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Succession in family business and environmental investment: the moderating role of external environment

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ABSTRACT

After more than 40 years of opening the door to the outside world, Chinese family firms have developed rapidly, but also caused the problem of serious environmental pollution. The solution to the problem stems inevitably from the innovation in environmental protection technology. This means the environmental investment of family firms determines whether the enterprise can maintain sustainable development. However, Chinese family firms have been going through a critical period of intergenerational succession. This study aims to use the data of Chinese Shanghai and Shenzhen A-share listed family firms from 2013 to 2020 to study the relationship between intergenerational succession of family enterprises and environmental protection investment. We also examine the moderating role of the two different types of external environment – the government and the market. The regression results of the Tobit model of the full sample and subsample show that succession has a significant positive impact on family business environmental investment, and this impact is more significant in companies whose successors have overseas experience. Environmental regulation will strengthen the positive impact of succession on corporate environmental investment, while market competition will weaken it. Based on the findings, we also discuss policy recommendations. These findings are of great significance to the green and sustainable development of family firms.

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1. Introduction

Green development is an important part of global environmental governance (Maggioni & Santangelo, 2017). With the continuous development of economy, both developed and developing countries are faced with the problem of environmental degradation, which has aroused widespread concern in academia. Al-Mulali et al. (2015) used the data of European countries from 1990 to 2013 and found that the growth of GDP will increase CO_2 emissions. The problem of environmental pollution

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is more prominent in developing countries: Farhani and Ozturk (2015) found that the financial development of Tunisia was carried out at the expense of the environment, and there was a positive monotonic relationship between the country's GDP and CO2 emissions; Murshed et al. (2021) found that economic globalization and urbanization in Argentina increased the country's CO_2 emissions; similarly, in developing Asian countries, Rehman et al. (2021a, 2021b, 2021c, 2021d) found that Pakistan's GDP growth, fuel imports, industrialization, population growth, and deepening economic globalization have all contributed to the problem of environmental pollution, which has led to ecological regression in Pakistan. As the largest developing country in Asia, China is also facing the problem of environmental pollution. According to the latest Environmental Performance Index 2020 (Wendling et al., 2020) released by Yale University, China's environmental performance index ranks 120th among 180 countries, which is below the average. Nearly 50% of the population is in an unsafe air environment. Therefore, the coordination of the relationship between economic growth and environmental protection has become one of the major issues China faces. For this reason, the Chinese government has successively promulgated a series of laws and regulations to strengthen the environmental protection of listed companies, such as the 'Notice on Environmental Protection Inspection of Listed Companies and Listed Companies Applying for Refinancing', and 'Guiding Opinions on Strengthening Environmental Protection Supervision and Management of Listed Companies'. There is no doubt that the implementation of these environmental policies will provide a legal basis for environmental improvement.

On the other hand, enterprises play an important role in the sustainable environmental governance system. They are not only the main force of economic development, but also the main source of environmental pollution (Yang et al., 2012). Therefore, increasing investment in environmental protection and actively reducing environmental pollution are social responsibilities that enterprises should take upon themselves. In the process of the transformation of China's economic development model, family businesses have been a force that cannot be ignored. The China Statistical Yearbook 2018 (National Bureau of Statistics of China, 2018) shows that Chinese family businesses account for nearly 80% of all private enterprises and play an important role in gross national product, job creation, export trade and taxation (Wang et al., 2016). At the same time, family businesses account for half of China's manufacturing industry and are the key supervision objects of environmental protection and pollution control. Therefore, the environmental decision of family companies plays a very important role in China's green development strategy. The traditional view is that compared with non-family businesses, family businesses tend to be conservative (Kellermanns et al., 2012), and generally choose investments with a relatively stable rate of return, so the willingness to invest in the environment is low. On the other hand, there are also studies that show that, compared with non-family businesses, family businesses pay more attention to non-economic goals, such as family reputation and image, and pay more attention to the long-term development of the company (Chrisman & Patel, 2012). This feature is consistent with the sustainable development goals of environmental protection, so family businesses are more willing to increase environmental investment.

However, few studies analyze the environmental investment of family enterprises from the perspective of intergenerational inheritance. Succession is a key factor to distinguish family businesses from non-family businesses (Bennedsen et al., 2007). In recent years, as the founders of Chinese family firms have reached retirement age and most companies have entered a critical period of generational replacement, succession has become a huge test facing Chinese family firms. According to the theory of Socioemotional Wealth (SEW), when a family business is in the intergenerational inheritance stage, the business tends to pay more attention to non-economic goals and pursue the long-term survival of the family (Sharma et al., 2003), and environmental investment can improve the long-term competition of enterprises. In addition, succession often has a positive impact on the performance of social responsibilities of family firms. This is because taking social responsibility can improve the social image of enterprises and the legitimacy of successors, and help enterprises ride out the fluctuation period of any leadership changes more smoothly (Dou et al., 2020). Environmental investment is an important manifestation of a company's environmental responsibility, so succession may increase the environmental investment of family businesses.

Based on the above analysis, this paper selects the data of Chinese listed family firms from 2013 to 2020 as a sample to empirically test the relationship between succession and family business environmental investment, studying the regulatory effect of the two external environments of government and market on their relationship.

The possible contributions of this study are as follows. First, in the context of economic transformation, China's green development is an urgent problem to be solved, and succession is a problem that Chinese family enterprises must face. This paper takes the lead in exploring the relationship between the two, empirically tests the impact of succession on family business environmental investment, which expands the research scope of environmental investment influencing factors. Second, this article enriches the research literature on the economic consequences of family business succession. The existing literature mainly focuses on research on corporate performance and innovation investment. This paper is based on the social responsibility perspective of environmental investment, which helps to fully understand the impact of succession on family business decision making. Third, from the perspective of external environment, we analyze the moderating effects of environmental regulation and market competition in the relationship between succession and environmental investment, which provides new ideas for family enterprises to carry out environmental investment and new empirical evidence for understanding how the external environment affects family enterprises' decision making.

2. Theoretical analysis and research hypotheses

2.1. Succession and environmental investments of family businesses

The development of economy, the advancement of industrialization and the deepening of globalization have brought many environmental problems to the world today, the most prominent of which is CO_2 emission. To solve this problem, scholars have carried out a series of studies. The effort is mainly divided into government and

enterprise levels. The government level effort includes adopting new policies, improving the energy sector, and paying attention to alternative energy (Rehman et al., 2021e, 2021f), and the existing studies have found that the development of renewable energy can significantly promote the country's GDP (Rehman et al., 2021g). At the enterprise level, it is necessary to invest in environmental protection and continuously improve environmental related technological innovations, so as to achieve sustainable economic growth (Khan et al., 2022). Environmental investment is a special decision that does not aim at economic returns (Farzin & Kort, 2000), and the investment effect is often in terms of social rather than economic benefits. Compared with non-family businesses, family businesses not only value economic goals, but also have a strong desire to pursue non-economic goals. To explain this special phenomenon, Gomez-Mejia et al. (2007) proposed the theory of SEW. They believe that the special feature of family businesses is that they regard the increase and loss of SEW as an important reference point for strategic decision-making. Furthermore, Miller and Le Breton-Miller (2014) divided SEW into restricted and extended types, among which restricted SEW tends to be short-term oriented, focusing on maintaining family control over the enterprise. The extended SEW tends to be long-term oriented, focusing on maintaining the compatibility of corporate reputation with the interests of external partners and guiding companies to attach importance to long-term development. So, whether environmental investment will add SEW to the family becomes an important judgment in corporate decision-making.

Family business in the stage of intergenerational inheritance pays more attention to extended SEW (Chrisman & Patel, 2012), because succession is a clear expression of the long-term orientation of family business, which guides family to pay attention to the long-term survival of the business (Sharma et al., 2003). Although environmental investment will bring economic pressure to enterprises in the short term, it can enable companies to increase clean-based innovations and reduce corporate environmental costs (Li & Ramanathan, 2020), which is beneficial to the long-term development of enterprises and consistent with the purpose of extended SEW. Moreover, the long-term survival of the enterprise often requires the family to balance their own interests with the internal and external stakeholders of the enterprise (Miller et al., 2007), where the internal and external stakeholders include the government, partners, and consumers. Enterprises that invest in environmental protection can experience a reduction in pressure from the government to deal with pollution, and the corporate image will be improved accordingly, achieving the effect of stabilizing partners and attracting consumers. Therefore, out of the pursuit of SWE, family businesses in the intergenerational inheritance stage will increase investment in environmental protection.

On the other hand, Chinese family businesses generally lack a clear intergenerational succession plan, which makes the successor face the problem of insufficient legitimacy when taking over the business (Wang & Wang, 2017). The legitimacy here refers to the support of the company's employees, management team, and the recognition of stakeholders in the external environment, including the government, regulatory agencies, media, and the public. When the legitimacy of heirs is low, they usually choose strategic change to show their ability and status, and obtain the

support of key stakeholders of the enterprise. The common methods include portfolio entrepreneurship, establishing political connections, etc. (Xu et al., 2015). Environmental investment is also a kind of strategic choice that can establish legitimacy. This is because environmental investment is a decision that is beneficial to society, so environmental investment is an act of social responsibility. Social responsibility is helpful to improve the good relationship between enterprises and stakeholders (Hillman & Keim, 2001) and help companies obtain legitimacy. At the same time, improving the governance and maintenance of the environment by companies can be recognized by the government and regulatory authorities, enhancing the legitimacy of family business managers (Saiia et al., 2003). Therefore, out of the pursuit of legitimacy, succession could positively affect the environmental investment of family businesses.

To sum up, whether it is to increase family SEW or improve the legitimacy of corporate heirs, family businesses in the stage of intergenerational inheritance will have stronger motivation to increase environmental investment. So, we propose the following hypothesis:

H1:With all other conditions unchanged, succession will have a positive impact on the environmental investment of family businesses.

According to the 'Forbes 2014 China Family Business Survey Report[1]', there are two main models for family businesses to train heirs. One is the internal training of the enterprise, so that the successor can be familiar with the various positions of the enterprise and grow together with the enterprise. The second is to go abroad for training, including studying and working abroad, then directly go to management after returning home. Since local training allows heirs to be trained in the enterprise for a long time, they can have a certain degree of legitimacy when they succeed (Cabrera-Suárez et al., 2001). However, heirs with overseas experience do not have the conditions for long-term experience in the enterprise, and they are more likely to have insufficient legitimacy when they succeed. Therefore, compared with the local successors, the social recognition and government support brought on by environmental investment will be more attractive to the successors with overseas experience. Also, overseas experience can give the successor of the family business a broad international perspective and an advanced management model (Giannetti et al., 2015). Enterprises in developed countries have basically completed the transformation from a development model that destroys the ecological environment to a green development model and have mature experience in the harmonious coexistence of environmental protection and corporate development. Therefore, heirs trained overseas who study and work in this environment will be more likely to accept the concept of green environmental protection, instead of focusing on the short-term benefits of consuming resources at the sacrifice of the environment. So, if the heir to the family business has overseas experience, the willingness of the enterprise to increase environmental investment will be stronger. In summary, we propose the following hypothesis:

H2:The positive impact of succession on environmental investment will be more significant in family businesses whose heirs have overseas experience.

2.2. The moderating role of external environment

Strategic choice theory (Child, 1997) believes that the strategic choice of an enterprise is dynamic and is often affected by the external environment. The external environment is the soil for the survival and development of enterprises, which can provide conditions and constraints for the business activities of enterprises. Therefore, the external environment is very important to the healthy development of the family business and will affect the decision making of the business management. Among them, the two external environments of government and market are important factors that affect the business activities of enterprises. For family business environmental investment, the external environment of the government mainly refers to a series of environmental regulations promulgated by the government, and the external environment of the market mainly refers to market competition. We discuss the mediating role of these two external environments in the relationship between succession and environmental investment separately.

2.2.1. The mediating role of environmental regulations

Environmental regulation refers to the collection of measures formulated by the government for environmental protection (Farzin & Kort, 2000), which belongs to the category of formal systems and has an important impact on regulating the environmental behavior of enterprises. Environmental regulation is an important guarantee for enterprises to carry out environmental protection, technological innovation, energy conservation, and emission reduction (Kesidou & Demirel, 2012). With the improvement of environmental regulation intensity, the legitimacy threats and operational risks faced by enterprises evading environmental responsibility also increase (Barbera & McConnell, 1990). Higher legitimacy threats and operational risks will inevitably affect the environmental investment decisions of family enterprises in the stage of intergenerational inheritance. Therefore, we analyze the regulatory role of environmental regulation from the following two perspectives.

First, environmental regulations will guide local governments to attach importance to green GDP (Zhan & Dear, 2017), which will bring greater administrative pressure on enterprises. According to the organizational legitimacy theory, if the behavior of an enterprise deviates from public expectations or legal requirements, the legitimacy of the enterprise will be threatened (Zimmerman & Zeitz, 2002). In the stage of intergenerational inheritance, a family business itself has problems of insufficient legitimacy of successors and fluctuation in organizational legitimacy. Therefore, in this sensitive period, family businesses will be more willing to invest in environmental protection to cater to the local government's pursuit of green GDP, thereby alleviating the pressure on legitimacy.

Second, environmental regulations will increase the supervision of environmental protection departments and the efforts of enterprises to evade environmental penalties. As the supervision of environmental protection departments increases, companies that evade environmental governance will find it difficult to survive. High fines and cessation of business for rectification will increase the business risk of the enterprise and cause it to be unable to produce normally. Compared with ordinary enterprises, family businesses in the intergenerational inheritance stage have obvious risk aversion preferences (Nordqvist et al., 2013). This is because there is uncertainty in succession (Bennedsen et al., 2015), which will increase the operational risk of a family business.

Therefore, family enterprises in leadership transition will choose to increase environmental investment to avoid the potential risks brought by environmental regulation.

So, whether it is to alleviate the threat of legitimacy or to avoid business risks, environmental regulation will strengthen the positive impact of succession on enterprise environmental investment. To sum up, we propose the following hypothesis:

H3:Environmental regulations will strengthen the positive impact of succession on environmental investment of family businesses.

2.2.2. The mediating role of market competition

Although family businesses are more persistent in pursuing non-economic goals than non-family businesses, family businesses are essentially the same as other businesses and are aimed at maximizing benefits (Chua et al., 2018). Family businesses need to balance economic interests with social environmental interests when making environmental investments. In this regard, when a family business is in a period of succession while the company faces fierce market competition, the conflict between economic interests and social environmental interests will be more serious, which will obviously affect the relationship between succession and environmental investment in the family business.

In terms of resource allocation, fierce market competition will compress the profit space of family businesses. Companies in such situations generally seek to reduce costs to maintain their competitive advantage, rather than engage in their own capacity building (Hodges et al., 2014). Family businesses will consume part of the economic resources due to the uncertainty of succession, which will bring economic pressure to the business. This will cause the family company to carefully consider any investment decisions in the face of fierce market competition, thereby greatly reducing their willingness to invest in environmental protection. Since investors in the equity market are generally not aware of the environmental protection activities, they pay more attention to corporate financial performances. The fierce market competition will further increase investors' attention to financial performance, so that investors will evaluate the ability of managers based on the profitability of the company and judge whether to invest in the company (Almeida & Dalmácio, 2015). In this case, the management of family business must consider the preferences of investors, so they will be conservative about environmental investment. Therefore, whether in terms of resource allocation or for the sake of corporate performance, market competition will weaken the positive impact of succession on environmental investment of family businesses. In summary, we propose the following hypothesis:

H4:Market competition will weaken the positive impact of succession on environmental investment of family businesses.

3. Data and empirical methods

3.1. Sample and data sources

We selected the 2013-2020 Chinese Shanghai and Shenzhen A-share listed family businesses as the initial sample for the study and used Anderson and Reeb (2003) and Gomez-Mejia et al. (2007) for reference to the definition of family enterprises.

The initial sample was screened as follows: (1) one or more family members were stockholders; (2) one or more family members were officers or directors; and (3) one or more family members held more than 20% of firm ownership. Then, the sample was screened according to the following principles: (1) Eliminate companies whose ultimate controller has changed; (2) eliminate companies in the financial and insurance industries; (3) eliminate special treatment (ST) and *ST companies with abnormal financial status; and (4) eliminate companies with incomplete information disclosure. The final sample included 482 companies and 2676 years of cross-sectional data.

Environmental investment data came from 'Corporate Social Responsibility Reports', 'Sustainability Reports' and 'Environmental Reports'. Environmental regulation data came from the 'China Environmental Statistical Yearbook' and 'China Statistical Yearbook'. The announcement of the successor of the family business as CEO or chairman came from the Wind database, and the financial data came from the CSMAR[2] database. Public information that was not disclosed but may have revealed family relationships was supplemented by manual collection.

3.2. Measurement of the variables

3.2.1. Explained variable

Environmental investment: Referring to the study of Tang et al. (2013), the indicator we set was the scale of enterprise environmental investment (*EI*), which was measured by the ratio of environmental protection investment to average total assets. This kind of measurement can effectively reduce the impact of enterprise scale on environmental investment.

3.2.2. Explanatory variables

Succession: Following Fan et al. (2012) definition of family business succession, we used the heir as the chairman or CEO of the company as a symbol of succession.

Training method of successor: If the successor of the family business has had overseas experience (studying abroad or working), the index *Oversea* was 1, otherwise 0.

Environmental regulations: We referred to the research of Lanoie et al. (2011), and used the ratio of regional environmental pollution control investment to regional GDP to measure the environmental regulation (*ER*). The larger the index, the higher the intensity of regional environmental regulation.

Market competition: We learned from the common practice of existing research and used the Herfindahl index conversion for measurement. The Herfindahl index refers to the sum of the square of the share of each market competitor in an industry, and the calculation formula is:

$HI = \sum_{i=1}^{N} (S_i/S)^2$ Where N is the number of listed companies in the industry, S_i is the operating income of company i in the observation year, and S is the total operating income of the industry in the observation year. *HI* is an indicator in the opposite direction, and the larger the index, the higher the market concentration and the less intense market competition. In this paper, this value was converted, and $HHI = 1\text{-}HI$ was used to measure market competition. The greater the *HHI* index, the greater the market competition.

Table 1. Definitions of variables.

Variables	Definition
EI	Environmental investment/average total assets
Suc	Dummy variable that equals 1 if the heir (including the founder's child, daughter-in-law or son-in-law) is the chairman or CEO of the company and 0 otherwise
Oversea	Dummy variable that equals 1 if the successor of a family business has overseas experience (study abroad or work) and 0 otherwise
ER	Investment in regional pollution control/Gross regional product
HHI	1- Herfindahl Index
Size	Natural logarithm of the company's total assets
Age	Natural logarithm of the difference between the observation year and the company's listing year
Lev	Total liabilities of the company in the current year/the book value of the company in the current year
ROA	Net profit/average net assets
Cash	Monetary fund balance/average total assets
Male	Dummy variable that equals 1if the actual controller of the enterprise is male and 0 otherwise.
Edu	The educational background of the actual controller of the enterprise is scored 1–6 according to elementary school, junior high school, high school (or technical secondary school), junior college, university undergraduate, postgraduate and above
Pc	Dummy variable that equals 1if the actual controller of a company acts as a deputy to the National People's Congress or a member of the Chinese People's Political Consultative Conference and 0 otherwise
Inde	The ratio of the number of independent directors to the number of board members
FamHold	The sum of the shareholding ratios of all family members
Year	The data year interval is 8 years, so 7 dummy variables are set.
Province	China has 31 provinces, so 30 dummy variables are set.
Industry	Adopting the first-level industry classification of the China Securities Regulatory Commission, this article involves 18 industries, so 17 dummy variables are set.

Source: calculated by author's formulas.

3.2.3. Control variables

To reduce the endogenous problems caused by missing dependent variables, referring to the research of Miller et al. (2007) and Xu et al. (2019), we controlled three types of variables. The company characteristic variables were company size (*Size*), company age (*Age*), asset liability ratio (*Lev*), profitability (*ROA*), and cash holding level (*Cash*). The personal characteristics variables of entrepreneurs were the gender (*Male*), education level (*Edu*), and political connection (*Pc*) of the actual controller of the enterprise. Corporate governance variables were the proportion of independent directors (*Inde*) and the proportion of family shareholding (*FamHold*). In addition, we also controlled for the year (*Year*), province (*Province*), and industry (*Industry*) of the sample companies. The definitions and value descriptions of variables are shown in Table 1.

3.3. Descriptive statistics

Table 2 shows the descriptive statistics of the variables. The results show that the average value of environmental investment (*EI*) was 0.012. The environmental investment scale of family businesses was relatively low, which shows that environmental investment has not received much attention in many family companies. The smooth transformation of China's economic development model requires the support of family companies, so how to stimulate the environmental protection enthusiasm of companies has certain research value. The mean value of intergenerational succession (*Suc*) was 0.452, indicating that the second generation of 45.2% of the sample companies had been

Table 2. Descriptive statistics.

Variables	N	Mean	Min	Std.	Median	Max
EI	2676	0.012	0.000	0.027	0.006	0.162
Suc	2676	0.452	0.000	0.468	0.000	1.000
Oversea	2676	0.382	0.000	0.318	0.000	1.000
ER	2676	0.016	0.004	0.008	0.020	0.045
HHI	2676	0.104	0.032	0.088	0.062	0.404
Size	2676	18.531	15.284	7.682	18.429	22.647
Age	2676	8.153	1.000	5.143	6.000	42.000
Lev	2676	0.396	0.068	0.213	0.425	0.863
ROA	2676	0.047	−0.168	0.019	0.044	0.183
Cash	2676	0.094	0.008	0.062	0.097	0.212
Male	2676	0.824	0.000	0.286	1.000	1.000
Edu	2676	4.215	1.000	1.213	4.000	6.000
Pc	2676	0.682	0.000	0.475	1.000	1.000
Inde	2676	0.367	0.200	0.052	0.333	0.667
FamHold	2676	35.257	12.230	3.984	32.286	76.380

Notes: The values in parentheses are the T-values.
*Significant at the 0.10 level,
**significant at the 0.05 level, and
***significant at the 0.01 level.
Source: calculated by author's formulas.

involved in corporate governance, underscoring the practical significance to study the impact of succession on family businesses. The mean value of *Oversea* was 0.382, indicating that 38.2% of the business heirs in the 2676 family business samples have had overseas experience. The mean value (0.016) of environmental regulation (*ER*) was less than the median value (0.020), indicating that most of the companies in the sample were in areas with low environmental regulation intensity. The mean value (0.104) of market competition (*HHI*) was greater than the median value (0.062), indicating that majority of the companies in the sample faced higher market competition.

3.4. Regression method

The explained variable *EI* is a set of truncated data with 0 as the lowest value, and most of the environmental investment of businesses in the data is 0. Tobit regression can obtain unbiased and consistent estimation for the data structure with positive continuous distribution and zero value of positive probability, so we used Tobit regression for hypothesis testing. The specific formulas are as follows:

$$EI_{it} = \alpha_0 + \alpha_1 Suc_{it} + \sum_{j=1}^{9} \alpha_{1+j} Control_{jit} + \mu_i + \eta_t + \varepsilon_{it} \quad (1)$$

$$EI_{it} = \beta_0 + \beta_1 Suc_{it} + \beta_2 ER_{it} + \beta_1 Suc_{it} \times ER_{it} + \sum_{j=1}^{9} \beta_{3+j} Control_{jit} + \mu_i + \eta_t + \varepsilon_{it} \quad (2)$$

$$EI_{it} = \gamma_0 + \gamma_1 Suc_{it} + \gamma_2 HHI_{it} + \gamma_3 Suc_{it} \times HHI_{it} + \sum_{j=1}^{9} \gamma_{3+j} Control_{jit} + \mu_i + \eta_t + \varepsilon_{it} \quad (3)$$

In addition, the maximum value of the variance inflation factor (VIF) of the variables was 1.58, which is much less than 10, indicating that the collinearity between the

Table 3. Tobit regression results of succession and environmental investment.

	Explained variable: *EI*			
	Full sample group		Oversea = 0	Oversea = 1
Explanatory variable	Model 1	Model 2	Model 3	Model 4
Constant	0.0306***	0.0245***	0.02853***	0.0236***
	(3.846)	(3.944)	(3.752)	(4.110)
Suc		0.0145***	0.0117*	0.0175***
		(2.842)	(1.828)	(3.174)
Size	−0.0016***	−0.0018***	−0.0016***	−0.0019***
	(−3.782)	(−3.810)	(−3.703)	(−3.724)
Age	−0.0008***	−0.0009***	−0.0006**	−0.0011***
	(−2.647)	(−2.704)	(−2.438)	(−2.964)
Lev	0.0124	0.0118	0.0121	0.0116
	(0.689)	(0.657)	(0.633)	(0.710)
ROA	−0.0185	−0.0172	−0.0188	−0.0170
	(−1.385)	(−1.296)	(−1.348)	(−1.116)
Cash	−0.0012	−0.0011	−0.0014	−0.0009
	(−1.428)	(−1.485)	(−1.496)	(−1.477)
Male	0.0072*	0.0068	0.0075*	0.0062
	(1.752)	(1.577)	(1.683)	(1.436)
Edu	0.0053*	0.0056*	0.0058*	0.0055*
	(1.824)	(1.773)	(1.792)	(1.764)
Pc	−0.0012***	−0.0013**	−0.0012***	−0.0011**
	(−2.816)	(−2.468)	(−2.751)	(−2.447)
Inde	0.0102***	0.0099***	0.0104***	0.0097***
	(2.927)	(2.911)	(3.089)	(2.887)
FamHold	−0.0005	−0.0004	−0.007	−0.0003
	(−1.248)	(−1.125)	(−1.253)	(−1.056)
Year	Yes	Yes	Yes	Yes
Province	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	2676	2676	1258	1022
Pseudo R^2	0.1872	0.2105	0.2033	0.2227

Notes: The values in parentheses are the T-values.
*Significant at the 0.1 level,
**significant at the 0.05 level, and
***significant at the 0.01 level.
Source: calculated by author's formulas.

variables was not serious. The test of the moderating effect adopted the method of interaction terms, and the central processing was carried out before multiplying.

4. Empirical results

4.1. The regression results of succession and enterprise environmental investment

First, taking *EI* as the explained variable, the relationship between succession and environmental investment was performed by Tobit regression based on different groups. The results are shown in Table 3.

Model 1 and Model 2 are full sample groups, and Model 1 is the regression result of the benchmark model with only the control variables. The results show that the coefficients of company size, company age, and political connection were negative at the 1% significance level, which are −0.0016, −0.0008, and −0.0012, respectively. This shows that the larger the scale of the enterprise, the longer the operation time and the higher the intensity of political connection, the lower the environmental

investment of family enterprises, which was consistent with the research results of Xu and Yan (2020). In addition, the coefficients of gender and educational background of the actual controller of the enterprise were positive at the significance level of 10%, which were 0.0072 and 0.0053, respectively, indicating that a male family enterprise controller and a high educational background can positively affect environmental protection investment, which was consistent with the research results of Zeng et al. (2020). Finally, the coefficient of the proportion of independent directors is positive (0.0102) at a significance level of 1%, indicating that the more independent directors on the board of a family company, the higher the company's environmental investment. This may be because independent directors were outsiders who have little relationship with the interests of the company, and paid more attention to their own reputation (Cuadrado-Ballesteros et al., 2015), promoting corporate social responsibility and increased investment in environmental protection. Model 2 examined the impact of succession on family business investment, and the results show that the coefficient of succession was positive (0.0145) at a significance level of 1%, indicating that succession positively affects family business environmental investment. So, Hypothesis 1 was supported.

Models 3 and 4 were grouped Tobit tests according to whether the successor has had overseas experience[3]. Among them, Model 3 was the group of successors without overseas experience, and the regression results showed that the coefficient of succession is positive (0.0117) at a significance level of 10%. Model 4 was the group of successors with overseas experience, and the coefficient of succession was positive (0.0175) at a significance level of 1%. The significance of the succession coefficient in Model 3 was lower than that in Model 4, which indicates that the positive impact of succession on enterprise environmental investment is more significant in the family enterprises whose heirs have overseas experience. Therefore, Hypothesis 2 is proved.

4.2. The regression results of the moderating effect of external environment

To test the moderating effect of environmental regulation and market competition on the relationship between succession and environmental investment, we introduced the interaction terms $Suc \times ER$ and $Suc \times HHI$ into the equation, and continued to use the Tobit model for regression testing. The results are shown in Table 4.

Model 1 tested the moderating effect of environmental regulation, and the results show that the coefficient of environmental regulation was positive (0.0148) at the significance level of 1%, which indicates that environmental regulation has a positive impact on enterprise environmental investment, consistent with the research results of Tang et al. (2013). The coefficient of the interaction term between environmental regulation and succession was positive (0.0275) at the 1% significance level, indicating that environmental regulations were positively moderating the relationship between succession and corporate environmental investment, so Hypothesis 3 was supported. Model 2 examined the moderating effect of market competition, and the coefficient on *HHI* was negative (−0.0094) at a significance level of 10%, indicating that market competition will inhibit family business environmental investment, which was consistent with our expectation. The coefficient of the interaction term between market

Table 4. Tobit regression results of the moderating effect of the external environment.

	Explained variable: *EI*		
Explanatory variable	Model 1	Model 2	Model 3
Constant	0.0296***	0.0273***	0.0301***
	(3.557)	(3.672)	(3.584)
Suc	0.0138***	0.0127***	0.0135***
	(2.827)	(2.912)	(2.875)
ER	0.0148***		0.0152***
	(2.732)		(2.718)
Suc × *ER*	0.0275***		0.0265***
	(2.788)		(2.745)
HHI		−0.0094*	−0.0086
		(−1.822)	(−1.612)
Suc × *HHI*		−0.0188**	−0.0184**
		(−2.634)	(−2.457)
Size	−0.0017***	−0.0019***	−0.0016***
	(−3.685)	(−3.537)	(−3.662)
Age	−0.0011***	−0.0008***	−0.0009**
	(−2.711)	(−2.685)	(−2.552)
Lev	0.0116	0.0120	0.0115
	(0.723)	(0.673)	(0.710)
ROA	−0.0173	−0.0175	−0.0168
	(−1.248)	(−1.125)	(−1.178)
Cash	−0.0009	−0.0013	−0.0011
	(−1.437)	(−1.511)	(−1.482)
Male	0.0066*	0.0071	0.0069
	(1.692)	(1.523)	(1.664)
Edu	0.0052*	0.0054*	0.0055*
	(1.755)	(1.737)	(1.812)
Pc	−0.0012**	−0.0014**	−0.0014**
	(−2.349)	(−2.434)	(−2.359)
Inde	0.0097***	0.0103***	0.0101***
	(2.931)	(2.855)	(2.822)
FamHold	−0.0005	−0.0004	−0.0006
	(−1.084)	(−1.149)	(−1.117)
Year	Yes	Yes	Yes
Province	No	Yes	No
Industry	Yes	No	No
N	2676	2676	2676
Pseudo R^2	0.2261	0.2228	0.2324

Notes: The values in parentheses are the T-values.
*Significant at the 0.1 level,
**significant at the 0.05 level, and
***significant at the 0.01 level.
Source: calculated by author's formulas.

competition and succession was negative (−0.0188) at the 5% significance level, indicating that, contrary to environmental regulations, market competition can negatively moderate the relationship between succession and corporate environmental investment. Therefore, Hypothesis 4 was proved. Finally, all the variables we examined were put into Model 3 for Tobit regression, and the results were basically the same as the previous ones.

4.3. The regression results of subsamples of intergenerational enterprises

To further verify the influence of successor training mode and external environment on the relationship between intergenerational inheritance and environmental protection investment, we used the Tobit model to retest the family enterprises that have

Table 5. Tobit regression results of the subsample of firms with succession.

	Explained variable: *EI*		
Explanatory variable	Model 1	Model 2	Model 3
Constant	0.03161***	0.03434***	0.03758***
	(3.557)	(3.672)	(3.584)
Oversea	0.0085***		
	(2.946)		
ER		0.0328***	
		(2.814)	
HHI			−0.0262***
			(−2.688)
Control variables	Yes	Yes	Yes
Year	Yes	Yes	Yes
Province	Yes	No	Yes
Industry	Yes	Yes	No
N	1210	1210	1210
Pseudo R^2	0.2173	0.2244	0.2136

Notes: The values in parentheses are the T-values.
*Significant at the 0.1 level,
**significant at the 0.05 level, and
***significant at the 0.01 level.
Source: calculated by author's formulas.

already undergone intergenerational inheritance as a sample. The results are shown in Table 5 (to save space, the control variables are omitted in the table).

Model 1 examined the relationship between the overseas experience of successors and corporate environmental investment in the sub-sample. The results show that the coefficient of overseas experience (*Oversea*) was positive (0.0085) at the 1% significance level while other control variables were unchanged, which indicates that in the family enterprises with intergenerational inheritance, the overseas experience of the heirs can positively affect the environmental investment, further strengthening Hypothesis 2. Model 2 tested the relationship between environmental regulation and corporate environmental investment. The results show that the environmental regulation (*ER*) coefficient was positive (0.0328) at a significance level of 1%, which means that the higher the intensity of environmental regulation, the higher the environmental investment of enterprises with succession, that is, the environmental regulation plays a positive role in moderating the relationship between succession and environmental investment. This result further supported Hypothesis 3. Model 3 examined the relationship between market competition and corporate environmental investment. The results show that the coefficient of market competition (*HHI*) was negative (−0.0262) at a significance level of 1%, which indicates that in family businesses with succession, the more fierce the market competition, the lower the environmental investment. In other words, market competition plays a negative regulatory effect on the relationship between succession and environmental investment, further supporting Hypothesis 4.

5. Conclusion and policy recommendation

Based on the samples of Chinese listed family enterprises from 2013 to 2020, we tested the impact of succession on environmental investment of family businesses. We also examined the moderating effects of the government and the market on the

relationship between succession and enterprise environmental investment. We thus reached the following conclusions: First, succession can promote the environmental protection investment of family firms. Second, compared with locally trained successors, the successors of overseas training are more willing to invest in environmental protection after taking over. Third, the external environment can moderate the relationship between succession and environmental investment, and the moderating role varies according to the source of the external environment. Environmental regulations from the government positively moderate the relationship between succession and corporate environmental investment, while the competition from the market negatively moderates the relationship.

Based on these research conclusions, we put forward the following policy recommendations. First, the government can improve the legal system and establish an effective private property rights protection mechanism, thereby enhancing the confidence of family firms and increasing the willingness to inherit the business. Also, the financial treatment of family businesses can be improved, and multiple financing channels can be established to help family businesses smoothly navigate through the fluctuation period of succession. Second, the government can bring regional environmental performances into local governments' policy assessment system, increase the local government's supervision and inspection of polluting enterprises, and urge enterprises to perform their corresponding environmental responsibilities. Government should also continue to strengthen the construction of targeted laws and regulations to provide a legal basis for standardizing corporate environmental governance. Third, the government can increase tax incentives for enterprises to make environmental investment projects and increase corresponding financial subsidies, thereby reducing the cost of environmental investment in family businesses and releasing the economic pressure brought by fierce market competition.

Notes

1. For details, please refer to the Forbes 2014 China Family Business Survey Report by Forbes Chinese website on September 17, 2014. https://www.forbeschina.com/.
2. The full name of CSMAR is China Stock Market Accounting Research, and the website is https://www.gtarsc.com/.
3. The sum of the sample size of models 3 and 4 was 2280, which was smaller than the total sample size. This was because there was a lack of successors in a small number of sample enterprises.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Almeida, J., & Dalmácio, F. Z. (2015). The effects of corporate governance and product market competition on analysts' forecasts: Evidence from the Brazilian capital market. *The International Journal of Accounting*, *50*(3), 316–339. https://doi.org/10.1016/j.intacc.2015.07.007

Al-Mulali, U., Ozturk, I., & Lean, H. (2015). The influence of economic growth, urbanization, trade openness, financial development, and renewable energy on pollution in Europe. *Natural Hazards*, *79*(1), 621–644. https://doi.org/10.1007/s11069-015-1865-9

Anderson, R. C., & Reeb, D. M. (2003). Founding-family ownership and firm performance: Evidence from the S&P 500. *The Journal of Finance*, *58*(3), 1301–1328. https://doi.org/10.1111/1540-6261.00567

Barbera, A. J., & McConnell, V. D. (1990). The impact of environmental regulations on industry productivity: Direct and indirect effects. *Journal of Environmental Economics and Management*, *18*(1), 50–65. https://doi.org/10.1016/0095-0696(90)90051-Y

Bennedsen, M., Fan, J. P. H., Jian, M., & Yeh, Y. H. (2015). The family business map: Framework, selective survey, and evidence from Chinese family firm succession. *Journal of Corporate Finance*, *33*(8), 212–226. https://doi.org/10.1016/j.jcorpfin.2015.01.008

Bennedsen, M., Nielsen, K. M., Perez-Gonzalez, F., & Wolfenzon, D. (2007). Inside the family firm: The role of families in succession decisions and performance. *The Quarterly Journal of Economics*, *122*(2), 647–691. https://doi.org/10.1162/qjec.122.2.647

Cabrera-Suárez, K., Saá-Pérez, P., & García-Almeida, D. 2. (2001). The succession process from a resource- and knowledge-based view of the family firm. *Family Business Review*, *14*(1), 37–48. https://doi.org/10.1111/j.1741-624800037.x

Child, J. (1997). Strategic choice in the analysis of action, structure, organizations and environment: Retrospect and prospect. *Organization Studies*, *18*(1), 43–76. https://doi.org/10.1177/017084069701800104

Chrisman, J. J., & Patel, P. C. (2012). Variations in R&D investments of family and nonfamily firms: Behavioral agency and myopic loss aversion perspectives. *Academy of Management Journal*, *55*(4), 976–997. https://doi.org/10.5465/amj.2011.0211

Chua, J., Chrisman, J., De Massis, A., & Wang, H. (2018). Reflections on family firm goals and the assessment of performance. *Journal of Family Business Strategy*, *9*(2), 107–113. https://doi.org/10.1016/j.jfbs.2018.02.001

Cuadrado-Ballesteros, B., Rodríguez-Ariza, L., & García-Sánchez, I. M. (2015). The role of independent directors at family firms in relation to corporate social responsibility disclosures. *International Business Review*, *24*(5), 890–901. https://doi.org/10.1016/j.ibusrev.2015.04.002

Dou, J., Wang, N., Su, E., Fang, H., & Memili, E. (2020). Goal complexity in family firm diversification: Evidence from China. *Journal of Family Business Strategy*, *11*(1), 100310–100312. https://doi.org/10.1016/j.jfbs.2019.100310

Fan, J. P. H., Wong, T. J., & Zhang, T. (2012). Founder succession and accounting properties. *Contemporary Accounting Research*, *29*(1), 283–311. https://doi.org/10.1111/j.1911-3846.2011.01099.x

Farhani, S., & Ozturk, I. (2015). Causal relationship between CO_2 emissions, real GDP, energy consumption, financial development, trade openness, and urbanization in Tunisia. *Environmental Science and Pollution Research International*, *22*(20), 15663–15676. https://doi.org/10.1007/s11356-015-4767-1

Farzin, Y. H., & Kort, P. M. (2000). Pollution abatement investment with environmental regulation is uncertain. *Journal of Public Economic Theory*, *2*(2), 183–212. https://doi.org/10.1111/1097-3923.00036

Giannetti, M., Liao, G., & Yu, X. (2015). The brain gain of corporate boards: Evidence from China. *The Journal of Finance*, *70*(4), 1629–1682. https://doi.org/10.1111/jofi.12198

Gomez-Mejia, L. R., Haynes, K. T., Nunez-Nickel, M., Jacobson, K. J. L., & Moyano-Fuentes, J. (2007). Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills. *Administrative Science Quarterly*, *52*(1), 106– 137. https://doi.org/10.2189/asqu.52.1.106

Hillman, A. J., & Keim, G. D. (2001). Shareholder value, stakeholder management, and social issues: What's the bottom line? *Strategic Management Journal*, *22*(2), 125–139. https://doi.org/10.1002/1097-0266(200101)22:23.0.CO;2-H

Hodges, C. W., Lin, B., & Lin, C. M. (2014). Product market competition, corporate governance, and cost of capital. *Applied Economics Letters*, *21*(13), 906–913. https://doi.org/10.1080/13504851.2014.896978

Kellermanns, F. W., Eddleston, K. A., Sarathy, R., & Murphy, F. (2012). Innovativeness in family firms: A family influence perspective. *Small Business Economics*, *38*(1), 85–101. https://doi.org/10.1007/s11187-010-9268-5

Kesidou, E., & Demirel, P. (2012). On the drivers of eco-innovations: Empirical evidence from the UK. *Research Policy*, *41*(5), 862–870. https://doi.org/10.1016/j.respol.2012.01.005

Khan, M. K., Babar, S. F., Oryani, B., Dagar, V., Rehman, A., Zakari, A., & Khan, M. O. (2022). Role of financial development, environmental-related technologies, research and development, energy intensity, natural resource depletion, and temperature in sustainable environment in Canada. *Environmental Science and Pollution Research International*, *29*(1), 622–638. https://doi.org/10.1007/s11356-021-15421-0

Lanoie, P., Laurent-Lucchetti, J., Johnstone, N., & Ambec, S. (2011). Environmental policy, innovation and performance: New insights on the porter hypothesis. *Journal of Economics & Management Strategy*, *20*(3), 803–842. https://doi.org/10.1111/j.1530-913400301.x

Li, R., & Ramanathan, R. (2020). Can environmental investments benefit environmental performance? The moderating roles of institutional environment and foreign direct investment. *Business Strategy and the Environment*, *29*(8), 3385–3398. https://doi.org/10.1002/bse.2578

Maggioni, D., & Santangelo, G. D. (2017). Local environmental non-profit organizations and the green investment strategies of family firms. *Ecological Economics*, *138*, 126–138. https://doi.org/10.1016/j.ecolecon.2017.03.026

Miller, D., & Le Breton-Miller, I. (2014). Deconstructing socioemotional wealth. *Entrepreneurship Theory and Practice*, *38*(4), 713–720. https://doi.org/10.1111/etap.12111

Miller, D., Le Breton-Miller, I., Lester, R. H., & Cannella, A. A. (2007). Are family firms really superior performers? *Journal of Corporate Finance*, *13*(5), 829–858. https://doi.org/10.1016/j.jcorpfin.2007.03.004

Murshed, M., Rashid, S., Ulucak, R., Dagar, V., Rehman, A., Alvarado, R., & Nathaniel, S. P. (2021). Mitigating energy production-based carbon dioxide emissions in Argentina: The roles of renewable energy and economic globalization. *Environmental Science and Pollution Research*, 1–20. https://doi.org/10.1007/s11356-021-16867-y

National Bureau of Statistics of China. 2018. *China Statistical Yearbook 2018*. http://www.stats.gov.cn/tjsj/ndsj/2018/indexch.htm.

Nordqvist, M., Wennberg, K., Bau, M., & Hellerstedt, K. (2013). An entrepreneurial process perspective on succession in family firms. *Small Business Economics*, *40*(4), 1087–1122. https://doi.org/10.1007/s11187-012-9466-4

Rehman, A., Ma, H., Ahmad, M., Ozturk, I., & Işık, C. (2021c). An asymmetrical analysis to explore the dynamic impacts of CO2 emission to renewable energy, expenditures, foreign

direct investment, and trade in Pakistan. *Environmental Science and Pollution Research International*, *28*(38), 53520–53532. doi:0.1007/s11356-021-14537-7.

Rehman, A., Ma, H., Ahmad, M., Ozturk, I., & Işık, C. (2021g). Estimating the connection of information technology, foreign direct investment, trade, renewable energy and economic progress in Pakistan: Evidence from ARDL approach and cointegrating regression analysis. *Environmental Science and Pollution Research International*, *28*(36), 50623–50635. https://doi.org/10.1007/s11356-021-14303-9

Rehman, A., Ma, H., & Ozturk, I. (2021b). Do industrialization, energy importations, and economic progress influence carbon emission in Pakistan. *Environmental Science and Pollution Research International*, *28*(33), 45840–45852. https://doi.org/10.1007/s11356-021-13916-4

Rehman, A., Ma, H., Ozturk, I., Murshed, M., & Dagar, V. (2021f). The dynamic impacts of CO_2 emissions from different sources on Pakistan's economic progress: A roadmap to sustainable development. *Environment, Development and Sustainability*, *23*(12), 17857–17824. https://doi.org/10.1007/s10668-021-01418-9

Rehman, A., Ma, H., Ozturk, I., & Ulucak, R. (2021a). Sustainable development and pollution: The effects of CO_2 emission on population growth, food production, economic development, and energy consumption in Pakistan. *Environmental Science and Pollution Research*, https://doi.org/10.1007/s11356-021-16998-2

Rehman, A., Ma, H., Radulescu, M., Sinisi, C. I., & Yousaf, Z. (2021e). Energy crisis in Pakistan and economic progress: Decoupling the impact of coal energy consumption in power and Brick Kilns. *Mathematics*, *9*(17), 2083. https://doi.org/10.3390/math9172083

Rehman, A., Radulescu, M., Ma, H., Dagar, V., Hussain, I., & Khan, M. K. (2021d). The impact of globalization, energy use, and trade on ecological footprint in Pakistan: Does environmental sustainability exist? *Energies*, *14*(17), 5234. https://doi.org/10.3390/en14175234

Saiia, D. H., Carroll, A. B., & Buchholtz, A. K. (2003). Philanthropy as strategy when corporate charity "begins at home". *Business & Society*, *42*(2), 169–201. https://doi.org/10.1177/0007650303042002002

Sharma, P., Chrisman, J. J., & Chua, J. H. (2003). Succession planning as planned behavior: Some empirical results. *Family Business Review*, *16*(1), 1–15. https://doi.org/10.1111/j.1741-6248.2003.00001.x

Tang, G., Li, L., & Wu, D. (2013). Environmental regulation, industry attributes and corporate environmental investment. *Accounting Research (in Chinese)*, *14*(6), 83–89.

Wang, D., Ma, G., Song, X., & Liu, Y. (2016). Political connection and business transformation in family firms: Evidence from China. *Journal of Family Business Strategy*, *7*(2), 117–130. https://doi.org/10.1016/j.jfbs.2016.05.001

Wang, Y., & Wang, Z. M. (2017). Influence of new generation succession on team performance: Evidence from China. *Social Behavior and Personality: An International Journal*, *45*(2), 281–298. https://doi.org/10.2224/sbp.6015

Wendling, Z. A., Emerson, J. W., de Sherbinin, A., Esty, D. C., et al. (2020). *2020 environmental performance index*. Yale Center for Environmental Law & Policy. epi.yale.edu.

Xu, X., Duan, L., & Yan, Y. (2019). The influence of Confucianism on corporate environmental investment: Evidence from Chinese private firms. *Sustainability*, *11*(21), 5941–20.5941. https://doi.org/10.3390/su1121

Xu, X., & Yan, Y. (2020). Effect of political connection on corporate environmental investment: Evidence from Chinese private firms. *Applied Economics Letters*, *27*(18), 1515–1521. https://doi.org/10.1080/13504851.2019.1693692

Xu, N., Yuan, Q., Jiang, X., & Chan, K. C. (2015). Founder's political connections, second generation involvement, and family firm performance: Evidence from China. *Journal of Corporate Finance*, *33*(8), 243–259. https://doi.org/10.1016/j.jcorpfin.2015.01.004

Yang, C. H., Tseng, Y. H., & Chen, C. P. (2012). Environmental regulations, induced R&D, and productivity: Evidence from Taiwan's manufacturing industries. *Resource and Energy Economics*, *34*(4), 514–532. https://doi.org/10.1016/j.reseneeco.2012.05.001

Zeng, C., Zhang, L., & Li, J. (2020). The impact of top management's environmental responsibility audit on corporate environmental investment: Evidence from China. *Sustainability Accounting, Management and Policy Journal*, *11*(7), 1271–1291. https://doi.org/10.1108/SAMPJ-09-2018-0263

Zhan, W., & Dear, K. (2017). Region and firm level determinants of environmental regulation violations: An empirical study in Chongqing, China. *Journal of Cleaner Production*, *141*, 1011–1022. https://doi.org/10.1016/j.jclepro.2016.09.090

Zimmerman, M. A., & Zeitz, G. J. (2002). Beyond survival: Achieving new venture growth by building legitimacy. *The Academy of Management Review*, *27*(3), 414–431. https://doi.org/10.2307/4134387