.038 (0.66)	0.035 (0.61)
Grow	−0.037 (−1.29)	−0.034 (−1.19)	−0.035 (−1.20)	−0.036 (−1.26)
Soe	0.061 *** (3.08)	0.066 *** (3.34)	0.065 *** (3.31)	0.065 *** (3.33)
Env_inv	0.025 (1.19)	0.026 (1.24)	0.025 (1.19)	0.025 (1.23)
Env_moni	−0.023 (−0.53)	−0.021 (−0.47)	−0.020 (−0.46)	−0.019 (−0.43)
Env_stad	0.005 (0.38)	0.004 (0.34)	0.004 (0.28)	0.003 (0.26)
Env_repo	0.022 (1.60)	0.022 (1.60)	0.023* (1.66)	0.023 (1.62)
Constant	−3.557 *** (−10.25)	−3.466 *** (−9.98)	−3.442 *** (−9.91)	−3.452 *** (−9.94)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
Observations	3667	3667	3667	3667
Stkcd	561	561	561	561

Note: t-statistics in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3.4. Further Analysis

Because companies of different ownership, sizes, and regions have significant differences in internal structures, agency conflicts, and external environments, analyzing these differences can further refine the research conclusions of this study. Therefore, we divide the sample into state-owned and non-state-owned enterprises (Models 1 and 2), large-scale and small-scale enterprises (Models 3 and 4) according to the median of enterprise size, and eastern and central/western regions (Models 5 and 6), which are shown in Table 7. It can be seen from Table 7 that the executive compensation of state-owned enterprises, large-scale enterprises, and enterprises in the eastern region exhibits a U-shaped threshold effect on

corporate environmental responsibility. State-owned enterprises, large-scale enterprises, and enterprises in the eastern region are all considered as “leaders” in their respective fields. With the increase in executive compensation, these different corporate executives gradually broaden their vision and their environmental awareness. Leading to a larger responsibility to improve their own prestige and honor, thereby enhancing their social status. The moderating effect of industry competition is positive for state-owned enterprises and large-scale enterprises, but it is not significant for enterprises in the eastern region, which may be due to the more mature form of corporate competition in the eastern region, and the promotion of industry competition on local corporate executives is not obvious.

Table 5. Robustness test with the Tobit model.

Variables	Model 1	Model 2	Model 3	Model 4
	Envrep	Envrep	Envrep	Envrep
Pay	0.045 (1.36)	−0.967 *** (−3.11)	−0.976 *** (−3.13)	−0.887 *** (−2.82)
Pay ²		1.033 *** (3.27)	1.042 *** (3.30)	0.953 *** (2.98)
IC			0.033 (1.07)	0.061 * (1.79)
IC×Pay ²				0.048 * (1.93)
Size	0.362 *** (12.41)	0.347 *** (11.79)	0.346 *** (11.76)	0.348 *** (11.81)
Age	0.008 (1.39)	0.008 (1.31)	0.008 (1.33)	0.008 (1.38)
Roa	0.102 (0.19)	0.006 (0.01)	0.004 (0.01)	−0.035 (−0.06)
Debt_a	0.036 (0.20)	0.024 (0.13)	0.040 (0.22)	0.033 (0.18)
Grow	−0.088 (−0.97)	−0.079 (−0.88)	−0.080 (−0.89)	−0.085 (−0.94)
Soe	0.053 (0.86)	0.067 (1.10)	0.066 (1.08)	0.068 (1.11)
Env_inv	0.088 (1.37)	0.092 (1.42)	0.090 (1.39)	0.092 (1.42)
Env_moni	−0.075 (−0.54)	−0.068 (−0.49)	−0.067 (−0.48)	−0.063 (−0.45)
Env_stad	0.027 (0.69)	0.026 (0.66)	0.025 (0.63)	0.024 (0.61)
Env_repo	0.052 (1.19)	0.052 (1.19)	0.053 (1.22)	0.052 (1.18)
Constant	−7.669 *** (−7.03)	−7.403 *** (−6.78)	−7.363 *** (−6.74)	−7.387 *** (−6.77)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
Observations	3667	3667	3667	3667
Stkcd	561	561	561	561

Note: t-statistics in parentheses, *** $p < 0.01$, * $p < 0.1$.

Table 6. Heckman two-stage test.

Panel A: First-Step Regression—Estimating Inverse Mills												
	Size	Age	Roa	Debt_a	Tobin	Ebit	Board	Lid_r	Cons	Year and Ind and Area	N	R ²
Envrep Dummy	0.254 *** (8.94)	0.006 (1.17)	0.070 (0.13)	−0.029 (−0.14)	0.003 (0.15)	−0.014 (−0.85)	0.031 ** (2.11)	−0.032 ** (−2.17)	−5.735 *** (−8.79)	Yes –	3702 –	0.129 –
Panel B: Second-Step Regression—Introducing Inverse Mills												
Dependent Variable: Corporate Environmental Responsibility												
	Model 11		Model 12		Model 13		Model 14					
Pay	0.043 (1.30)		−0.997 *** (−3.24)		−1.005 *** (−3.26)		−0.918 *** (−2.95)					
Pay ²	–		1.062 *** (3.40)		1.069 *** (3.42)		0.982 *** (3.10)					
IC	–		–		0.030 (0.96)		0.057 * (1.65)					
IC×Pay ²	–		–		–		0.046 * (1.81)					
Size	0.257 *** (4.62)		0.233 *** (4.16)		0.234 *** (4.18)		0.233 *** (4.16)					
Age	0.003 (0.52)		0.002 (0.40)		0.003 (0.42)		0.003 (0.45)					
Roa	−0.291 (−0.53)		−0.392 (−0.72)		−0.394 (−0.72)		−0.435 (−0.80)					
Debt_a	−0.071 (−0.38)		−0.094 (−0.50)		−0.077 (−0.41)		−0.088 (−0.47)					
Grow	−0.099 (−1.10)		−0.092 (−1.02)		−0.093 (−1.03)		−0.097 (−1.07)					
Soe	0.036 (0.58)		0.050 (0.82)		0.049 (0.80)		0.050 (0.82)					
Env_inv	0.077 (1.19)		0.081 (1.25)		0.079 (1.22)		0.080 (1.24)					
Env_moni	−0.042 (−0.30)		−0.035 (−0.25)		−0.034 (−0.25)		−0.030 (−0.22)					
Env_stad	0.028 (0.71)		0.027 (0.68)		0.025 (0.64)		0.024 (0.61)					
Env_repo	0.037 (0.86)		0.037 (0.85)		0.038 (0.88)		0.037 (0.84)					

Table 6. Cont.

Panel B: Second-Step Regression—Introducing Inverse Mills				
Dependent Variable: Corporate Environmental Responsibility				
	Model 11	Model 12	Model 13	Model 14
IMR	−0.766 ** (−2.09)	−0.837 ** (−2.28)	−0.822 ** (−2.24)	−0.846 ** (−2.31)
Constant	−2.616 (−1.54)	−2.077 (−1.22)	−2.094 (−1.23)	−2.026 (−1.19)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
Observations	3561	3561	3561	3561
Stkcd	0.235	0.238	0.238	0.239

Note: t-statistics in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7. Heterogeneity analysis.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Envrep	Envrep	Envrep	Envrep	Envrep	Envrep
Pay	−1.376 *** (−3.91)	−0.593 (−0.62)	−0.725 ** (−2.19)	−0.291 (−0.21)	−1.208 *** (−3.72)	1.374 (1.32)
Pay ²	1.515 *** (4.08)	0.590 (0.63)	0.741 ** (2.19)	0.448 (0.32)	1.378 *** (4.13)	−1.495 (−1.45)
IC	0.001 (0.02)	0.110 ** (2.00)	0.066 (1.48)	0.064 (1.24)	0.028 (0.72)	0.115 * (1.69)
IC×Pay ²	0.076 * (1.73)	0.041 (1.22)	0.136 *** (2.78)	−0.001 (−0.02)	0.025 (0.68)	0.051 (1.29)
Size	0.358 *** (9.57)	0.324 *** (6.40)	0.419 *** (8.55)	0.137 ** (2.19)	0.307 *** (8.31)	0.319 *** (6.66)
Age	0.018 ** (2.09)	0.012 (1.51)	0.013 (1.50)	0.009 (1.12)	0.009 (1.42)	−0.001 (−0.12)
Roa	−0.135 (−0.19)	−0.137 (−0.18)	−1.314 (−1.60)	0.692 (1.00)	−1.271 ** (−1.97)	2.935 *** (3.19)
Debt_a	−0.035 (−0.15)	0.176 (0.64)	−0.188 (−0.63)	0.342 (1.55)	−0.065 (−0.30)	0.250 (0.81)
Grow	−0.164 (−1.42)	0.015 (0.12)	−0.065 (−0.53)	−0.103 (−0.85)	−0.047 (−0.42)	−0.161 (−1.15)
Soe			0.134 (1.50)	−0.061 (−0.73)	0.008 (0.11)	0.029 (0.27)
Env_inv	0.239 *** (2.87)	−0.114 (−1.19)	0.062 (0.63)	0.089 (1.13)	0.111 (1.40)	0.073 (0.65)
Env_moni	−0.077 (−0.42)	−0.035 (−0.17)	0.121 (0.58)	−0.216 (−1.24)	−0.139 (−0.78)	0.227 (0.91)
Env_stad	0.052 (1.02)	−0.010 (−0.18)	−0.027 (−0.51)	0.069 (1.30)	0.061 (1.22)	−0.033 (−0.48)
Env_repo	0.006 (0.12)	0.095 (1.41)	0.030 (0.46)	0.047 (0.88)	−0.009 (−0.16)	0.167 ** (2.34)
Constant	−8.300 *** (−5.83)	−7.411 *** (−3.93)	−9.496 *** (−5.24)	−1.803 (−1.06)	−6.023 *** (−4.07)	−8.589 *** (−4.13)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2084	1583	1855	1812	2408	1259
Stkcd	272	312	313	381	380	181

Note: t-statistics in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. Discussion and Conclusions

In this study, the data of 561 China's Shanghai and Shenzhen A-share listed manufacturing companies from 2006 to 2018 is used as the research subject to study the threshold effect of executive compensation on corporate environmental responsibility. The research results show that: (1) Executive compensation has a significant U-shaped threshold effect on corporate environmental responsibility. (2) Industry competition eases the U-shaped threshold effect of executive compensation in promoting corporate environmental responsibility. (3) Further analysis shows that the executive compensation of state-owned enterprises, large-scale enterprises, and enterprises in the eastern region has a U-shaped threshold effect on corporate environmental responsibility. Industry competition eases the impact of the U-shaped threshold effect of executive compensation of state-owned enterprises and large-scale enterprises in promoting corporate environmental responsibility but does not alleviate the U-shaped threshold effect of the executive compensation of enterprises in the eastern region in promoting corporate environmental responsibility.

5.1. Theoretical Contributions

- (1) This study explores the nonlinear relationship between executive compensation and corporate environmental responsibility, provides a new perspective for the study of executive compensation and corporate environmental responsibility, and constructs a unique analysis framework by introducing industry competition. The upper echelon theory holds that executives, as decision makers and executors of corporate environmental responsibility, are motivated by marginal benefits and costs [5]. Executive compensation is a key factor affecting corporate environmental responsibility. Increases in compensation enhance the self-confidence of executives, who will actively engage in corporate environmental responsibility and other social welfare activities. In addition, the ERG theory believes that low-level needs can gradually develop into high-level needs. Salary incentives are a crucial factor in the living standards of executives. When executives' salaries are low, they will only pay attention to the financial performance and economic benefits of the company and ignore the implementation of other indicators of the company (such as corporate environmental responsibilities). When executive compensation crosses a certain boundary, the material living standards of executives are greatly improved, and executives whose material desires are satisfied will pursue higher-level needs, such as the fulfillment of corporate environmental responsibilities. Being able to manage higher-level needs and being able to demonstrate to other members of the board of directors and the public media of their noble moral qualities will help increase their reputation and promotion chances [76]. The results here show a U-shaped threshold effect between executive compensation and corporate environmental responsibility.
- (2) This study provides a new theoretical basis for industry competition to ease the threshold effect of executive compensation and enhance corporate environmental responsibility, and it further expands the stakeholder theory, agency theory, and other related theories. The stakeholder theory believes that companies should pay attention to stakeholders related to their production and operation, including investors, suppliers, and consumers. The needs and expectations of these stakeholders will directly affect the survival and development of the enterprise [33]. In the process of production and development, enterprises will face many industry competitors who provide similar or substitute products. The ability to survive and grow under industry competition requires enterprises to commit and implement in social welfare activities. Actively fulfilling corporate environmental responsibilities can maximize the interests of stakeholders related to the production and operation, improve the economic benefits, and strengthen the core competitiveness of the enterprise. A reasonable compensation mechanism can effectively promote corporate executive's environmental awareness, prompting corporate executives to perform corporate environmental responsibilities and improve corporate environment. This paper uses industry competition as a moderating variable to test the U-shaped threshold effect of industry competition that eases executive compensation and enhances corporate environmental responsibility. This enriches expands the connotation of the stakeholder theory.
- (3) This paper explores the nonlinear relationship between executive compensation and corporate environmental responsibility, expands previous studies on the linear relationship of corporate environmental responsibility, and is the echo and expansion of the existing research. This paper argues that executive compensation has a significant U-shaped threshold effect on corporate environmental responsibility, and industry competition alleviates this U-shaped threshold effect. The conclusions of this paper expand the current research on CEO compensation and environmental strategies based on linear relationships, including the view based on management theory that the CEO acts in a non-profit rather than a completely selfish manner, so there is no need for explicit compensation measures to motivate the CEO to meet their environmental commitments [12]; that is, there is an inverse relationship between CEO compensation and environmental reputation/social responsibility [11,16,18,77],

there seems to be a lack of link between incentives and corporate sustainability [78]. Based on institutional theory, institutional theory and environmental management research, some scholars believe that there is a positive correlation between executive compensation and corporate environmental responsibility [23,41,43]. Some studies have shown that the pay differences between the CEO and other executives prompt the CEO to assume more social responsibility, so limiting the financial incentives of senior executives may damage their motivation to participate in corporate social responsibility [21,44]. In addition, some studies believe that incentive dominance has an inverted U-shaped effect on corporate performance [79], but overall, there is not much literature to explore the u-shaped relationship between executive compensation and corporate environmental responsibility. Most of the existing literature believes that there is a positive or negative linear relationship between executive compensation and corporate environmental responsibility. However, this view may be one-sided, which separates the relationship between executive demand stage and pursuit level. In this paper, based on the theory of demand hierarchy, and through the introduction of industry competition, this paper defines the boundary conditions of executive compensation affecting corporate environmental responsibility from different levels of demand, different degrees of competition in different industries, and under a variety of heterogeneous conditions. The findings of this paper not only provide new empirical evidence for giving full play to the incentive role of executive compensation in corporate environmental responsibility, but also deepen the understanding of corporate governance in eastern emerging economies.

5.2. Practical Contributions

This study provides the following practical implications. First, this paper provides a practical contribution to improve the incentive mechanism for executive compensation and promoting the optimization of executive compensation design. When designing CEO compensation, the compensation committee and compensation consultants should fully consider the needs of senior executives and use compensation to encourage executives to strive for environmental responsibility and other corporate sustainable development goals. As the decision makers and executors of business management, corporate executives' behavior is affected by the compensation mechanism. If the salary level is low and the executives' own desires are not met, there will be insufficient motivation to implement corporate environmental responsibility. A reasonable salary incentive system can not only reduce the short-sighted behavior of managers and stimulate managers to serve the long-term development goals of enterprises, but also reduce the principal-agent problem. Only when the salary level crosses a certain boundary and the executives' physiological needs are met, can their environmental awareness be stimulated to fulfill corporate environmental responsibility. In the reform of the internal mechanism of corporate governance, a standardized and effective compensation incentive mechanism should be established. The compensation mechanism should be linked to the corporate environmental responsibility, so that the compensation levels of the executives are closely linked with the performance of corporate environmental responsibility and promote the high-level development of environmental responsibility.

Second, strengthen the moderating role of industry competition. In intensive industry competition, corporate executives' environmental violations will be subjected to the supervision and attention of competitors and media. These groups will continue to expand the company's environmental violations, which will attract the attention of corporate stakeholders and harm the company's goodwill, reducing operating profit of the enterprise and endangering its survival and development. To survive and develop in intensive industry competition, corporate executives should actively focus on social welfare activities such as the fulfillment of corporate environmental responsibilities, so as to create a good corporate green image, win the trust of the media and stakeholders, and gain external resources to establish a long-term core competitive advantage. Therefore, industry competition can

alleviate the threshold effect of executive compensation and corporate responsibility. A scientific and reasonable industry competition system can improve mutual regulation and the construction of a standardized system, so as to promote the performance of corporate environmental responsibilities and the improvement of environmental quality [68].

Finally, enterprises should improve their awareness of environmental commitment. With the attention of investors, suppliers, and consumer stakeholders to environmental issues and the increasing demand and expectation for corporate environmental responsibility, taking the initiative to assume environmental responsibility can not only establish a good green image and enhance the core competitiveness in the fierce market competition, but also promote the sustainable development of enterprises. Therefore, enterprises should pay more attention to the combination of executive incentives and environmental responsibility; further cultivate the environmental awareness of senior executives; make use of compensation, equity, and other incentive means to promote the convergence of managers and shareholders; and reduce the principal-agent problem. Additionally, they should avoid the short-sighted behavior of senior executives and actively assume corporate environmental responsibility.

5.3. Limitations

First, the research scope of this article is limited to the manufacturing industry, and it does not discuss the implementation of environmental responsibilities of enterprises in different industries (such as heavy-polluting, high-tech, energy-saving, or environmental protection industries). The performance of corporate environmental responsibilities in different industries may be different, which can be analyzed and confirmed by future research. Second, the executive compensation mechanism is only one aspect of the company's internal governance. In the future, more personality characteristics of executives can be explored, such as the impact of executive education, professional background, age, gender, and tenure on corporate environmental responsibility. In addition, industry competition is only one of the influencing factors of corporate external governance. Future research can examine more external governance factors (such as environmental enforcement and public environmental concern) to conduct more comprehensive and in-depth research and provide more scientific theories to improve internal governance structure and the government's environmental measures.

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