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Unique types and innovation input of family firm CEOs: moderating role of managerial ability in Chinese listed firms

Sadeen Ghafoor[1], Weidong Huo[1], Man Wang[2], Yunjiang Geng[2]✉, Muhammad Zulfiqar[1] & Muhammad Usman Yousaf[3]

In family firms the role of CEO is highly significant with reference to devise strategic decisions and deciding if it is feasible to invest in innovation input. This study aims to investigate the behaviour analyses of the diverse types of CEOs in family firms towards innovations. This study also analyzes the moderating role of managerial ability in the nexus of CEO types and innovation input. The data are obtained from Chinese A-share listed family firms from Accounting Research and China Stock Exchange in 2012–2020 and analysed using ordinary least squares regression. Tobit and probit regressions are also employed to confirm the results. Results indicate that non-family and family CEOs (with no controlling rights) show identical behaviour concerning their lower intentions to promote innovations in R&D projects than family CEOs with actual controlling rights. In addition, family CEOs with actual controlling rights exert a positive effect on R&D, indicating that they are more willing to invest in innovative projects. Moreover, we observe the significant moderating role of managerial ability in the nexus of CEO types and innovation activities. We find that high managerial ability alters the behaviour of different CEOs. With the moderation of managerial ability, non-family and family CEOs (without actual controlling rights) also show willingness to invest in innovative projects and without managerial ability, CEOs' willingness to make innovations decline. This study is a pioneer work that investigates the impact of diverse types of CEOs to unlock notable insights regarding the R&D investment behaviour of Chinese family firms with moderating role of managerial ability. This study is useful to all parties involved with the company, including employees, clients, suppliers and customers. The results of this study can also assist board members in selecting and recruiting non-family CEOs or keeping family CEOs (with or without actual controlling rights).

[1] School of Finance and Trade, Liaoning University, Shenyang, China. [2] School of Accounting, Dongbei University of Finance and Economics, China and China Internal Control Research Center, Dalian, China. [3] Lyallpur Business School, Government College University, Faisalabad, Pakistan. ✉email: gyjiang@dufe.edu.cn

Introduction

Innovation drives the modern economy, but investing in innovative technologies, products or services is slightly risky (Custódio et al. 2019). Research on family firms highlights the origin of innovation, particularly how family businesses differ from non-family ones (Chrisman and Patel 2012; Muñoz-Bullón and Sanchez-Bueno 2011; Tajpour et al. 2022). Family businesses are frequently regarded as firms that adhere to conservative strategies because family members want to avoid losing their socio-emotional wealth (SEW), which refers to the benefit that family business owners receive from the non-economic components of the firm (Gómez-Mejía et al. 2007). Thus, family businesses are less inclined than other types of businesses to undertake risky tactics, such as investing in R&D (Duran et al. 2016). Multiple studies have demonstrated that the involvement of family members have a detrimental effect on innovation inputs, such as investments in research and development (R&D) (Block 2012; De Massis et al. 2013).

R&D funding and research initiative priorities are frequently determined by a family firm's senior executive. When making business decisions, managers utilise skills acquired during their careers. Information about the influence of CEOs in strategic decisions involving family firm innovation is limited, despite the growing interest in the effects of individual actions (López-Fernández et al. 2016). Surprisingly, very few studies have been conducted on the subject given how notably CEO's decisions and actions influence R&D investments (Duran et al. 2016). Notable exceptions include the research conducted by Duran et al. (2016) on the risk tolerance of family founder CEOs; Kraiczy et al. (2015) on CEO risk propensity in family firms; Kammerlander and Ganter (2015) on the non-economic goals of family CEOs and Stanley (2010) on the emotional and risk-taking differences amongst family CEO types (family CEO with controlling rights, family CEO without controlling rights and non-family CEO). Following De Massis and Foss (2018) who advocated for a micro foundational approach in family business research, we analyse whether and how distinct types of CEOs within family firms behave towards R&D investment based on control diversity and how does managerial ability (MA) change the CEO's behaviour?

According to Custódio et al. (2019) owing to inherent risks associated with R&D investments, innovation has a high level of risk from the perspective of actual profit realisation. Professional CEOs are likely to capitalise on innovation projects because they are confident in managing the associated risks through their experience. A failure in one industry may not necessarily indicate incompetence in other sectors, allowing a family CEO to shift between businesses easily. Thus, various external options are available to these CEOs but not to professional non-family CEOs, who then function as a mechanism of failure tolerance on the labour market that may stimulate innovation (Lerner and Wulf 2007; Tian and Wang 2014). This technique may serve as an alternative to CEO contracts containing long-term salary and job security provisions. Manso (2011) demonstrated that this technique is the ideal approach for incentivising innovation rewards for long-term success whilst tolerating early failure.

According to Jiang et al. (2020), family owners typically have a longer investment horizon than other investors, so they may decide against investing in R&D. The reason is that intensive R&D investments often involve external financing, such as issuance of new shares, borrowing of cash through loans or issuance of debt (Jiang et al. 2020). Therefore, receiving finance from other sources may result in the family owners having less influence, which may adversely affect their SEW. Gómez-Mejía et al. (2007) presented SEW, which explains that the utility family owners gain from a firm's non-economic component when investigating the risk-taking behaviour of family firms. The behavioural agency model (BAM) is a derivation of prospect theory (Kahneman &Tversky, 1979) and is formulated to understand executive risk-taking behaviour. Based on this theory, Gómez-Mejía et al. (2007) concluded that the effect of family firms' actions on their SEW influences their risk-taking behaviour. The SEW is the key guide for future profits or losses in family businesses (Gomez-Mejia et al. 2011). The BAM seeks to solve the shortcomings of agency theory and helps understand the risk-taking behaviour of family firms (Chrisman and Patel 2012). When a family member acts as the board chairman, family owners have greater immediate authority over their businesses. The reason is that the board chair has significant power to discipline senior executives and confirm strategy decisions (Krause et al. 2014; Sundaramurthy et al. 1997).

Given that family CEOs with controlling rights improve the capability of family owners to manage the company, the family may consider R&D investment as an inception of long-term competitiveness rather than a risk of losing family SEW (Block 2012; Jiang et al. 2020). From another perspective, businesses controlled by families are more likely to see investments in R&D as having the potential for gain than loss (Gómez-Mejía et al. 2007). Therefore, family businesses with a family member serving as the CEO may be more willing to invest in R&D than those without it. Furthermore, we contend that the extent to which family owners are worried about SEW is a critical factor in determining whether a positive link exists between family chairs and the amount of money spent on R&D by family businesses (Jiang et al. 2020).

Andreou et al. (2017) found that CEOs with strong MA highly invest during crises to balance the problem of underinvestment, which ultimately increases business value. Yung and Chen (2018) found that CEOs with great MA are willing to take risks, spend less money on capital expenditures and invest money in R&D projects. Similarly, competent CEOs possessing exceptional managerial abilities may be greatly effective at taking the necessary risks to generate creative results. Great management competency is associated with low volatility in future earnings and stock returns, in addition to high credit ratings (Bonsall IV, et al. 2017). A CEO with a great MA would not only be able to handle innovation-related risk efficiently but also be likely to do so (Lin et al. 2021). CEOs possessing MA are also great at building the trust of stakeholders, which lowers the cost of capital and aids in distributing and placing innovation-related resources (Yangyang Chen et al. 2015).

MA is considered a critical driver for earning quality, tax avoidance, goodwill and reputation and many other business policies (Lee et al. 2018). It can have a significant impact on a company's R&D efforts and its ability to drive innovation (Yangyang Chen et al. 2015). A company's success in R&D often depends on the quality of its management, including the ability to make effective decisions, allocate resources efficiently and manage risks (Yung and Chen 2018). In highly dynamic and competitive environments, businesses frequently participate in entrepreneurial endeavours to secure their success and survival (Dana et al. 2022).

This study contributes to the existing body of knowledge in numerous ways. The study is novel in terms of categorising unique types of family CEOs, namely, non-family CEOs, family CEOs with controlling rights and family CEOs without controlling rights. After categorising CEO types, the study investigates the impact of each type of CEO on innovation strategies (measured through R&D investment) in Chinese family firms. This study is also one of the pioneer works investigating the impact of MA on the nexus between different types of family CEOs and R&D investment. Moreover, this study compares the impact of different types of CEOs to unlock notable insights regarding the

R&D investment behaviour of Chinese family firms. Using behavioural agency theory (BAT), this study finds behavioural differences in the various types of CEOs and their attitudes toward innovation in family firms. This study makes a valuable contribution to the field of behavioural agency theory (BAT) by examining how managerial ability moderates the relationship between various types of CEOs and the innovation levels of family enterprises.

Theoretical review. Regarding the competency of non-family CEOs in family firms' agency issues, assumptions of behavioural agency theory (BAT) vary. According to this theory, agents are astute in nature, yet they are closely monitored and heavily incentivised to ensure that the interests of shareholders are protected (Miller et al. 2014). According to this description, a family CEO will have an advantage over non-family CEOs who are only agents because the former will be a substantial shareholder in the company, and/or their interests will intersect with those of the owner's family (Miller and Le Breton-Miller 2005, 2006).

By contrast, professionals of behavioural agencies anticipate some form of reciprocal gain. They assume that taking risks is a natural human behaviour that is always rewarded by society. For example, to preserve the social and emotional capital of their sold company, family CEOs are willing to put the company's economic success at risk to avoid taking intelligent business risks (Gómez-Mejía et al. 2007). Maintaining socio-emotional goals includes retaining control over the operations of the family business, selecting new family leaders, expanding corporate resources and avoiding financial commitment to speculative investment endeavours (Gomez-Mejia et al. 2011; Miller and Le Breton-Miller 2005; Miller et al. 2011; Miller et al. 2013). Consequently, family CEOs with controlling rights are more inclined to reinforce these socio-emotional wealth goals than non-family CEOs without controlling rights who are not concerned about preserving the profits and interests of the owner.

The BAT can have implications for the type of CEO used in an organisation as well as for the management of R&D activities. Regarding CEOs, the BAT suggests that principals should consider the characteristics of the agent and the nature of the task being performed when choosing amongst different types of CEOs. For example, if the agent is highly motivated and capable, then a flexible and decentralised controller may be appropriate to encourage creativity and innovation. However, if the agent is less motivated or prone to opportunistic behaviour, then a rigid and centralised controller may be necessary to ensure compliance with the principal's objectives (Chrisman et al. 2012).

With regard to R&D activities, the BAT highlights the importance of aligning the interests of R&D managers and employees with those of the organisation as a whole (Chrisman and Patel 2012). This process can be challenging owing to the long-time horizons and uncertainty associated with R&D activities as well as the potential for conflicting objectives between R&D personnel and other departments. To address these challenges, principals may need to provide incentives and monitoring mechanisms that encourage R&D personnel to prioritise the organisation's objectives and coordinate effectively with other departments. Overall, the BAT provides useful insights into the design and management of control systems and R&D activities, helping principals to align the interests of agents with their own objectives and promote desirable behaviour. In the current study, the BAT is suitable because interests regarding the R&D investment behaviour may vary depending on the CEO type.

Hypothesis development

Non-family CEOs and R&D investment. According to Xu et al. (2015), businesses headed by CEOs from the same family perform worse than those controlled by non-family CEOs. According to Bennedsen et al. (2007) and Smith and Amoako-Adu (1999) this performance issue is linked with the inability of family members to handle their affairs and the intense competitiveness amongst grandchildren. In this perspective, the circumstances of Chinese family firms differ significantly from that of Western economies. The majority of Chinese family businesses are run smoothly and efficiently by their patriarchs, and internal power battles are quite rare (Q. Cheng 2014). Even when a company is handled by the next generation, the management knowledge they have is highly professional because imparting business knowledge between the founder and his/her offspring is easier than that between the founder and a CEO who is not a member of the founding family (Bertrand and Schoar 2006). In addition, the shortage of managed labour in China presents significant challenges for the CEOs of businesses that are not owned by families. Consequently, non-family CEOs almost always do more harm than good for shareholder advantage.

Financial salary, managerial labour market status and intangible incentives are the most important economic benefits for non-family CEOs with limited firm ownership. These factors contribute to the CEO's position as a manager (Burkart et al. 2003). However, considering that China does not have a managerial labour market and an incentive system based on equity, employees may look for intangible forms of compensation. To maximise their usefulness, somebody can choose to forsake financial gains (Bertrand and Schoar 2006). People can place blame for their failures on the results of their investments on the unpredictability of their circumstances rather than on their own ineffective decision-making. Hence, people may feel compelled to seek the convenience of acquiring additional personal benefits by engaging in less risky investments (Yang Chen et al. 2014). In contrast, family CEOs serve more as caretakers than agents in running their enterprises (Burkart et al. 2003; Morck and Yeung 2003). According to Waldkirch (2020), non-family CEOs must be able to communicate and create a professional relationship with family owners that is characterised by transparency and trust to avoid agency problems. D. Wang et al. (2023) found that non-family acclaimed native CEOs show a positive effect towards CEO compensation, but this effect starts to diminish as the tenure increases.

Their primary economic rewards come from increasing the value of the firm, whether they are the founders or the successors. The basic concept is that family businesses can benefit from 'patient capital', a focus on optimising long-term returns and the motivation to explore investment possibilities because of the connections that exist between present and later generations (Bertrand and Schoar 2006). Moreover, the resource-based view contends that in developing countries with insufficient institutional frameworks, access to resources is frequently gained through a variety of informal private networks rather than through formal channels (Peng 2003). With regard to the approach of acquiring these unique resources, family CEOs may have a competitive advantage over non-family CEOs. Resources in the business groups may be accessible to family CEOs but may not be accessible to non-family CEOs. This advantage may come as a result of the familial ties that bind family CEOs (Peng and Jiang 2010). Therefore, in comparison to the investment that non-family CEOs make to increase their gains, the investments that family CEOs make are focused on the maximum efficiency through which resources are utilised. Family CEOs have a great degree of interest alignment with family owners, and the presence of such familial relationships may result

in a reduction in the agency costs incurred between principals and agents (Westphal 1999).

H_1: *Non-family CEOs show a negative attitude towards innovation in family firms.*

Family CEOs control diversity and R&D investment. Innovation is essential to a company's long-term survival (Aghion et al. 2013; Cefis and Marsili 2006) and is regarded as a success driver in today's highly competitive environment (Moghadamzadeh et al. 2020). A CEOs' internal control site is particularly useful for explaining the control options of small and medium-sized enterprises (SMEs). A large volume of documentation supports the notion that SMEs are usually captivated by 'ubiquitous' CEOs who attempt to control the entire organisation. In addition, this control directly influences the establishment and execution of the plan (Mintzberg and Waters, 1982; Ward, 1988). Scholars believe that CEO with great internal control are receptive to innovative service and manufacturing methods (Miller et al. 1982). According to the literature on SMEs, CEOs with fixed shares have higher autonomy to propose ideas and plans and a stronger direct effect on the formulation and execution of strategy than (professional) outside directors (Mintzberg and Waters 1982; Ward, 1988). Highly advanced theories view stock ownership as a form of 'management discretion' which boosts the impact of executives' psychological traits on strategy and management decisions (Finkelstein and Peteraf 2007; Hambrick and Finkelstein 1987). Otherwise, proponents of BAT presume the existence of mutual benefit. Risk-taking, in their view, is an inevitable result of one's present circumstances. Family CEOs, for instance, will often put the company's economic performance at risk to save the social and emotional capital of the business they sold (Ghafoor et al. 2022; Gomez-Mejia et al. 2011; Zulfiqar et al. 2021). Objectives from a socio-emotional perspective include keeping the family in charge of the firm, appointing family members to key positions, growing the company's resources and avoiding risky investments (Miller et al. 2013). The CEOs of family businesses with and without true controlling rights are analysed, along with their R&D spending habits.

Previous studies investigated the effect that CEOs have on R&D spending at family businesses. The CEO of a company plays a pivotal role in establishing the level of resources devoted to innovation, setting the tone for innovation investment (which forms the backbone of any effective organisational structure) and fostering an environment that encourages creative problem-solving (Duran et al. 2016). CEOs of family businesses sometimes avoid R&D spending because it requires funding from sources outside the company. Hence, the family owner's control over the company may be weakened (Duran et al. 2016). Therefore, businesses led by members of the same family as the company's founders invest less in R&D. We can then extend the scope of the research and categorise family CEOs into two distinct categories (family CEOs with controlling rights and those without).

Owing to the convergence of ownership manifested by small private enterprises, CEOs of these companies often wield considerable influence within the board of directors. Mace (1971) expanded the CEO's authority to the point where they can appoint and remove board members at will (Harris 1989; Mace 1971). However, if the company's CEO is not a family member, R&D investments will dilute the owner family's influence. When a non-family member serves as the chairman, taking an active role in R&D decision-making and resource allocation may be challenging for family business owners. The loss of emotional and social value is a major issue for family owners due to the absence of proper corporate governance systems and the incapability to control R&D investment decisions. Consequently, they may opt to forgo risky R&D investments, even though they may be essential in the long run for maintaining emotional and social richness. Given the foregoing discussion, a chasm clearly exists, and learning further about how different types of CEOs inside family businesses feel about R&D expenditures is meaningful.

H_2: *Family CEOs with actual controlling rights exhibit a positive attitude towards innovation in family firms.*

H_3: *Family CEOs without actual controlling rights exhibit a negative attitude towards innovation in family firms.*

Non-family CEOs' ability and R&D investment (performance of professional CEOs on innovation). Many family firms are hesitant to bring in new staff from outside to prevent internal strife and protect the company's legacy (Gomez-Mejia et al. 2010). Nevertheless, non-family CEOs typically acquire fresh ideas and intangible talents to greatly support and manage R&D intensity (Chang et al. 2010). As a result, a family business's ability to choose and evaluate promising R&D initiatives may be severely hampered if it restricts employees to only family members (Chang et al. 2010). Family members may not have the specialised managerial abilities, expertise or experience to identify successful R&D projects (Muñoz-Bullón and Sanchez-Bueno 2011). As a result, R&D intensity suffers from a lack of experienced management of R&D initiatives (H.-L. Chen and Hsu 2009). Inevitably, the focus of family firms on R&D diminishes.

Investment options for a family business are constrained by its ability to raise or use debt. However, families are typically unwilling to rely on external financing due to members' desires to maintain ownership and management (Gomez-Mejia et al. 2010). When a company that needs plenty of management talent hires a professional manager as CEO, the family that owns the business reduces their control on the company and the CEO's ability to make strategic decisions, which can negatively influence the company's R&D spending (Kim et al. 2008).

Family businesses are hesitant to hire outsiders as CEOs because they want to keep power inside the family (Gomez-Mejia et al. 2010). Their capacity to encourage investment in R&D may be hampered as a result. Issues arise when family members try to manage external financial resources to finance R&D investments (Gallo et al. 2004). This analysis contrasts the perspectives of family and non-family CEOs on drastically reducing R&D intensity. Reducing R&D intensity in family businesses may be the result of agency costs, which are incurred when family members support one another out of altruism even if doing so is harmful to the firm (Kim et al. 2008; Lim et al. 2010; Salvato and Moores 2010; Schulze et al. 2003).

Depending on the nature of the business, the controlling family may choose to appoint a member of the family to the position of CEO. The CEO has the power to shape the company's culture and values through management decisions. Professional CEOs may prioritise R&D by increasing their budget, for instance (Shleifer and Vishny 1986). We believe that reduced family involvement in the company's R&D investment decision-making process is necessary to attract and retain a competent chief executive officer.

H_4: *Managerial ability moderates the relationship between non-family CEOs' behaviour and innovation in family firms.*

Family CEO types, ability and R&D investment. CEOs with high MA are likely to take risks, reduce capital expenditures and invest in R&D projects (Yung and Chen 2018), whereas CEOs with less managerial abilities are likely to minimise risk and reduce capital expenditure and R&D expenses. Yung and Chen (2018) also discovered that companies whose CEOs possess superior managerial abilities are customer-centric, see less

pushback from employees and receive high overall ratings. Moreover, the BAT can assist family firms in comprehending the risk-taking and decision-making processes at play (Kumeto 2015). Loss aversion and risk-taking amongst family business proprietors are interesting topics to investigate, and (Gomez–Mejia et al. 2014) argued that the BAT is the right tool for the job.

The controlling family typically appoints the CEO to maximise the family's welfare, which is equivalent to the value of their shares plus additional benefits that can only be realised if actual control remains within the family (Burkart et al. 2003). As long as the perks of becoming a family CEO are not worth the sacrifices, decision-making remains inside the family. The main disadvantage for the family in charge is that a CEO picked from inside the family is usually less qualified than that is hired from outside (Lin and Hu 2007). Financial performance suffers when a company's CEO comes from within the family (Lin and Hu 2007). However, a family CEO may result in decreased monitoring costs for the controlling family. The family also has the unique ability to exercise control and the right to expropriate the assets of minority shareholders.

Family management and governance have a negative association with innovation inputs but a good relationship with innovation output, according to Matzler et al. (2015) in their research on companies traded on the Frankfurt Stock Exchange. Kraiczy et al. (2015) studied a different group of German family enterprises and reached a similar conclusion: the favourable impact of the CEO's risk-taking tendency on firm innovation diminishes as the company ages because of increasing proprietorship by the firm's top management. Their findings imply that when families go through further generations and power is dispersed amongst many relatives, the gap between capability and enthusiasm grows. The long-term orientation of family-owned businesses increases their capacity to put resources into R&D, but not their eagerness to participate, according to an interesting examination of small and medium-sized Italian firms (Sciascia et al. 2015).

MA correlates positively with business innovation (Yangyang Chen et al. 2015). When comparing the skill sets of managers in the investment industry, Koijen (2014) discovered large discrepancies. Individual variation in decision-making skills is substantial, as demonstrated theoretically and experimentally (Costa-Gomes and Crawford 2006). Leadership skills may be an asset to any business. Management skills are highly sought after. Murphy and Zabojnik (2007) and Custódio et al. (2013) reported that businesses frequently use enticing compensation packages to lure away talented CEOs from other firms. Management quality and the CEO's standing in the industry are two factors that affect a company's ability to attract capital (Chemmanur et al. 2009). Recent research by financial economists showed that efficient management is crucial to a company's success. The quality of a company's earnings (Choi et al. 2015; Demerjian et al. 2012), the innovation activities of a company (Yangyang Chen et al. 2015), the creation of bank liquidity (Andreou et al. 2016) and the strategic entry into new markets are all influenced by the managerial abilities of the company's leaders (Goldfarb and Xiao 2011). Andreou et al. (2016) found that only companies whose chief executives have a wide variety of managerial abilities benefit from the positive correlation between managerial aptitude and investment during a crisis.

According to Yung and Chen (2018) high and low-ability managers have opposite effects on firms' risk-taking behaviour and firm value. By contrast, previous studies found a positive relationship between MA and business venture conduct (Cheng and Zhang 2022; Yung and Chen 2018). Comparatively, low-ability managers tend to avoid risk, whereas high-ability managers are often receptive to it. Managers with low abilities reduce capital utilisation and R&D expenditures, whereas those with high abilities reduce only the former (Ting et al. 2021). Managers with high ability tend to be associated with greater levels of firm concentration than those with low ability. The following analysis reveals that R&D spending is positively influenced by a competent CEO. We also detail how the different types of CEOs' R&D investment behaviour are affected by the family firm's MA. The research is useful for family business leaders because it sheds light on the elements that can sway R&D spending decisions. In addition, this research clarifies what influences Chinese family businesses to spend on R&D. This research adds to the existing body of literature by offering an alternative explanation for the influence of the family CEO's management in overcoming overinvestment and underinvestment.

H_5: *Managerial ability moderates the relationship between the behaviour of family CEOs with actual controlling rights and innovation in family firms.*

H_6: *Managerial ability moderates the relationship between the behaviour of family CEOs without actual controlling rights and innovation in family firms.*

Sample and data

The focal point of this study is the unique types of CEOs within family firms and data was collected from the CSMAR. The data was collected from 2012 to 2020. The data was from firms with issued A shares and were listed in the Shenzhen Stock Exchange and Shanghai Stock Exchange. CSMAR is regarded as one of the leading database sources for publicly traded Chinese enterprises (Carney et al. 2019). It is a specialised database for non-state-owned enterprises (non-SOEs) (Xu et al. 2015). All SOEs were omitted from our data collection. To make the analysis credible, we excluded firms that had missing values for the current research variables and had zero or negative values for important study variables. We removed outliers from our sample to keep our variables between the 1st and 99th percentiles. A similar technique was also used in other works (Carney et al. 2019; Kale and Shahrur 2007).

Variable measurements

R&D investment. The dependent variable of this study is R&D investment. It is measured by dividing annual R&D expenditures by year-end total assets (Jiang et al. 2015; Tsao et al. 2015; Tyler and Caner 2016). An alternative measure of R&D investment was used, which was calculated by dividing annual R&D expenditures by year-end total sales. This same approach was used by several researchers (Alam et al. 2019; Honoré et al. 2015; Wang et al. 2017). In this study, another measure of innovation (R&D dummy) was used to confirm the robustness result.

CEO types. In this study, we categorised the Chinese family firms' CEOs into three categories:

1. Family CEO with actual controlling rights, where the CEO is a member of the family and has controlling rights.
2. Family CEO without controlling rights, where the CEO is a member of the family but does not have actual controlling rights.
3. Non-family CEO, where the CEO is working in the family firm but not a family member.

We used the dichotomous variables of CEO type. Majority of the CEOs do not change positions with the passage of time. Consequently, pooled ordinary least-square (POLS regression was chosen for our investigation.

Table 1 Mean comparison table.

Variables	Others	Non-family CEO	T-test score	Other	Family CEO & actual controller	T-test score	Other	Family CEO	T-test score
R&D	0.0022115	0.0016529	4.6239***	0.0016378	0.0023835	−5.9525***	0.0019456	0.0013245	2.5503**
Managerial Ability	0.5853274	0.5879986	−1.7849*	0.587701	0.5851573	1.6423	0.5863451	0.592602	−2.1145**
Leverage	0.332449	0.4025498	−17.5911***	0.3993922	0.3199571	19.3223***	0.3700927	0.373647	−0.4466
ROE	0.0788211	0.0699163	4.1482***	0.0688863	0.082979	−6.3395***	0.0738262	0.0762297	−0.5620
Size	21.2788	21.40522	−6.4426***	21.40492	21.2465	7.8005***	21.33675	21.49259	−4.0196***
CEO Pay	12.94866	12.94769	0.0572	12.93613	12.96937	−1.9075*	12.95242	12.89053	1.8765*
CEO Power	0.2358878	0.2312572	2.6560***	0.2306833	0.2381137	−4.1124***	0.2340631	0.2239746	2.9510***
CEO Overconfidence	0.2382561	0.3521603	−10.6735***	0.3426133	0.2214603	10.7964***	0.3060029	0.254386	2.5794***
Ind_Director_Ratio	0.3783636	0.3709861	7.0007***	0.3711986	0.3799081	−7.9886***	0.3745925	0.3714442	1.5154

This table reports a meancomparison of the variables. ***, **, and * indicate $P < 1\%$, 5%, and 10%, respectively.

Table 2 Descriptive analysis & VIF.

Variables	Mean	Std. Dev.	Min	Max	VIF
R&D investment	0.001905	0.0060131	0	0.0375463	
Non_Family CEO	0.5427971	0.4981868	0	1	1.07
Family CEO & Actual Controller	0.3619814	0.4805945	0	1	1.07
Family CEO	0.0671276	0.2502538	0	1	1.01
Managerial Ability	0.5864146	0.0823132	−0.02011361	0.9276931	1.90
Leverage	0.3706731	0.2064461	0.046011	0.90267	1.39
ROE	0.1232087	7.291028	−167.1067	713.2036	1.15
Size	21.34741	1.00412	18.81058	24.25099	1.71
CEO Pay	12.94813	0.7683455	10.59663	14.98669	1.83
CEO Power	0.2342238	0.0841617	0	1.164983	1.44
CEO Overconfidence	0.302027	0.4591679	0	1	1.04
Ind_Director_Ratio	0.3743754	0.0536421	0.1428571	0.6666667	1.03

MA. Demerjian et al. (2012) established the MA-score measure, which reflects a firm's managers' efficiency in generating income through specified inputs. Demerjian et al. (2012) noted that managers with more skills should be able to make more money from the same set of resources than other managers in the same industry. They presented a two-step approach to assess firm efficiency from which the managerial competence score is derived.

Control variables. The following control variables are used in this study. Leverage is measured through total debt divided by the total assets (Zulfiqar et al. 2020). Return on equity (ROE) is calculated by net earnings divided by equity at the previous year end (Jiang et al. 2020; Zulfiqar et al. 2021). Firm size (SIZE) is measured by taking the natural logarithm of assets (Sun et al. 2019; Xue 2007). CEO pay is measured by taking the values directly from financial reports. CEO overconfidence is a dummy variable with a value of 1 if the CEO is overconfident and 0 if otherwise (X. Lu et al. 2020; Zulfiqar et al. 2021). The independent director ratio is calculated by multiplying the board size by the number of independent directors ratio (Jiang et al. 2020; Zulfiqar and Hussain 2020).

Estimation techniques. We used sophisticated and appropriate statistical tools to reduce biases in the model. Two actions were performed to control the issue of endogeneity and omitted variable biases. Firstly, the industry effect and year effect were controlled with the help of dummy variables. Secondly, a one-year lag was taken for all independent variables. Heteroskedasticity and serial correlation were also managed with tobit multiplicative heteroskedasticity regression and robust-standard-errors parentheses. The pooled regression model was also used because the family CEOs are dichotomous and normally remain constant over time. Many studies applied the pooled regression model in the same situations (Bozec and Di Vito 2019; Fu 2019; Schmid et al. 2014). The tobit regression is typically used for robustness checks. The tobit model is suggested to evaluate the linear relation between variables when either left or right stifling occurs in the outcome. Similar tactics were employed by (Zulfiqar et al. 2022). We also used probit regression for robustness checks. When the dependent variable is binary (dichotomous), then the probit model is quite suitable. The probit model is appropriate for the dichotomous dependent variable, and several studies (Bozec and Di Vito 2018; Gentry et al. 2016) used this model. We substituted our dependent variable R&D investment with R&D DUMMY. When the firm spends R&D expenditure, the variable is equal to 1 and 0 if otherwise.

Empirical model.

$$R\&D_{it} = \alpha_o + \beta_1 CEO\,type_i + \beta_2 MA_{it} + \beta_3 CEO\,types_i{}^{*}MA_{it} + \beta_j \sum Controls_{it} + yr_t + ind_i + \varepsilon_{it}$$

Results

Mean comparison analysis. Table 1 show the t-statistics value for the difference of means test for the three types of CEOs within family firms. According to the t-statistics, all variables are significant except CEO pay in non-family CEOs, MA in family CEOs with actual controlling rights and leverage, ROE and independent director ratio in family CEOs without actual controlling rights.

Descriptive analysis and variance inflation factor (VIF). Table 2 presents a descriptive statistics analysis. Chinese family businesses invest 0.19% of their total assets in R&D. The mean value for non-family CEOs is 0.5427971, indicating that 54% of CEOs in

Table 3 Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
R&D investment	1.0000											
Non_Family CEO	−0.0462*	1.0000										
Family CEO & Actual Controller	0.0595*	−0.8207*	1.0000									
Family CEO	−0.0255	−0.2923*	−0.2021*	1.0000								
Managerial Ability (MA)	−0.0342*	0.0138	−0.0104	0.0208	1.0000							
Leverage	−0.1264*	0.1699*	−0.1861*	0.0041	0.2994*	1.0000						
ROE	−0.0022	−0.0091	−0.0075	−0.0018	0.0096	0.0242*	1.0000					
Size	0.0011	0.0627*	−0.0759*	0.0392*	0.7411*	0.3679*	−0.0201	1.0000				
CEO pay	0.0379*	−0.0006	0.0208	−0.0204	0.3219*	0.0700*	−0.0012	0.4123*	1.0000			
CEO Power	−0.0369*	−0.0237	0.0402*	−0.0332*	−0.0183	−0.0056	0.0247	−0.0327*	0.4439*	1.0000		
CEO Overconfidence	−0.0154	0.1231*	−0.1245*	−0.0300*	0.0569*	0.0574*	0.0091	0.0292	−0.0312	−0.0325	1.0000	
Ind_Director_Ratio	0.0368*	−0.0685*	0.0782*	−0.0149	−0.0617*	−0.0433*	0.0073	−0.0528*	0.0179	0.0059	0.0414*	1.0000

This table reports the pairwise correlations between the dependent and explanatory variables.
*Shows significance at the 0.1 level.

our sample do not belong to a family. The second type of CEO in our data is family members and actual controllers, with a mean value of 36%. The third type of CEO is a family member who is not an actual controller of the family business, with a mean value of approximately 0.7%. The mean value of MA is 0.5864146, and the average MA value is around 58%. In Table 2, the last column presents the VIF analysis. All values are less than 2, meaning our dataset has no multicollinearity issue.

Correlations. Table 3 shows the results of pair-wise correlation analysis. The analysis shows that our sample dataset does not have multi-collinearity, which is a basic requirement for regression analysis. Our correlation analysis reveals statistical correlations amongst our research variables, control variables and R&D expenditure. R&D investment has a negative correlation with non-family and family CEOs without controlling rights and a positive correlation with family CEOs with actual controlling rights. MA has a negative relationship with R&D investment.

Regression results and discussion

R&D assets. Table 4 presents the regression results of the behavioural analysis of CEOs' unique types of innovation in family firms. M1 in Table 4 indicates a negative effect of non-family CEOs on R&D, as measured by R&D expenditures divided by total assets. The negative coefficient indicates that non-family CEOs are less inclined to invest in R&D. Hence, H_1 is accepted. M4 depicts a positive effect of family CEOs with actual controlling rights on R&D, indicating that family CEOs having actual controlling rights are willing to invest in long-term risky projects. Here, H_2 is acknowledged. In M3, the family CEOs without actual controlling rights negatively influence R&D, indicating that the third type of CEO is less willing to spend on R&D. Thus, H_3 is sustained. This study shows, for the first time, that Chinese family businesses have three types of CEOs. The results in M1–M3 of Table 4 show that all three types of CEOs have significant results and diverse behaviours towards innovations (R&D). The family CEOs with controlling rights have complete authority over all aspects of decision-making. In this circumstance, they need to have self-confidence to make a decision and resolve agency conflicts. M4–M6 report the moderating effect of MA on the relations of diverse types of CEOs and R&D. The MA (in M4) has a positive impact on R&D, indicating that MA causes family firms to be inclined towards innovations.

However, comparing the results of M4 and M1, we find that the coefficient of non-family CEO changes from negative to positive. As a moderator, MA plays an antagonistic role in the relationship between non-family CEOs and R&D. Thus, MA is a factor that changes the behaviour of non-family CEOs towards innovations. Therefore, H_4 is supported. Similarly, comparing the findings of M2 and M5, the moderating force changes the strength of the relationship between family CEOs with actual controlling rights and R&D. Here, H_5 is acknowledged. Moreover, when we compare the results of M3 and M6, we find that MA decreases the coefficient of family CEO (without controlling rights) from 0.000426 to 0.00329. This finding shows that MA is a force that drops the negative effect of family CEOs (without controlling rights) on innovations in family firms. The decreasing coefficient states that MA plays a buffering role in the relationship between family CEO (without controlling rights) and R&D. Thus, our H_6 is also sustained. In addition, the interaction terms in M4–M6 are significant, which confirms the significant moderating role of MA.

Robustness. Table 5 shows the robust results, where the measure of innovation changes from R&D assets to R&D sales. The robust

Table 4 R&D assets.

Variables	M1 R&D	M2 R&D	M3 R&D	M4 R&D	M5 R&D	M6 R&D
Non_Family CEO	−0.000336** (0.000164)			0.00454*** (0.00132)		
Family CEO & Actual Controller		0.000355** (0.000179)			−0.00452*** (0.00157)	
Family CEO			−0.000426* (0.000239)			−0.00329* (0.00176)
Managerial Ability (MA)				0.00509** (0.00226)	−0.00232 (0.00156)	−0.000007 (0.00157)
Non_Family CEO X MA				−0.00810*** (0.00215)		
Family CEO & Actual Controller X MA					0.00807*** (0.00257)	
Family CEO X MA						0.00472* (0.00286)
Leverage	−0.00177*** (0.000432)	−0.00176*** (0.000430)	−0.00185*** (0.000434)	−0.00178*** (0.000432)	−0.00185*** (0.000430)	−0.00183*** (0.000435)
ROE	0.000192 (0.000662)	0.000207 (0.000663)	0.000226 (0.000663)	0.000308 (0.000675)	0.000279 (0.000679)	0.000207 (0.000679)
Size	0.000028 (0.000096)	0.000028 (0.000096)	0.000029 (0.000096)	0.000050 (0.000130)	0.000060 (0.000131)	0.000008 (0.000131)
CEO Pay	0.000394*** (0.000150)	0.000390*** (0.000151)	0.000392*** (0.000150)	0.000407*** (0.000150)	0.000402*** (0.000151)	0.000394*** (0.000151)
CEO Power	−0.00447*** (0.00132)	−0.00446*** (0.00132)	−0.00450*** (0.00132)	−0.00465*** (0.00133)	−0.00468*** (0.00134)	−0.00452*** (0.00132)
CEO Overconfidence	−0.000057 (0.000166)	−0.000057 (0.000166)	−0.000101 (0.000168)	−0.000021 (0.000167)	−0.00002 (0.000168)	−0.000100 (0.000169)
Ind_Director_Ratio	0.00258* (0.00151)	0.00253* (0.00150)	0.00277* (0.00150)	0.00239 (0.00149)	0.00238 (0.00148)	0.00274* (0.00150)
Constant	−0.00319 (0.00214)	−0.00345 (0.00215)	−0.00342 (0.00215)	−0.00672*** (0.00248)	−0.00271 (0.00219)	−0.00298 (0.00225)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.080	0.080	0.079	0.082	0.082	0.079

Robust standard errors are in parenthesis ***, **, and * indicates $P < 1\%$, 5%, and 10%.

findings presented in Table 5 are fully (partially) acknowledged based on research design (significance). We once more put the POLS regression model through the models M1 to M6. This same strategy was used by other scholars (Zulfiqar et al. 2021) to verify their regression results. We look at the maximum value of our dependent variable's R&D assets. The tobit model is suggested to evaluate the linear relation amongst variables when either left or right stifling occurs in the outcome. Similar tactics were employed by (Bozec and Di Vito 2019). Table 6 presents the outcomes of the tobit regression, and the findings are identical to the results presented in Table 4. Our outcome variable (R&D) is changed to an R&D dummy. The variable's value is 1 when the company invests in R&D and 0 if otherwise. The probit model works well when the dependent variable is binary (dichotomous). The probit model was utilised in various studies (Bozec and Di Vito 2019; Gentry et al. 2016; Ghafoor et al. 2023) and is suitable for the dichotomous outcome. In Table 7, we discovered quantitatively comparable results. Thus, the robustness also confirms the moderating role of MA in altering the CEOs' behaviour towards innovation outcomes.

Discussion. This study analyses the behaviour of unique types of family CEOs towards innovation in family firms. The study is novel as it categorises CEOs into three diverse kinds based on controlling rights (Family CEOs with actual controlling rights, Family CEOs without controlling rights, Non-family CEOs). The study further explores how MA changes the CEOs' willingness towards innovation in family firms. Based on BAT, we find behavioural differences in the diverse types of CEOs and their attitude towards innovations in family firms. Thus, this research contributes to BAT by investigating the moderating role of MA in relation with different types of CEOs and family firms' innovations.

The results indicate that non-family CEOs have a negative effect on innovations in family firms showing that they are less inclined to invest in R&D projects. Thus, H_1 is accepted. Family CEOs with actual controlling rights have a positive effect on R&D, indicating that family CEOs having actual controlling rights are willing to invest in risky projects, thereby acknowledging H_2. The family CEOs (without actual controlling rights) negatively influence R&D projects. Hence, they are less willing to spend on innovation activities, thereby supporting H_3. Our results are similar to prior findings (Ghafoor et al. 2022; Zulfiqar et al. 2021). Hence, non-family and family CEOs (with no controlling rights) show identical behaviour concerning their lower intentions to promote innovations in R&D projects than family CEOs with actual controlling rights. Agency problems arise because of the lack of true controlling rights. Given the nature of a heterogeneous family business, its performance depends on export decisions and product innovation plans that consider the characteristics of its target market(De Massis et al. 2015; Lu et al. 2015) in addition to economics (Jain et al. 2015; McCloskey 2013; Rugman et al. 2016). Furthermore, comparing family CEOs with true ownership rights, these restrictions prevent them from

Table 5 R&D sale.

Variables	M7 R&D	M8 R&D	M9 R&D	M10 R&D	M11 R&D	M12 R&D
Non_Family CEO	−0.000821			0.0280**		
	(0.00154)			(0.0121)		
Family CEO & Actual Controller		0.00145			−0.0405***	
		(0.00161)			(0.0132)	
Family CEO			−0.00640***			−0.00976
			(0.00102)			(0.00949)
Managerial Ability (MA)				0.0468*	−0.00330	0.0165
				(0.0245)	(0.0199)	(0.0199)
Non_Family CEO X MA				−0.0473**		
				(0.0199)		
Family CEO & Actual Controller X MA					0.0696***	
					(0.0219)	
Family CEO X MA						0.00583
						(0.0156)
Leverage	−0.00724*	−0.00709	−0.00742*	−0.00640	−0.00682	−0.00644
	(0.00437)	(0.00442)	(0.00438)	(0.00429)	(0.00430)	(0.00430)
ROE	−0.0133**	−0.0132**	−0.0128*	−0.0138**	−0.0138**	−0.0138**
	(0.00675)	(0.00675)	(0.00675)	(0.00682)	(0.00682)	(0.00684)
Size	0.00280***	0.00281***	0.00286***	0.00154	0.00173	0.00147
	(0.00103)	(0.00103)	(0.00103)	(0.00162)	(0.00163)	(0.00165)
CEO Pay	−0.00119	−0.00120	−0.00124	−0.000791	−0.000791	−0.000904
	(0.00137)	(0.00137)	(0.00137)	(0.00132)	(0.00132)	(0.00132)
CEO Power	0.0102	0.0102	0.00985	0.00765	0.00729	0.00812
	(0.0124)	(0.0124)	(0.0123)	(0.0123)	(0.0122)	(0.0123)
CEO Overconfidence	0.00422**	0.00427**	0.00402**	0.00410**	0.00430**	0.00373**
	(0.00177)	(0.00175)	(0.00177)	(0.00175)	(0.00173)	(0.00175)
Ind_Director_Ratio	0.0301**	0.0295**	0.0297**	0.0282**	0.0271*	0.0287**
	(0.0140)	(0.0140)	(0.0140)	(0.0140)	(0.0139)	(0.0140)
Constant	−0.0361*	−0.0370*	−0.0366*	−0.0414	−0.0153	−0.0208
	(0.0212)	(0.0214)	(0.0213)	(0.0265)	(0.0271)	(0.0270)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.055	0.055	0.056	0.055	0.056	0.054

Robust standard errors are in parenthesis ***, **, and * indicates $P < 1\%$, 5%, and 10%.

investing in innovative projects. This outcome is consistent with the SEW perspective; a family CEO will demonstrate the family's intention to maintain emotional endowment. When senior family managers aim for substantial social and economic wealth, they often choose to promote within the family, which might limit the firm access to talented individuals from outside the family (Cerrato and Piva 2012).

We enhance our discussion on H_1 that the non-family CEOs may not remain in a single-family business for an extended period, which explains why their interest in long-term investment is minimal. Some agency problems deter non-family CEOs from making long-term investments. Most people agree that having outside managers could reduce the family's impact on the workplace culture (particularly during the challenging internationalisation process), which would reduce the cohesiveness of top managers and heighten disagreements with family managers. Additionally, the senior management team may be less cohesive. Increased information asymmetry might also result from their potential experience, which the family managers might not have (Gomez-Mejia et al. 2011). As a result, external management may repel long-term investments necessary for internationalisation because it requires long-term positioning instead favouring short-term efficiency and profit-taking strategies (Lin and Wang 2021).

Concerning H_2, we note that family CEOs with complete controlling rights exhibit distinct behaviours than non-family CEOs owing to the former's greater willingness to spend on lengthy, hazardous projects. According to a framework presented by Aulakh et al. (2000), export performance is linked to product development and improvement. This finding suggests that ongoing research, development and innovation are crucial to a company's competitiveness and growth (Eriksson et al. 1997), and family businesses are willing to engage in these crucial activities. The two primary reasons favour a family CEO with complete authority. Firstly, family CEOs with complete controlling rights stay in family businesses for a very long time. They might even be the company's founders as skilled and knowledgeable founders make good strategists (Rey-Martí et al. 2016).Secondly, few agency problems occur because only one individual actually has the governing rights and that man is also a family. The majority of family members are typically appointed as top managers when senior family managers desire large social and economic wealth, which can limit hiring exceptional external talent (Jaskiewicz et al. 2015).The findings on H_3 of the study (negative effect of family CEOs with controlling rights on innovations) are described in a way that an agency issue arises when the CEO of a family business does not have complete control. Although CEOs are a company's highest authority, other senior management has actual control over decisions. The CEO's limited ability to use their skills for R&D results in unpleasant behaviour from the family CEO who lacks real power.

Although CEOs are autonomous bodies, senior management makes decisions when no genuine controlling rights exist. As CEOs are limited in their ability to invest in R&D, their actions can have a negative impact on future decisions on R&D

Table 6 Robust regression results with Tobit model.

Variables	M13 R&D	M14 R&D	M15 R&D	M16 R&D	M17 R&D	M18 R&D
Non_Family CEO	−0.000456***			0.00399***		
	(0.000163)			(0.00129)		
Family CEO & Actual Controller		0.000512***			−0.00385***	
		(0.000172)			(0.00144)	
Family CEO			−0.000558*			−0.00405
			(0.000299)			(0.00276)
Managerial Ability (MA)				−0.000636	−0.00750***	−0.00537***
				(0.00211)	(0.00174)	(0.00163)
Non_Family CEO X MA				−0.00744***		
				(0.00213)		
Family CEO & Actual Controller X MA					0.00732***	
					(0.00236)	
Family CEO X MA						0.00572
						(0.00452)
Leaverage	−0.00306***	−0.00305***	−0.00324***	−0.00298***	−0.00302***	−0.00315***
	(0.000422)	(0.000421)	(0.000418)	(0.000422)	(0.000422)	(0.000419)
ROE	−0.000360	−0.000359	−0.000370	0.000231	0.000218	0.000071
	(0.000786)	(0.000786)	(0.000786)	(0.000798)	(0.000798)	(0.000798)
Size	0.000017	0.000020	0.000024	0.000360**	0.000374***	0.000327**
	(0.000101)	(0.000101)	(0.000101)	(0.000142)	(0.000142)	(0.000142)
CEO Pay	0.000604***	0.000597***	0.000603***	0.000613***	0.000606***	0.000606***
	(0.000134)	(0.000134)	(0.000134)	(0.000134)	(0.000134)	(0.000134)
CEO Power	−0.00704***	−0.00701***	−0.00709***	−0.00729***	−0.00727***	−0.00717***
	(0.00123)	(0.00123)	(0.00123)	(0.00123)	(0.00123)	(0.00123)
CEO Overconfidence	−0.000166	−0.000162	−0.000225	−0.000101	−0.000092	−0.000197
	(0.000170)	(0.000170)	(0.000169)	(0.000170)	(0.000170)	(0.000169)
Ind_Director_Ratio	0.00177	0.00169	0.00196	0.00149	0.00143	0.00187
	(0.00155)	(0.00155)	(0.00155)	(0.00155)	(0.00155)	(0.00154)
Constant	−0.00394*	−0.00432**	−0.00425**	−0.0109***	−0.00740***	−0.00752***
	(0.00206)	(0.00206)	(0.00206)	(0.00252)	(0.00237)	(0.00236)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes

Tobit Multiplicative Heteroscedasticity Regression (tobithetm) tested.
Robust standard errors are in parenthesis ***, **, and * indicates $P < 1\%$, 5%, and 10%.

investment and innovations made by family firms. The innovations require a long-term outlook owing to their great unpredictability, high levels of risk and lengthy return horizons. However, non-family CEOs' short-term focus prevents them from favouring R&D over projects that produce quick results. The outcome of an investment, however, can have a negative impact on their financial situation and current employment. The CEO is probably the most important non-family person a family business can employ. Given the limited number of family fellows, family businesses frequently hire such people.

Regarding our moderation hypotheses, we find that MA significantly moderates the relationship between diverse unique types of family CEOs and their R&D investment behaviour, which supportsH4–6. Thus, MA is a factor that changes the behaviour of non-family CEOs towards innovations. From the large moderating effects, further MA promotes business innovation. According to Narayanan (1985), rational managers will typically under-invest in innovation owing to concerns about their careers because of the intrinsic uncertainty and long-term nature of innovative projects. To demonstrate their competence in the market, managers will have an incentive to pursue projects that produce payoffs quickly and with great assurance. Managers who have established a track record should find less significance in the management signalling scenario (Narayanan 1985). As a result, we confirm the favourable role of MA in the nexus between diverse types of CEOs and innovation activities. The results state that innovation activities become strong in the presence of high MA. We look at how CEO types and MA interact. Innovative project results are naturally unpredictable and unique. As a result, even the most skilled managers are unable to foresee every possible event. Prior research demonstrated that a risk-taking attitude is required to overcome the inherent barriers to innovation (Yang Chen et al. 2014). As a result, MA will alter the relationship between CEO types and innovative behaviour. However, a counterargument is that highly capable managers might spend much on innovation because they can greatly control the risks connected with it. Hence, the innovation increases.

Conclusion

The family firms exhibit a high degree of heterogeneity. This study depicts that firm with family CEOs are more willing to invest in innovation activities than those without. The research extends the scope by conducting a behavioural analysis of diverse types of CEOs towards innovations within family firms. We also extend the literature by investigating the moderating role of MA in the relations between different types of CEOs and family firms' innovations. The study introduces three unique and diverse types of CEOs in the family firms of China and obtains significant findings. Based on BAT, we find behavioural differences in the diverse types of CEOs and their attitude towards innovations in family firms. Family

Table 7 Robust regression results with Probit model.

Variables	M19 R&D	M20 R&D	M21 R&D	M22 R&D	M23 R&D	M24 R&D
Non_Family CEO	−0.0814*			0.341		
	(0.0445)			(0.357)		
Family CEO & Actual Controller		0.142***			−0.235	
		(0.0463)			(0.381)	
Family CEO			−0.176**			−2.388***
			(0.0769)			(0.859)
Managerial Ability (MA)				1.997***	1.560***	1.477***
				(0.655)	(0.574)	(0.545)
Non_Family CEO X MA				−0.685		
				(0.586)		
Family CEO & Actual Controller X MA					0.172	
					(0.624)	
Family CEO X MA						3.615**
						(1.427)
Leverage	−0.122	−0.107	−0.146	−0.135	−0.118	−0.148
	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)
ROE	−0.0179	−0.00671	−0.00872	−0.115	−0.110	−0.124
	(0.221)	(0.221)	(0.222)	(0.225)	(0.225)	(0.225)
Size	0.0999***	0.102***	0.101***	−0.0003	0.0038	−0.0088
	(0.0299)	(0.0300)	(0.0298)	(0.0454)	(0.0456)	(0.0460)
CEO Pay	0.192***	0.191***	0.193***	0.189***	0.187***	0.189***
	(0.0373)	(0.0374)	(0.0372)	(0.0375)	(0.0375)	(0.0375)
CEO Power	−1.617***	−1.607***	−1.627***	−1.572***	−1.550***	−1.574***
	(0.336)	(0.336)	(0.335)	(0.335)	(0.336)	(0.336)
CEO Overconfidence	0.0207	0.0266	0.00766	0.0211	0.0235	0.0053
	(0.0478)	(0.0478)	(0.0478)	(0.0479)	(0.0477)	(0.0478)
Ind_Director_Ratio	1.586***	1.525***	1.604***	1.570***	1.535***	1.583***
	(0.411)	(0.413)	(0.410)	(0.412)	(0.413)	(0.410)
Constant	−5.482***	−5.582***	−5.557***	−4.516***	−4.404***	−4.052***
	(0.640)	(0.643)	(0.639)	(0.800)	(0.777)	(0.772)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes

Probit Multiplicative Heteroscedasticity Regression tested.
Robust standard errors are in parenthesis ***, **, and * indicates $P < 1\%$, 5%, and 10%."

CEOs with full controlling rights have high confidence to make timely decisions, which results in minimum agency conflicts.

We also analyse the moderating role of MA in the nexus between CEO types and innovation activities. We find that high MA alters the behaviour of different CEOs. With the moderation of MA, non-family CEOs also show a willingness to invest in innovative projects, stating that without MA, their willingness to make innovations declines. The minimal influence of the family CEO in the linkages between innovations and voting rights is a major factor in this study's findings. That is, longer investment periods rather than risk aversion have the advantage of information and arguments. The findings show that professional CEOs of family enterprises are encouraged to participate in value-added R&D expenditures due to the family-based investment voting system. Thus, we conclude that MA has a significant moderating role in altering the behaviour of different CEOs in family firms.

Managerial implications. This research helps explain the behaviour of diverse family CEOs towards making investments in innovation activities through MA. Family CEOs with complete controlling rights benefit businesses in the long run and increase innovative output. By contrast, non-family and family CEOs with no controlling rights are risk-averse and compatible with BAT. We show that the R&D activities of family firms increase when the MA is high. However, we support appointing family CEOs and managers with expertise and authority. Skilled managers also appear to be well known to investors. Family firms are prevalent on a global scale, and the economic prosperity of numerous countries is reliant upon their presence. This study demonstrates the significance of managerial ability in relation to the success and sustained innovation of organisations. This study aims to provide insights for investors regarding the propensity of CEOs to invest in research and development (R&D). The importance of innovation in family enterprises is crucial for fostering economic progress. The sole means by which family CEOs can augment their worth is through the allocation of resources towards research and development (R&D) activities. This study is useful to all parties involved with the company, including employees, clients, suppliers and customers, in light of the CEOs of family-owned businesses' remarks and actions. The results of this study can also assist board members in selecting and recruiting non-family CEOs or keeping family CEOs (with or without actual controlling rights).

Limitations and future research avenues. This study has few restrictions that present potential for future investigation. Our study focuses only on Chinese family businesses, and examining how our suggested model functions across cultures is crucial. Many criteria can be used to categorise CEOs; however, in this research, the types of family CEOs have been considered based on control diversity. Market dominance and the increase in scientific and engineering employment can be leveraged in the future to manage the impact of innovations. Considering the lack of data for the most recent years,

the data have only been gathered up to 2020. According to literature, several factors including the relationship between family wealth and corporate equity may have an impact on innovations in family firms (Sciascia et al. 2015). The inclusion of such characteristics can be advantageous. The reason is that when all of the family money is invested in the company and ownership is concentrated, family enterprises have a tendency to avoid risky activities that could endanger SEW endowment, such as globalisation. We must use caution when extrapolating findings from a single-nation study because our sample is only comprised of Chinese companies. Our understanding might be improved by a comparison of private family businesses from other nations, which would demonstrate whether and how CEOs impact innovations in family businesses. Finally, the CEO's geographical distribution is a limitation we cannot get around but creates interesting research topics because our data cannot account for the existence of producing sites outside of national borders.

Data availability

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

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References

Aghion P, Van Reenen J, Zingales L (2013) Innovation and institutional ownership. Am Economic Rev 103(1):277–304
Alam MS, Atif M, Chien-Chi C, Soytaş U (2019) Does corporate R&D investment affect firm environmental performance? Evidence from G-6 countries. Energy Econ 78:401–411
Andreou PC, Karasamani I, Louca C, Ehrlich D (2017) The impact of managerial ability on crisis-period corporate investment. J Bus Res 79:107–122
Andreou PC, Philip D, Robejsek P (2016) Bank liquidity creation and risk-taking: Does managerial ability matter? J Bus Financ Account 43(1-2):226–259
Aulakh PS, Kotabe M, Teegen H (2000) Export strategies and performance of firms from emerging economies: Evidence from Brazil, Chile, and Mexico. Acad Manag J 43(3):342–361
Bennedsen M, Nielsen KM, Pérez-González F, Wolfenzon D (2007) Inside the family firm: The role of families in succession decisions and performance. Q J Econ 122(2):647–691
Bertrand M, Schoar A (2006) The role of family in family firms. J economic Perspect 20(2):73–96
Block JH (2012) R&D investments in family and founder firms: An agency perspective. J Bus Venturing 27(2):248–265
Bonsall IV SB, Holzman ER, Miller BP (2017) Managerial ability and credit risk assessment. Manag Sci 63(5):1425–1449
Bozec, Y, & Di Vito, J (2018). Founder-controlled firms and R&D investments: New evidence from Canada. Family Bus Rev, https://doi.org/10.1177/0894486518793237
Bozec Y, Di Vito J (2019) Founder-controlled firms and R&D investments: New evidence from Canada. Fam Bus Rev 32(1):76–96
Burkart M, Panunzi F, Shleifer A (2003) Family firms. J Financ 58(5):2167–2201
Carney M, Zhao J, Zhu L (2019) Lean innovation: Family firm succession and patenting strategy in a dynamic institutional landscape. J Fam Bus Strategy 10(4):100247
Cefis E, Marsili O (2006) Survivor: The role of innovation in firms' survival. Res Policy 35(5):626–641
Cerrato D, Piva M (2012) The internationalization of small and medium-sized enterprises: the effect of family management, human capital and foreign ownership. J Manag Gov 16(4):617–644
Chang SC, Wu WY, Wong YJ (2010) Family control and stock market reactions to innovation announcements. Br J Manag 21(1):152–170
Chemmanur TJ, He S, Hu G (2009) The role of institutional investors in seasoned equity offerings. J financial Econ 94(3):384–411
Chen H-L, Hsu W-T (2009) Family ownership, board independence, and R&D investment. Fam Bus Rev 22(4):347–362
Chen Y, Podolski EJ, Veeraraghavan M (2015) Does managerial ability facilitate corporate innovative success? J Empir Financ 34:313–326
Chen Y, Tang G, Jin J, Xie Q, Li J (2014) CEO s' transformational leadership and product innovation performance: The roles of corporate entrepreneurship and technology orientation. J Prod Innov Manag 31:2–17
Cheng L, Zhang Y (2022) Do able managers take more risks? J Innov Knowl 7(2):100182
Cheng Q (2014) Family firm research–A review. China J Account Res 7(3):149–163
Choi YR, Zahra SA, Yoshikawa T, Han BH (2015) Family ownership and R&D investment: The role of growth opportunities and business group membership. J Bus Res 68(5):1053–1061
Chrisman JJ, Chua JH, Pearson AW, Barnett T (2012) Family involvement, family influence, and family–centered non–economic goals in small firms. Entrepreneurship Theory Pract 36(2):267–293
Chrisman JJ, Patel PC (2012) Variations in R&D investments of family and non-family firms: Behavioral agency and myopic loss aversion perspectives. Acad Manag J 55(4):976–997
Costa-Gomes MA, Crawford VP (2006) Cognition and behavior in two-person guessing games: An experimental study. Am Economic Rev 96(5):1737–1768
Custódio C, Ferreira MA, Matos P (2013) Generalists versus specialists: Lifetime work experience and chief executive officer pay. J financial Econ 108(2):471–492
Custódio C, Ferreira MA, Matos P (2019) Do general managerial skills spur innovation? Manag Sci 65(2):459–476
Dana L-P, Salamzadeh A, Mortazavi S, Hadizadeh M (2022) Investigating the impact of international markets and new digital technologies on business innovation in emerging markets. Sustainability 14(2):983
De Massis, A, & Foss, NJ (2018) Advancing family business research: The promise of microfoundations, Vol. 31, pp. 386–396, Sage Publications Sage CA, Los Angeles, CA
De Massis A, Frattini F, Lichtenthaler U (2013) Research on technological innovation in family firms: Present debates and future directions. Fam Bus Rev 26(1):10–31
De Massis A, Frattini F, Pizzurno E, Cassia L (2015) Product innovation in family versus nonfamily firms: An exploratory analysis. J Small Bus Manag 53(1):1–36
Demerjian P, Lev B, McVay S (2012) Quantifying managerial ability: A new measure and validity tests. Manag Sci 58(7):1229–1248
Duran P, Kammerlander N, Van Essen M, Zellweger T (2016) Doing more with less: Innovation input and output in family firms. Acad Manag J 59(4):1224–1264
Eriksson K, Johanson J, Majkgård A, Sharma DD (1997) Experiential knowledge and costs in the internationalization process. J Int Bus Stud 28:337–360
Finkelstein S, Peteraf MA (2007) Managerial activities: A missing link in managerial discretion theory. Strategic Organ 5(3):237–248
Fu, Y (2019) The impact of married couples on firm innovation: Evidence from Chinese family firms. Finance Res Lett 33:101220
Gallo MÁ, Tàpies J, Cappuyns K (2004) Comparison of family and nonfamily business: Financial logic and personal preferences. Fam Bus Rev 17(4):303–318
Gentry R, Dibrell C, Kim J (2016) Long–term orientation in publicly traded family businesses: Evidence of a dominant logic. Entrepreneurship Theory Pract 40(4):733–757
Ghafoor S, Wang M, Chen S, Zhang R, Zulfiqar M (2022) Behavioural investigation of the impact of different types of CEOs on innovation in family firms: moderating role of ownership divergence between cash flow rights and voting rights. Economic Res-Ekonomska Istraživanja 35(1):2906–2929
Ghafoor, S, Zulfiqar, M, Wang, M, Wang, C, & Islam, MR (2023) Behavioural Phenomena of Family Firm Control Diversity and R&D Investment with Moderating Role CEO Compensation. Psychol Res Behav Manag 16:397–417
Goldfarb A, Xiao M (2011) Who thinks about the competition? Managerial ability and strategic entry in US local telephone markets. Am Economic Rev 101(7):3130–3161
Gomez-Mejia LR, Cruz C, Berrone P, De Castro J (2011) The bind that ties: Socioemotional wealth preservation in family firms. Acad Manag Ann 5(1):653–707
Gómez-Mejía LR, Haynes KT, Núñez-Nickel M, Jacobson KJ, Moyano-Fuentes J (2007) Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills. Adm Sci Q 52(1):106–137
Gomez-Mejia LR, Makri M, Kintana ML (2010) Diversification decisions in family-controlled firms. J Manag Stud 47(2):223–252
Gomez–Mejia LR, Campbell JT, Martin G, Hoskisson RE, Makri M, Sirmon DG (2014) Socioemotional wealth as a mixed gamble: Revisiting family firm R&D investments with the behavioral agency model. Entrepreneurship Theory Pract 38(6):1351–1374
Hambrick DC, Finkelstein S (1987) Managerial discretion: A bridge between polar views of organizational outcomes. Res Org Behav 9:369–406
Harris TB (1989) Some comments on family firm boards. Fam Bus Rev 2(2):150–152
Honoré F, Munari F, de La Potterie BVP (2015) Corporate governance practices and companies' R&D intensity: Evidence from European countries. Res Policy 44(2):533–543

Jain S, Nair A, Ahlstrom D (2015) Introduction to the special issue: Towards a theoretical understanding of innovation and entrepreneurship in India, Vol. 32, pp. 835–841, Springer, Asia Pacific Journal of Management
Jaskiewicz P, Combs JG, Rau SB (2015) Entrepreneurial legacy: Toward a theory of how some family firms nurture transgenerational entrepreneurship. J Bus Venturing 30(1):29–49
Jiang F, Jiang Z, Kim KA, Zhang M (2015) Family-firm risk-taking: does religion matter? J Corp Financ 33:260–278
Jiang F, Shi W, Zheng X (2020) Board chairs and R&D investment: Evidence from Chinese family-controlled firms. J Bus Res 112:109–118
Kahneman D, Tversky A (1979) Intuitive prediction: Biases and corrective procedures. TIMS Studies in Management Science 12:313–327
Kale JR, Shahrur H (2007) Corporate capital structure and the characteristics of suppliers and customers. J financial Econ 83(2):321–365
Kammerlander N, Ganter M (2015) An attention-based view of family firm adaptation to discontinuous technological change: Exploring the role of family CEOs' noneconomic goals. J Prod Innov Manag 32(3):361–383
Kim H, Kim H, Lee PM (2008) Ownership structure and the relationship between financial slack and R&D investments: Evidence from Korean firms. Organ Sci 19(3):404–418
Koijen RS (2014) The cross-section of managerial ability, incentives, and risk preferences. J Financ 69(3):1051–1098
Kraiczy ND, Hack A, Kellermanns FW (2015) What makes a family firm innovative? CEO risk-taking propensity and the organizational context of family firms. J Prod Innov Manag 32(3):334–348
Krause R, Semadeni M, Cannella Jr AA (2014) CEO duality: A review and research agenda. J Manag 40(1):256–286
Kumeto G (2015) Behavioural agency theory and the family business, Theoretical perspectives on family businesses. Edward Elgar Publishing, Cheltenham, p. 78-98
Lee C-C, Wang C-W, Chiu W-C, Tien T-S (2018) Managerial ability and corporate investment opportunity. Int Rev Financial Anal 57:65–76
Lerner J, Wulf J (2007) Innovation and incentives: Evidence from corporate R&D. Rev Econ Stat 89(4):634–644
Lim EN, Lubatkin MH, Wiseman RM (2010) A family firm variant of the behavioral agency theory. Strategic Entrepreneurship J 4(3):197–211
Lin SH, Hu SY (2007) A family member or professional management? The choice of a CEO and its impact on performance. Corp Gov: Int Rev 15(6):1348–1362
Lin W-T, Wang LC (2021) Family firms, R&D, and internationalization: the stewardship and socio-emotional wealth perspectives. Asia Pac J Manag 38(1):91–119
Lin Z, Patel P, Oghazi P (2021) The value of managerial ability and general ability for inventor CEOs. J Bus Res 135:78–98
López-Fernández MC, Serrano-Bedia AM, Pérez-Pérez M (2016) Entrepreneurship and family firm research: A bibliometric analysis of an emerging field. J Small Bus Manag 54(2):622–639
Lu JW, Liang X, Shan M, Liang X (2015) Internationalization and performance of Chinese family firms: The moderating role of corporate governance. Manag Organ Rev 11(4):645–678
Lu X, Sheng Y, Wang J (2020) The influence of executive compensation incentives on R&D investment: the moderating effect of executive overconfidence. Technol Anal Strategic Manag 32(10):1169–1181
Mace ML (1971) Directors: Myth and reality, Harvard Business School Press
Manso G (2011) Motivating innovation. J Financ 66(5):1823–1860
Matzler K, Veider V, Hautz J, Stadler C (2015) The impact of family ownership, management, and governance on innovation. J Prod Innov Manag 32(3):319–333
McCloskey DN (2013) Tunzelmann, Schumpeter, and the hockey stick. Res Policy 42(10):1706–1715
Miller D, Kets de Vries MF, Toulouse J-M (1982) Top executive locus of control and its relationship to strategy-making, structure, and environment. Acad Manag J 25(2):237–253
Miller D, Le Breton-Miller I (2005) Management insights from great and struggling family businesses. Long Range Plan 38(6):517–530
Miller D, Le Breton-Miller I (2006) Family governance and firm performance: Agency, stewardship, and capabilities. Fam Bus Rev 19(1):73–87
Miller D, Le Breton-Miller I, Lester RH (2011) Family and lone founder ownership and strategic behaviour: Social context, identity, and institutional logics. J Manag Stud 48(1):1–25
Miller D, Le Breton-Miller I, Minichilli A, Corbetta G, Pittino D (2014) When do non-family CEO s outperform in family firms? Agency and behavioural agency perspectives. J Manag Stud 51(4):547–572
Miller D, Minichilli A, Corbetta G (2013) Is family leadership always beneficial? Strategic Manag J 34(5):553–571
Mintzberg H, Waters JA (1982) Tracking strategy in an entrepreneurial firm. Acad Manag J 25(3):465–499
Moghadamzadeh A, Ebrahimi P, Radfard S, Salamzadeh A, Khajeheian D (2020) Investigating the role of customer co-creation behavior on social media platforms in rendering innovative services. Sustainability 12(17):6926
Morck R, Yeung B (2003) Agency problems in large family business groups. Entrepreneurship Theory Pract 27(4):367–382
Muñoz-Bullón F, Sanchez-Bueno MJ (2011) The impact of family involvement on the R&D intensity of publicly traded firms. Fam Bus Rev 24(1):62–70
Murphy KJ, Zabojnik J (2007) Managerial capital and the market for CEOs. Available at SSRN 984376
Narayanan M (1985) Managerial incentives for short-term results. J Financ 40(5):1469–1484
Peng MW (2003) Institutional transitions and strategic choices. Acad Manag Rev 28(2):275–296
Peng MW, Jiang Y (2010) Institutions behind family ownership and control in large firms. J Manag Stud 47(2):253–273
Rey-Martí A, Ribeiro-Soriano D, Sánchez-García JL (2016) Giving back to society: Job creation through social entrepreneurship. J Bus Res 69(6):2067–2072
Rugman AM, Nguyen QT, Wei Z (2016) Rethinking the literature on the performance of Chinese multinational enterprises. Manag Organ Rev 12(2):269–302
Salvato C, Moores K (2010) Research on accounting in family firms: Past accomplishments and future challenges, Vol. 23, pp. 193–215, SAGE Publications Sage CA, Los Angeles, CA
Schmid T, Achleitner A-K, Ampenberger M, Kaserer C (2014) Family firms and R&D behavior–New evidence from a large-scale survey. Res Policy 43(1):233–244
Schulze WS, Lubatkin MH, Dino RN (2003) Toward a theory of agency and altruism in family firms. J Bus Venturing 18(4):473–490
Sciascia S, Nordqvist M, Mazzola P, De Massis A (2015) Family ownership and R&D intensity in small-and medium-sized firms. J Prod Innov Manag 32(3):349–360
Shleifer A, Vishny RW (1986) Large shareholders and corporate control. J political Econ 94(3, Part 1):461–488
Smith BF, Amoako-Adu B (1999) Management succession and financial performance of family controlled firms. J Corp Financ 5(4):341–368
Stanley LJ (2010) Emotions and family business creation: An extension and implications. Entrepreneurship Theory Pract 34(6):1085–1092
Sun X, Lee S-H, Phan PH (2019) Family firm R&D investments in the 2007–2009 great recession. J Fam Bus Strategy 10(4):100244
Sundaramurthy C, Mahoney JM, Mahoney JT (1997) Board structure, antitakeover provisions, and stockholder wealth. Strategic Manag J 18(3):231–245
Tajpour M, Salamzadeh A, Salamzadeh Y, Braga V (2022) Investigating social capital, trust and commitment in family business: Case of media firms. J Fam Bus Manag 12(4):938–958
Tian X, Wang TY (2014) Tolerance for failure and corporate innovation. Rev Financial Stud 27(1):211–255
Ting IWK, Tebourbi I, Lu W-M, Kweh QL (2021) The effects of managerial ability on firm performance and the mediating role of capital structure: evidence from Taiwan. Financial Innov 7(1):1–23
Tsao S-M, Lin C-H, Chen VY (2015) Family ownership as a moderator between R&D investments and CEO compensation. J Bus Res 68(3):599–606
Tyler BB, Caner T (2016) New product introductions below aspirations, slack and R&D alliances: A behavioral perspective. Strategic Manag J 37(5):896–910
Waldkirch M (2020) Non-family CEOs in family firms: Spotting gaps and challenging assumptions for a future research agenda. J Fam Bus Strategy 11(1):100305
Wang D, Wu Z, You J, Zhu B, Zhang R (2023) Does hometown connection between chairmen and CEOs improve compensation–performance sensitivity in China? Humanities Soc Sci Commun 10(1):1–12
Wang Y, Wei Y, Song FM (2017) Uncertainty and corporate R&D investment: Evidence from Chinese listed firms. Int Rev Econ Financ 47:176–200
Ward JL (1988) The special role of strategic planning for family businesses. Fam Bus Rev 1(2):105–117
Westphal JD (1999) Collaboration in the boardroom: Behavioral and performance consequences of CEO-board social ties. Acad Manag J 42(1):7–24
Xu N, Yuan Q, Jiang X, Chan KC (2015) Founder's political connections, second generation involvement, and family firm performance: Evidence from China. J Corp Financ 33:243–259
Xue Y (2007) Make or buy new technology: The role of CEO compensation contract in a firm's route to innovation. Rev Account Stud 12(4):659–690
Yung K, Chen C (2018) Managerial ability and firm risk-taking behavior. Rev Quant Financ Account 51:1005–1032
Zulfiqar M, Chen S, Yousaf MU (2021) Birth mode of family firms, family entering time and R&D investment: evidence from China. J Innov Manag 25(5):1242–1265
Zulfiqar M, Huo W, Wu S, Chen S, Elahi E, Yousaf MU (2022) Behavioural Psychology of Unique Family FirmsToward R&D Investment in the Digital Era: The Role of Ownership Discrepancy. Front Psychol 13:928447
Zulfiqar M, Hussain K (2020) CEO compensation and firm innovation: moderating role of ownership concentration. Int J Innov Manag 24(06):2050058
Zulfiqar M, Hussain K, Yousaf MU, Sohail N, Ghafoor S (2020) Moderating role of CEO compensation in lean innovation strategies of Chinese listed family firms. Corp Gov: Int J Bus Soc 20(5):887–902

Zulfiqar M, Yousaf MU, Islam MR, Ghafoor S (2021) Family firms propensity to lean innovation in the emerging economy: a moderating role of executive's compensation. J Fam Bus Manag 11(1):32–50
Zulfiqar M, Zhang R, Khan N, Chen S (2021) Behavior Towards R&D Investment of Family Firms CEOs: The Role of Psychological Attribute. Psychol Res Behav Manag 14:595

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Author contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Competing interests

The authors declare no competing interests.

Ethical approval

This study does not require approval from an Institutional Review Board or Ethics Committee. In our study we have used secondary data from Chinese Listed Family Firms. It is publicly available on CSMAR, through a paid source.

Informed consent

This article does not contain any studies with human participants performed by any of the authors.

Additional information

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Correspondence and requests for materials should be addressed to Yunjiang Geng.