Family management, family succession, and R&D investment: An empirical study

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Abstract

Using data from the statements issued by A-share family firms listed on Chinese stock markets between 2008 and 2019, this paper explores the impacts of family management and family succession on R&D investment. We draw on the perspective of restricted and extended socioemotional wealth and differentiate exploitative R&D and explorative R&D in a detailed study. The study finds that the proportion of family members among board members or senior executives and the kinship of the CEO or chair of the board of directors have different effects on R&D investment, indicating that a diversity exists in how family members identify their role within the company. Furthermore, the participation of the controller's children in the enterprise can promote explorative R&D investment instead of exploitative R&D, but only during the process of intergenerational succession. The findings differ from prior research in calling attention to the facts that the impact of family management is not always homogeneous owing to the dispersion of family members into different positions, and it can be misleading to conclude that R&D investment is more conservative in family businesses without considering the structure of R&D investment.

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Introduction

Currently, R&D has become essential for the survival and sustainable competitive advantage of enterprises, including family firms. Influenced by traditional culture, Chinese people always value family, and family firms are a common form of enterprises in China. A survey from Pricewaterhouse Coopers (2021) reported that 51% of family businesses in mainland China aim to increase R&D investment in the next two years, which is significantly higher than the global average of 28%. At the same time, family owner-managers are considered to be more risk averse than their counterparts in nonfamily firms (Gómez-Mejía et al., 2007). This phenomenon makes us wonder: under what circumstances are family businesses willing to increase R&D investment? This paper focuses on the influences of family management and family succession on R&D investment.

We draw on the perspective of socioemotional wealth (SEW). The concept of SEW is proposed to illustrate the nonfinancial benefits the family receives from the enterprise that can satisfy their emotional needs, and SEW is regarded as a strategic decision-making reference point in family firms (Gómez-Mejía et al., 2007). The underlying idea is that family firms value SEW even more than they value financial benefits, and this idea is empirically supported (Belda-Ruiz et al., 2021; Hernández-Perlines et al., 2019). When the family is seen in its entirety, the preferences of family members involved in management can be very different from those of outsiders. Family involvement is often related to the preservation of SEW and seen as unfavorable to R&D investment (Matzler et al., 2015). However, are the preferences of family members in different company positions always homogeneous? According to Miller and Le Breton-Miller (2014), it is likely that SEW preferences vary among family members. However, related empirical studies are quite limited. Furthermore, while family succession is recognized as a driver of long-term orientations in family firms (Chrisman & Patel, 2012; Le Breton-Miller & Miller, 2006), is R&D investment encouraged when intergenerational succession is foreseeable? Do the preferences of family members change owing to family succession? To answer these questions, we employ a sample of 7969 observations from Chinese A-share listed family firms between 2008 and 2019 and empirically analyze the impacts of family management and family succession on R&D investment.

The study contributes to the literature in several ways. First, we explore the possible variation in SEW preferences among family members by analyses of the impacts of family management on R&D investment. SEW preferences can be heterogeneous, and few empirical studies exist. Second, this paper differs from prior research in that it differentiates exploitative R&D and explorative R&D to further understand the relationship between family business and innovation, drawing on the perspective of restricted and extended SEW. Compared with studies regarding innovation as a whole, there is a lack of empirical evidence for exploitative and explorative R&D investment in family firms. Finally, the study investigates whether the R&D investment of family firms is contingent on the context of family succession. We find that there is actually a change in the structure of R&D

investment rather than a seemingly more conservative attitude toward R&D investment when family succession is concerned.

The rest of the paper is organized as follows. In the "Hypothesis development" section, we focus on the hypothesis development. After setting out the empirical strategy and data in the "Empirical strategy" section, we present and discuss the empirical results in the "Analysis of the results" section. The "Conclusions" section concludes with discussions on practical implications.

Hypothesis development

There have been mixed findings about the relationship between family business and innovation, including three main viewpoints. First, empirical studies have shown that there is a negative correlation between family involvement and R&D investment (Matzler et al., 2015; Muñoz-Bullón & Sanchez-Bueno, 2011; Yang et al., 2019). According to Gómez-Mejía et al. (2011), the conservative attitude toward R&D investment in family businesses is due to the aversion to SEW losses caused by R&D activities. Second, family firms are seen as displaying a more long-term vision in their investments than most of their nonfamily counterparts (Gentry et al., 2016; Le Breton-Miller & Miller, 2006; Zellweger, 2007). Asaba (2013) and Ashwin et al. (2015) also reported some evidence indicating that family involvement positively influences R&D investment. Third, some studies believe that the R&D investment of family firms is contingent. It varies according to the compatibility of short-term and long-term goals as well as the difference between current performance and the company's aspiration level (Chrisman & Patel, 2012). Choi et al. (2015) also claimed that family ownership is negatively related to R&D investment, but the relationship becomes positive in the presence of growth opportunities. Regarding the SEW perspective, Llanos-Contreras et al. (2021) point out that family firms could be both risk willing and risk averse depending on the scenario they face. Thus, we will go along with the third viewpoint in this paper to see whether R&D investment is contingent on the context of family succession.

One reason for the mixed findings is that family involvement in the enterprise has many aspects. Astrachan et al. (2002) stressed the extent and manner of family involvement. Most recent studies concerning family involvement (e.g., Cano-Rubio et al., 2021; Daspit et al., 2018; Muñoz-Bullón & Sanchez-Bueno, 2011) focus mainly on family ownership and management. In this paper, we intend to focus on the influences of family management when the effects of family ownership are controlled. The more family members occupy positions on the board or senior management team, the more powerful the controlling family becomes in management. Meanwhile, apart from the quantity of family members in management, the importance of a family member's position is also noteworthy. Whether a family member holds the CEO or chair position is valued in the literature (Ashwin et al., 2015; Del Bosco & Bettinelli, 2020). Villalonga and Amit (2006) affirmed that family ownership creates value only when the founder serves as CEO or as chair of the board with a hired CEO. Therefore, this paper uses both the proportion of family members and the kinship of the CEO or chair to measure family management.

According to Gómez-Mejía et al. (2007), SEW contains the ability to exercise authority, the satisfaction of needs for belonging, affect, and intimacy, the perpetuation of family values, the preservation of the family dynasty, the conservation of the family firm's social capital, the fulfillment of family obligations based on blood ties, and the opportunity to be altruistic to family members. Berrone et al. (2012) claimed that SEW should have five dimensions: family control and influence, the identification of family members with the firm, binding social ties, the emotional attachment of family members, and the renewal of family bonds to the firm through dynastic succession. On the basis of these extensively recognized dimensions (Hernández-Perlines et al., 2019), Miller and Le Breton-Miller (2014) classified SEW into two categories: restricted SEW and extended SEW. Restricted SEW refers to priorities that are of narrow and short-term benefits to the controlling family, and extended SEW represents priorities that are of long-term benefits to a broader range of stakeholders. This typology has been used by Schierstedt et al. (2020) in the study of diversified acquisitions in family firms.

Drawing on restricted SEW and extended SEW, the overall impact of family management on R&D investment is theoretically uncertain. SEW losses from R&D investment are often related to restricted SEW. For example, R&D may require continuous investments and external financing or force the family to draw on external expertise, which results in the risk of dilution of family control (Garcés-Galdeano et al., 2016; Ghafoor et al., 2021). The controller tends to engage more in preserving family loyalties, reciprocity, and altruism in the presence of family members, with greater importance attached to restricted SEW that can be disadvantageous for R&D investment (Luo et al., 2019; Sánchez-Marín et al., 2020). If R&D activities are seen as possible threats to SEW, the aversion to SEW losses will drive family decision-makers to be conservative toward R&D investment (Chrisman & Patel, 2012; Gómez-Mejía et al., 2007, 2011). However, R&D investment is beneficial to the long-term development of the enterprise and is not necessarily contradictory to the preservation of extended SEW. It is noteworthy that the conservative attitude toward R&D investment is not due to the aversion to uncertainty of R&D activities but to the possible losses of family SEW (Gómez-Mejía et al., 2011). Gómez-Mejía et al. (2014) argued that family firms may be motivated by potential SEW gains. Therefore, when there appears to be gains in extended SEW, the attitude toward R&D investment can turn out to be more positive.

Furthermore, the kinship of CEOs can be a source of power, while empirical evidence suggests that powerful CEOs can better allocate resources to support R&D investment (Chen, 2014). The kinship of the chair may result in a reduction in the regulatory role of the board and help the controlling family obtain greater power to promote R&D investment. Thus, we propose the following hypotheses:

Hypothesis 1: The proportion of family members among board members or senior executives is positively associated with total R&D investment intensity in family firms.
Hypothesis 2: The kinship of the CEO or chair is positively associated with total R&D investment intensity in family firms.

Whether a certain type of R&D has low-level risk or high-level risk is another factor that can significantly affect R&D investment strategy. Following organizational learning theory, Danneels (2002) conceptualized innovations as exploitative and explorative. In general, exploitative innovation refers to the expansion, refinement, or upgrading of existing products or technologies, while explorative innovation is carried out by enterprises to open up new markets and has weak relevance to existing technological or customer competencies (Danneels, 2002; Rothaermel & Alexandre, 2009). Returns from explorative innovation are more uncertain and remote in time compared with exploitative innovation, while firms can choose whether to emphasize exploitative or explorative innovations (Greve, 2007; Zhao & Peng, 2018). Explorative innovation often has a more enduring vision that may accord with extended SEW. Since explorative innovation often has higher requirements for continuous investments or external expertise that can result in the dilution of family control, we propose that family management has a negative influence on explorative R&D investment.

According to China's accounting standards for business enterprises (2006), the investment of R&D projects is divided into research-stage investment and exploitation-stage investment. Compared with exploitation-stage investment, research-stage investment is more exploratory with greater risks, and the expenditure should be settled by the expense method. Therefore, this paper adopts the expensed expenditure of R&D activities as a measure of explorative R&D investment and capitalized expenditure as a measure of exploitative R&D investment. We propose the following hypotheses:

> Hypothesis 3: The proportion of family members among board members or senior executives is negatively associated with the ratio of expensed R&D investment in family firms.
> Hypothesis 4: The kinship of the CEO or chair is negatively associated with the ratio of expensed R&D investment in family firms.

Succession in family firms has been recognized as a source of change in innovation (Porfírio et al., 2020). Beck et al. (2011) showed that later-generation family firms demonstrate a lower level of innovation because later generations focus on preserving family wealth. Duran et al. (2016) also affirmed that family firms invest less in innovation and that this effect is stronger when the CEO is a member of a younger generation of the family. Nevertheless, Kellermanns et al. (2008) argued that founder-centered firms often need fresh innovative momentum given by later-generation members. According to Chrisman and Patel (2012), intentions for transgenerational family control can lead to a long-term orientation and greater risk taking.

While a substantial share of empirical studies focus on SEW losses brought by R&D investment, from the perspective of SEW, foreseeable family succession extends the orientation of the controlling family and makes SEW gains from R&D investment possible. R&D investment can easily be regarded as tending to the wealth of the younger generation, which is consistent with extended SEW. Zhao and Peng (2018) pointed out that a firm's existing competencies quickly become outdated when the importance of exploration is seriously underestimated. This kind of

underestimation does not conform with extended SEW. Hence, in the presence of intergenerational succession, R&D activities with higher risks may be re-estimated as necessary or acceptable. Since the participation of the controller's children in the enterprise is a sign of succession, the children are used in this paper to measure family succession. Thus, we propose the following hypotheses:

Hypothesis 5: The participation of the controller's children in the enterprise is positively associated with total R&D investment intensity in family firms.
Hypothesis 6: The participation of the controller's children in the enterprise is positively associated with the ratio of expensed R&D investment in family firms.

Empirical strategy

To investigate the effects of family management and family succession on R&D investment, this paper estimates various forms of the models below:

$$RDSumRatio_{it} = \alpha_0 + \alpha_1 Familymanagement_{it} + \alpha_2 Familysuccession_{it} + \beta Controls_{it} + \varepsilon_{it} \tag{1}$$

$$RDexpenRatio_{it} = \alpha_0 + \alpha_1 Familymanagement_{it} + \alpha_2 Familysuccession_{it} + \beta Controls_{it} + \varepsilon_{it} \tag{2}$$

where i indexes the firm and t indexes the year. Following prior studies (e.g., Beladi et al., 2021), for the dependent variable $RDSumRatio_{it}$, we use the ratio of R&D input to operating revenue. $Familymanagement_{it}$ refers to the kinship of the CEO or chair and the proportion of family members among board members or senior executives. First, as in previous studies (e.g., Del Bosco & Bettinelli, 2020), we use a dummy variable for family CEO or board chair. Second, following the definition of a top management team in previous studies (e.g., Cirillo et al., 2015), family management is also assessed through the ratio of family members among board members or senior executives. $Familysuccession_{it}$ refers to the number of the controller's children participating in the enterprise. According to De Massis et al. (2016), incumbents' attitudes toward intrafamily succession are influenced by the number of their children. $Controls_{it}$ refers to a control variable vector that includes firm-level characteristics and year, province, and industry fixed effects. We control for a series of firm-level characteristics that may be associated with R&D investment. These factors include family ownership proportion, whether a family member of a later generation is participating in the enterprise as CEO or chair, whether the firm was a family enterprise when listed, chair's or CEO's service time and election method, CEO duality, power balance with shareholder structure, separation of ownership and control, firm age, firm size, and leverage. For the separation of ownership and control, we traced each firm's control chains as disclosed in annual reports. Family ownership and control are calculated using techniques from the relevant literature (e.g., Claessens et al., 2000; La Porta et al., 1999). Definitions of the main variables are shown in Table 1.

Table 1 Variable definitions

	Variable names	Variable definitions
Dependent variables	RDSumRatio	R&D total input/operating revenue*100
	RDexpenRatio	Expensed amount of R&D input/R&D total input*100
Independent variables	IsCChFamMember	The value of this dummy variable is 1 if the CEO or chair is a family member, and 0 otherwise.
	FamdirexecRatio	This variable is measured by number of family members on the board or in executive roles divided by number of people on the board or in executive roles and then multiplied by 100.
	ChildrenNum	This variable is measured by number of the ultimate controller's children participating in the enterprise.
Control variables	FamStyle	The value of this dummy variable is 1 if the firm was a family enterprise when listed, and 0 otherwise.
	ChairmanPer	(Data collection date–starting date of chair's appointment)/365
	AsChairmanPattern	The value of this dummy variable is 1 if the way of serving as chair is by internal promotion of the enterprise, and 0 otherwise.
	CeoPer	(Data collection date–starting date of CEO's appointment)/365
	AsCeoPattern	The value of this dummy variable is 1 if the way of serving as CEO is by internal promotion of the enterprise, and 0 otherwise.
	ConcurrentPosition	The value of this dummy variable is 1 if the chair and CEO is the same person, and 0 otherwise.
	ManageGD	The value of this dummy variable is 1 if a family member of later generation is participating in the enterprise as chair or CEO, and 0 otherwise.
	OwnershipProportion	This variable is measured by the controlling family's cash flow rights share multiplied by 100.
	BalanceIndicators	This variable is measured by total shareholding ratio of the 2nd-5th largest shareholders divided by shareholding ratio of the largest shareholder.
	SeparationRate	This variable is measured by the controlling family's cash flow rights divided by its voting rights share.
	Lev	This variable is measured by the family firm's total liabilities divided by its total assets and then multiplied by 100.
	FirmSize	This variable is measured by the natural logarithm of the firm's total assets.
	FirmAge	(Data collection date–firm establishment date)/365

This paper uses data from the statements issued by A-share family firms listed on the main board of Chinese stock markets between 2008 and 2019. The data are obtained from the CSMAR database (China Stock Market & Accounting Research Database). In each firm of the sample, apart from the controller, there is at least one family member who holds, manages or controls the listed family enterprise or the

controlling shareholder enterprise based on the distinction between family firms and lone-founder firms proposed by Miller et al. (2011) and Diéguez-Soto et al. (2015). We delete samples that show abnormal data (e.g., when *RDexpenRatio* appears to be greater than 1). Meanwhile, we delete samples with special treatment having an ST/*ST/S/SST mark in the database. Samples in finance or insurance industries are also deleted, as suggested by previous studies (Cirillo et al., 2015; Llanos-Contreras et al., 2021). All the continuous variables are winsorized at 1%. The descriptive statistics for the main variables are presented in Table 2.

Analysis of the results

Multivariate regression results

This subsection presents the results of the regressions. All the regressions use robust standard errors to eliminate heteroskedasticity and are estimated using Stata 16. Table 3 presents the impacts of family management on total R&D investment intensity, while Table 4 shows the impacts of family management on the ratio of expensed R&D investment in family firms.

The results of Table 3 show that the coefficients on *IsCChFamMember* are positive, while the coefficients on *FamdirexecRatio* are negative. All of the above coefficients are statistically significant at the 1% significance level. It is reasonable that

Table 2 Descriptive statistics

	N	Mean	Std. Dev	min	max
RDSumRatio(%)	6936	3.9184	3.7211	0	58.2500
RDexpenRatio(%)	6933	96.0255	13.8441	0	100
IsCChFamMember	7969	0.8763	0.3293	0	1
FamdirexecRatio(%)	7951	19.7319	11.7086	0	66.6700
ChildrenNum	7958	1.1272	1.4144	0	12
FamStyle	7969	0.8130	0.3899	0	1
ChairmanPer	7945	5.0695	3.4692	0.1000	14.9800
AsChairmanPattern	7944	0.8774	0.3280	0	1
CeoPer	7929	3.9455	3.0374	0.0411	13.3836
AsCeoPattern	7921	0.8631	0.3437	0	1
ConcurrentPosition	7906	0.3666	0.4819	0	1
ManageGD	6980	0.2713	0.4447	0	1
OwnershipProportion(%)	7821	40.0116	17.7752	0.0281	99.3200
BalanceIndicators	7969	0.7699	0.5925	0.0379	2.8400
SeparationRate	7894	0.8772	0.1913	0.0109	1
Lev(%)	7969	38.8096	19.3161	4.7445	83.9565
FirmSize	7969	21.8476	1.0414	19.9263	24.9267
FirmAge	7969	16.0470	5.9518	3.1700	30.7600

Table 3 Impacts of family management on total R&D investment intensity

VARIABLES	(1) RDSumRatio	(2) RDSumRatio	(3) RDSumRatio	(4) RDSumRatio	(5) RDSumRatio	(6) RDSumRatio
IsCChFam-Member	1.6381***		0.9462***		1.4651***	
	(0.2884)		(0.2981)		(0.2909)	
Famdirex-ecRatio		-0.0239***		-0.0234***		-0.0233***
		(0.0038)		(0.0038)		(0.0038)
FamStyle	0.3135*	0.3518**	0.6120***	0.6563***	0.4061**	0.4362***
	(0.1632)	(0.1625)	(0.1674)	(0.1669)	(0.1635)	(0.1627)
ChairmanPer	0.0706***	0.0713***			0.0621***	0.0615***
	(0.0126)	(0.0125)			(0.0149)	(0.0148)
AsChairman-Pattern	0.1642	0.2144			0.3074	0.3443*
	(0.1740)	(0.1746)			(0.1924)	(0.1927)
CeoPer			0.0503***	0.0532***	0.0218	0.0248
			(0.0142)	(0.0142)	(0.0169)	(0.0168)
AsCeoPattern			-0.5872***	-0.5379***	-0.6080***	-0.5644***
			(0.1911)	(0.1901)	(0.1984)	(0.1976)
Concurrent-Position	0.2719***	0.3715***	0.2367***	0.3281***	0.2951***	0.3865***
	(0.0825)	(0.0839)	(0.0835)	(0.0845)	(0.0847)	(0.0864)
ManageGD	-0.1217	-0.0475	-0.1649*	-0.0922	-0.1380	-0.0668
	(0.0882)	(0.0907)	(0.0870)	(0.0893)	(0.0876)	(0.0900)
Ownership-Proportion	-0.0024	0.0002	-0.0042	-0.0015	-0.0019	0.0007
	(0.0030)	(0.0031)	(0.0029)	(0.0029)	(0.0030)	(0.0030)
BalanceIndi-cators	0.1322*	0.1439*	0.1152	0.1264*	0.1417*	0.1527**
	(0.0775)	(0.0781)	(0.0754)	(0.0759)	(0.0770)	(0.0775)
Separation-Rate	0.1519	0.1085	0.1491	0.1047	0.0977	0.0572
	(0.2612)	(0.2600)	(0.2571)	(0.2562)	(0.2592)	(0.2582)
Lev	-0.0352***	-0.0361***	-0.0353***	-0.0362***	-0.0356***	-0.0364***
	(0.0027)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)
FirmSize	-0.1491***	-0.1852***	-0.1091**	-0.1455***	-0.1584***	-0.1939***
	(0.0522)	(0.0527)	(0.0500)	(0.0501)	(0.0523)	(0.0527)
FirmAge	-0.0295***	-0.0272***	-0.0284***	-0.0263***	-0.0289***	-0.0267***
	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0076)	(0.0075)
Constant	3.7170***	6.2860***	4.1382***	6.0106***	4.6674***	7.0233***
	(1.3124)	(1.2762)	(1.2566)	(1.2256)	(1.3221)	(1.2863)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Province	Control	Control	Control	Control	Control	Control
Observations	6,090	6,079	6,085	6,074	6,085	6,074

Table 3 (continued)

VARIABLES	(1) RDSumRatio	(2) RDSumRatio	(3) RDSumRatio	(4) RDSumRatio	(5) RDSumRatio	(6) RDSumRatio
R-squared	0.4023	0.4050	0.4024	0.4049	0.4046	0.4072
F-value	33.20	33.52	33.18	33.46	32.94	33.22
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Robust standard errors in parentheses

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

involving more family members on the board or as senior executives makes SEW more important for the firm's decision-making and tends to decrease total R&D investment intensity. More notably, the kinship of CEO or chair has an opposite effect. Hypothesis 2 is supported, while Hypothesis 1 is not supported.

A family member in the position of CEO or chair is often the current or future ultimate controller as well. In other cases, he or she is very close to the ultimate controller. The kinship of the CEO or chair can be conducive to the innovation of family enterprises. The family CEO or chair has a higher tolerance for R&D failure because kinship enables him or her to obtain trust and common understanding more easily than outsiders, which is favorable to R&D investments (Kor, 2006). It helps to reduce excessive risk aversion and stimulate the spirit of innovation (Manso, 2011; Tian & Wang, 2014). Family members as CEOs or chairs are inclined to recognize themselves more as entrepreneurs. Compared with kinship-bound CEOs or chairs, other family members or external managers often have a lower tolerance for R&D failure. Family members on the board or among executives probably identify themselves more as family stewards instead of entrepreneurs. The diversity of family members' identity recognition leads to different evaluations of SEW gains and losses.

Table 4 reports the impacts of family management on family firms' ratio of expensed R&D investment. The results show that the coefficients on *IsCChFam-Member* become negative and statistically significant at the 1% significance level, while *FamdirexecRatio* does not have any significant influence on the ratio of expensed R&D investment. Compared with the results of Table 3, the kinship of the CEO or chair is negatively associated with the ratio of expensed R&D investment, while it is also positively associated with total R&D investment intensity. The results reveal that a kinship-bound CEO or chair tends to pay more attention to exploitative R&D rather than explorative R&D. The risk of explorative R&D is much higher than that of exploitative R&D. We can see that the family member as CEO or chair still has a conservative side while pursuing R&D progress. He or she is often willing to take on some risk brought by exploitative R&D but tends to avoid the higher risks brought by explorative R&D.

Since later-generation management (such as CEO or chair) demonstrates stronger intentions for family succession, we conduct subsample regressions on this basis. Table 5 shows the impacts of family succession on total R&D investment intensity, while Table 6 presents the impacts of family succession on the ratio of expensed R&D investment in family firms.

Table 4 Impacts of family management on the ratio of expensed R&D investment

VARIABLES	(1) RDexpenRatio	(2) RDexpenRatio	(3) RDexpenRatio	(4) RDexpenRatio	(5) RDexpenRatio	(6) RDexpenRatio
IsCChFamMember	-10.2370***		-7.6580***		-10.0460***	
	(1.9588)		(1.8686)		(1.9874)	
FamdirexecRatio		0.0160		0.0134		0.0130
		(0.0149)		(0.0148)		(0.0148)
FamStyle	3.9612***	3.9033***	2.8288***	2.7923***	3.7770***	3.7290***
	(1.0710)	(1.0671)	(0.9661)	(0.9642)	(1.0648)	(1.0615)
ChairmanPer	-0.2481***	-0.2470***			-0.2857***	-0.2834***
	(0.0601)	(0.0602)			(0.0716)	(0.0716)
AsChairmanPattern	-1.0733	-1.0769			-1.4166	-1.4121
	(1.0398)	(1.0465)			(1.1119)	(1.1179)
CeoPer			-0.0400	-0.0421	0.0909	0.0882
			(0.0605)	(0.0608)	(0.0727)	(0.0730)
AsCeoPattern			1.0721	1.0488	1.1682	1.1481
			(0.7512)	(0.7487)	(0.7989)	(0.7964)
ConcurrentPosition	-0.2134	-0.2697	-0.1170	-0.1599	-0.3859	-0.4271
	(0.3363)	(0.3482)	(0.3390)	(0.3495)	(0.3372)	(0.3490)
ManageGD	-0.3896	-0.4411	-0.3095	-0.3537	-0.4333	-0.4742
	(0.3584)	(0.3639)	(0.3577)	(0.3628)	(0.3573)	(0.3619)
OwnershipProportion	0.0153	0.0137	0.0260**	0.0245**	0.0155	0.0142
	(0.0111)	(0.0112)	(0.0106)	(0.0107)	(0.0110)	(0.0111)
BalanceIndicators	-0.4336	-0.4547	-0.3161	-0.3346	-0.4380	-0.4562
	(0.3100)	(0.3106)	(0.3117)	(0.3121)	(0.3096)	(0.3103)
SeparationRate	-1.7537	-1.7144	-1.9609	-1.9242	-1.7244	-1.6975

Table 4 (continued)

VARIABLES	(1) RDexpenRatio	(2) RDexpenRatio	(3) RDexpenRatio	(4) RDexpenRatio	(5) RDexpenRatio	(6) RDexpenRatio
	(1.1855)	(1.1896)	(1.1997)	(1.2048)	(1.1878)	(1.1930)
Lev	-0.0138	-0.0134	-0.0140	-0.0138	-0.0129	-0.0127
	(0.0108)	(0.0109)	(0.0108)	(0.0109)	(0.0108)	(0.0109)
FirmSize	-1.4345***	-1.4052***	-1.6735***	-1.6471***	-1.4468***	-1.4223***
	(0.2420)	(0.2431)	(0.2358)	(0.2371)	(0.2430)	(0.2443)
FirmAge	0.0602*	0.0596*	0.0566*	0.0562*	0.0590*	0.0587*
	(0.0320)	(0.0320)	(0.0317)	(0.0317)	(0.0320)	(0.0319)
Constant	135.8573***	124.9042***	137.7230***	129.4288***	135.2927***	124.6677***
	(6.3368)	(5.8870)	(6.3469)	(5.8958)	(6.4642)	(5.9829)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Province	Control	Control	Control	Control	Control	Control
Observations	6,090	6,079	6,085	6,074	6,085	6,074
R-squared	0.1892	0.1893	0.1865	0.1866	0.1901	0.1902
F-value	11.51	11.50	11.29	11.28	11.38	11.36
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Robust standard errors in parentheses

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 5 Impacts of family succession on total R&D investment intensity

VARIABLES	(1) RDSumRatio Total sample	(2) RDSumRatio ManageGD = 1	(3) RDSumRatio ManageGD = 0	(4) RDSumRatio Total sample	(5) RDSumRatio ManageGD = 1	(6) RDSumRatio ManageGD = 0
ManageGD	-0.0550			-0.0090		
	(0.0963)			(0.0975)		
ChildrenNum	-0.0806***	-0.2658***	0.0007	-0.0570**	-0.2496***	0.0328
	(0.0256)	(0.0543)	(0.0291)	(0.0255)	(0.0533)	(0.0293)
IsCChFamMember	1.5795***		2.1336***			
	(0.2896)		(0.3547)			
FamdirexecRatio				-0.0223***	-0.0211***	-0.0238***
				(0.0037)	(0.0055)	(0.0046)
FamStyle	0.4149**	1.2224***	0.1662	0.4375***	1.2220***	0.2013
	(0.1634)	(0.2696)	(0.2221)	(0.1626)	(0.2687)	(0.2201)
ChairmanPer	0.0633***	0.1006***	0.0731***	0.0622***	0.1064***	0.0672***
	(0.0150)	(0.0269)	(0.0188)	(0.0149)	(0.0270)	(0.0185)
AsChairmanPattern	0.3343*	0.1148	0.4357*	0.3527*	0.1447	0.4647**
	(0.1936)	(0.3660)	(0.2223)	(0.1929)	(0.3671)	(0.2204)
CeoPer	0.0231	0.0291	0.0201	0.0259	0.0287	0.0249
	(0.0169)	(0.0354)	(0.0181)	(0.0168)	(0.0352)	(0.0180)
AsCeoPattern	-0.5998***	-0.4385	-0.4554**	-0.5635***	-0.3339	-0.4471**
	(0.1981)	(0.4927)	(0.1975)	(0.1974)	(0.4929)	(0.1971)
ConcurrentPosition	0.2822***	0.1394	0.3223***	0.3720***	0.1385	0.4465***
	(0.0841)	(0.1643)	(0.0940)	(0.0856)	(0.1645)	(0.0955)
OwnershipProportion	-0.0009	0.0047	0.0013	0.0014	0.0070	0.0038
	(0.0030)	(0.0064)	(0.0036)	(0.0030)	(0.0064)	(0.0037)

Table 5 (continued)

VARIABLES	(1) RDSumRatio	(2) RDSumRatio	(3) RDSumRatio	(4) RDSumRatio	(5) RDSumRatio	(6) RDSumRatio
BalanceIndicators	0.1632**	0.2535**	0.2234**	0.1714**	0.2844**	0.2289**
	(0.0774)	(0.1117)	(0.0989)	(0.0777)	(0.1113)	(0.0992)
SeparationRate	0.0675	0.3844	-0.1108	0.0264	0.3057	-0.1544
	(0.2588)	(0.3876)	(0.3295)	(0.2569)	(0.3825)	(0.3285)
Lev	-0.0359***	-0.0271***	-0.0332***	-0.0365***	-0.0281***	-0.0337***
	(0.0028)	(0.0046)	(0.0033)	(0.0028)	(0.0046)	(0.0033)
FirmSize	-0.1528***	-0.1499*	-0.1961***	-0.1889***	-0.1893**	-0.2245***
	(0.0525)	(0.0832)	(0.0674)	(0.0530)	(0.0850)	(0.0679)
FirmAge	-0.0276***	-0.0095	-0.0403***	-0.0259***	-0.0060	-0.0380***
	(0.0076)	(0.0134)	(0.0095)	(0.0076)	(0.0132)	(0.0096)
Constant	4.4088***	2.3023	5.2924***	6.9128***	3.4010	8.2456***
	(1.3312)	(2.1793)	(1.6084)	(1.2917)	(2.2126)	(1.5468)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Province	Control	Control	Control	Control	Control	Control
Observations	6,078	1,632	4,446	6,074	1,632	4,442
R-squared	0.4060	0.4585	0.4388	0.4075	0.4615	0.4396
F-value	32.82	12.43	27.47	33.00	12.45	27.54
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Robust standard errors in parentheses

IsCClhFamMember is automatically deleted in Column (2) due to multicollinearity

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 6 Impacts of family succession on the ratio of expensed R&D investment

VARIABLES	(1) RDexpenRatio Total sample	(2) RDexpenRatio ManageGD = 1	(3) RDexpenRatio ManageGD = 0	(4) RDexpenRatio Total sample	(5) RDexpenRatio ManageGD = 1	(6) RDexpenRatio ManageGD = 0
ManageGD	-0.4859			-0.5102		
	(0.3888)			(0.3919)		
ChildrenNum	0.0501	0.5775***	-0.2071	0.0354	0.5644****	-0.2319
	(0.1092)	(0.2093)	(0.1502)	(0.1071)	(0.2105)	(0.1476)
IsCChFamMember	-10.1167***		-11.5052***			
	(2.0079)		(2.7496)			
FamdirexecRatio				0.0123	0.0171	0.0165
				(0.0146)	(0.0276)	(0.0183)
FamStyle	3.7788***	4.0133**	3.5937***	3.7282***	4.0136**	3.5031**
	(1.0668)	(1.7090)	(1.3738)	(1.0616)	(1.7087)	(1.3628)
ChairmanPer	-0.2863***	-0.2380**	-0.3044***	-0.2838***	-0.2428**	-0.2980***
	(0.0717)	(0.1140)	(0.0914)	(0.0716)	(0.1172)	(0.0919)
AsChairmanPattern	-1.4281	-0.3962	-0.5265	-1.4173	-0.4204	-0.5009
	(1.1183)	(1.8930)	(1.3494)	(1.1191)	(1.9022)	(1.3479)
CeoPer	0.0898	0.0157	0.0679	0.0876	0.0161	0.0639
	(0.0732)	(0.1209)	(0.0889)	(0.0733)	(0.1209)	(0.0895)
AsCeoPattern	1.1661	3.7027**	0.1180	1.1475	3.6180**	0.1087
	(0.7982)	(1.6850)	(0.8980)	(0.7961)	(1.6821)	(0.8971)
ConcurrentPosition	-0.3755	0.1863	-0.6838*	-0.4181	0.1870	-0.7634*
	(0.3359)	(0.6037)	(0.4072)	(0.3467)	(0.6044)	(0.4282)
OwnershipProportion	0.0146	0.0042	0.0145	0.0138	0.0023	0.0133
	(0.0112)	(0.0233)	(0.0126)	(0.0113)	(0.0237)	(0.0125)

Table 6 (continued)

VARIABLES	(1) RDexpenRatio	(2) RDexpenRatio	(3) RDexpenRatio	(4) RDexpenRatio	(5) RDexpenRatio	(6) RDexpenRatio
BalanceIndicators	-0.4580	-0.4900	-0.5017	-0.4678	-0.5151	-0.5104
	(0.3122)	(0.5925)	(0.3801)	(0.3124)	(0.5859)	(0.3813)
SeparationRate	-1.6874	-5.3286***	-0.5303	-1.6784	-5.2648***	-0.5247
	(1.1951)	(2.0159)	(1.4976)	(1.1956)	(2.0071)	(1.4997)
Lev	-0.0129	-0.0185	-0.0087	-0.0126	-0.0177	-0.0087
	(0.0108)	(0.0209)	(0.0123)	(0.0109)	(0.0208)	(0.0124)
FirmSize	-1.4492***	-1.9785***	-1.2990***	-1.4255***	-1.9465***	-1.2726***
	(0.2427)	(0.5183)	(0.2671)	(0.2433)	(0.5217)	(0.2661)
FirmAge	0.0584*	-0.1227**	0.1405***	0.0582*	-0.1256**	0.1396***
	(0.0323)	(0.0611)	(0.0402)	(0.0323)	(0.0609)	(0.0402)
Constant	135.4024***	149.8718***	129.5508***	124.7364***	148.9812***	117.4357***
	(6.4537)	(13.1855)	(7.2757)	(5.9516)	(13.2009)	(6.5518)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Province	Control	Control	Control	Control	Control	Control
Observations	6,078	1,632	4,446	6,074	1,632	4,442
R-squared	0.1901	0.2408	0.2316	0.1902	0.2410	0.2317
F-value	11.27	4.66	10.59	11.27	4.61	10.59
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Robust standard errors in parentheses

IsCChFamMember is automatically deleted in Column (2) due to multicollinearity

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

According to the results of Tables 5 and 6, when total R&D investment intensity is concerned, the coefficients on *ChildrenNum* are both negative and statistically significant at the 5% significance level in the total sample and the subsample with later-generation management. When the ratio of expensed R&D investment is concerned, the coefficients on *ChildrenNum* are positive and statistically significant at the 1% significance level in the subsample with later-generation management. The results indicate that the participation of the controller's children in the enterprise can lead to higher enthusiasm in explorative R&D investment instead of exploitative R&D, but only during the process of intergenerational succession with a later-generation member as chair or CEO. Explorative R&D investment is encouraged with greater involvement of the controller's children, while total R&D investment intensity tends to decrease. The reason may be that a large part of former investment in exploitative R&D is transferred to explorative R&D. Due to the higher risk of explorative R&D, its increase is less than the decrease in exploitative R&D investment, which leads to an unchanged overall risk from R&D investment. Our results echo the viewpoint of Chrisman and Patel (2012) that convergence of short- and long-term family goals and risk acceptance are more likely to co-occur when strong intentions for intergenerational succession exist, with a more detailed study focused on the influence of family succession on R&D investment. Notably, our findings suggest that it can be misleading to conclude that R&D investment tends to be more conservative in the presence of family succession without considering the structure within R&D investment.

We also investigate the interaction effects between family management and family succession on the R&D investment of the enterprise. The results are shown in Table 7. There is a substitution effect between the controller's children participating in the enterprise and the proportion of family members among board members or executives. When the number of the controller's children participating in the enterprise is larger, the negative impact of the proportion of family members among board members or executives on total R&D investment intensity is reduced. The substitution effect reflects the balance between the spirit of innovation brought by the controller's children in the enterprise and the conservative attitude held by family members among board members or executives.

Robustness tests

Our regressions use robust standard errors to correct for heteroscedasticity and control for firm-level characteristics and year, province, and industry to eliminate the measurement errors caused by unobservable fixed effects. The continuous variables are winsorized at 1% to eliminate the influence of outliers.

In this subsection, we carry out further robustness tests. We use a dummy variable referring to whether the controller has one son or more participating in the enterprise as an alternative measurement of family succession, since Chinese traditional culture often pays more attention to the inheritance of family business by male offspring. The value of *SonD* is 1 if the ultimate controller has one son or more participating in the enterprise and 0 otherwise. The results are shown in Tables 8 and 9. When total

Table 7 Interaction effects between the controller's children participating in the enterprise and the proportion of family members among board members or executives

VARIABLES	(1) RDSumRatio	(2) RDexpenRatio
ChildrenNum	-0.3043***	0.2165
	(0.0681)	(0.2706)
ChildrenNum*FamdirexecRatio	0.0094***	-0.0069
	(0.0021)	(0.0080)
FamdirexecRatio	-0.0340***	0.0209
	(0.0049)	(0.0186)
FamStyle	0.4388***	3.7273***
	(0.1627)	(1.0615)
ChairmanPer	0.0601***	-0.2823***
	(0.0148)	(0.0717)
AsChairmanPattern	0.3645*	-1.4260
	(0.1930)	(1.1212)
CeoPer	0.0261	0.0874
	(0.0168)	(0.0734)
AsCeoPattern	-0.5689***	1.1515
	(0.1974)	(0.7967)
ConcurrentPosition	0.3804***	-0.4242
	(0.0856)	(0.3474)
ManageGD	0.0114	-0.5251
	(0.0981)	(0.3932)
OwnershipProportion	0.0018	0.0135
	(0.0030)	(0.0114)
BalanceIndicators	0.1392*	-0.4442
	(0.0781)	(0.3155)
SeparationRate	0.0230	-1.6759
	(0.2568)	(1.1961)
Lev	-0.0369***	-0.0123
	(0.0028)	(0.0109)
FirmSize	-0.1720***	-1.4378***
	(0.0533)	(0.2442)
FirmAge	-0.0261***	0.0583*
	(0.0076)	(0.0323)
Constant	6.8176***	124.8061***
	(1.2893)	(5.9560)
Year	Control	Control
Industry	Control	Control
Province	Control	Control
Observations	6,074	6,074
R-squared	0.4091	0.1903
F-value	32.95	11.18
Prob > F	0.0000	0.0000

Robust standard errors in parentheses

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 8 Impacts of the controller's son participating in the enterprise on total R&D investment intensity

VARIABLES	(1) RDSumRatio	(2) RDSumRatio	(3) RDSumRatio	(4) RDSumRatio	(5) RDSumRatio	(6) RDSumRatio
	Total sample	ManageGD = 1	ManageGD = 0	Total sample	ManageGD = 1	ManageGD = 0
ManageGD	-0.0640			-0.0079		
	(0.0983)			(0.1000)		
SonD	-0.1752**	-0.7598***	-0.0661	-0.1428	-0.7431***	-0.0231
	(0.0887)	(0.2461)	(0.0894)	(0.0890)	(0.2458)	(0.0896)
IsCChFamMember	1.5431***		2.1480***			
	(0.2926)		(0.3560)			
FamdirexecRatio				-0.0228***	-0.0243***	-0.0231***
				(0.0038)	(0.0058)	(0.0046)
FamStyle	0.3963**	1.0962***	0.1625	0.4281***	1.0940***	0.1965
	(0.1630)	(0.2690)	(0.2216)	(0.1624)	(0.2681)	(0.2199)
ChairmanPer	0.0620***	0.1038***	0.0728***	0.0614***	0.1109***	0.0679***
	(0.0149)	(0.0266)	(0.0188)	(0.0148)	(0.0270)	(0.0186)
AsChairmanPattern	0.3326*	0.1983	0.4420**	0.3644*	0.2524	0.4761**
	(0.1944)	(0.3732)	(0.2229)	(0.1947)	(0.3808)	(0.2213)
CeoPer	0.0223	0.0232	0.0211	0.0251	0.0225	0.0251
	(0.0169)	(0.0351)	(0.0181)	(0.0168)	(0.0351)	(0.0181)
AsCeoPattern	-0.6111***	-0.5005	-0.4562**	-0.5680***	-0.3770	-0.4462**
	(0.1986)	(0.4949)	(0.1968)	(0.1979)	(0.4941)	(0.1965)
ConcurrentPosition	0.2893***	0.1971	0.3178***	0.3803***	0.1905	0.4393***
	(0.0846)	(0.1642)	(0.0941)	(0.0863)	(0.1640)	(0.0958)
OwnershipProportion	-0.0017	0.0009	0.0015	0.0008	0.0039	0.0040
	(0.0030)	(0.0064)	(0.0036)	(0.0030)	(0.0064)	(0.0037)

Table 8 (continued)

VARIABLES	(1) RDSumRatio	(2) RDSumRatio	(3) RDSumRatio	(4) RDSumRatio	(5) RDSumRatio	(6) RDSumRatio
BalanceIndicators	0.1499*	0.0552	0.2327**	0.1587**	0.1066	0.2353**
	(0.0766)	(0.1043)	(0.0985)	(0.0772)	(0.1032)	(0.0992)
SeparationRate	0.0451	0.2420	-0.1690	0.0166	0.1664	-0.1899
	(0.2561)	(0.3837)	(0.3266)	(0.2551)	(0.3772)	(0.3273)
Lev	-0.0355***	-0.0271***	-0.0330***	-0.0364***	-0.0281***	-0.0338***
	(0.0028)	(0.0047)	(0.0033)	(0.0028)	(0.0046)	(0.0033)
FirmSize	-0.1544***	-0.1707**	-0.1967***	-0.1898***	-0.2157**	-0.2220***
	(0.0524)	(0.0849)	(0.0676)	(0.0530)	(0.0871)	(0.0681)
FirmAge	-0.0276***	-0.0093	-0.0400***	-0.0257***	-0.0052	-0.0372***
	(0.0076)	(0.0133)	(0.0095)	(0.0076)	(0.0131)	(0.0096)
Constant	4.5784***	3.1533	5.3430***	6.9912***	4.3651*	8.2161***
	(1.3327)	(2.2619)	(1.6135)	(1.2866)	(2.2737)	(1.5482)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Province	Control	Control	Control	Control	Control	Control
Observations	6,085	1,634	4,451	6,074	1,632	4,442
R-squared	0.4050	0.4550	0.4386	0.4074	0.4586	0.4395
F-value	32.72	12.15	27.49	32.98	12.31	27.53
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Robust standard errors in parentheses

IsCCHFamMember is automatically deleted in Column (2) due to multicollinearity

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 9 Impacts of the controller's son participating in the enterprise on the ratio of expensed R&D investment

VARIABLES	(1) RDexpenRatio Total sample	(2) RDexpenRatio ManageGD = 1	(3) RDexpenRatio ManageGD = 0	(4) RDexpenRatio Total sample	(5) RDexpenRatio ManageGD = 1	(6) RDexpenRatio ManageGD = 0
ManageGD	-0.4410 (0.4138)			-0.4679 (0.4178)		
SonD	0.0181 (0.4104)	1.5618* (0.8852)	-0.4350 (0.4668)	-0.0153 (0.4094)	1.5454* (0.8834)	-0.4706 (0.4704)
IsCChFamMember	-10.0540*** (2.0306)		-11.6038*** (2.7705)			
FamdirexecRatio				0.0130 (0.0147)	0.0243 (0.0273)	0.0139 (0.0186)
FamStyle	3.7780*** (1.0690)	4.2874** (1.7132)	3.5987*** (1.3793)	3.7282*** (1.0658)	4.2908** (1.7142)	3.5111** (1.3690)
ChairmanPer	-0.2856*** (0.0716)	-0.2463** (0.1136)	-0.3102*** (0.0914)	-0.2834*** (0.0716)	-0.2535** (0.1169)	-0.3048*** (0.0919)
AsChairmanPattern	-1.4192 (1.1219)	-0.5831 (1.8968)	-0.5355 (1.3566)	-1.4099 (1.1273)	-0.6403 (1.9326)	-0.5073 (1.3552)
CeoPer	0.0909 (0.0728)	0.0298 (0.1205)	0.0690 (0.0888)	0.0882 (0.0731)	0.0305 (0.1208)	0.0654 (0.0895)
AsCeoPattern	1.1686 (0.7999)	3.8421** (1.6790)	0.0903 (0.8992)	1.1477 (0.7976)	3.7183** (1.6774)	0.0796 (0.8980)
ConcurrentPosition	-0.3853 (0.3357)	0.0483 (0.5978)	-0.6739* (0.4080)	-0.4278 (0.3470)	0.0546 (0.5977)	-0.7388* (0.4303)
OwnershipProportion	0.0154 (0.0110)	0.0126 (0.0229)	0.0132 (0.0125)	0.0143 (0.0111)	0.0096 (0.0235)	0.0120 (0.0124)

Table 9 (continued)

VARIABLES	(1) RDexpenRatio	(2) RDexpenRatio	(3) RDexpenRatio	(4) RDexpenRatio	(5) RDexpenRatio	(6) RDexpenRatio
BalanceIndicators	-0.4389	-0.0595	-0.5158	-0.4556	-0.1113	-0.5279
	(0.3062)	(0.5397)	(0.3739)	(0.3072)	(0.5320)	(0.3767)
SeparationRate	-1.7190	-5.0365**	-0.5284	-1.7019	-4.9618**	-0.5103
	(1.1804)	(2.0329)	(1.4563)	(1.1854)	(2.0264)	(1.4668)
Lev	-0.0129	-0.0184	-0.0077	-0.0126	-0.0173	-0.0077
	(0.0108)	(0.0213)	(0.0122)	(0.0109)	(0.0212)	(0.0123)
FirmSize	-1.4473***	-1.9335***	-1.2896***	-1.4219***	-1.8883***	-1.2655***
	(0.2423)	(0.5215)	(0.2667)	(0.2433)	(0.5244)	(0.2665)
FirmAge	0.0589*	-0.1232**	0.1404***	0.0588*	-0.1273**	0.1398***
	(0.0325)	(0.0609)	(0.0403)	(0.0324)	(0.0608)	(0.0403)
Constant	135.3019***	148.0814***	129.5466***	124.6643***	146.8662***	117.4007***
	(6.4728)	(13.3559)	(7.2966)	(5.9711)	(13.3219)	(6.5679)
Year	Control	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control	Control
Province	Control	Control	Control	Control	Control	Control
Observations	6,085	1,634	4,451	6,074	1,632	4,442
R-squared	0.1901	0.2392	0.2315	0.1902	0.2395	0.2316
F-value	11.29	4.58	10.60	11.27	4.58	10.58
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Robust standard errors in parentheses

IsCChFamMember is automatically deleted in Column (2) due to multicollinearity

* p < 0.1; ** p < 0.05; *** p < 0.01

Table 10 Interaction effects between the controller's son participating in the enterprise and the proportion of family members among board members or executives

VARIABLES	(1) RDSumRatio	(2) RDexpenRatio
SonD	-0.4853**	-0.3026
	(0.2020)	(0.8867)
SonD*FamdirexecRatio	0.0153**	0.0128
	(0.0070)	(0.0290)
FamdirexecRatio	-0.0295***	0.0074
	(0.0052)	(0.0194)
FamStyle	0.4367***	3.7354***
	(0.1622)	(1.0627)
ChairmanPer	0.0605***	-0.2842***
	(0.0148)	(0.0717)
AsChairmanPattern	0.3710*	-1.4043
	(0.1949)	(1.1293)
CeoPer	0.0242	0.0875
	(0.0169)	(0.0730)
AsCeoPattern	-0.5676***	1.1480
	(0.1978)	(0.7977)
ConcurrentPosition	0.3893***	-0.4202
	(0.0861)	(0.3484)
ManageGD	-0.0116	-0.4710
	(0.1000)	(0.4170)
OwnershipProportion	0.0008	0.0143
	(0.0030)	(0.0112)
BalanceIndicators	0.1461*	-0.4661
	(0.0776)	(0.3126)
SeparationRate	-0.0058	-1.7207
	(0.2560)	(1.1763)
Lev	-0.0365***	-0.0127
	(0.0028)	(0.0109)
FirmSize	-0.1822***	-1.4155***
	(0.0531)	(0.2460)
FirmAge	-0.0254***	0.0590*
	(0.0076)	(0.0325)
Constant	6.9800***	124.6549***
	(1.2848)	(5.9754)
Year	Control	Control
Industry	Control	Control
Province	Control	Control
Observations	6,074	6,074
R-squared	0.4078	0.1902
F-value	32.77	11.18
Prob > F	0.0000	0.0000

Robust standard errors in parentheses

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

R&D investment intensity in family firms is considered, the coefficients on *SonD* are negative and statistically significant in the subsample with later-generation management. Meanwhile, when the ratio of expensed R&D investment is considered, the coefficients on *SonD* are positive and statistically significant in the subsample with later-generation management. These results align with our main estimations.

We also test the robustness of the interaction effects. The results are presented in Table 10. When total R&D investment intensity in family firms is concerned, the coefficients on *SonD* and *FamdirexecRatio* are negative and statistically significant, while the coefficient on *SonD*FamdirexecRatio* is positive and statistically significant. The substitution effect still exists, confirming the robustness of our results.

Conclusions

This study explores the impacts of family management and family succession on R&D investment. Based on the data of family-owned listed firms from China, we find that the impacts of family management are not always homogeneous due to the diversity of family members' identity within the company and SEW preferences. An increased proportion of family members among board members or senior executives is negatively associated with total R&D investment intensity in family firms, while a kinship-bound CEO or chair has the opposite effect. Moreover, the kinship of the CEO or chair is negatively associated with the ratio of expensed R&D investment, while the proportion of family members does not have any significant influence. The results indicate that a kinship-bound CEO or chair tends to pay more attention to exploitative R&D rather than explorative R&D. Meanwhile, different family members with positions as board members or senior executives may have diverse preferences with regard to exploitative R&D and explorative R&D investments, which leads to an overall nonsignificant effect.

When family succession is concerned, the results have shown that the participation of children in the enterprise is negatively associated with total R&D investment intensity in family firms, which seems to indicate that family succession leads to a more conservative attitude toward R&D investment. However, there is actually a change in the structure of R&D investment. The participation of the controller's children in the enterprise leads to higher enthusiasm for explorative R&D investment, but only during the process of intergenerational succession. Furthermore, there is a substitution effect between the participation of children in the enterprise and the proportion of family members among board members or executives, which reflects a balance drawn between the spirit of innovation brought by the younger generation participating in the enterprise and the conservative attitude held by family members among board members or executives.

There are several practical implications. First, family members in different management positions can have diverse preferences with regard to R&D investment. Uniformly reducing or increasing family involvement in management may not be effective for R&D investment. Second, the findings of this study provide insights into the contingent decisions of R&D investment in family firms. Explorative R&D investment is encouraged by family succession, suggesting that extended SEW is

helpful for promoting explorative R&D investment. Both government and family firms need to be aware of the value of extended SEW. Maximizing the opportunities afforded by SEW is favorable to R&D investment in family firms.

Declarations

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References

Asaba, S. (2013). Patient investment of family firms in the Japanese electric machinery industry. *Asia Pacific Journal of Management, 30*, 697–715.

Ashwin, A. S., Krishnan, R. T., & George, R. (2015). Family firms in India: Family involvement, innovation and agency and stewardship behaviors. *Asia Pacific Journal of Management, 32*(4), 869–900.

Astrachan, J. H., Klein, S. B., & Smyrnios, K. X. (2002). The F-PEC scale of family influence: A proposal for solving the family business definition problem. *Family Business Review, 15*(1), 45–58.

Beck, L., Janssens, W., Debruyne, M., & Lommelen, T. (2011). A study of the relationships between generation, market orientation, and innovation in family firms. *Family Business Review, 24*(3), 252–272.

Beladi, H., Deng, J., & Hu, M. (2021). Cash flow uncertainty, financial constraints and R&D investment. *International Review of Financial Analysis*. https://doi.org/10.1016/j.irfa.2021.101785

Belda-Ruiz, M., Sánchez-Marín, G., & Baixauli-Soler, J. S. (2021). Influence of family-centered goals on dividend policy in family firms: A socioemotional wealth approach. *International Entrepreneurship and Management Journal*. https://doi.org/10.1007/s11365-021-00741-x

Berrone, P., Cruz, C., & Gomez-Mejia, L. R. (2012). Socioemotional wealth in family firms: Theoretical dimensions, assessment approaches, and agenda for future research. *Family Business Review, 25*(3), 258–279.

Cano-Rubio, M., Fuentes-Lombardo, G., & Sanchez-Famoso, V. (2021). Family involvement as influencer on family firm's growth. *Journal of International Entrepreneurship*. https://doi.org/10.1007/s10843-021-00290-y

Chen, H. (2014). Board capital, CEO power and R&D investment in electronics firms. *Corporate Governance: An International Review, 22*(5), 422–436.

Choi, Y. R., Zahra, S. A., Yoshikawa, T., & Han, B. H. (2015). Family ownership and R&D investment: The role of growth opportunities and business group membership. *Journal of Business Research, 68*(5), 1053–1061.

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

Cirillo, A., Romano, M., & Ardovino, O. (2015). Does family involvement foster IPO value? Empirical analysis on Italian stock market. *Management Decision, 53*(5), 1125–1154.

Claessens, S., Djankov, S., & Lang, L. H. P. (2000). The separation of ownership and control in east Asian corporations. *Journal of Financial Economics, 58*(1), 81–112.

Danneels, E. (2002). The dynamics of product innovation and firm competences. *Strategic Management Journal, 23*(12), 1095–1121.

Daspit, J. J., Chrisman, J. J., Sharma, P., Pearson, A. W., & Mahto, R. V. (2018). Governance as a source of family firm heterogeneity. *Journal of Business Research, 84*, 293–300.

De Massis, A., Sieger, P., Chua, J. H., & Vismara, S. (2016). Incumbents' attitude toward intrafamily succession: An investigation of its antecedents. *Family Business Review, 29*(3), 278–300.

Del Bosco, B., & Bettinelli, C. (2020). How do family SMEs control their investments abroad? The role of distance and family control. *Management International Review, 60*, 1–35.

Diéguez-Soto, J., López-Delgado, P., & Rojo-Ramírez, A. (2015). Identifying and classifying family businesses. *Review of Managerial Science, 9*, 603–634.

Duran, P., Kammerlander, N., Van Essen, M., & Zellweger, T. (2016). Doing more with less: Innovation input and output in family firms. *Academy of Management Journal, 59*(4), 1224–1264.

Garcés-Galdeano, L., Larraza-Kintana, M., García-Olaverri, C., & Makri, M. (2016). Entrepreneurial orientation in family firms: The moderating role of technological intensity and performance. *International Entrepreneurship and Management Journal, 12*, 27–45.

Gentry, R., Dibrell, C., & Kim, J. (2016). Long-term orientation in publicly traded family businesses: Evidence of a dominant logic. *Entrepreneurship Theory and Practice, 40*(4), 733–757.

Ghafoor, S., Wang, M., Chen, S., Zhang, R., & Zulfiqar, M. (2021). 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 Research- Ekonomska Istraživanja.* https://doi.org/10.1080/1331677X.2021.1985569

Gómez-Mejía, L. R., Campbell, J. T., Martin, G., Hoskisson, R. E., Makri, M., & Sirmon, D. G. (2014). Socioemotional wealth as a mixed gamble: Revisiting family firm R&D investments with the behavioral agency model. *Entrepreneurship Theory and Practice, 38*(6), 1351–1374.

Gómez-Mejía, L. R., Cruz, C., Berrone, P., & De Castro, J. (2011). The bind that ties: Socioemotional wealth preservation in family firms. *The Academy of Management Annals, 5*(1), 653–707.

Gómez-Mejía, L. R., Haynes, K. T., Núñez-Nickel, M., Jacobson, K. J. L., & Moyano-Fuentes, J. (2007). Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills. *Administrative Science Quarterly, 52*(1), 106–137.

Greve, H. R. (2007). Exploration and exploitation in product innovation. *Industrial and Corporate Change, 16*(5), 945–975.

Hernández-Perlines, F., Moreno-García, J., & Yáñez-Araque, B. (2019). The influence of socioemotional wealth in the entrepreneurial orientation of family businesses. *International Entrepreneurship and Management Journal, 15*, 523–544.

Kellermanns, F. W., Eddleston, K. A., Barnett, T., & Pearson, A. (2008). An exploratory study of family member characteristics and involvement: Effects on entrepreneurial behavior in the family firm. *Family Business Review, 21*(1), 1–14.

Kor, Y. Y. (2006). Direct and interaction effects of top management team and board compositions on R&D investment strategy. *Strategic Management Journal, 27*, 1081–1099.

La Porta, R., Lopez-De-Silanes, F., & Shleifer, A. (1999). Corporate ownership around the world. *The Journal of Finance, 54*, 471–517.

Le Breton-Miller, I., & Miller, D. (2006). Why do some family businesses out-compete? Governance, long-term orientations, and sustainable capability. *Entrepreneurship: Theory and Practice, 30*(6), 731–746.

Llanos-Contreras, O., Arias, J., & Maquieira, C. (2021). Risk taking behavior in Chilean listed family firms: A socioemotional wealth approach. *International Entrepreneurship and Management Journal, 17*, 165–184.

Luo, J., Li, X., Wang, L. C., & Liu, Y. (2019). Owner type, pyramidal structure and R&D Investment in China's family firms. *Asia Pacific Journal of Management.* https://doi.org/10.1007/s10490-019-09702-z

Manso, G. (2011). Motivating Innovation. *The Journal of Finance, 66*(5), 1823–1860.

Matzler, K., Veider, V., Hautz, J., & Stadler, C. (2015). The impact of family ownership, management, and governance on innovation. *Journal of Product Innovation Management, 32*(3), 319–333.

Miller, D., & Le Breton-Miller, I. (2014). Deconstructing socioemotional wealth. *Entrepreneurship: Theory and Practice, 38*(4), 713–720.

Miller, D., Le Breton-Miller, I., & Lester, R. H. (2011). Family and lone founder ownership and strategic behaviour: Social context, identity, and institutional logics. *Journal of Management Studies, 48*(1), 1–25.

Muñoz-Bullón, F., & Sanchez-Bueno, M. J. (2011). The impact of family involvement on the R&D intensity of publicly traded firms. *Family Business Review, 24*(1), 62–70.

Porfírio, J. A., Felício, J. A., & Carrilho, T. (2020). Family business succession: Analysis of the drivers of success based on entrepreneurship theory. *Journal of Business Research, 115*, 250–257.

Pricewaterhouse Coopers. (2021). *Global Family Business Survey 2021-China Report*. Retrieved July 12, 2022, from https://www.pwccn.com/en/services/entrepreneurial-and-private-business/private-family-business-services/global-family-business-survey-2021.html

Rothaermel, F. T., & Alexandre, M. T. (2009). Ambidexterity in technology sourcing: The moderating role of absorptive capacity. *Organization Science, 20*(4), 759–780.

Sánchez-Marín, G., Carrasco-Hernández, A. J., & Danvila-del-Valle, I. (2020). Effects of family involvement on the monitoring of CEO compensation. *International Entrepreneurship and Management Journal, 16*, 1347–1366.

Schierstedt, B., Henn, M., & Lutz, E. (2020). Diversified acquisitions in family firms: Restricted vs. extended family priorities. *Journal of Family Business Strategy*. https://doi.org/10.1016/j.jfbs.2020.100357

Tian, X., & Wang, T. Y. (2014). Tolerance for failure and corporate innovation. *The Review of Financial Studies, 27*(1), 211–255.

Villalonga, B., & Amit, R. (2006). How do family ownership, control and management affect firm value? *Journal of Financial Economics, 80*, 385–417.

Yang, J., Ma, J., Zhao, H., Cater, J., & Arnold, M. (2019). Family involvement, environmental turbulence, and R&D investment: Evidence from listed Chinese SMEs. *Small Business Economics, 53*, 1017–1032.

Zellweger, T. (2007). Time horizon, costs of equity capital, and generic investment strategies of firms. *Family Business Review, 20*, 1–15.

Zhao, H., & Peng, X. (2018). Exploitation versus exploration: The impact of network embeddedness on the innovation of subsidiary firms. *Chinese Management Studies, 12*(3), 547–574.