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RESEARCH ARTICLE

CEO tenure and environmental fraud for listed family firms

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Abstract

This paper examines CEO tenure's impact on the environmental fraud committed by listed Chinese family firms from the year 2012 to 2019. Using a bivariate probit model, we provide robust evidence that CEO tenure is positively related to the environmental fraud commission, indicating that longer-serving CEOs are more likely to violate environmental regulations and to commit fraud in the family firms. Besides, when there is a higher proportion of independent directors, CEO tenure is negatively related to the environmental fraud commission but positively related to fraud detection. Moreover, when there is a greater proportion of family members in senior positions, CEOs with longer tenure are more likely to commit environmental fraud. Our additional analysis finds that compared to non-family professional CEOs, family CEOs are more likely to commit environmental fraud. Overall, our results call for the introduction of CEO tenure limits and the increased recruitment of independent directors in family firms.

KEYWORDS

CEO tenure, environmental fraud, family CEOs, family firms, independent directors

1 | INTRODUCTION

A large number of private enterprises were formed and proliferated in China since the economic reforms in 1978, of which family businesses formed the majority. Family firms represent approximately 40% of firms in the United States and Western Europe (Jiang et al., 2020). They are also tremendously important to China's business and economic development. Recent statistics suggest that families controlled about 35% of listed firms in China by the end of 2019, and 65% of them saw revenue growth in 2019, and their contribution to national GDP has increased over the years (PWC, 2021).

China has the world's second-largest economy, with an economic output of \$14.7 trillion by the end of 2020, accounting for 18.3% of global GDP (World Bank, 2021). Nevertheless, China's fast growth has been coupled with quick rises in environmental problems. Corporate

environmental fraud occurred with increasing incidence over the past two decades.¹ Some serious environmental fraud not only caused individual health risks or corporate productivity losses but also damaged the reputation of family firms with severe financial consequences (Xu et al., 2012). Such serious consequences have prompted academic research to identify the causes of corporate environmental fraud. CEOs' characteristics are arguably one of the critical factors affecting the incidence of environmental fraud.

This study examines the relationship between CEO tenure and environmental fraud in listed family firms, as CEO tenure has a significant impact on a firm's decision-making process (Muttakin

¹Following previous literature such as Xiong et al. (2021), environmental fraud is defined as failure of a firm's activities in complying with current environmental laws and regulations. This, in turn, leads to a firm's failure to fulfil its environmental responsibility, causing pollution to the environment and reputational risks for firms. Corporate environmental fraud occurred with increasing incidence over the past two decades in China. Xu et al. (2012) classify environmental fraud in China into four major types, including exhaust gas emission, wastewater discharge, river pollution and other potential environmental risks.

Abbreviations: CEO, chief executive officer; CSR, corporate social responsibility.

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et al., 2019; Zhou et al., 2020). The early-tenure CEOs have a relatively long-term career horizon, and they are more likely to consider the long-term development of family firms (Simsek, 2007). As the tenure increases, CEOs develop stronger feelings of psychological ownership in family firms. This drives CEOs more likely to engage in risk-taking activities, for example, environmental fraud, and not comply with environmental regulations, which benefits family CEOs and members' short-term interests but sacrifices long-term benefits of family firms (Huybrechts et al., 2013; Khan et al., 2020).

With the help of a bivariate probit model, this paper investigates the role of CEO tenure in environmental fraud commission and detection for Chinese listed family firms between 2012 and 2019. It is reported that longer CEO tenure is associated with a lower likelihood of environmental fraud detection, increasing firms' propensity to engage in fraud. Moreover, the impact of CEO tenure on the environmental fraud commission is more pronounced when a greater number of family members serve in senior positions. Independent directors can effectively discipline CEOs to comply with environmental regulations. In particular, a higher proportion of independent directors is positively related to a firm's propensity to detect fraud, reducing long-serving CEOs' incentives to commit environmental fraud.

This paper is motivated by the differences between family and non-family firms and their CEOs' willingness to fulfil environmental responsibility. Correspondingly, CEO tenure's impact on environmental fraud can go in both directions. On the one hand, long-tenure family CEOs tend to consider long-term investments, and they wish family businesses could be passed to future generations. Arguably, family firms may engage in environmental protection activities to preserve their reputation (García-Sánchez, Gallego-Álvarez, & Zafra-Gómez, 2021). On the other hand, family firms might be more concerned about financial profitability because of large undiversified shares in the firms. Consequently, family founders and long-term serving CEOs have the motivation to benefit themselves at the expense of minority shareholders and other stakeholders. They may ignore environmental responsibility and even commit fraud, as environmental activities may not necessarily enhance firm value (Abeysekera & Fernando, 2020). In addition, the awareness of firm environmental responsibility is relatively weak in China compared to Western countries (Xu & Liu, 2020). Therefore, examining the association between family CEO tenure and environmental fraud has become a pressing policy concern for regulators in China.

This paper has made the following contributions. First, the ambiguity regarding the association between CEO tenure and environmental fraud is alleviated. Previous family business research from the perspective of stewardship theory argues that family firms are more likely to implement environmental and social strategies and preserve socioemotional wealth, because their CEOs are more attached to the interests and reputation of the family business (Battisti et al., 2023; Nikolakis et al., 2022). Subsequently, family members tend to attach great importance to non-financial, for example, environmental goals (Payne et al., 2011). However, we provide the opposite evidence that long-serving CEOs are more likely to collude with family firm members and overlook a firm's environmental objectives. In

particular, we find that CEO tenure is positively related to corporate environmental fraud committed by listed Chinese family firms. Moreover, when there is a greater proportion of family members serving in the senior positions of companies, the positive impact of CEO tenure on the environmental fraud commission is more pronounced. Moreover, compared to non-family CEOs, firms with family CEOs are more likely to commit environmental fraud.

Second, this paper provides new evidence on how the relationship between CEO tenure and environmental fraud can be moderated by board independence. Independent directors accumulate greater firm-specific knowledge and experience, helping family firms monitor CEOs' behaviours more effectively (Patro et al., 2018). Subsequently, we fill the literature gap by demonstrating that long-tenured CEOs are less likely to commit environmental fraud when more independent directors serve on the board.

Third, this paper extends the previous fraud studies (e.g., Chen et al., 2013; Hou & Moore, 2010) by addressing the issue of partial observability and mitigating biases caused by incomplete fraud detection. In particular, our study adopts a bivariate probit model, which allows us to consider corporate environmental fraud commission and regulatory detection, respectively (Wang et al., 2019).

The remainder of the paper is organized as follows: Section 2 introduces the context of the study, and Section 3 reviews pertinent literature and develops the research hypotheses. Section 4 describes the data selection process and research methodology. Section 5 presents and discusses the empirical results, and Section 6 concludes.

2 | CONTEXT OF STUDY: ENVIRONMENT PROTECTION AND FAMILY FIRMS

China has experienced rapid economic growth with annual growth of 7% over the past two decades. However, the problem of environmental pollution is becoming more striking (Li et al., 2022). China was by far the largest driver of energy consumption, accounting for more than three-quarters of net global growth in energy consumption in 2019 (BP, 2020). The vast consumption leads to severe air pollution and water pollution, aside from deteriorating ecological destruction (Miao et al., 2012). The environmental issues have attracted increasing attention from Chinese society and policymakers. Subsequently, great efforts have been made to tackle the environmental problems (Zhang et al., 2013). Environmental regulators have promulgated a series of laws such as the revised Environmental Protection Law to discipline firm behaviours and improve the regulatory enforcement level. With rising public environmental awareness coupled with more stringent regulatory policies, there is an increasing demand for firms to demonstrate the extent to which they are fulfilling their environmental responsibilities (Qin et al., 2019). In response, firms tend to invest more in environmentally friendly activities, thereby maintaining their social legitimacy and enhancing public image (Li et al., 2020). Yet, firms' responses to environmental concerns vary, with certain firms such as those in the oil and gas industries disclosing more environment-related information than others (Zeng et al., 2020).

China operated a centrally planned economy for nearly three decades since the founding of the People's Republic of China in 1949 (Chen et al., 2006). The private sector, wherein most family firms operate, did not exist until the *Economic Reforms and Opening-up* policy began in 1978. This policy introduced market principles, and family firms have experienced rapid growth since the implementation of this policy. Over 140,000 entrepreneurs started up family businesses in the early 1980s (Chen et al., 2021). The number of private family firms has gradually increased over the years, and they were legally recognized by the Chinese National People's Congress in 1999. In addition, family firm founders were formally allowed to apply for the communist party membership in 2002, which further increased the social status of Chinese family firm founders (Shen & Su, 2017). The private firms, notably family businesses, expanded quickly in the early 2000s and considerably boosted China's economic growth. By the end of 2017, more than 27 million private firms were in China, with a significant proportion of them being family firms (Chen et al., 2021). For the majority of Chinese family firms, they have not experienced a succession event yet. In other words, these family firms are still under the control and management of the founders' generation (Shi et al., 2019).

On the one hand, China has an imperfect legal environment, leading to relatively weak property rights protection. This can cause an expropriation effect that dominant family owners tend to expropriate minority shareholders' wealth through related-party transactions (Anderson & Reeb, 2003). In particular, family owners in China often have dominant control over their firms' operations and management. Under such a control structure, family owners and members often override CEOs in making decisions on corporate environmental strategy (Jiang & Kim, 2015). Subsequently, family decision-making procedures replace the traditional business decision-making procedures suggested by the corporate governance code (Ding et al., 2011). Managers are more likely to collude with family owners to pursue private benefits and invest less in environmental protection activities.

On the other hand, Chinese family firms are ideologically inferior and experience discrimination; thus, they are less likely to receive governmental support (Xu et al., 2019). As a result, family firms tend to fulfil more environmental responsibilities to enhance their social reputation. In this way, they can get more support from the government and reduce the negative consequences of their fraudulent behaviours (Zhang et al., 2018).

3 | LITERATURE REVIEW

3.1 | Theoretical framework

3.1.1 | Institutional theory

Most studies on environmental management have used the institutional theory (An et al., 2016; Huang et al., 2022). Classical institutional theorists have highlighted external forces and constraints imposed on firms and the advisability of compliance with environmental protection practices. Firms exhibiting good environmental

performance can gain legitimacy in this institutional field (Bansal, 2005). In addition, environmentally legitimate firms are more likely to isolate themselves from public scrutiny, reducing the risks of social penalties (Godfrey, 2005). Gaining legitimacy also enables firms to have better access to resources (Bansal & Clelland, 2004), especially financial resources that family firms are eager to obtain (King & Lenox, 2002; Wang & Bansal, 2012).

Two offsetting impacts may affect family firms' strategic orientations to institutional procedures. The first is institutional change, which happens due to firms' responses to contingency shifts arising from internal or external events. For instance, firms' incentives to conform to environmental legitimacy might be driven by evolutionary procedures within or centralized mandates across the firms. The second is institutional inertia, which leads to firms failing to comply with environmental regulations because they cannot perceive a net benefit (Chen et al., 2016). Institutional inertia tends to persist as long as the expected returns from fraud do not exceed the costs of committing fraud. Consistent with the 'institutional inertia' view, Campopiano and De Massis (2015) find that family firms are less compliant with Global Reporting Initiative Standards.

3.1.2 | Entrenchment theory

With greater family control, family members are more likely to interfere with the way that a firm is managed. As a result, family members and firm managers are more likely to extract private benefits of control, thus increasing managerial entrenchment and expropriating shareholders' interests (Anderson & Reeb, 2003). Evidently, El Ghoul et al. (2016) suggest that family owners are more likely to use their dominant voting rights to pressure managers to divert resources from corporate socially responsible (CSR) activities to other activities that can meet family needs over stakeholders' needs. In fact, one way of maintaining control is for the family to pass ownership or control to family members or to non-family members who can serve at the best interests of the controlling family. This approach provides family members with privileges that may lead to poor monitoring effectiveness over the managerial decision-making process and further promote managerial entrenchment (Minichilli et al., 2014).

Compared to non-family firms, family firms' owners often have considerable and under-diversified shareholdings, making them face potential risks, for example, price discounting about outside investors' perceptions of family owner entrenchment (Moore et al., 2017). Powerful entrenched CEOs in family firms generally have less concerns about effective risk management mechanism. Their power positions enable them to pursue risky operating objectives. In addition, entrenched CEOs are more likely to resist external pressure of pursuing social and environmental responsibility (Tan & Liu, 2016). Subsequently, it leads to higher risks of committing environmental fraud in the pursuit of short-term financial benefits (Tsai et al., 2009).

CEOs play a critical role in shaping firm environmental practices (Delmas & Toffel, 2008). The roles of CEOs differ from other managerial roles, as a CEO is the most critical member of a firm's management

team and has a significant impact on formulating corporate environmental policies (Chen et al., 2021). This is especially the case for entrenched CEOs, as their powerful positions may damage the effectiveness of board monitoring, thus affecting boards' decisions such as the approval of corporate environmental spending. In this regard, the engagement of environmental protection activities becomes a part of their strategy only if it helps the family firms gain financial profits (Khan et al., 2020). There are also studies arguing that entrenched CEOs need to protect themselves from influential stakeholders. As a result, CEOs may fulfil environmental responsibility in order to gain stakeholder satisfaction. However, in practice, most CEOs tend to give higher priority to meeting controlling families' goals rather than stakeholders' goals to preserve their positions (Arena & Michelin, 2018).

3.1.3 | Stewardship theory

Stewardship theorists hold the view that family CEOs act as stewards and are committed to the interests of owners and business goals, which would, in turn, have a positive impact on the performance of family firms (Nikolakis et al., 2022). Family CEOs' behaviours are based on an intrinsic desire to serve the firms; thus, they are in line with shareholders' interests. In addition, family-owned business fosters a sense of belonging, shared identity, interpersonal trust, and social capital within the family firms. Trustworthiness and the binding ties as family resources unite and motivate family CEOs to serve as stewards of their organizations and prioritize the goals of firms over their own (Zahra, 2003). Subsequently, family CEOs as stewards are more likely to adhere to ethical principles and make decisions that would benefit the long-term development of the firms (Pieper, 2010). Consistent with this view, Battisti et al. (2023) find that family firms tend to be more socially and environmentally responsible than non-family firms because of the presence of stewards.

3.2 | Hypothesis development

3.2.1 | CEO tenure and environmental fraud

A family CEO has greater power with increased tenure, making his or her position more entrenched (Ryan & Wiggins, 2001). The rationale behind this is that CEO tenure reflects a CEO's control over the business. Early in CEOs' tenure, they have relatively less power and limited influence over the operation of the business. The longer they serve as a CEO, the more influence they can exert over organizations (Huybrechts et al., 2013). Given the excessive power that long-serving family CEOs have, they are more likely to take advantage of their controlling positions to engage in opportunistic activities at the expense of minority shareholders (Ali et al., 2007). Some previous evidences suggest that long-serving CEOs lead to excessive firm risk-taking, poor internal control quality, and declining firm value (Taylor, 2010). This further increases CEO entrenchment, making decisions that

benefit themselves or controlling families instead of minority shareholders. Consequently, they are less likely to comply with environmental regulations and more likely to commit environmental fraud.

Traditionally, family firms often select the child with the best quality of business and management as their choice for succession. However, the enactment of the one-child policy in China interrupts family succession, as it directly reduces the number of qualified heirs that can be selected for secession (Cao et al., 2015). Recent studies suggest that family firms are increasingly facing human capital challenges relating to within-family succession (Cao et al., 2015). This problem is further exaggerated as there is a lack of separation of ownership rights and control in some small and medium family firms. Regarding environmental protection activities, with unqualified CEOs, the longer-tenure CEOs from family firms could opportunistically decrease corporate environmental spending and not comply with the relevant environmental standards, given the reduced incentives to assure environmental legitimacy and the 'green' reputation of the firms. These long-tenured CEOs tend to favour short-term family financial benefits. Consequently, they have more incentives to engage in environmental fraud (Liu, 2018).

In terms of fraud detection, long-serving CEOs with excessive decision-making power hinder the speedy detection of fraudulent activities. The board of supervisors, who are supposed to play an effective check and balance role, are less willing to challenge family CEOs' decision-making or blow-whistle to environmental regulators, due to concern about CEOs' threat of withdrawal of benefits or potential retaliation (Wang et al., 2019). This entrenchment drives CEOs to take more risks. Moreover, long-tenured CEOs in family firms are more likely to build political connections with local regulators (You & Du, 2011), making it difficult for regulatory investigation and fraud detection. Therefore, we develop our hypothesis as follows:

H1. CEO tenure is positively related to the likelihood of fraud commission and negatively related to the likelihood of fraud detection.

3.2.2 | CEO tenure, environmental fraud, and board independence

We further argue that independent directors could play a moderating role between CEO tenure and environmental fraud. The roles of independent directors have two main dimensions, including providing a counterbalance to CEOs and other executive directors and contributing to the leadership and development of the firms, which are important for the success of the family firms (Conyon & He, 2011). Independent directors are more objective than executive directors, and a high proportion of independent directors are an essential control mechanism, leading to an increase in the quality of board vigilance (Cuadrado-Ballesteros et al., 2015). Recent research has supported that independent director supervision can effectively deter the manipulation of earnings and managerial opportunistic behaviours (Agrawal & Chadha, 2005). Underperforming CEOs are at a higher risk

of being dismissed if firms have a high proportion of independent directors (Pi & Lowe, 2011). Such career-related concern is more prevalent when board independence increases. Subsequently, CEOs' incentives to engage in environmental protection activities increase in their early service years.

Literature also suggests that when there is a strong independent board, longer-serving CEOs are more likely to protect themselves and shareholders and maintain their reputation as top executives (Muttakin et al., 2019). This is consistent with the notion that independent directors' experience and knowledge can discipline CEOs' behaviours and improve board monitoring, putting pressure on longer-tenured CEOs to comply with environmental standards. In this regard, independent directors can contribute to public accountability by ensuring that long-tenured CEOs are not involved in unethical environmental violations (García-Sánchez, Martín-Moreno, et al., 2021). Evidently, Conyon and He (2011) find that a more independent board reduces the likelihood of CEO entrenchment by exercising more effective monitoring roles. In addition, independent directors play a liaison role between the board of directors and external stakeholders, for example, environmental groups or regulators. They tend to consider the demands of stakeholders and actively monitor CEOs' behaviours (Chau & Gray, 2010). Moreover, a greater number of independent directors have the knowledge and expertise to stand up against entrenched CEOs for violations. Some independent directors sit on the sustainability committee, which allows them to further blow whistles to environmental regulators (Wang et al., 2019). Consequently, with a more significant proportion of independent directors, long-tenured CEOs are less likely to commit environmental fraud, fostering the possibility of fraud detection. Therefore, we posit the following hypothesis:

H2. When there is a higher proportion of independent directors, CEO tenure reduces fraud commission but increases fraud detection.

3.2.3 | CEO tenure, environmental fraud, and family member involvement

In this section, we examine the impact of long-tenured CEOs on environmental fraud if they work in family firms with more family members serving in senior positions. From a stewardship perspective, family CEOs are not motivated by individual goals. They are stewards whose incentives align with their principals' objectives (Battisti et al., 2023). In this regard, family CEOs are viewed as both principals and agents who are motivated to uphold the family business and promote the long-term development of the firm (Deephouse & Jaskiewicz, 2013). In addition, they are more likely to value socioemotional wealth, for example, the firms' non-financial objectives, such as good reputation, smooth succession, and objectives related to sustainability. Subsequently, with more family members serving in senior positions, family firms might be more sustainable-oriented and less likely to engage in environmentally irresponsible practices (Nikolakakis et al., 2022).

Nevertheless, the greater the degree of family involvement, the more likely for family firms to pursue financial objectives over non-financial objectives (Chen & Hsu, 2009). Family members who serve in the senior positions may discourage corporate environmental spending, as it may negatively affect family members' wealth (Chrisman & Patel, 2012). In this regard, with substantial family involvement, CEOs become passive in running the business, and board members are unwilling to replace the underperforming CEOs (Rachpradit et al., 2012). CEOs may collude with family members and consider short-term financial interests, which cause long-term environmental damages (Chen & Hsu, 2009).

When more family members serve as senior management, CEOs are pressured to make strategic decisions. That is, family members can impact firms' environmental policies to meet their interests (Morck et al., 1988). Under this circumstance, family owners have more incentives to maintain weaker internal controls, thereby extracting private benefits from non-family shareholders (Chen et al., 2020). Prior studies such as Bardhan et al. (2015) find that family firms with a high level of family member involvement are more motivated to seek corporate financial goals over social and environmental goals. Subsequently, family members may draw resources away from environmental projects, and family firms are less likely to comply with environmental regulations. Therefore, we develop our hypothesis as follows:

H3. The positive impact of CEO tenure on the fraud commission is more pronounced when a greater proportion of family members serve in senior positions.

4 | DATA AND METHODOLOGY

4.1 | Data and variables

Our research data include all the family firms² listed on China's two stock exchanges, that is, Shenzhen and Shanghai Stock Exchanges between 2012 and 2019. We hand-collected environmental fraud cases, which are based on the sanction reports issued by the environmental regulators and downloaded from the central and regional Environment Protection Bureau websites. Corporate governance, firm characteristics and financial performance data are obtained from the China Stock Market & Accounting Research (CSMAR) database. The final sample consists of 7004 firm-year observations.

Our dependent variable is the environmental fraud commission, which is a dummy variable that equals one if a family firm commits fraud and zero otherwise. To implement the bivariate probit model,

²There are variations in the definition of a Chinese family firm, but a general agreement is that family owners can exercise decisive power on key internal control, governance choices and strategies of the family firms (Li et al., 2021). This is especially the case in China as majority of the family firms are still under control of the founders' generation. Ding et al. (2011) define a Chinese family firm as a firm that is controlled by a private person, and his or her family has impact on the operation of business through direct shareholding or a pyramid shareholding structure.

another dummy variable relating to fraud detection is introduced. Fraud detection equals one if a family firm is subject to a punishment imposed by an environmental regulator and zero otherwise. To examine [Hypothesis 1](#), CEO tenure is included, and it is defined as the number of years that the CEO has served in this position. To test [Hypothesis 2](#), an interaction variable CEO tenure * Independence is created. Independence refers to a firm's proportion of independent directors on the board of directors. Likewise, to test [Hypothesis 3](#), an interaction variable CEO tenure * family member is created. Family member refers to the number of family members who work in the senior positions of a family firm, that is, firm directors or managers. These independent variables are included in both fraud commission and fraud detection models.

Control variables related to the propensity of fraud commission are included. First, CEO duality is included as CEOs who are also chairmen could have more power, and employees are less likely to challenge their decisions; therefore, they may engage in environmental violations (Aggarwal et al., 2015). Board size is included, as a large board may lead to ineffective monitoring of management due to communication problems among board members. Consequently, CEOs may exercise greater control over the board and engage in environmental fraud (Persons, 2006). Board meeting is included, as more frequent board meetings presumably result in a higher level of oversight, resulting in fewer opportunities for fraud (Wang et al., 2019). Big four accounting firms are controlled as large accounting firms are more effective in disciplining CEOs (Lisic et al., 2015). Audit opinion is controlled, which equals one if a firm receives a standard audit opinion by its auditor and zero if a firm receives a modified audit opinion. Chen et al. (2013) find that the issuance of modified audit opinions helps regulators and investors deter directors from committing fraud. As institutional investors have a strong motivation to monitor a firm's environmental performance (Harjoto et al., 2017), the proportion of institutional ownership is added as a control variable. Moreover, we control family ownership, which is defined as the proportion of outstanding shares held by family shareholders.

On the detection side, following Wang (2013), we mainly include financial performance variables, including firm size, return on assets (ROA), Tobin's Q, and firm annual stock returns. Firm size is controlled as larger firms are more likely to be subject to greater regulatory scrutiny (Wang et al., 2019). ROA as a firm's financial performance predictor is controlled because firms with abnormal financial performance are more likely to attract attention from the regulators (Shi et al., 2020). Tobin's Q and stock returns are also controlled to predict the propensity of fraud detection, as firms with better performance in the capital market are more likely to be stakeholder orientated and are less likely to attract regulatory attention (Wang & Zhang, 2020). Firm leverage is controlled on both commission and detection sides, as firms with higher leverage are more likely to commit fraud for the pursuit of short-term financial interests. Subsequently, highly leveraged firms are more closely monitored by regulators (Khanna et al., 2015; Wang et al., 2019). Table 1 summarizes the definitions of all variables.

TABLE 1 Variable definitions.

Variable type	Variable name	Definition
Dependent variable	Environmental fraud	A dummy variable equals to one if a family firm commits environmental fraud and zero otherwise
Main variables	CEO tenure	The number of years that a CEO has served in the position
	Independence	A firm's proportion of independent directors on the board of directors
	Family member	The total number of family members work in the senior position of a family firm i.e., firm directors or managers.
Control variables	Duality	A dummy variable equals to one if a CEO also serves as the chairman and zero otherwise
	Meeting	The number of board meetings held annually
	Big4	A dummy variable equals to one if a firm recruits one of the big four accounting firms and zero otherwise
	BD size	The number of the board of directors
	Opinion	A dummy variable equals to one if a firm obtains a standard audit opinion by its auditor and zero otherwise
	Institution	The proportion of outstanding shares held by the institutional shareholders
	Family ownership	The proportion of outstanding shares held by the family shareholders
	Leverage	The ratio of total liabilities to a company's total assets
	Firm size	Natural logarithm of a company's total assets
	ROA	The ratio of net profits to total assets
	Tobin's Q	The ratio of the market value of common equity divided by the book value of total assets
Stock returns	Annual firm stock returns (with cash dividend reinvested)	

4.2 | Research model

To address partial observability, we use the bivariate probit model as suggested by Wang (2013). The detected environmental fraud is modelled as a function of the joint realizations of the two latent variables: fraud commission and fraud detection. F_i^* denotes the firm i 's probability to commit environmental fraud, and D_i^* represents the firm i 's

probability of detection conditional on the firm i committing environmental fraud. The reduced form model is given as below:

$$F_i^* = x_{F,i}\beta_F + u_i \quad (1)$$

$$D_i^* = x_{D,i}\beta_D + v_i \quad (2)$$

$x_{F,i}$ is a set of variables that explain firm i 's propensity to commit environmental fraud, and $x_{D,i}$ contains variables that explain firm i 's potential for getting detected. u_i , v_i are zero-mean disturbances with a bivariate normal distribution. The variances are normalized to unity as these cannot be estimated, and the correlation between u_i and v_i is assessed to be ρ .

For the environmental fraud commission, F_i^* is transferred into a binary variable F_i , where $F_i = 1$ if $F_i^* > 0$, and $F_i = 0$ otherwise. For fraud detection, D_i^* is transformed into a binary variable D_i , where $D_i = 1$ if $D_i^* > 0$, and $D_i = 0$ otherwise. Instead of directly observing D_i and F_i , we observe Z_i , which is an interaction term between D_i and F_i , where

$$Z_i = F_i * D_i \quad (3)$$

$Z_i = 1$ if the firm i has committed environmental fraud and has also been detected. $Z_i = 0$ if the firm i has not committed environmental fraud, or firm i has committed environmental fraud but has not been detected. The empirical model for Z_i is as follows:

$$P(Z_i = 1) = P(F_i D_i = 1) = P(F_i = 1, D_i = 1) = \Phi(x_{F,i}\beta_F, x_{D,i}\beta_D, \rho) \quad (4)$$

$$P(Z_i = 0) = P(F_i D_i = 0) = P(F_i = 0, D_i = 0) + P(F_i = 1, D_i = 0) = 1 - \Phi(x_{F,i}\beta_F, x_{D,i}\beta_D, \rho) \quad (5)$$

where Φ is the bivariate standard normal cumulative distribution function. Full identification of the model parameters requires that $x_{F,i}$ and $x_{D,i}$ in the equations cannot include the same set of factors. The equations can be then estimated by using the maximum-likelihood method with the log-likelihood function:

$$L(\beta_F, \beta_D, \rho) = \sum_{z_i=1} \log(P(Z_i = 1)) + \sum_{z_i=0} \log(P(Z_i = 0)) = \sum_{i=1}^N \left\{ z_i \log[\Phi(x_{F,i}\beta_F, x_{D,i}\beta_D, \rho)] + (1 - z_i) \log[1 - \Phi(x_{F,i}\beta_F, x_{D,i}\beta_D, \rho)] \right\} \quad (6)$$

5 | RESULT ANALYSIS

5.1 | Descriptive statistics

Descriptive statistics are presented in Table 2 (Panel A). On average, the CEO tenure is 4.359 years, and 34.8% of CEOs have dual

positions. About 3.254 family members serve in the senior positions of listed family firms. In addition, the board of family firms has 8.31 directors on average, and 19.1% of the family firms have hired big four auditors. The features of fraudulent versus non-fraudulent family firms are also compared. The average CEO tenure for the fraud subsample is 4.472 and 4.359 for the non-fraud subsample. This indicates that CEO tenure is longer in the fraudulent firms. Likewise, on average, fraudulent firms have 3.575 family members serving in senior positions, which is higher than non-fraudulent firms that have 3.251 family members serving in senior positions. Moreover, compared to the fraudulent firms, non-fraudulent firms have a relatively high proportion of independent directors serving on the board. Non-fraudulent firms are larger in board size. For financial performance, fraudulent family firms have worse stock returns and lower Tobin's Q than the non-fraudulent family firms. The variance inflation factor (VIF) test is also conducted. The result shows that the mean VIF value is 2.92, indicating that multicollinearity is not a concern for our study.

Panel B presents the types and incidences of environmental fraud cases in our study. Sixty-five listed family firms committed environmental fraud based upon the punishments released by the environmental regulators in our sample. Among these cases, most listed family firms have failed to comply with environmental laws or regulations, such as the *Environmental Protection Law*; the *Water Pollution Prevention and Control Law*; the *Law of the Prevention and Control of Environmental Pollution by Solid Waste*; and the *Regulations on Environmental Management of Construction Project*. As shown in Panel B, we divide the environmental fraud cases of listed family firms into four major types, including wastewater discharge, exhaust gas emission, hazardous solid waste disposal, and potential environmental risks. Twenty listed family firms (30.8%) received administrative penalties related to wastewater discharge violations. In particular, 10 firms discharged sewage illegally, and another 10 firms engaged in high pollutant emission violations; that is, the concentrations of PH value, fluoride, CODcr, and petroleum exceeded the national standard in the test sample of production wastewater discharged by these family firms. There were also 20 listed family firms (30.8%) involved in exhaust gas emission violations. Specifically, eight firms discharged exhaust gases illegally; another eight firms discharged exhaust gases including hydrogen chloride and nitrogen oxide; and four firms committed dust pollution violations. Punishments were also imposed on five listed family firms (7.7%) that illegally disposed of hazardous solid waste. For instance, family firms stacked hazardous waste in the open air or failed to instal distinguishing marks of hazardous waste. Lastly, 20 listed family firms (30.8%) committed violations relating to causing potential environmental risks since their equipment failed to pass environmental protection assessments of the construction projects.

5.2 | Main results

Our main results are presented in Table 3. Model 1 shows that the coefficient of CEO tenure is significantly positive in the fraud commission model while significantly negative in the detection model. The

TABLE 2 Descriptive statistics.

Panel A: Summary statistics and comparison between fraud and non-fraud firms				
Variables	Full sample	Non-fraud firms	Fraud firms	Mean difference
CEO tenure	4.359	4.359	4.472	-0.113
Independence	0.375	0.375	0.372	0.003
Family member	3.254	3.251	3.575	-0.324
Environmental fraud	0.007	0	1	1
Duality	0.348	0.348	0.340	0.008
Meeting	10.037	10.040	9.840	0.198
Big4	0.191	0.191	0.220	-0.029
BD size	8.309	8.310	8.120	0.190
Opinion	0.963	0.963	0.960	0.003
Institution	0.275	0.275	0.284	-0.009
Family ownership	0.352	0.341	0.368	-0.027
Leverage	0.416	0.416	0.369	0.047
Firm size	21.878	21.880	21.990	-0.111
ROA	0.035	0.034	0.042	-0.008
Tobin's Q	2.871	2.877	2.006	0.870
Stock returns	0.175	0.176	0.022	0.154*
Panel B: Types of environmental fraud				
Environmental fraud types	Number of cases			
Wastewater discharge violation events	20			
Illegal sewage discharge	10			
High pollutant emission level	10			
Exhaust gas emission violation events	20			
Illegal exhaust gas discharge	8			
High pollutant emission level	8			
Dust pollution	4			
Hazardous solid waste disposal violation events	5			
Potential environmental risks	20			
Restoration actions failed environment assessment	19			
Permission expired	1			

*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

finding is consistent with our H1, which indicates that CEOs with a long service history have more power and fewer career-related concerns. Consequently, they are more likely to violate environmental regulations and commit fraud in family firms.

Model 2 exhibits the results of the moderating effect played by the independent directors. The interaction terms between CEO tenure and independent director proportion flip signs in both the commission and detection equations. The results support the H2 that independent directors can mitigate the negative impact of long-serving CEOs on corporate environmental practices. This is consistent with the argument in Muttakin et al. (2019) that independent directors have incentives to conduct effective monitoring and are more likely to cooperate with external regulators to discipline managerial opportunistic behaviours; thus, long-tenured CEOs are less likely to commit environmental fraud.

Model 3 presents the results for Hypothesis 3. We use an interaction variable 'CEO tenure*Family member' to capture whether the impact of CEO tenure on environmental fraud is shaped by family members' involvement. A positive coefficient of the interaction variable in the fraud commission model and a negative coefficient in the fraud detection model are reported.³ In other words, long-tenured CEOs are more likely to commit environmental fraud when there are a greater number of family members serving in senior positions of family firms. In addition, with greater senior family members' support, long-serving CEOs can reduce the speedy detection of fraudulent activities. This is because family members who serve in senior positions are more likely to collude with long-serving CEOs; and use their positions to extract the benefits from nonfamily shareholders and hide

³The results for marginal effect analysis are available upon request.

TABLE 3 Regression results.

Variables	Model 1		Model 2		Model 3	
	P(F)	P(D F)	P(F)	P(D F)	P(F)	P(D F)
CEO tenure	0.112*** (0.024)	-0.055*** (0.008)	0.035*** (0.006)	-0.453*** (0.083)	0.128*** (0.039)	-0.039*** (0.007)
Independence			-0.443*** (0.028)	0.392*** (0.056)		
Family					0.855*** (0.066)	-0.344*** (0.059)
CEO Tenure * Independence			-0.537*** (0.029)	0.366*** (0.096)		
CEO Tenure * Family member					0.428*** (0.039)	-0.499*** (0.026)
Duality	0.503*** (0.010)		0.383*** (0.017)		1.077*** (0.208)	
Meeting	-0.036*** (0.008)		-0.029*** (0.003)		-0.040*** (0.006)	
Big4	-0.113*** (0.042)		-0.143*** (0.030)		-0.827** (0.380)	
BD size	-0.125*** (0.008)		-0.039*** (0.004)		-0.076*** (0.006)	
Opinion	-0.292*** (0.065)		-0.423*** (0.040)		-0.309* (0.091)	
Institution	-0.546*** (0.051)		-0.157* (0.062)		-0.893*** (0.093)	
Family ownership	0.408*** (0.047)		0.476*** (0.048)		0.299*** (0.025)	
Leverage	-1.615*** (0.049)	0.558*** (0.083)	-0.455*** (0.070)	0.638*** (0.126)	-2.369*** (0.214)	0.653*** (0.131)
Firm size		-0.239*** (0.023)		-0.059*** (0.022)		0.133*** (0.025)
ROA		-0.226*** (0.031)		-0.886*** (0.192)		-0.882*** (0.174)
Tobin's Q		-0.303*** (0.033)		-0.777*** (0.212)		-0.123*** (0.040)
Stock returns		-0.382*** (0.033)		-0.643*** (0.168)		-0.538*** (0.035)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Rho		6.087*** (0.816)		8.576*** (0.924)		8.879*** (1.107)
Observations	7004	7004	7004	7004	4624	4624

Note: P(F) is the probability of environmental fraud commission, and P(D|F) is the probability of detection conditional on environmental fraud commission. All variables are defined in Table 1.

*** $p < .01$, ** $p < .05$, and * $p < .1$.

bad news from regulators. Consequently, long-serving CEOs may overlook the environmental issues and engage in fraudulent practices when facing strong pressures from the involvement of family members (Krishnan & Peytcheva, 2019).

Turning to the corporate governance and financial control variables,⁴ the results are similar to the prior findings (e.g., Shi et al., 2020; Wang et al., 2019). CEO duality is positively associated with fraud commission, implying that CEOs with dual positions have more power and are more likely to commit environmental fraud. The coefficients of institutional ownership are negative and statistically significant, indicating when institutional investors own a significant proportion of a firm's shares, the propensity of firms committing environmental fraud is significantly lower. The coefficients of Tobin's Q are negative. This indicates that the likelihood of fraud detection is significantly higher for firms with lower Tobin's Q.

5.3 | Additional analysis: Family CEOs versus non-family CEOs

This section examines the relationship between CEO tenure and environmental fraud while considering the differences between family CEOs and non-family CEOs. We argue that compared to non-family CEOs, family CEOs are more likely to commit environmental fraud when they serve in organizations for a longer period. Within-family succession is a tradition for most Chinese family firms due to the imperfect legal environment and relatively weak corporate governance mechanisms (Cao et al., 2015). The heir is often identified and cultivated internally to fill in leadership roles to maintain dynastic management. Recent studies suggest that Chinese family firms are more likely to appoint CEOs and senior managers internally rather than externally, regardless of the talents and qualifications of heirs. Consequently, family CEOs have less willingness to fulfil environmental responsibilities, and they may abuse voting power to divert firms' CSR resources to other projects that can benefit them financially (Zona, 2016). In contrast, non-family professional CEOs are more likely to comply with relevant environmental standards, and they may want to engage in CSR practices to enhance their reputation and improve the dialogue with corporate stakeholders. In addition, professional non-family CEOs can provide independent thinking to the organizations, especially when key family members are advocates of a particular view (Gavana et al., 2017). As such, for family CEOs, the longer time they stay in power, the more likely they tend to favour short-term family financial interests and overlook the environmental responsibilities they need to fulfil (Cao et al., 2015).

⁴As family firms may be subject to financial pressure stemming from third parties' expectations, long-tenured CEOs may overwhelmingly pursue financial interests and commit environmental fraud. Therefore, we re-estimate Table 3 by including financial performance variables (i.e., leverage, firm size, margin, ROA, Tobin's Q, and stock returns) in both fraud commission and detection equations. The results are presented in Appendix A, which are consistent with our baseline findings.

To empirically test this proposition, we divide the sample into two groups, including firms with family CEOs and those with professional non-family CEOs and re-estimate the regression models. The results are reported in Table 4, and they are in line with our expectations. In particular, for the firms with family CEOs, a positive coefficient of CEO tenure in the fraud commission model and a negative coefficient in the fraud detection model are reported. In contrast, there is no relationship between CEO tenure and fraud commission or detection in the group of non-family CEOs. An explanation for this is that non-family CEOs tend to feel attached to family firms as they work longer period with family members, for example, developing feelings of belonging and psychological ownership towards the family firms (Pierce et al., 2001). In addition, as non-family CEOs' tenure increases, they will also have a higher degree of familiarity with family culture and networks (Chen & Hsu, 2009). As a result, their professionalism is damaged, and they may tend to ignore the environmental responsibilities that firms should perform.

5.4 | Robustness check

5.4.1 | Addressing endogeneity

One potential concern is that there could be some omitted variables that are related to CEO tenure and the probability of environmental fraud. To address the endogeneity issue, we carry out a two-stage least square (2SLS) estimation. According to Khan et al. (2020), one valid instrumental variable (IV) choice is the lagged industry average of CEO tenure, which could directly impact firms' CEO tenure, while not correlating with the likelihood of environmental fraud. Second, in the spirit of Li and Wahid (2018), we use the cost of living per province as the second instrument. This IV is measured as the ratio of average house price to average income. The rationale is that there will be fewer professionals to draw upon for director roles for a longer period, if a firm is located in a more expensive region. Subsequently, we may expect that the cost of living negatively affects CEO tenure. Meanwhile, the cost of living is unlikely to affect a family firm's propensity to commit fraud and its likelihood of being detected by regulators.

The results are reported in Table 5. Regarding the relevance and strength of the instruments, the industry average CEO tenure ($\beta = .842, p < .001$) and the cost of living ($\beta = -.045, p < .001$) are highly correlated to CEO tenure, satisfying the non-weakness requirements. In addition, the Cragg–Donald's Wald F statistic (40.83) is well above the Stock–Yogo weak identification tests of 10% critical values (19.93), suggesting that we can support the strength of the IVs (Stock & Yogo, 2005). Moreover, we have conducted the Sargan–Hansen tests to examine the validity of our IVs. The p value of the Sargan–Hansen statistics is above .1 in the first stage (p value is .178), implying that two IVs are not correlated with the error terms (Wang et al., 2021). The predicted CEO tenure in the second stage is significantly positive in the commission model and negative in the detection model, which shows the same signs as our baseline results. Therefore, our results are robust when accounting for the endogeneity.

TABLE 4 Additional analysis: Family CEOs versus non-family CEOs.

Variables	Family CEOs		Non-family CEOs	
	P(F)	P(D F)	P(F)	P(D F)
CEO tenure	0.377*** (0.002)	-0.051*** (0.004)	0.005 (0.019)	-0.026 (0.023)
Duality	0.537*** (0.045)		0.699*** (0.072)	
Meeting	-0.053*** (0.007)		-0.057*** (0.004)	
Big4	-0.237*** (0.041)		-0.198** (0.053)	
BD size	-0.247*** (0.017)		-0.185*** (0.021)	
Opinion	-2.213*** (0.069)		-1.594*** (0.382)	
Institution	-0.832*** (0.175)		-0.773*** (0.147)	
Family ownership	0.689*** (0.039)		0.376*** (0.048)	
Leverage	-0.568*** (0.071)	0.721*** (0.022)	-0.716*** (0.058)	0.861*** (0.262)
Firm size		-0.230*** (0.005)		-0.179*** (0.008)
ROA		-0.204* (0.088)		-0.384*** (0.032)
Tobin's Q		-0.100*** (0.004)		-0.282*** (0.064)
Stock returns		-0.014 (0.009)		-0.0618*** (0.007)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Rho		8.838*** (1.002)		12.690*** (0.664)
Observations	3916	3916	3088	3088

Note: Family CEO is defined as a dummy variable that equals to one if the CEO is recruited from the family members and zero if the CEO is recruited externally. P(F) is the probability of environmental fraud commission, and P(D|F) is the probability of detection conditional on environmental fraud commission. All variables are defined in Table 1.

*** $p < .01$, ** $p < .05$, and * $p < .1$.

5.4.2 | Alternative measure of dependent variable

Third, we show that our result is robust to an alternative measure of the dependent variable. In particular, we use 'corporate environmental spending' to replace 'environmental fraud' to examine the impact of CEO tenure on corporate environmental spending. Specifically, we hand-collect firms' environmental spending from corporate environmental responsibility reports and use its natural logarithm value as our alternative dependent variable. We subsequently run a fixed effect panel regression. The coefficient of CEO tenure is negatively

significant at the 1% level in model 1 (Table 6), indicating that long CEO tenure is associated with unsatisfactory environmental performance, that is, less environmental spending.

5.4.3 | CEO tenure and environmental fraud: Industrial heterogeneity

Fourth, we investigate the heterogeneous impact of CEO tenure on environmental violations at the industry level. Based on the China

Instrumental variable regression			
	1st stage	2nd stage	
Variables	CEO tenure	Fraud P(F)	P(D F)
Industry mean CEO tenure	0.842*** (0.092)		
Cost of living	-0.045*** (0.015)		
CEO tenure predicted		0.959*** (0.056)	-0.101*** (0.032)
Other variables	Controlled	Controlled	Controlled
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Log-likelihood		-259.413	
Rho			23.686*** (0.092)
F statistics (IVs)	17.60		
Sargan statistic (<i>p</i> value)	0.178		
Cragg-Donald (CD) Wald <i>F</i> statistic	40.83		
Stock and Yogo (2005) (10% maximum IVs)	19.93		
Observations	7004	7004	7004

Note: Table 5 reports the instrumental variable regression results. The endogenous variable is CEO tenure. The instrumental variables are lagged industry mean CEO tenure and the cost of living per province. The classification of the industry is based on the China Securities Regulatory Commission Industrial Classification Guideline (2012). Cost of living is defined as the ratio of average house price to average income in each province. Column 1 reports the first-stage estimation results, and Columns 2 and 3 report the second-stage results. P(F) is the probability of environmental fraud commission, and P(D|F) is the probability of detection conditional on environmental fraud commission.

****p* < .01, ***p* < .05, and **p* < .1.

Securities Regulatory Commission (2012) Industrial Classification Guideline, we divide all the industries into the high-polluting and low-polluting sectors. Model 2 (Table 6) shows that the interaction term of the high-polluting industry dummy and CEO tenure is negative in the commission equation and positive in the detection equation. It demonstrates that firms with long-serving CEOs are less likely to commit environmental fraud and more likely to attract regulatory attention among firms in the heavy-polluting sector. In other words, the heavy-pollution industry attracts greater attention from regulators, the media and the public. Subsequently, with stronger pressures and monitoring, long-tenured CEOs have fewer opportunities to commit environmental fraud.

5.4.4 | CEO tenure and environmental fraud: Firm and CEO level heterogeneity

Fifth, we examine the impact of CEO tenure on environmental fraud while considering the number of years that firms have been established. The results are presented in model 1 (Table 7). The coefficient of the interaction variable is significantly positive in the fraud commission equation and significantly negative in the fraud detection

TABLE 5 Robustness tests: Addressing endogeneity.

equation. It shows that the positive impact of CEO tenure on the environmental fraud commission is more pronounced in the long-established family firms. This finding is similar to Amankwah-Amoah (2016)'s argument that older family firms are more likely to violate regulations than younger start-ups because of high-cost pressure resulting from redundant organizational structures in the face of sinking turnover or weakened financial profit margins in the rapidly changing industries.

Sixth, according to Troy et al. (2011), CEOs' demographic factors such as degrees affect their propensity to engage in fraud. Thus, we examine how CEOs' business educational background (i.e., their majors at colleges or universities) affects the relationship between their tenure and the propensity of fraud. An indicator variable CEO major is created, which equals to one if a CEO had his or her college or university degree in accounting, finance or business fields and zero otherwise. The results are presented in model 2 (Table 7). A positive coefficient of the interaction variable (CEO Tenure * CEO major) in the fraud commission model and a negative coefficient in the fraud detection model are observed. That is, the positive impact of CEO tenure on environmental fraud in family firms is more pronounced when CEOs majored in accounting, finance or business programmes. Our finding is consistent with Daboub et al. (1995) and Mun et al.'s

TABLE 6 Robustness tests:
Alternative dependent variable and
industrial heterogeneity.

Variables	Model 1	Model 2	
	Environmental spending	P(F)	P(D F)
CEO tenure	-0.104*** (0.023)	0.267*** (0.014)	-0.821*** (0.126)
Heavy pollution		-0.028* (0.011)	1.193*** (0.079)
CEO Tenure * Heavy pollution		-0.284*** (0.013)	0.692*** (0.105)
Duality	-0.098 (0.391)	-0.203*** (0.017)	
Meeting	0.085*** (0.013)	-0.002 (0.010)	
Big4	0.949*** (0.198)	-1.116*** (0.118)	
BD size	-0.068 (0.050)	-0.030*** (0.009)	
Opinion	0.080 (0.107)	-0.636*** (0.056)	
Institution	1.237* (0.574)	-0.426*** (0.042)	
Family ownership	0.166*** (0.025)	0.186*** (0.022)	
Leverage	-0.623** (0.281)	-1.211*** (0.025)	0.327*** (0.045)
Firm size	1.150*** (0.136)		-0.164*** (0.044)
ROA	0.792 (0.711)		-0.354 (0.393)
Tobin's Q	0.157*** (0.026)		-0.128*** (0.009)
Stock returns	-0.099 (0.263)		-0.337* (0.140)
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Rho			10.345*** (1.009)
Observations	386	7004	7004

Note: In model 1, the dependent variable is replaced with the natural logarithm of corporate environmental spending, and a fixed-effect model is used. In model 2, heavy-polluting firms include firms with following industrial codes based on the China Securities Regulatory Commission Industrial Classification Guideline (2012): B06-B09, C17, C19, C22, C25-C28, C30-C33 and D44. Other variables are defined in Table 1. P(F) is the probability of environmental fraud commission, and P(D|F) is the probability of detection conditional on environmental fraud commission.

*** $p < .01$, ** $p < .05$, and * $p < .1$.

(2020) argument that graduates with the business-related educational background are associated with more self-interested behaviours. This is especially the case if the graduates become CEOs or senior management of firms, as they have decision-making power and tend to focus more on achieving short-term financial interests. Subsequently, they

have less willingness to fulfil environmental and social responsibilities and are more likely to engage in environmental violations.

Lastly, we examine the effect of CEO age on the relationship between CEO tenure and environmental fraud. CEO age affects one's career horizon. In other words, as CEOs get older, their career

TABLE 7 Robustness tests: Firm-level and CEOs' demographic level heterogeneity.

Variables	Model 1		Model 2		Model 3	
	P(F)	P(D F)	P(F)	P(D F)	P(F)	P(D F)
CEO tenure	0.452*** (0.062)	-0.268*** (0.026)	0.511*** (0.066)	-0.368*** (0.076)	0.776*** (0.077)	-0.066** (0.028)
Firm years	0.143*** (0.038)	-0.011*** (0.003)				
CEO major			0.532*** (0.021)	-0.804*** (0.267)		
CEO age					0.012*** (0.004)	-0.023*** (0.004)
CEO Tenure * Firm years	1.226*** (0.195)	-0.070** (0.030)				
CEO Tenure * CEO major			0.375*** (0.051)	-0.406*** (0.037)		
CEO Tenure * CEO age					0.005*** (0.002)	-0.004*** (0.001)
Duality	-0.216*** (0.043)		0.246*** (0.067)		-0.274*** (0.051)	
Meeting	-0.611*** (0.064)		-0.406*** (0.037)		-0.160*** (0.009)	
Big4	-0.041*** (0.006)		-0.045*** (0.008)		-0.155*** (0.032)	
BD size	-0.231*** (0.026)		-0.134*** (0.011)		-0.217*** (0.029)	
Opinion	-0.917* (0.543)		-0.793*** (0.280)		-0.286*** (0.024)	
Institution	-0.533*** (0.099)		-0.680*** (0.075)		-0.957*** (0.067)	
Family ownership	0.288*** (0.065)		0.538*** (0.045)		0.326*** (0.053)	
Leverage	-1.283*** (0.113)	0.829*** (0.163)	-0.751*** (0.021)	0.905 (1.497)	-0.800*** (0.275)	0.089 (0.126)
Firm size		-0.034* (0.015)		-0.024 (0.021)		-0.026 (0.023)
ROA		-0.143*** (0.021)		-0.368*** (0.059)		-0.160* (0.082)
Tobin's Q		-0.093*** (0.009)		-0.034*** (0.009)		-0.097*** (0.003)
Stock returns		-0.527*** (0.105)		-0.311*** (0.049)		-0.524*** (0.054)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Rho		13.286*** (0.428)		14.482*** (0.902)		15.636*** (0.599)
Observations	6981	6981	2069	2069	6482	6482

Note: Firm years refer to the natural logarithm of the number of years since the establishment of the family firm. CEO major is a dummy variable that equals to one if a firm's CEO has a college or university degree in accounting, finance, economic or business programmes and zero otherwise. $P(F)$ is the probability of environmental fraud commission, and $P(D|F)$ is the probability of detection conditional on environmental fraud commission. All variables are defined in Table 1.

*** $p < .01$, ** $p < .05$, and * $p < .1$.

horizons get shorter. Subsequently, older CEOs have fewer incentives to engage in CSR-related activities (Oh et al., 2016). To test this proposition, we create an interaction variable (CEO Tenure * CEO age) and include it in both commission and detection models. In model 3 of Table 7, the coefficient of the interaction term is positive and significant in the commission model and negative in the detection model. The results are in line with our previous findings, which indicate that the positive impact of CEO tenure on the environmental fraud commission is more pronounced for older CEOs. This is because older CEOs who are close to the conventional retirement age have less career horizons and tend to focus on achieving short-term outcomes. However, the engagement in environmentally friendly activities would require a longer period to pay off. As a result, older CEOs with long tenure are less likely to comply with environmental regulations and more likely to commit environmental fraud.

6 | CONCLUSION

This paper is among the first to examine the association between CEO tenure and environmental fraud in Chinese listed family firms. We apply a bivariate probit model and show that CEO tenure is positively related to corporate environmental fraud commission in family firms. This evidence reveals that CEOs with a longer service history are more likely to violate environmental regulations and commit fraud in Chinese family firms. In addition, we find that the impact of CEO tenure on the environmental fraud commission is more pronounced when there is a greater number of family members serving in the senior positions of family firms. This suggests that long-serving CEOs are more likely to collude with family members, and they tend to use their positions to extract private benefits from non-family shareholders. Subsequently, long-tenured CEOs are more likely to overlook the environmental responsibility that they are supposed to fulfil and engage in environmental fraud. Meanwhile, our analysis provides evidence on the essential roles played by independent directors in the family firms. We find that a higher level of board independence could mitigate the negative effect brought by long-serving CEOs; thus, long-tenured CEOs are less likely to commit environmental fraud.

We have conducted several robustness tests, and our results remain consistent. For example, we show that our result is robust to an alternative dependent variable of corporate environmental spending. In addition, we carry out a two-stage least squares estimation. Our baseline results still hold when accounting for the endogeneity. The heterogeneous impacts of CEO tenure on environmental violations at the industry level, firm-level and CEOs' demographic level are also investigated. In particular, we find that long-serving CEOs

are more likely to attract regulatory attention among heavy-polluting firms. In addition, compared to non-family professional CEOs, family CEOs are more likely to commit environmental fraud. Moreover, the positive impact of CEO tenure on environmental fraud commission is more pronounced in the family firms that have been long-established. Furthermore, we find that older long-tenured CEOs and long-tenured CEOs with accounting, finance or business degrees are more likely to commit environmental fraud.

Our findings allow us to derive policy implications that are helpful to address the present corporate environmental protection issues in China. Firstly, although there is no statutory restriction on the CEO tenure of listed family firms, our findings suggest that introducing such tenure limits can help reduce the incidence of environmental fraud commission. CEO tenure limits can effectively decrease the influential power of entrenched CEOs within family firms and contribute to corporate compliance with environmental regulations. In addition, our results call for more integrity checks to be conducted on long-tenured family CEOs.

Secondly, the policymakers should continuously encourage family firms to recruit more independent directors to the family boards to reduce the incidence of environmental fraud and mitigate the adverse impact of long CEO tenure. It is worth noting that our research is limited to the family firms that are listed on the stock exchanges, and there are many private family firms that are not listed. These firms are not required to have board or independent directors, which could have more severe CEO entrenchment problems (Jiang & Kim, 2015). More regulatory attention should also be paid to these private family firms, especially their long-serving CEOs and their impact on corporate compliance with environmental regulations.

Thirdly, we suggest that Chinese regulators should encourage listed firms, especially listed family firms to introduce sustainability related senior positions, for example, *Vice President of Sustainability* or *Chief Officer of CSR* at the board level to promote environmental responsibility within firms. Compared to firms in developed economies, such positions are rarely established in China (Arora et al., 2020). Subsequently, it is important for family firms to appoint such positions, to incorporate sustainability initiatives into organizational practices, enhance public image and help to reduce the occurrence of environmental fraud.

Lastly, greater and more transparent disclosure of family involvement in management should be made to investors and regulators, to reduce investment risks and improve regulatory efficiency. Investors and regulators should be aware of the adverse impact of strong family involvement on corporate environmental practices. It is believed that our study could be of interest to external parties such as environmental protection organizations and long-term institutional investors. These parties have a keen interest in comprehensively understanding,

evaluating and predicting corporate environmental performance and behaviours to make informed decisions.

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CONFLICT OF INTEREST STATEMENT

We have no conflict of interest to declare.

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APPENDIX A: FINANCIAL VARIABLES IN COMMISSION AND DETECTION MODELS

Variables	Model 1		Model 2		Model 3	
	P(F)	P(D F)	P(F)	P(D F)	P(F)	P(D F)
CEO tenure	0.349*** (0.095)	-0.062*** (0.015)	0.032*** (0.003)	-0.421*** (0.054)	0.343*** (0.096)	-0.516*** (0.011)
Independence			-0.424* (0.299)	0.610*** (0.037)		
Family					0.787*** (0.127)	-0.475*** (0.084)
CEO Tenure * Independence			-0.732*** (0.005)	0.258*** (0.089)		
CEO Tenure * Family member					0.396*** (0.025)	-0.333* (0.189)
Duality	0.310* (0.130)		0.256 (0.189)		0.583* (0.224)	
Meeting	-0.037*** (0.013)		-0.089*** (0.028)		-0.055*** (0.016)	
Big4	-0.130** (0.066)		-0.213*** (0.071)		-0.284*** (0.0515)	
BD size	-0.154*** (0.028)		-0.117** (0.044)		-0.147** (0.073)	
Opinion	-0.754*** (0.085)		-0.821* (0.447)		-0.429*** (0.088)	
Institution	-0.902*** (0.247)		-1.119*** (0.308)		-0.953*** (0.241)	
Family ownership	0.272*** (0.024)		0.306*** (0.029)		0.315*** (0.033)	
Leverage	-1.824*** (0.175)	0.676*** (0.157)	-1.577*** (0.158)	0.595** (0.670)	-1.156*** (0.164)	-0.635*** (0.088)
Firm size	2.843*** (0.226)	-0.995*** (0.035)	2.053*** (0.139)	-0.446*** (0.089)	1.457*** (0.172)	-1.170*** (0.063)
ROA	0.595*** (0.001)	-0.388*** (0.089)	0.329*** (0.001)	-1.047*** (0.116)	0.214*** (0.0234)	-0.734*** (0.093)
Tobin's Q	0.940*** (0.073)	-0.288*** (0.235)	0.526* (0.285)	-0.208*** (0.065)	0.702*** (0.086)	-0.376*** (0.069)
Stock returns	0.842*** (0.068)	-0.554*** (0.061)	-0.724*** (0.085)	-0.283*** (0.047)	-0.447* (0.272)	-0.812*** (0.057)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Rho		10.885*** (0.818)		8.932*** (1.823)		7.606*** (0.632)
Observations	7004	7004	7004	7004	4624	4624

Note: P(F) is the probability of environmental fraud commission, and P(D|F) is the probability of detection conditional on environmental fraud commission. All variables are defined in Table 1.

*** $p < .01$, ** $p < .05$, and * $p < .1$.