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The Influence of CEO's Overseas Background on Firms' Green Technology Innovation Based on the Moderating Effect of the Nature of Firms' Property Rights

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Abstract. Based on China's current emphasis on green development and the bottleneck of green innovation faced by enterprises in practice, this paper focuses on analyzing the role of executives' overseas experience in corporate green innovation. Utilizing data from A-share listed companies in China from 2008 to 2022, this study finds that CEOs with overseas experience significantly promote corporate green technology innovation. The study further reveals the intrinsic mechanisms by which CEOs with overseas experience promote firms' green technological innovation, including the positive impact of their internationalized vision, environmental protection concepts and long-term planning on firms' innovation decisions. Meanwhile, the study also takes into account the heterogeneity of firms, and finds that the overseas experience of CEOs in private firms has a more significant effect on green technological innovation than that of state-owned firms. Through empirical research, this paper clarifies the influence mechanism and boundary conditions of CEOs with overseas experience on corporate green technology innovation, which provides useful insights for corporate management practice and policy making.

Keywords: Green Technology Innovation; CEO's Overseas Background; Nature of Corporate Property Rights.

1. Introduction

In recent years, with the environmental pollution, climate change and other problems continue to appear, the concept of green development in China has been taken seriously, the Chinese government has repeatedly emphasized the concept of green development, put forward the goal of carbon peak, carbon neutral, environmental protection to the level of the national strategy, the green innovation thus also constitutes a powerful tool for the green development of the enterprise, the green innovation in China's economy is playing an increasingly important role. General Secretary Xi Jinping emphasized at the National Science and Technology Innovation Conference that "we need to rely on scientific and technological innovation to build a beautiful China with blue sky, green earth and clear water". "During the 13th Five-Year Plan, "green development" was written into the national five-year plan for the first time, and the 14th Five-Year Plan re-emphasized the need to promote green development and harmonious coexistence between human beings and nature. The report of the Twentieth National Congress has proposed to "guide enterprises to actively research and introduce advanced and applicable green and low-carbon technologies, and enhance the level of green manufacturing. Strengthen innovation capacity building, support leading enterprises to integrate universities, research institutes and other forces, industry chain upstream and downstream resources, the establishment of green technology innovation consortium, to carry out joint research. Establish and improve the assessment and trading system of green and low-carbon technologies, and accelerate the transformation of innovation achievements." The use of green innovation technology in production activities is conducive to the realization of the coordinated development of the economy and the environment (Ma Yuan et al., 2014) In this context, the research related to enterprise green technology innovation has also increasingly become the focus of attention in the industry. However, in practice, the development of green innovation in China has not yet broken through the bottleneck. According to statistics, the average number of professional applications of listed companies in China

is about 5, which is less than 1/10 of the number of patent applications around the world. under the incentive of "promotion tournament" (Shen Kunrong et al., 2020), which takes economic growth as the key assessment index, the laxity of environmental law enforcement by the local governments in China happens from time to time, and the mobilization of enterprises' enthusiasm for green innovation is ineffective. The effect of mobilizing enterprises' enthusiasm for green innovation is not good. Therefore, exploring how to drive green technological innovation in enterprises is not only an important part of microenterprises to establish new competitive advantages and realize high-quality development, but also the key to China's response to the new situation and new challenges and the promotion of green development.

In the course of China's green innovation, corporate executives have always played an irreplaceable role. In the Guiding Opinions on Building a Market-oriented Green Technology Innovation System, the Development and Reform Commission put forward the idea of "connecting with the world". In order to introduce the best technology in the world, it is necessary to have foreign talents. In addition to scientific and technological personnel with foreign specialized intellectual property rights, it is also necessary to introduce corporate management with "green technology innovation" capabilities. Corporate management is an important part of the company's strategic choices, innovation tendency and CSR, therefore, corporate management should play a role in promoting corporate green technology innovation. Compared with China, developed countries in Europe and the United States have a higher concept of ecological protection than China, and are ahead of China in green technology innovation, with more experience and more experience. Therefore, returned managers are able to recognize the importance of green technology innovation in their companies because they have had foreign experience and pay more attention to environmental protection. However, there are some potential risks such as R&D failure and low economic value. At the same time, managers with foreign experience are more proactive in their thinking than local managers, focusing more on long-term plans and technological innovation (Fan Wei and Cai Xuejun, 2013), and this mentality of their employees has a driving effect on the innovative behavior of companies (Hirshleifer, 2012). With the increasing number of managers with overseas backgrounds in Chinese enterprises, whether the overseas experience of corporate executives can promote the company's green technological innovation, practice the new development concept, and establish a low-carbon, sustainable, and sustainable development model, so as to achieve carbon neutrality, has become an issue of concern.

The green technology innovation of enterprises is now widely emphasized by scholars at home and abroad. Existing studies have deeply analyzed the intrinsic mechanism of corporate green technology innovation from various perspectives, such as environmental regulation, government regulation, environmental protection appointment, digital transformation, ESG performance, green credit and international trade (Li, 2018; Ling Hongcheng et al., 2022; Tao Feng et al., 2021). Existing studies mainly focus on external factors such as institutions and market environment, ignoring the influence of CEO, sustainability, stakeholders and other factors on corporate green technology innovation behavior. Green technology innovation is a kind of decision-making behavior dominated by corporate strategy, and the biggest decision-making body is the top management of the enterprise, whose "green cognition" and "green orientation" will directly affect whether the enterprise carries out the operation and investment based on green technology innovation (Dai Yunhao and Wang, et al., 2021). Their "green cognition" and "green orientation" will directly affect whether enterprises carry out operations based on green science and technology innovation (Yunhao Dai and Dongmin Kong, 2017; Zhen Liu and Danhua Huang, 2021).

Based on the theoretical and practical background, this paper examines how the overseas background of CEOs affects green technology innovation in Chinese enterprises. Using a sample of Chinese A-share listed companies spanning 2000 to 2022, it explores the impact and underlying mechanisms. The findings reveal that CEOs with overseas experience positively influence corporate green technology innovation.

Contribution of this paper:

This paper contributes to the field of green technological innovation by examining the role of executives' internationalization experience on green tech innovation in Chinese listed companies. It theoretically and empirically analyzes the impact of executives' overseas experience on firms' green technology innovation, enriching existing theories. The paper also explores the characteristic of "offshore experience" among managers and its connection to green tech innovation, expanding related studies. Finally, it clarifies the influence mechanism, considering firm heterogeneity and exploring boundary conditions for the impact of multinational business experience on green technology innovation.

2. Literature Review and Theoretical Analysis

2.1. Literature Review

2.1.1. Impact of CEO's Overseas Experience

For the study of overseas experience as an executive trait, existing research on executive overseas experience mainly focuses on the impact of executive overseas experience on corporate performance, corporate innovation, corporate governance, and corporate strategy.

It has been shown that senior executives of Chinese listed companies with foreign experience, such as CEOs and CFOs, outperform local executives during their tenure due to their rich experience, broadened horizons, and rich professional backgrounds, thus driving company performance. Based on Chinese private firms, Liu Qing and Zhang Chao et al. (2013) showed that private entrepreneurs' previous overseas study experience and foreign study experience after work can improve the company's business performance, in which the foreign study experience has a greater driving effect than the further study abroad, and their study argued that this is mainly due to the fact that foreign experience can broaden the international perspective of business owners and improve their business level. Masulis et al. (2012) showed that when individuals study or work abroad, they are infected by the local culture, which leads to changes in their thinking, cognition, and values. Individuals who grow up in such a context are more likely to be forward-looking and focus their vision globally, which in turn can have a significant impact on the company's strategy and company performance. It can be found that executives with a returnee background have a significant impact on the enhancement of corporate value and performance due to the various attributes attached to their overseas experience.

Song Jianbo and Wen Wen (2016) measured the innovation capability of a company by the number of patent applications of the company, and the study showed that CEOs with overseas experience have a significant effect on promoting the innovation capability of the company, and on the basis of this, the study also showed that in the case of foreign work experience, compared with the independent directors, if they do not have overseas work experience, they are able to promote the innovation of the company in a better way. Based on the data of Chinese GEM firms, Zhang Xindong and Wu Jing (2016) empirically analyzed that overseas returned CEOs can significantly improve the technological innovation ability of firms, i.e., they have a significant effect on both R&D investment and R&D output. Lu Xiaofan et al. (2021) found through empirical analysis that returnee CEOs can improve the innovation efficacy of enterprises, in which the factors of education and professional background have a significant effect on the innovation efficacy of enterprises.

CEOs with overseas backgrounds, on the other hand, act as intermediaries in the dissemination of science, technology and knowledge, and are able to introduce different decision-making and management concepts into local firms, and foreign management concepts and international perspectives into local firms, thus further enhancing the firm's governance capacity. Khanna et al. (2009) argue that corporate executives with overseas study experience usually contribute to the enhancement of the firm's corporate culture atmosphere and the improvement of its ethics. construction. Cumming et al. (2015) suggest that when CEOs grow up in countries with better institutions, they send good messages about corporate governance to their home countries. The

increasing number of returning executives has also created some changes in the company's board of directors.

The results of existing studies show that in the internationalization strategy of an enterprise, the resources and technologies it possesses are the key to determining its success. Zhou Zegong et al. (2017) studied the multinational business behavior of multinational enterprises and found that the social capital possessed by the executives of multinational enterprises can significantly improve the multinational business ability of the enterprises, reduce the transaction costs of the enterprises, and promote the internationalization process of the enterprises. Sambharya (1996) carried out an empirical study on 54 multinational enterprises in the U.S.A. With the increase in the proportion of the executives with a returnee background, the greater the heterogeneity of the transnational experience, the longer the experience, the greater the heterogeneity of international experience, and its strategy tends to tend to diversify. Reuber et al. (1997) conducted a study on 164 Canadian SMEs, and found that when there are executives with overseas backgrounds in the management of the firms, there are more chances of cooperating with foreign firms, and their performance in overseas markets will be better.

2.1.2. Concept of Green Technology Innovation

Cao and Wang (2017) proposed that "green technology" refers to technology that can reduce energy consumption; in the Guidance Opinions on Building a Market-Oriented Green Technology Innovation System, "green technology" is regarded as a new technology that can promote the harmonious development of human and In the Guiding Opinions on Building a Market-oriented Green Technology Innovation System, "green technology" is regarded as a new type of science and technology that can promote the harmonious development of human beings and nature, ecological civilization and social harmony.

As China's enterprises enter the development stage one after another, more and more scholars begin to pay attention to green technological innovation, academics usually interpret green technological innovation from the "production process" and "characteristics" of two aspects.

For the production process, Shrivastava (1995) suggests that "green technological innovation" refers to changes in production methods, processes, designs, equipment and tools that reduce pollution of the environment. According to Hellström (2007), the entire process from the conceptual stage until the product is put on the market is considered as green technological innovation. Hellström (2007) argues that the whole process from the conceptual stage until the product is put on the market is considered as a green technological innovation, where the whole process does not cause environmental pollution and consumes less resources. Scholars in China have also paid considerable attention to the production process. Cai Ning and Ge Chaoyang (2000) defined the connotation of green technological innovation from a broad perspective, pointing out that green technological innovation refers to the "greening" of the entire process from product research and development, production to the market. Based on the perspective of "technology social formation theory", Li Ping (2005) believes that the "green" of an enterprise is a social process composed of a number of different groups of "enterprises". social process. Wang et al. (2010) introduced the concept of "triple helix modeling theory" to multiple levels, including enterprises, governments and universities, to systematically explain green innovation. Li Kun et al. (2017) argued that green technological innovation is an integrated process from technology to market, and whether it can create a good environment for enterprises to carry out effective innovation behavior will play an important role in the development path and performance of enterprises.

In view of its characteristics, foreign scholars Bernauer et al. (2006) believe that green technological innovation is a kind of technological update that can bring positive impacts to the environment.Porter and Linde (1995) proposed a technology that can promote enterprises to improve production efficiency, so as to achieve the purpose of energy saving and emission reduction. Rennings (2000) believes that in order to alleviate the pressure on the environment or to realize sustainable development, environmental pressure is alleviated by improving products and processes. Domestic

scholars Gan Dejian and Wang Lili (2003) suggest that green technological innovation refers to "green" innovation with the goal of sustainable development, which consists of products, awareness and technology. According to Wang Yuanyuan et al. (2013), green technological innovation of enterprises refers to behaviors that enable enterprises to obtain economic benefits or public welfare. According to Yang Dong and Chai Huimin (2015), "green technology innovation" is a kind of innovation that can realize energy saving and emission reduction, and reduce or even eliminate the negative impact on the environment by means of technology, process and product. Li Wanhong (2017) suggests that the principle of environmental protection is integrated into every innovation in the R&D process so as to minimize the impact on the environment.

2.1.3. Green Technology Innovation Influencing Factors

Academic research on the influence factors of enterprise green technology innovation can be summarized in two parts: external influence factors and internal influence factors.

In terms of external impacts, the Porter hypothesis first mentions the impact of environmental regulation on green technological innovation, which is believed to promote technological innovation because it can reduce production costs and improve product quality, thereby increasing the international competitiveness of domestic enterprises.

Of the external factors at the national level, Xu Xiaoyan et al. (2013) empirically analyzed the drivers of green technology innovation in China by using panel data among Chinese provinces from 2003 to 2009, and found that compared with command-and-control regulation, market-incentive regulation has a more significant effect on the promotion of green technological innovation; at the industry level, Li Nanbo (2019), by empirically analyzing the data of companies listed in China's heavy pollution industry from 2014 to 2018 empirical analysis of data from listed companies in China's heavy pollution industry, it is argued that with the enhancement of environmental regulation, it will affect the degree of attention to environmental issues by the executive team in the company, which in turn promotes the green technological innovation of the enterprise, and the attention of the executive team plays a mediating role. Using panel data from 16 high-pollution industries in China, Li Wanhong et al. (2013) found that the government's adoption of stringent environmental regulations can promote green technological innovation in high-pollution industries; at the firm level, Wang Fengzheng et al. (2018) investigated the impact of government quality and environmental regulation on firms' green technological innovation, concluding that both government quality and environmental regulation can promote green production and process upgrading in firms. Vanessa et al. (2009) suggested that the interaction between firms' technological systems, demand conditions, and national policies is the main reason for firms to implement green technological innovation.

In terms of internal factors, senior executives are able to drive green innovation in their firms because they can have a direct impact on their decisions. Executives' views on environmental issues will make firms approach environmental issues with the same views, and executives' environmental awareness will affect firms' strategic decisions and make them more inclined to develop green strategies. Chassagnon and Haned (2015) suggest that there is a close relationship between firms' innovative leadership behaviors and their pursuit of green technological innovations. Leenders and Chandra (2013) suggested that the firm's own environmental awareness and quality control have a significant impact on the firm's green technology innovation as opposed to external influences. Moffat et al. (2006) showed that, in addition to the manager's personal reasons, the firm's environmental management system (EMS), the firm's size, the firm's nature, and the degree of technological development have a significant impact on the firm's environmental technological innovation behavior have a significant impact. In particular, energy saving, recycling, emission reduction and environmentally friendly commodities can show a preference for green technologies. The green innovation ability of enterprises will vary depending on their nature. China's unique market-oriented system determines that state-owned enterprises are the main body of the market economy, therefore, the influence of the property rights attributes of enterprises on their green technology innovation has been the focus of many scholars' attention. Based on the policy perspective, Sun Xiaohua and Li

Mingshan (2016) argued that the technological innovation ability of SOEs is inferior to that of private enterprises, which is mainly due to the existence of a large number of state interventions within SOEs. Jean-Jacques and Jean (1993) suggested from the perspective of the executives that technological innovation of SOEs lacks motivation and efficiency due to the existence of serious principal-agent problems within the enterprises.

After collating the research results of many scholars at home and abroad, it can be seen that scholars have discussed the main research variables of this paper - overseas experience and green technological innovation in some depth, and there are relatively more relevant literatures that study overseas experience and green technological innovation alone, but further depth and exploration are needed in some aspects. In terms of the economic consequences of CEO overseas experience, although the research results are quite rich, there are fewer studies on the relationship between CEO overseas experience and corporate green development, while the literature on the study of green technological innovation is even more scarce, which suggests that the study of the impact of CEO overseas experience on corporate green technological innovation is practicable and can be explored in greater depth.

2.2. Theoretical Analysis and Research Hypothesis

2.2.1. CEO's Overseas Experience and Corporate Green Technology Innovation

CEOs with overseas background pay more attention to the company's investment in research and development, thus providing a basis for the company to formulate strategies for green development. Overseas universities and market environments place more emphasis on incentivizing R&D and innovation, and along with the rapid development of the high-tech industry, overseas universities and companies are working together to establish high-tech parks, thus contributing to the country's economic and social development. At the same time, in terms of applied technology research, CEOs with overseas experience also pay more attention to the development and transfer of products and the acquisition of patents. According to the higher class theory, the executives' overseas experience will reshape their company's management philosophy, and their strategic decisions will have a certain impact on the company's production operations and development direction; CEOs with foreign backgrounds will be more internationalized and market-oriented when formulating company strategies, and their sense of innovation will be stronger, thus further increasing the company's R&D investment (Li Mei et al. 2022; Yang Lin. 2018). The technological innovation of corporate green is closely related to the R&D investment, which will promote technological innovation and energy saving and emission reduction of enterprises (Deng Huihui et al., 2019). Therefore, CEOs with overseas backgrounds will pay more attention to R&D investment, so as to carry out green technological innovation, control the costs and benefits of green innovation with a professional perspective, and improve corporate performance. CEOs with overseas cultural background will pay more attention to their investment in research and development, thus controlling the costs and benefits of green innovation, and thus improving the company's performance. In addition, CEOs with foreign cultural backgrounds pay more attention to corporate social responsibility performance, which establishes an ideological guarantee for the implementation of "green development". A social responsibility education system has been established in some Western countries (Slater and Dixon-Fowler, 2009). On the other hand, executives with overseas backgrounds have more experience in cutting-edge overseas ESG practices. Companies in some Western countries are relatively mature in ESG performance practices, and executives with overseas backgrounds will have a better understanding of the practice path of corporate ESG performance (Xinfei Li et al., 2020). On the other hand, both academic research and market practice of ESG in China are in the preliminary stage. Therefore, executives with overseas backgrounds will be influenced by foreign value concepts and are more likely to take on corporate social responsibility so as to fulfill the concept of green development, implement environmentally friendly corporate strategies, and enhance corporate competitiveness, so the hypothesis is proposed:

H1 : CEO's overseas background positively affects firms' green technology innovation.

2.2.2. Impact of the Nature of Business Ownership

Due to China's unique institutional background, corporate CEOs tend to make a number of different decisions in the course of their operations. Differences in the property rights attributes of enterprises will lead to differences in their understanding of problems and their ability to deal with them, which will result in the degree of preference they show for green technological innovations in their enterprises. (Shen Lu et al., 2020). Compared with private enterprises, the real controller of state-owned enterprises is the state, and their appointment is strongly administrative, and their decision-making is constrained by many factors such as institutional constraints, political expectations and credit. While assisting the state in realizing its own economic purposes, SOEs are also required to provide the state with matching social benefits to meet a set of social and political indicators, such as education, healthcare, recreational activities, pensions, and other indices of sociality (Bai et al., 2000). CEOs of SOEs tend to make decisions that fulfill their political expectations. Therefore, the management of SOEs is more inclined to invest money in projects with short-term benefits than in environmental science and technology innovations that take a longer period of time. Compared with state-owned enterprises, private enterprises are subject to more stringent environmental regulations and, under the pressure of various stakeholders, they will want to use their green technological innovations to gain competitive advantages of originality and uniqueness, to take the lead in the industry, to achieve a win-win situation in terms of economy and protection, to alleviate the pressure of environmental protection on enterprises, and to get support from all parties. Influenced by the management concept of foreign enterprises, private enterprises in China have a strong flexibility and openness compared with state-owned enterprises. Therefore, in private enterprises, the qualities of returned CEOs can be utilized, and they are better able to find opportunities in the "environment" than managers with no "study abroad experience", thus prompting enterprises to actively adjust their environmental strategies. Therefore, the hypothesis is proposed:

H2: The overseas background of CEOs of private firms has a greater role in promoting corporate green technology innovation than that of state-owned enterprises.

3. Research Design

3.1. Linear Regression Model

In order to study the impact of CEO's overseas background on corporate green technology innovation, this paper constructs the following basic model:

$$\mathrm{EvrPat}_{it} = \beta_0 + \beta_1 \mathrm{oversea}_{it} + \beta_2 \mathrm{Control}_{it} + \varepsilon_{it}$$

where subscripts i and t denote firms and years, respectively, and the explanatory variable is firms' green technological innovation (EvrPat), theβ_0 denotes the intercept term, andβ_1 is the explanatory variable firm CEO's overseas background ($\mathrm{oversea}_{it}$) of the parameter to be estimated, ifβ_1 is significantly positive, it indicates that CEO's overseas background promotes green technology innovation of enterprises, and the research hypothesis H1 is valid.$\mathrm{Control}_{it}$ denotes the set of control variables, andε_{it} is the randomized disturbance term.

3.2. Variable Selection

3.2.1. Explained Variables

This paper adopts the green patent application volume, which can more intuitively reflect the green innovation output and is more time-sensitive, to measure the green innovation level of enterprises. According to the research of Wang Banban (2016) and Qi Shaozhou (2018), the green innovation indicator system in this paper includes green utility patents and green invention patents on the basis of the overall green patent application volume, further reflecting the different types and values of green patents.

3.2.2. Explanatory Variables

The independent variable in this paper is CEO overseas experience, about the measurement of this variable, construct a dummy variable to measure executive overseas experience, which is defined as: if the CEO of a listed company has overseas study or work experience, it is assigned the value of 1, otherwise it is zero.

3.2.3. Control Variables

The selection of control variables refers to the relevant literature, and controls the following variables: gearing (Lev), using the ratio of total liabilities to total assets as a measure, return on assets (ROA) using the ratio of net profit to total assets as a measure, the proportion of shares held by the first major shareholder of the enterprise (Top1), using the proportion of shares held by the first major shareholder as a measure, the number of directors and the number of sole directors (Indep) , CEO gender (gender) dummy variable, if male assigned to 1 female assigned to 0, CEO age (age), inventory percentage (INV), cash flow ratio (Cashflow).

The explanation of the variables in this paper is shown in Table 1

Table 1. Variable definitions and descriptions

variable name	notation	Definition of variables
Enterprise green technology innovation	EvrPat	Logarithmic value of the total number of green technology innovation applications plus 1
CEO Overseas Experience	oversea	1 if the CEO has overseas experience, 0 otherwise.
gearing	Lev	Ratio of total liabilities to total assets
return on assets	ROA	Ratio of net profit to total assets
Shareholding ratio of the enterprise's largest shareholder	Top1	Number of shares held by the enterprise's largest shareholder as a percentage of total share capital
Number of directors and sole directors	Indep	Measured against actual enterprise data
Gender of CEO	gender	Mark 1 if the CEO is a male, 0 otherwise.
Age of CEO	age	Measured by the actual age of the CEO
Inventory as a percentage	INV	Ratio of inventory value to current assets
Cash flow ratio	Cashflow	Net cash flows from operating activities to current liabilities

3.3. Sample and Data Sources

"In this paper, the listed companies in Shanghai and Shenzhen A-shares from 2008 to 2022 are selected as the initial sample, and the sample is screened as follows in accordance with the research practice: (1) excluding the listed companies in the financial category; (2) excluding the companies that are ST, *ST, and PT; and (3) excluding the samples with missing data. The data are obtained from CSMAR database. In addition, to reduce the effect of extreme values, this paper shrinks the upper and lower 1% quartiles of continuous variables (Winsorize)."

4. Empirical Findings

4.1. Descriptive Statistics

The descriptive statistics of this paper are shown in Table 2

As can be seen from Table 2, the mean value of the number of green technology patent applications is 0.236, and the median values are all 0. The study shows that the number of patents and the scale of production of Chinese enterprises in green technology are on the small side, that is, the enterprises do not invest enough in research and development of green technology, and the enthusiasm of green innovation and development strategy for it is not high. The results of the study show that the mean value of the CEOs of listed companies in China who have studied or worked abroad is 0.086, which means that there are fewer CEOs with overseas backgrounds, in addition, the descriptive indexes of the other variables are within a reasonable range.

Table 2. Variable definitions and descriptions

Variable	Obs	Mean	Std. Dev.	Min	Max.
EnvrPat	35955	0.236	0.314	0	1.096
oversea	35955	0.086	0.28	0	1
lev	35955	0.419	0.199	0.101	0.773
roa	35955	0.057	0.046	-0.041	0.152
top1	35955	0.345	0.14	0.135	0.622
Indep	35955	0.371	0.044	0.333	0.455
gender	35955	0.935	0.247	0	1
age	35955	49.588	6.016	38	60
INV	35955	0.138	0.11	0.006	0.431
Cashflow	35955	0.047	0.061	-0.07	0.165

4.2. Correlation Analysis

Table 3. Correlation analysis

Variable	EnvrPat	oversea	lev	roa	top1	Indep	gender	age	INV	Cashflow
EnvrPat	1									
oversea	0.022***	1								
lev	0.173***	-0.069***	1							
roa	-0.029***	0.011**	-0.311***	1						
top1	0.003	-0.045***	0.050***	0.130***	1					
Indep	0.010*	0.036***	-0.033***	-0.020***	0.031***	1				
gender	0.035***	-0.019***	0.027***	-0.015***	-0.003	-0.050***	1			
age	0.086***	-0.023***	0.007	0.027***	0.023***	0.015***	0.034***	1		
INV	-0.074***	-0.030***	0.300***	-0.088***	0.043***	0.005	-0.005	-0.025***	1	
Cashflow	0.004	0.020***	-0.152***	0.439***	0.092***	-0.023***	-0.010*	0.059***	-0.225***	1
Note: ***p<0.01, **p<0.05, *p<0.1										

As shown in Table 3, the correlation relationship between the variables, from the table we can see that the correlation coefficients of the main explanatory variables are below 0.5, which indicates that there is no significant multicollinearity between the variables. The correlation coefficients of CEO's overseas experience (Oversea) and green technological innovation (EvrPat) are both significant at the 1% level, so it can be judged that there is a correlation, that is, the executives' overseas experience It can be judged that there is a correlation between the two, i.e., the overseas experience of executives may have a positive effect on the green technological innovation of enterprises, and the hypothesis H1 is preliminarily verified. Regarding the control variables, the gearing ratio (Lev), the return on assets (ROA), the proportion of shares held by the first largest shareholder of the enterprise (Top1), the number of directors and the number of sole directors (Indep), the gender of CEOs, the age of CEOs, the percentage of inventories (INV), the ratio of cashflow (Cashflow), and the green technological innovation (EvrPat). (Cashflow) and green technology innovation (EvrPat) are significantly correlated, which is basically in line with the results of previous studies, indicating that the control variables selected in this paper are reasonable.

4.3. Multicollinearity Test

Before the empirical analysis, in order to ensure that there is no problem of multicollinearity between the variables, this study conducted a variance inflation factor test, and the test results are shown in Table 4. As can be seen from the table, the value of the variance inflation factor (VIF) of each variable is near 1, and the average value is 1.124, which are all much less than 10, from which we can determine that there is no problem of multicollinearity between the variables.

Table 4. Tests for multicollinearity

Variable	VIF	1/VIF
roa	1.373	0.728
Cashflow	1.304	0.767
lev	1.226	0.816
INV	1.153	0.868
top1	1.034	0.967
oversea	1.009	0.991
Indep	1.008	0.992
age	1.006	0.994
gender	1.005	0.995
Mean VIF	1.124	.

4.4. Main Regression Results

In order to investigate the relationship between CEOs' overseas background and firms' green technology innovation, the results of the benchmark regression are shown in Table 5.

As shown in column (1) of Table 5, CEO's overseas background is positively related to firms' green technology innovation and is significant at 1% level. It is further verified that H1 . The regression analyses in columns (2)-columns (4) of Table 5 using the three modeling approaches of OLS, FE, and RE, respectively, all show that the CEO's overseas background has a significant positive impact on firms' green technological innovation and is significant at the 1% level. After controlling for other potential influences, firms led by CEOs with overseas backgrounds exhibit higher levels of green technology innovation. This finding is of great significance for understanding the dynamics and mechanisms of corporate innovation, and also provides new perspectives and ideas for promoting green technology innovation.

Table 5. Main regression results

	NO-Controls (1)	OLS (2)	FE (3)	RE (4)
Variable	EnvrPat	EnvrPat	EnvrPat	EnvrPat
oversea	0.0575***	0.0390***	0.0488***	0.0423***
	-8.93	-6.74	-7.82	-7.37
lev		0.356***	0.239***	0.280***
		-39.73	-20.69	-26.99
roa		0.228***	-0.168***	-0.133***
		-5.59	(-4.86)	(-3.97)
top1		-0.0156	-0.432***	-0.280***
		(-1.34)	(-22.95)	(-17.77)
Indep		0.127***	0.291***	0.246***
		-3.45	-7.08	-6.46
gender		0.0353***	-0.00339	0.00126
		-5.41	(-0.49)	-0.2
age		0.00418***	0.00609***	0.00578***
		-15.59	-23.51	-23.53
INV		-0.393***	-0.305***	-0.329***
		(-24.99)	(-14.07)	(-17.00)
Cashflow		-0.0616**	0.0603**	0.0553**
		(-2.03)	-2.56	-2.39
_cons	0.231***	-0.155***	-0.0772***	-0.114***
	-189.11	(-7.46)	(-3.41)	(-5.37)
N	35955	35955	35955	35955
R2	0.00252	0.0569	0.0684	0.0662
Note: ***p<0.01, **p<0.05, *p<0.1				

4.5. Robustness Tests

Given the small proportion of executives with overseas experience in the sample firms, in order to reduce possible endogeneity problems and improve the accuracy of the research results, this paper changes the measurement of green technology innovation of enterprises and replaces it with the proportion of the number of green technology patent applications and the number of green technology authorizations in the total number of technology patent applications and authorizations by the enterprises.

The main effects regression results after replacing the explanatory variables are shown in Table 6, after the explanatory variables are measured by green invention patents, column (1) shows the regression results of EnvrPa_ratio, and column (2) shows the regression analysis on the basis of continuous variables with before and after 1% shrinkage treatment, and the regression coefficients are all significant at 5% level, which is in line with the regression results of the previous section, and H1 still holds.

Table 6. Robustness test

	Replacement of explanatory variables (1)	Indentation processing (2)
Variable	EnvrPa_ratio	EnvrPa_ratio
oversea	0.0211**	0.0181**
	-2.1	-2.1
lev	0.000285	-0.00434
	-0.01	(-0.23)
roa	-0.0435	-0.0281
	(-1.04)	(-0.55)
top1	-0.0162	-0.0191
	(-0.51)	(-0.65)
Indep	-0.0209	-0.0397
	(-0.40)	(-0.69)
gender	-0.00654	-0.00373
	(-0.50)	(-0.33)
age	0.000161	-0.00000121
	-0.38	(-0.00)
INV	0.018	0.0344
	-0.48	-1.01
Cashflow	0.0832**	0.0673*
	-2.35	-1.85
_cons	0.148***	0.153***
	-4.24	-4.52
N	11028	11028
R2	0.00138	0.00115
Note: ***p<0.01, **p<0.05, *p<0.1		

5. Moderating Effects of the Nature of Enterprise Property Rights

The results of the regressions grouped by firm nature are shown in Table 7, with columns (1) and (2) showing the grouped regressions for oversea. the coefficients of oversea and EnvrPat are significantly positive at the 1% level in the sample of non-SOEs, and there is no significant difference in the sample of SOEs. the coefficients of oversea and EnvrPat are significantly positive at the 1% level in the sample of private firms, and there is no significant difference in the sample of SOEs. the coefficients of oversea and EnvrPat are significantly positive at the 1% level in the sample of SOEs. level and is significantly positive in the sample of state-owned enterprises, while there is no significant difference in the sample of state-owned enterprises. This suggests that the overseas experience of executives can promote green technology innovation in private enterprises, but not in state-owned enterprises, and the hypothesis H2 is tested. This result suggests that the political mission and institutional environment of state-owned enterprises may hinder the positive effect of returnee executives on green technology innovation, while in private enterprises, their culture and institutional system are more flexible and open, so they can make full use of the characteristics of returnee executives to combine

the management concepts of enterprises with the decision-making concepts of returnee executives, and thus promote green technology innovation

Table 7. Moderating effects of the nature of business ownership

	State-owned enterprises (1)	Non-state enterprises (2)
Variable	EnvrPat	EnvrPat
oversea	-0.008	0.0494***
	(-0.77)	-6.93
lev	-0.002	0.280***
	(-1.50)	-19.87
roa	0.014	-0.128***
	(0.70)	(-3.05)
top1	0.066**	-0.509***
	(2.40)	(-21.29)
Indep	0.091***	0.110**
	(14.54)	-2.04
gender	-0.054	0.0103
	(-1.36)	-1.23
age	0.070	0.00432***
	(1.24)	-13.58
INV	-0.055*	-0.223***
	(-1.82)	(-8.08)
Cashflow	0.0393	0.0563*
	-0.97	-1.93
_cons	-2.99	0.0423
	-1.11	-1.5
N	12993	22457
R2	0.0596	0.0786
Note: ***p<0.01, **p<0.05, *p<0.1		

6. Summary

This study empirically analyzes how CEOs' overseas experience impacts firms' green technological innovation, considering the moderating effect of firm ownership. Results show that overseas-experienced CEOs significantly enhance green innovation, offering a fresh perspective on corporate innovation dynamics. Notably, this effect is more pronounced in private firms than state-owned ones, highlighting the influence of firm ownership on the link between executives' overseas backgrounds and green technology innovation.

The findings of this study have important implications for business management practices and policy making.

First of all, for enterprises, especially when recruiting and selecting executives, they should pay full attention to the overseas experience of candidates. Overseas experience not only brings executives a broader vision and richer knowledge, but also significantly improves the level of green technological innovation of enterprises. Therefore, enterprises can optimize the executive selection mechanism and

actively introduce talents with overseas background to promote the green development and innovation transformation of enterprises.

Second, the findings also suggest that there may be differences between enterprises of different natures in utilizing executives' overseas experience to promote green technology innovation. In particular, private enterprises may be better able to fully utilize the advantages of executives' overseas experience to promote the development of green technological innovation due to their flexible management mechanism and keen market insights. Therefore, private enterprises should pay more attention to the utilization and cultivation of executives' overseas experience when formulating innovation strategies and human resource management policies.

In conclusion, from a policymaking viewpoint, it is imperative for the government and concerned organizations to bolster their support for green technology innovation in private enterprises. This entails the implementation of policies that offer financial aid, tax incentives, and technology transfer to stimulate active participation in green technology innovation. Furthermore, establishing public service platforms and fostering industry-university-research collaboration can provide private enterprises with additional opportunities to access overseas advanced technology and management expertise, thereby fostering sustained growth in green technology innovation.

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