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Family involvement, family member composition and firm innovation

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ABSTRACT

Based on the data of Chinese listed family firms from 2008 to 2016, we investigate the impact of family involvement on firm innovation and the moderating effect of family member composition. The results show that increased family involvement significantly reduces R&D investment intensity and the number of patent applications. With the increased richness of the kinship of family members involved in management, the negative impact of family involvement on patent applications is weakened, but family member composition does not have a significant moderating effect on the relationship between family involvement and R&D investment intensity. Further analysis shows that the number of invention patent applications decreases as the degree of family involvement increases, but family involvement has no significant effect on utility model patent and design patent applications. Family member composition has a significant moderating effect on the relationship between family involvement and invention patent applications. The results have value as a reference for exploring how family involvement affects firm innovation and can also help the actual controller to take effective measures to optimize family member composition and improve the innovation performance of family firms.

1. Introduction

Innovation has been recognized as a primary means of firms' future investment. It is not only the basis for a firm to gain market competitiveness, but also a source of vitality for economic and social development (Ettlie, 1998). For family firms, innovation can integrate existing resources, cultivate sustainable competitive advantages, and create economic value (De Massis et al., 2014). In other words, innovation is the cornerstone of

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family firms' prosperity. However, as *The Chinese Family Business Health Index Report 2014* shows, the R&D intensity of Chinese family firms is generally less than the average level of private firms. Increasing evidence also suggests that the R&D investment of family firms is significantly lower than that of non-family firms (Block, 2010; Classen et al., 2014; Wu and Chen, 2014).

Different from non-family firms, family firms combine "family" and "firm"; their most distinctive feature is that family members are involved in corporate governance (Chua et al., 1999; Songini and Gnan, 2015). Among them, socioemotional wealth has become the essential feature of family involvement (Gómez-Mejía et al., 2007), which creates a series of non-economic goals for the firm, primarily (a) enhancing and perpetuating family image and reputation (Chrisman et al., 2012; Evert et al., 2018), (b) maintaining family control of ownership and management, and (c) sustaining the family's dynastic aspirations and ensuring that the business remains viable across future generations (Evert et al., 2018). Hence, family involvement can give firms a long-term strategic motivation, create a positive environment, and bring reliable and unique resources, thereby promoting firm innovation (Sirmon and Hitt, 2003). However, these socioemotional wealth goals do not always benefit firms; in fact, they often conflict with the economic interests of firms (Yan and Ye, 2014; Qi and Li, 2017), result in a lack of talent, and bring agency problems. In these cases, family firms often reduce their innovative activities to avoid the associated high risks and protect their socioemotional wealth (Gómez-Mejía et al., 2007). We set out to disentangle the family firm's decision process by asking how family involvement influences firm innovation.

The current research on this question has not reached a unified conclusion. Most research focuses on comparing family firms and non-family firms and regards family members as highly homogeneous. However, differences in the kinship of family members involved in the firm leads to different types of family member compositions, thereby affecting governance efficiency and business decisions. Influenced by the traditional family culture, the governance structure of Chinese family firms shows an obvious "differential order pattern" centered on family kinship (Wang et al., 2014, p. 146). The closer the kinship between family members, the easier it is to create intimacy, unconditional trust, and other emotions (Hu, 2016). Therefore, different compositions of kinship contribute to different tradeoffs between socioemotional wealth and economic interests, which in turn affect the behavior of family members involved in the business. Based on family member composition, our study explores the impact of family involvement on firm innovation.

Using a sample of Chinese listed family firms from 2008 to 2016, we find a significant relationship between family involvement and firm innovation. Family firms with higher degrees of family involvement tend to have lower levels of R&D investment intensity and patent applications. We divide our sample into three types, controlling ownership, sibling partnership, and cousin consortium firms, based on the kinship between family members and the actual controller, and find a significant moderating effect of family member composition. With the increased richness of the kinship of family members involved in management, the negative impact of family involvement on patent applications is weakened, but family member composition does not have a significant moderating effect on the relationship between family involvement and R&D investment intensity. Further analysis shows that increased family involvement mainly contributes to the reduction of invention patent applications but has no significant effect on utility model patent and design patent applications. Furthermore, the negative relationship between family involvement and invention patent applications is weakened by the richness of kinship of family members involved in management. The conclusions hold when we control for endogeneity problems and perform robustness tests.

The remainder of our study is organized as follows. Section 2 reviews the relevant literature and develops hypotheses. Section 3 describes the sample and variables, and documents the methodology. Section 4 presents the data analyzed, empirical results, endogeneity analysis, and robustness tests. The final section serves as a conclusion.

2. Hypothesis development

2.1. Family involvement and firm innovation

In family firms, family members are usually involved not only in ownership but also in management (Chua et al., 1999; La Porta et al., 1999; Yang and Li, 2009; Astrachan and Shanker, 2013; Songini and Gnan, 2015).

Family involvement in ownership refers to the proportion of equity possessed by family members (Sciascia and Mazzola, 2008; Chen and Chen, 2014; De massis et al., 2015). Family involvement in management reflects family participation in strategic decision making, which is usually measured by the proportion of family members in the top management team (e.g., Zahra, 2003; Sciascia and Mazzola, 2008; Sciascia et al., 2012; De massis et al., 2015; Pan et al., 2019; Yan et al., 2019), the proportion of family employees (e.g., Pan et al., 2019), and whether family members are senior managers (e.g., Chen and Chen, 2014; Songini and Gnan, 2015; Pan et al., 2019; Yan et al., 2019).

Family involvement provides the family with the ability and power to influence the firm's innovation decisions by shaping firm goals, strategies, and behaviors (Chrisman et al., 2012). Specifically, a greater degree of family ownership enables the family to exercise more unrestricted discretion due to its status as a business owner (Chen and Chen, 2014) and to impose significant influence over strategic and tactical options presented to the top management team by virtue of their voting power (Evert et al., 2018). Likewise, more family involvement in management strengthens family members' influence on penetration of the firm (Chen and Chen, 2014), enhancing the ability to develop firm innovation decisions. Innovation, as a firm's future investment (Ettlie, 1998), is vital for long-term success in many business contexts (Wu et al., 2005; Banno, 2016) and is usually positively related to sales and stock performance, thus improving the reputation of firms. Therefore, family members have strong motivations to encourage innovation. To achieve sustained control of the firm, family members tend to maintain the prosperity of both the family and the firm (Chua et al., 1999; Gu et al., 2017), so the strategy is usually long-term rather than short-term oriented (Sirmon and Hitt, 2003; Le Breton-Miller and Miller, 2006). Thus, the greater the family's involvement is, the more positive the firm's attitude toward innovation will be. Further, high ownership concentration can diversify the risks of family firms by implementing innovative strategies and exploring new business areas (Hsu et al., 2016), which lead to a positive motivation for innovation. Family involvement in management also determines the emotional identification of family members with the business (Berrone et al., 2012). Family members regard the business as a family asset and have a strong desire to inherit the family business (Ward, 2004). In turn, corporate inheritance makes family firms pay more attention to sustainable development and active innovation (Zhu et al., 2016).

Second, family involvement can form a positive environment for innovation. Family firms provide family employees with a sense of professional security (Zhou, 2014). In return, family employees exhibit stronger commitment to the firm (Stark and Falk, 1998; Zahra et al., 2008). Within the domain of the altruism perspective, employee empowerment and the promotion of discretionary contributions can help family owners to orient themselves toward a stewardship role rather than self-interested agency action (Stark and Falk, 1998; Schulze et al., 2003b; Zahra et al., 2008). As the degree of family involvement increases, family members' sense of ownership and emotional attachment to the firm also increase (Schulze et al., 2003a), which contributes to the formation of a stewardship culture (Zahra et al., 2008). The stewardship culture is conducive to family members' adjusting their preferences, focusing on long-term competitiveness, using corporate resources efficiently for family interests (Carney et al., 2019), and being more courageous in the face of the potential risks associated with innovation (Cai et al., 2016). At the same time, family power in the business continues to increase with the degree of family involvement, which can allow the family to form a high level of cohesion and trust, making it smoother to communicate and cooperate (Schulze et al., 2003b) and thus facilitating firm innovation.

Finally, family involvement brings intangible resources for innovation. On the one hand, family firms have the advantage of low supervision costs (Chrisman et al., 2007). Firms with a high degree of family involvement, especially in management, can create a family culture atmosphere, which naturally urges family members to form a strong commitment to the firm (Zhou, 2014). This commitment encourages family managers to associate personal interests with corporate interests, greatly reducing the agency cost between shareholders and managers (Jensen and Meckling, 1976) and allowing family firms to invest in innovation activities. On the other hand, families are likely to simultaneously participate in both business and family relationships in their personal and professional lives. The duality of these relationships increases human resource diversity and creates a unique support system for intellectual capital and social capital (Sirmon and Hitt, 2003), which are what family firms need for innovation activities (Yan et al., 2019).

According to the above analysis, as the degree of family involvement increases, the active motivation, positive environment, and intangible resources of innovation in the firm increase, which are beneficial to the development of firm innovation. Thus, Hypothesis 1a is proposed as follows:

H1a. Family involvement has a positive effect on firm innovation, ceteris paribus.

Family involvement is a "double-edged sword" (Dyer, 2003, p.405). Increased family involvement may also become an obstacle to firm innovation (Block, 2010; Classen et al., 2014). First, the innovation strategy may conflict with family goals. In the operation of a family firm, socioemotional wealth plays a central role in this conflict (Yan and Ye, 2014). According to socioemotional wealth theory, increased family involvement leads to a closer relationship between family and business, and a higher psychological dependence of family members on the firm. Although innovation is beneficial to the long-term development of firms, there are uncertainties regarding the financial pay-offs due to R&D investment (Dai et al., 2012), which pose a huge threat to family interests (Wu and Chen, 2014; Cucculelli et al., 2016; Zhu et al., 2016). Therefore, the willingness of family members to protect socioemotional wealth becomes stronger as family involvement increases (Gómez-Mejía et al., 2013). Firms with greater family involvement are less willing to engage in such high-risk innovative activities (Duran et al., 2016), and thus tend to be conservative and cautious in the process of strategy development and investment plan selection (Wu et al., 2005).

Second, family firms lack innovative talent. On the one hand, family firms usually have a high degree of distrust of "outsiders" (Qi and Li, 2017, p.1144), while showing strong or even unconditional trust in family members (Gold et al., 2002). As a result, the actual controllers are more willing to appoint trusted family members, even if they are not competent, to work for the firm (Le Breton-Miller and Miller, 2009; Carney et al., 2019). Therefore, the increase in family involvement disperses, to some extent, the innovative enthusiasm of talents. On the other hand, as family power in firms grows, the influence of family culture, a fundamentally relationship-oriented culture, gradually deepens. Influenced by family culture, it is not rules and regulations that judge and restrict the actual controller's behavior, but interpersonal relationships. The manifestation of this perceptual talent evaluation system in family firms reflects the fact that managers appreciate employees' having a close relationship with them, whether they are family or non-family employees (Qi and Li, 2017) and regardless of their performance. On this condition, overemphasizing interpersonal relationships results in a lack of an effective talent incentive mechanism (Schulze et al., 2003b) and eliminates professional work enthusiasm. Therefore, a high degree of family involvement leads to a relationship-oriented culture and ineffective incentives for innovative professionals.

Finally, family involvement may create agency problems. With involvement in ownership, management, control, and other aspects, family members are likely to pursue more of their private goals (Block, 2010; Huang et al., 2018; Yan et al., 2019), which leads to fewer available resources and less efficient innovation activities in firms (Le Breton-Miller and Miller, 2009). In addition, the use of external expertise and capital in the R&D process may dilute family control and damage the family's socioemotional wealth (Gómez-Mejía et al., 2007). Therefore, as the degree of family involvement increases, family owners increasingly favor less R&D investment and focus on conservation rather than growth. Moreover, emotional conflicts mean that family members are not always united (Schulze et al., 2003a). Family managers have the dual identities of "steward" and "agent" (Zahra et al., 2008, p. 1037). When more family members are involved in management, families play more of the role of agent than steward (Tosi et al., 2003). Due to these agency problems, family members preferentially seek control-oriented benefits and self-interest rather than firm growth (Schulze et al., 2003a), which makes the overall investment vision of family firms short-sighted (Su and Lee, 2013), thereby neglecting opportunities for innovation.

Previous analysis suggests that a higher degree of family involvement in a firm is more likely to cause conflict, less innovative talent, and more agency problems, which taken together result in higher constraints on innovation resources. Thus, Hypothesis 1b is proposed as follows:

H1b. Family involvement has a negative effect on firm innovation, ceteris paribus.

2.2. The moderating effects of family member composition

Some scholars focus on differences among family members. Compared with distant relatives, close relatives have stronger cohesion and a greater sense of identity (Schulze et al., 2003a). They construct a foundation of

trust and have a similar and strong sense of responsibility to the family business, so it is easier to form a consensus in decision-making (He et al., 2010). However, family members with different kinship relationships have different degrees of willingness to protect socioemotional wealth (Yu et al., 2018). Close relatives are more willing to preserve socioemotional wealth at the expense of governance efficiency, while distant relatives usually do not attach firm interest to socioemotional wealth, which restrains the efficiency of corporate governance and the effectiveness of decision-making. Therefore, based on the kinship between family members involved in business management and the actual controller and inspired by Gersick et al. (1997), we divide family firms into three types: controlling ownership, sibling partnership, and cousin consortium firms.

Conflicts in family firms may originate from sibling rivalry, identity conflict, the following generations' desire to be different from their parents, or the different goals of individual family members regarding the development of the firm. These conflicts lead to divergence in preferences and different levels of cohesion (Gersick et al., 1997). The biggest characteristic of controlling ownership firms is that family members involved in management are limited to the nuclear relatives of the actual controller, such as the actual controller's spouse and his, her, or their parents and/or children. The nuclear family members usually regard themselves as the owners of the business (Stark and Falk, 1998), and will take actions that they believe will benefit the nuclear family and business (Schulze et al., 2003b). The nuclear family members are closely related to each other, with the same experience, shared cognition, and a strong spirit of reciprocity (Schulze et al., 2003a), and tend to be more loyal to family firms and willing to invest more financial support and other resources in business operations (Chen et al., 2016), which gives the family firms strong cohesion. In sibling partnership firms, new family members who are closely related to the actual controller, such as his, her, or their siblings and/or spouses, are involved in management. The nature of altruism in sibling partnerships weakens gradually, while egoism makes this alignment of interests among family members much more difficult to obtain. This is because egoism gives each sibling manager an incentive to place their own nuclear household's welfare ahead of the welfare of their extended family members and even the firm (Lubatkin et al., 2005), so that rent-seeking and moral hazard are intensified with the enrichment of family involvement (Gersick et al., 1997), leading to a decline in the cohesion of family firms. In cousin consortium firms, the actual controller's cousins and even distant relatives are involved in management. Compared with nuclear family members, distant family members have a weaker sense of loyalty and belonging, which can reduce effectiveness as they value self-interest more than socioemotional wealth (Miller et al., 2013). In this case, family conflicts that arise among core and non-core family members are more likely to cause agency problems and additional coordination costs (He et al., 2010), leading to a further reduction in family cohesion. In addition, affected by the traditional family culture, the actual controllers of Chinese family firms often treat family members differently, based on kinship rather than ability, which can easily lead to multiple discrimination (Lubatkin et al., 2005). In summary, family member composition ranges from controlling ownership to sibling partnership and then to cousin consortium firms. The richer the kinship ties between family members involved in management, the more likely egoism and agency problems are to contribute to a lower level of cohesion and governance efficiency and thus negatively moderate the relationship between family involvement and firm innovation. Thus, hypothesis 2a is proposed as follows:

H2a. With increased richness of the kinship of family members involved in management, the negative effect of family involvement on firm innovation will be strengthened, whereas the positive effect will be weakened, ceteris paribus.

The richness of kinship ties among family members involved in management may also improve corporate governance efficiency. In controlling ownership family firms, the actual controllers usually have a dominant position both in firms and families, which makes the board of directors a ''rubber stamp board'' or a ''paper board'' (Gersick et al., 1997, p.32). In both cases, these boards cannot perform the real advisory role and only serve to endorse what the owner-manager has already decided (Gersick et al., 1997). When siblings participate in the management of the firm, although the closeness of their blood ties allow them to maintain a sense of loyalty and identification with the family (Schulze et al., 2003a), they also desire respect and involvement in good decision making. As a result, family employees will not follow the decisions of the actual controller blindly, limiting the absolute authority of the actual controller (Gersick et al., 1997). Therefore, in the process of corporate governance and decision-making with siblings, family members are independent and supervise each other, improving corporate governance efficiency to a certain extent. When distant relatives are involved

in business management, firms transit into extended family. The power of management becomes more dispersed or fractionalized, with a dilution of control, and the family's attachment to the organization tends to weaken. Family employees work toward above-target performance, which is independent from financial considerations and socioemotional wealth (Yu et al., 2018). Therefore, in cousin consortium firms, professional and effective governance helps to restrain unreasonable resource allocation, improve resource utilization, and encourage innovative activities. Theoretically, the richer the kinship in a family firm, the more effective the corporate governance mechanism is likely to be, which can positively moderate the relationship between family involvement and innovation performance. Thus, Hypothesis 2b is proposed as follows:

H2b. With the increased richness of the kinship of family members involved in management, the negative effect of family involvement on firm innovation will be weakened, while the positive effect will be strengthened, ceteris paribus.

3. Data and variables

3.1. Sample and data

We select family firms listed on the Chinese A-share market from 2008 to 2016 as our initial sample. Following Wang et al. (2014) and Pan et al. (2019), only firms that meet the following conditions are selected: (a) the ultimate actual controller of the firm is an individual or a family; and (b) at least one family member is involved in top management teams. Moreover, we exclude firms in the financial sector, firms in severe financial distress/undergoing bankruptcy, and firms with missing variables and details of family members. Finally, all continuous variables are winsorized at the 1% and 99% levels, resulting in a total sample of 925 family firms with a total of 3882 observations. All data are from the CNRDS database. Based on these data, family involvement in ownership and family member composition are calculated manually.

3.2. Variables

3.2.1. Family involvement

Ownership and management are the most essential features to measure family involvement (La Porta et al., 1999; Astrachan and Shanker, 2013). Therefore, we adopt family ownership, namely the percentage of shares held by family members (FI_{own}), to measure the degree of family involvement in ownership. In the robustness tests, family involvement is measured by calculating the proportion of family members involved in top management teams ($FI_{manager}$) from the perspective of involvement in management.

3.2.2. Firm innovation

It makes sense to differentiate innovation input and output as variables used to measure the innovation efficiency of family firms (Carney et al., 2019). We adopt the ratio of R&D investment to operating revenue (RD_{OR}) to measure innovation input, and the natural logarithm of the number of patent applications plus 1 (PA_{apply}) to measure innovation output. In the robustness tests, the ratio of R&D investment to total assets (RD_{AS}) and the natural logarithm of the number of patent grants plus 1 (PA_{grant}) are used as the alternative measures of innovation input and output, respectively.

3.2.3. Family member composition

Following Gersick et al. (1997), we divide family firms into three types, namely controlling ownership, sibling partnership, and cousin consortium firms, based on the kinship between the family members involved in management and the actual controller. In controlling ownership firms, only the actual controller's spouse and his, her, or their parents and/or children are involved in top management teams. In sibling partnership firms, there are new family managers who are closely related to the actual controller, such as his, her, of their siblings and/or spouses. In cousin consortium firms, the actual controller's cousins and even distant relatives are involved in management. We use a dummy variable to measure the family member composition (*Type*), where 1 indicates that the sample firm belongs to a controlling ownership, 2 indicates that the sample firm belongs to a sibling ownership, and 3 indicates that the sample firm belongs to a cousin consortium.

Table 1
Definitions of the variables.

Variables	Symbols	Variable measurement
Dependent variables		
Innovation input	RD_{OR}	The ratio of R&D investment to operating revenue
Innovation output	PA_{apply}	The natural logarithm of the number of patent applications plus 1
Independent variable		
Family involvement	FI_{own}	The percentage of shares held by family members
Moderating variable		
Family member composition	*Type*	Dummy variable equals to 1 if the sample is a controlling ownership firm, 2 if the sample is a sibling partnership firm, and 3 if the sample is a cousin consortium firm.
Control variables		
Firm size	*Size*	The natural logarithm of total assets at the end of the year
Firm age	*Age*	The year of establishment
Leverage	*Lev*	The asset-liability ratio
Profitability	*Roa*	The ratio of net profit to average total assets
Ownership concentration	Top_1	The percentage of shares held by the largest shareholder
CEO duality	*Dual*	Dummy variable equals to 1 if the CEO is also the board president and 0 otherwise
Board independence	*Inde*	The percentage of independent directors
Separation of two rights	*Sep*	The ratio of ownership to control right of the actual controller
Marketization index	*Market*	The marketization index of the registered location of sample firms

Table 2
Descriptive statistics of the full sample.

Variables	*N*	Mean	S.D.	Minimum	25%	50%	75%	Maximum
RD_{OR}	3882	0.044	0.041	0.000	0.027	0.036	0.052	0.627
PA_{apply}	3882	2.527	1.144	0.693	1.609	2.398	3.258	7.402
FI_{own}	3882	0.436	0.155	0.123	0.313	0.436	0.558	0.749
Type	3882	1.800	0.744	1.000	1.000	2.000	2.000	3.000
Size	3882	21.508	0.923	19.341	20.808	21.404	22.064	25.846
Age	3882	13.149	5.431	1.000	9.000	13.000	16.000	40.000
Lev	3882	0.319	0.183	0.008	0.167	0.299	0.446	0.861
Roa	3882	0.017	0.024	−0.059	0.005	0.011	0.021	0.252
Top_1	3882	0.361	0.129	0.042	0.261	0.353	0.449	0.738
Dual	3882	0.403	0.491	0.000	0.000	0.000	1.000	1.000
Inde	3882	0.376	0.049	0.250	0.333	0.333	0.429	0.667
Sep	3882	0.905	0.177	0.000	0.875	1.000	1.000	1.000
Market	3882	8.296	1.691	0.800	7.393	8.890	9.680	10.000

3.2.4. Control variables

To control for other effects, we include the set of standard control variables in the regression models, including firm size (*Size*), firm age (*Age*), leverage (*Lev*), profitability (*Roa*), ownership concentration (Top_1), CEO duality (*Dual*), board independence (*Inde*), separation of two rights (*Sep*), and marketization index (*Market*). We also control for year effect (*Year*), industry effect (*Industy*), and area effect (*Area*). Table 1 summarizes the definitions and the measurements of the variables used in our empirical analysis.

3.3. Empirical model

To test the hypotheses, the standard OLS regression models are carried out as follows.

$$RD_{OR}\left(PA_{apply}\right) = \alpha_0 + \alpha_1 FI_{own} + \alpha_i \sum Control + \varepsilon \quad (1)$$

Table 3
Pearson correlation coefficient analysis.

	RD_{OR}	PA_{apply}	FI_{own}	*Type*	*Size*	*Age*	*Lev*	*Roa*	Top_1	*Dual*	*Inde*	*Sep*	*Market*
RD_{OR}	1												
PA_{apply}	0.045***	1											
FI_{own}	−0.015**	−0.037**	1										
Type	−0.014	−0.064***	0.125***	1									
Size	−0.180***	0.306***	−0.198***	−0.005	1								
Age	−0.080***	0.012	−0.097***	−0.024	0.188***	1							
Lev	−0.310***	0.1506***	−0.261***	−0.024	0.545***	0.141***	1						
Roa	−0.071***	−0.012	0.135***	0.031*	−0.124***	−0.100***	−0.234***	1					
Top_1	−0.076***	0.047***	0.457***	0.004	−0.011	−0.052**	−0.045***	0.110***	1				
Dual	0.074***	0.044	0.105***	−0.012	−0.138***	−0.047***	−0.105***	0.060***	0.090***	1			
Inde	0.065***	0.054***	0.168***	−0.018	−0.005	−0.003	−0.021	−0.011	0.075***	0.152***	1		
Sep	0.098***	−0.016	−0.173***	0.0285	−0.176***	−0.051***	−0.172***	0.006	−0.134***	0.133***	0.162	1	
Market	0.037**	0.039***	0.103***	−0.001	0.103***	0.125***	0.039**	−0.027	0.038**	0.066***	0.047***	0.000	1

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4
Regression results.

	Model (1)		Model (2)	
	RD_{OR}	PA_{apply}	RD_{OR}	PA_{apply}
Constant	0.099***	−4.981***	0.066***	−3.973***
	(3.63)	(−9.26)	(3.54)	(−6.87)
FI_{own}	−0.012***	−0.322**	−0.009	−0.067**
	(−2.68)	(−2.55)	(−0.83)	(−2.39)
Type			0.022	0.144***
			(0.88)	(5.06)
FI_{own}·*Type*			−0.007	0.229***
			(−1.35)	(7.24)
Size	−0.003***	0.295***	−0.001	0.279***
	(−3.77)	(12.34)	(−0.81)	(10.68)
Age	−0.001***	−0.009**	−0.001***	−0.009**
	(−6.12)	(−2.48)	(−4.65)	(−2.44)
Lev	−0.066***	−0.115	−0.074***	−0.323**
	(−16.49)	(−0.96)	(−17.59)	(−2.54)
Roa	−0.207***	0.356	−0.228***	0.223
	(−7.94)	(0.46)	(−8.74)	(0.28)
Top_1	−0.020***	0.005***	−0.001*	0.006***
	(−4.11)	(3.34)	(−1.81)	(3.13)
Dual	0.003***	0.093**	0.003**	0.106***
	(2.81)	(2.52)	(2.03)	(2.72)
Inde	0.037***	0.137	0.041***	0.173
	(3.30)	(0.41)	(3.48)	(0.48)
Sep	0.001	0.810***	0.012**	0.096
	(0.43)	(8.17)	(2.33)	(0.68)
Market	0.004***	0.056***	0.001***	0.026**
	(6.63)	(3.35)	(3.41)	(2.36)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
N	3882	3882	3882	3882
Adjusted R^2	0.178	0.090	0.141	0.089

Notes: The numbers in parentheses are *t*-values. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

$$RD_{OR}(PA_{apply}) = \beta_0 + \beta_1 FI_{own} + \beta_2 Type + \beta_3 FI_{own} \cdot Type + \beta_j \sum Control + \mu \quad (2)$$

Eq. (1) tests the empirical results of family involvement and firm innovation. Eq. (2) tests the moderating effect of family member composition. RD_{OR} and PA_{apply} represent innovation input and output. FI_{own} represents family involvement. *Type* represents family member composition. *Control* represents control variables. α_i and β_j represent coefficients. ε and μ represent random error terms.

4. Empirical results

4.1. Data analysis

Data analyses are performed in two steps. The first is the calculation of descriptive statistics. Table 2 summarizes the descriptive statistics of the full samples for the main regression variables. The mean of RD_{OR} and PA_{apply} are 4.4% and 2.527, respectively. On average, 43.6% and 36.1% of shares are held by family members and the largest shareholders, 40.3% of CEOs are also board president, and 37.6% of board members are independent directors. On average, the separation degree of ownership and control is 0.905. Financial characteristics suggest that the samples have an average leverage of 31.9% and average *Roa* of 1.7%. Moreover, 1561 observations, approximately 40.22%, are controlling ownership firms; 1565 observations, approximately 40.31%, are sibling partnership firms; and 756 observations, approximately 19.47%, are cousin consortium

Table 5
Endogeneity test results I: Instrumental variables estimation.

Variables	I	II	III	IV
	FI_{own}	RD_{OR}	FI_{own}	PA_{apply}
Constant	0.145	0.074***	0.017	−4.760***
	(0.53)	(3.26)	(0.60)	(−5.37)
$FI_{own}\_IV_1$	0.032***		0.031***	
	(3.46)		(3.40)	
$FI_{own}\_IV_2$	0.909***		0.910***	
	(110.90)		(110.67)	
FI_{own}		−0.012**		−0.348**
		(−2.17)		(−2.27)
Size	−0.002	0.001	−0.002	0.285***
	(−1.49)	(0.49)	(−1.55)	(7.29)
Age	0.001***	−0.001***	0.001***	−0.006
	(4.35)	(−5.96)	(4.29)	(−1.39)
Lev	−0.010	−0.084***	−0.010	−0.114
	(−1.64)	(−12.70)	(−1.52)	(−0.78)
Roa	0.137**	−0.658***	0.145**	2.699
	(2.05)	(−7.15)	(2.19)	(1.56)
Top_1	0.001***	−0.000***	0.001***	0.005***
	(9.07)	(−3.53)	(9.04)	(2.79)
Dual	0.000	0.002	0.000	0.117**
	(0.12)	(1.49)	(0.19)	(2.58)
Inde	0.005	0.035***	0.004	0.522
	(0.30)	(2.85)	(0.28)	(1.32)
Sep	−0.000	0.003	−0.000	0.793***
	(−0.04)	(0.80)	(−0.09)	(6.54)
Market	−0.000	0.000	−0.000	0.026**
	(−0.44)	(1.05)	(−0.58)	(2.22)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
Weak instrumental variable test	7331.92		7292.150	
Sargan Score	1.792		0.216	
	($p = 0.181$)		($p = 0.64$)	
N	2800	2800	2800	2800
Adjusted R^2	0.925	0.162	0.925	0.075

Notes: The numbers in parentheses are *t*-values. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

firms. The next step is Pearson correlation coefficient analysis. Table 3 reveals the relationships between the main variables. The results show that most of the control variables are significantly correlated with RD_{OR} and PA_{apply}, suggesting that the control variables are effective. The maximum correlation between the control variables does not exceed 0.6 and the maximum VIF is 1.991. There is no serious problem of multicollinearity, which is considered meaningful for further analysis.

4.2. Regression results

Table 4 reports the main regression results. Model 1 tests the impact of family involvement on firm innovation. The results show that the coefficients of FI_{own} to RD_{OR} and PA_{apply} are significantly negative at the 1% and 5% level, respectively. These results suggest that increased family involvement significantly reduces both innovation input and output, which supports Hypothesis 1b. The results indicate that the decision-making of Chinese family firms is mainly based on family interests. Due to the ownership and management characteristics of family members, the ambition to secure the firm's survival leads family firms to protect socioemotional wealth and focus on a conservative strategy (Miller et al., 2011). Due to uncertain pay-offs of R&D investment, family firms make tradeoffs between socioemotional wealth loss and innovation revenue, causing a greater preference for socioemotional wealth than innovation activities (Gómez-Mejía et al., 2007; Gómez-

Table 6
Endogeneity test results II: PSM.

	RD_{OR}	PA_{apply}
Constant	0.141***	−6.219***
	(11.47)	(−14.72)
FI_{own}	−0.022***	−0.995***
	(−8.47)	(−11.43)
Size	−0.004***	0.386***
	(−6.89)	(20.02)
Age	−0.001***	−0.009***
	(−7.43)	(−2.78)
Lev	−0.063***	−0.152
	(−19.88)	(−1.41)
Roa	−0.092***	1.983***
	(−4.66)	(2.93)
Top_1	−0.000***	0.007***
	(−4.65)	(5.75)
Dual	0.002**	0.078**
	(2.38)	(2.26)
Inde	0.037***	0.812***
	(4.19)	(2.68)
Sep	−0.000**	−0.005**
	(−2.16)	(−2.55)
Market	0.001**	0.041***
	(2.49)	(3.83)
Year	Yes	Yes
Industry	Yes	Yes
Area	Yes	Yes
N	5254	5254
Adjusted R^2	0.179	0.174

Notes: The numbers in parentheses are *t*-values. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Mejía et al., 2013). Therefore, the higher the degree of family involvement, the greater the aversion to risk, leading to less innovation input and output and less innovation efficiency in family firms.

Model 2 reports the moderating effect of family member composition. The coefficient of $FI_{own}{\cdot}Type$ to RD_{OR} is negative but insignificant. However, the coefficient of $FI_{own}{\cdot}Type$ to PA_{apply} is significantly negative at the 1% level. These results show that when the richness of the kinship of family members involved in management increases, the negative impact of family involvement on patent applications is weakened. However, family member composition does not have a significant moderating effect on the relationship between family involvement and R&D investment intensity. Hypothesis 2b is partially confirmed. The family's attachment to the organization is greatest when the firm is owned and managed by the nuclear family members. This attachment tends to weaken as the firm's ownership transitions to extended family (Schulze et al., 2003a), because family influence becomes more dispersed or fractionalized, with a dilution of control. As a result, with the increased richness of the kinship of family members, firms are more willing to attempt to limit irrational behavior by placing restrictions on the employment of family members and increasingly adopting professional management practices. The efficiency of corporate governance in extended family firms is better than that in controlling ownership firms. Thus, the richness of the kinship of family members solves the conflicts between corporate interests and family interests. The extension of family involvement probably has a positive impact on innovation output. However, control concentration is highly pronounced among Chinese listed family firms (Carney et al., 2019). These controllers tend to play leading roles in the strategic decision-making process. Therefore, regardless of the degree of family involvement, decision-making power in terms of strategy, especially innovation, still belongs to a few family members (Wu, 2016), resulting in an insignificant moderating effect of family member combination on R&D investment intensity.

Table 7
Robustness test I: Alternative measure of family involvement.

Variables	Model (1)		Model (2)	
	RD_{OR}	Pa_{apply}	RD_{OR}	PA_{apply}
Constant	0.118***	−4.020***	0.077***	−2.406***
	(6.08)	(−6.94)	(3.88)	(−3.44)
FI_{manger}	−0.692***	−32.221***	−0.360	−58.525***
	(−3.18)	(−4.85)	(−0.64)	(−7.38)
Type			−0.002*	0.008
			(−1.68)	(0.16)
FI_{manger}·*Type*			0.145	0.163*
			(0.60)	(1.67)
Size	−0.004***	0.251***	−0.001***	0.212***
	(−4.51)	(9.72)	(−3.73)	(6.91)
Age	−0.001***	−0.008**	−0.001***	−0.005
	(−5.86)	(−2.19)	(−4.58)	(−1.27)
Lev	−0.066***	−0.116	−0.071***	−0.200
	(−16.48)	(−0.98)	(−17.07)	(−1.36)
Roa	−0.206***	0.480	−0.233***	−0.614
	(−7.87)	(0.62)	(−8.93)	(−0.68)
Top_1	−0.028***	0.003**	−0.028***	0.006***
	(−6.25)	(2.22)	(−4.91)	(3.08)
Dual	0.003***	0.093**	0.003**	0.093**
	(2.80)	(2.53)	(2.18)	(2.09)
Inde	0.034***	0.058	0.037***	−0.062
	(3.06)	(0.17)	(3.16)	(−0.15)
Sep	0.001	0.806***	0.003	0.225***
	(0.38)	(8.15)	(0.65)	(−3.47)
Market	0.004***	0.055***	0.001***	0.012***
	(6.52)	(3.33)	(3.34)	(3.93)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
N	3882	3882	3882	3882
Adjusted R^2	0.179	0.094	0.137	0.095

Notes: The numbers in parentheses are *t*-values. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.3. Endogeneity test

We adopt both instrumental variable estimation and propensity score matching (PSM) to solve possible endogenous problems.

4.3.1. Instrumental variable estimation

We select both the average family ownership of other sample firms in the same province and the same year ($FI_{own}\_IV_1$) and the one-year lagged family ownership ($FI_{own}\_IV_2$) as instrumental variables. The degree of family involvement is similar for firms in the same province, as shared culture has no direct relationship with innovation efficiency. Similarly, lagged family ownership relates to the degree of family involvement in ownership in this period but has no relation to innovation efficiency. Both instrumental variables are assumed to be exogenous. Table 5 reports the results of instrumental variable estimation using the two stage least squares method (2SLS). Column I and III in Table 5 are the first stage regression results of innovation input and output, respectively, showing that the coefficients of instrumental variables are both significantly positive. The exogenous original assumption of the instrumental variables is accepted by the weak instrumental variables test and the over identification test. Column II and IV in Table 5 report the second stage regression results. The coefficients of FI_{own} are both negative and significant, which are consistent with the previous conclusions.

Table 8
Robustness test II: Alternative measures of innovation.

Variables	Model (1)		Model (2)	
	RD_{AS}	PA_{grant}	RD_{AS}	PA_{grant}
Constant	0.048***	−3.960***	0.038***	−3.037***
	(5.16)	(−6.99)	(3.84)	(−4.55)
FI_{own}	−0.007***	−0.256*	−0.006	−0.230**
	(−3.04)	(−1.93)	(−1.05)	(−2.59)
Type			0.010	0.524***
			(0.77)	(4.64)
FI_{own}·*Type*			−0.002	0.241***
			(−0.80)	(7.13)
Size	−0.001***	0.236***	−0.001**	0.228***
	(−3.57)	(9.38)	(−2.57)	(7.56)
Age	−0.000***	−0.011***	−0.000***	−0.005
	(−4.49)	(−2.79)	(−3.78)	(−1.15)
Lev	−0.008***	0.108	−0.009***	−0.182
	(−3.94)	(0.86)	(−4.19)	(−1.24)
Roa	−0.013	0.170	−0.020	0.617
	(−0.97)	(0.21)	(−1.44)	(0.67)
Top_1	−0.007	0.005***	−0.000	0.006***
	(−1.099)	(2.89)	(−0.61)	(2.90)
Dual	−0.003	0.060	−0.001	0.095**
	(−1.35)	(1.56)	(−0.94)	(2.10)
Inde	−0.001	−0.010	0.009	0.037
	(−1.01)	(−0.03)	(1.49)	(0.91)
Sep	−0.000	0.823***	0.005**	0.231
	(−0.28)	(7.89)	(2.23)	(1.48)
Market	0.002***	0.058***	0.001***	0.011***
	(6.30)	(3.32)	(5.62)	(3.80)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
N	3882	3882	3882	3882
Adjusted R^2	0.048	0.075	0.027	0.062

Notes: The numbers in parentheses are *t*-values. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.3.2. PSM method

We adopt the PSM method to alleviate the potential endogeneity problem caused by the self-selection of samples. A sample of non-family firms with similar characteristics to the sample family firms is constructed under the 1:1 matching principle to compare the relationship between family involvement and firm innovation. The matching results in Table 6 suggest that the coefficients of FI_{own} are both significantly negative, indicating that increased family involvement has a negative effect on innovation input and output, which is consistent with the main findings.

4.4. Robustness tests

To assess the robustness of the findings, we conduct four robustness tests. First, following Zahra (2003) and Pan et al. (2019), we develop regression analysis by alternative measure of family involvement. From the perspective of involvement in management, the proportion of family members involved in top management teams ($FI_{manager}$) is adopted to measure the degree of family involvement in management. Table 7 shows the results. Second, following Carney et al. (2019), we conduct regression analyses for alternative measures of innovation. The ratio of R&D investment to total assets (RD_{AS}) and the natural logarithm of the number of patent grants plus 1 (PA_{grant}) are used as the alternative measures of innovation input and innovation output, respectively. Table 8 shows the results. Third, following Yan and Ye (2014), we redefine family firms. Ceteris paribus, fam-

Table 9
Robustness test III: Re-define family firms.

Variables	Model (1)		Model (2)	
	RD_{OR}	PA_{apply}	RD_{OR}	PA_{apply}
Constant	0.092***	−5.144***	0.028*	−2.319***
	(5.11)	(−9.33)	(1.76)	(−4.03)
FI_{own}	−0.012**	−0.289**	−0.010	−0.008***
	(−2.64)	(−2.05)	(−0.97)	(−2.74)
Type			−0.001	0.002**
			(−0.52)	(3.57)
FI_{own}·*Type*			0.002	0.382***
			(0.33)	(7.51)
Size	−0.003***	0.296***	−0.001***	0.204***
	(−3.35)	(12.03)	(−3.23)	(7.88)
Age	−0.001***	−0.009**	−0.000***	−0.006
	(−5.46)	(−2.47)	(−4.39)	(−1.56)
Lev	−0.066***	−0.104	−0.083***	−0.138
	(−16.31)	(−0.84)	(–23.26)	(−1.09)
Roa	−0.203***	0.280	−0.257***	−0.271
	(−7.82)	(0.35)	(−10.63)	(−0.35)
Top_1	−0.017***	0.005***	−0.010***	0.006***
	(−3.32)	(3.41)	(−3.62)	(3.48)
Dual	0.004***	0.092**	0.005***	0.090**
	(3.30)	(2.42)	(4.05)	(2.30)
Inde	0.035***	0.238	0.026**	0.027
	(3.08)	(0.68)	(2.53)	(0.77)
Sep	0.000	0.845***	0.011**	0.187**
	(0.14)	(8.27)	(2.53)	(2.62)
Market	0.004***	0.057***	0.003***	0.011***
	(6.72)	(3.34)	(7.46)	(5.50)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
N	3655	3655	3655	3655
Adjusted R^2	0.180	0.095	0.162	0.067

Notes: The numbers in parentheses are *t*-values. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

ily firms should meet the condition that the total family ownership is greater than 15%. The results are listed in Table 9. Forth, given the lag effect of family involvement on innovation decision-making, regressions are conducted on the lagged independent and control variables. The results are shown in Table 10. All of the results of the robustness tests are consistent with the main regression results.

4.5. Additional analysis

The Patent Law of the People's Republic of China divides patents into three categories: invention patent, utility model patent, and design patent. Unlike utility model patent and design patent, invention patent should meet the requirements of novelty, inventiveness, and practical applicability. Invention patent is associated with higher R&D costs and a longer research and development time, which can greatly enhance the core competitiveness of firms. However, family firms prefer less risky, short-term, conservative investments to risky, long-term, radical investments (Gómez-Mejía et al., 2007). Due to the high level of family involvement in family firms, the fear of socioemotional wealth loss produced by investment in invention patent may be greater than that for utility model patent and design patent. Accordingly, family involvement may have different effects on innovation strategy, resulting in different decisions concerning the types of patents for which a firm applies. We further analyze the influence of family involvement on the three types of patent applications and the moderating role of family member composition. Table 11 reports the results.

Table 10
Robustness test VI: One-year lagged independent and control variables.

Variables	Model (1)		Model (2)	
	RD_{OR}	PA_{apply}	RD_{OR}	PA_{apply}
Constant	0.010***	−4.603***	0.100***	−4.642***
	(4.50)	(−7.07)	(4.47)	(−7.03)
FI_{own}	−0.013**	−0.343**	−0.007	−0.548***
	(−2.52)	(−2.32)	(−1.12)	(−2.99)
FI_{own}·*Type*			−0.003	0.102*
			(−1.27)	(1.68)
Size	−0.003**	0.307***	−0.003**	0.297***
	(−2.54)	(10.46)	(−2.51)	(9.97)
Age	−0.001***	−0.007	−0.001***	−0.006
	(−4.90)	(−1.56)	(−4.93)	(−1.48)
Lev	−0.068***	−0.111	−0.001***	−0.144
	(−14.07)	(−0.78)	(−14.05)	(−0.98)
Roa	−0.153***	1.211	−0.152***	2.597
	(−4.76)	(1.28)	(−4.71)	(1.43)
Top_1	−0.024***	0.005***	−0.000***	0.005***
	(−4.03)	(2.64)	(−4.10)	(2.79)
Dual	0.003**	0.104**	0.004**	0.093**
	(2.25)	(2.37)	(2.21)	(2.15)
Inde	0.040***	0.288	0.040***	0.212
	(2.91)	(0.71)	(2.88)	(0.54)
Sep	0.004	0.414***	0.004	0.771***
	(1.01)	(3.59)	(1.01)	(6.71)
Market	0.003***	0.042**	0.003***	0.035*
	(4.51)	(2.10)	(4.50)	(1.78)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes
N	2801	2801	2801	2801
Adjusted R^2	0.170	0.077	0.170	0.089

Notes: The numbers in parentheses are *t*-values. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Model 1 in Table 11 shows the results of tests of the impacts of family involvement on three types of patent applications. The results show that there is a significantly negative relationship between family involvement and invention patent applications (INV_{apply}). However, the effects on utility model patent (APP_{apply}) and design patent applications (DES_{apply}) are statistically insignificant. In other words, the negative effect of family involvement on innovation output mainly contributes to the reduction of invention patent applications. Invention patent has the most risks and uncertain pay-offs at the cost of socioemotional wealth loss. Family members are likely to implement conservative strategies and pursue the interests of the family. As such, family involvement in firms leads to the increased rejection of invention patent. Therefore, the negative effect of family involvement on invention patent applications is significant. In addition, the risks of utility model patent and design patent are not as great as those of invention patent. As such, family involvement has insignificant effects on utility model patent and design patent applications.

Model 2 in Table 11 shows the results of tests of the moderating effect of family member composition. For the regression results for invention patents, the coefficient of the interaction is positive and significant at the 1% level, indicating that the negative effects of family involvement on invention patent applications are weakened when the kinship of family member composition is richer. These results further suggest that the increased richness of kinship leads to improved corporate governance efficiency and more rational innovation decisions, which is beneficial for family firms in achieving business objectives.

Table 11
Additional analysis.

Variables	Model (1)			Model (2)		
	INV_{apply}	APP_{apply}	DES_{apply}	INV_{apply}	APP_{apply}	DES_{apply}
Constant	−7.082***	−3.809***	−1.814***	−7.355***	−4.901***	−2.755***
	(−13.31)	(−6.35)	(−3.48)	(−11.67)	(−7.23)	(−4.56)
FI_{own}	−0.548***	−0.023	0.024	−0.526***	−0.026	−0.349
	(−4.38)	(−0.17)	(0.19)	(−2.99)	(−0.65)	(−1.47)
Type				0.054***	−0.835	0.537***
				(3.41)	(0.91)	(2.94)
FI_{own}·*Type*				0.190***	0.225	0.059
				(3.66)	(1.13)	(0.93)
Size	0.377***	0.179***	0.113***	0.385***	0.265***	0.135***
	(15.93)	(6.71)	(4.88)	(13.50)	(8.90)	(4.83)
Age	−0.004	−0.011***	−0.004	−0.002	−0.004	−0.002
	(−1.00)	(−2.79)	(−1.19)	(−0.49)	(−0.81)	(−0.48)
Lev	−0.458***	0.557***	−0.374***	−0.562***	0.422***	−0.305**
	(−3.87)	(4.17)	(−3.22)	(−3.97)	(2.90)	(−2.07)
Roa	1.097	−0.983	0.069	−0.146	−1.538	−0.328
	(1.43)	(−1.13)	(0.09)	(−0.17)	(−1.62)	(−0.37)
Top_1	0.004***	0.004**	0.002	0.005***	0.007***	0.003
	(3.00)	(2.49)	(1.32)	(3.11)	(3.32)	(1.38)
Dual	0.104***	0.066	0.181***	0.108***	0.107**	0.220***
	(2.85)	(1.61)	(5.08)	(3.97)	(2.24)	(4.90)
Inde	0.058	0.031	−0.076	0.125	−0.018	−0.130
	(0.17)	(0.08)	(−0.23)	(0.36)	(−0.04)	(−0.84)
Sep	0.467***	0.741***	0.278***	0.244*	0.314*	0.749*
	(4.76)	(6.70)	(2.89)	(1.69)	(1.98)	(1.75)
Market	0.058***	0.060***	0.024	0.044***	0.023	0.012
	(3.52)	(3.23)	(1.49)	(3.43)	(1.58)	(0.93)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes	Yes	Yes
N	3882	3882	3882	3882	3882	3882
Adjusted R^2	0.101	0.065	0.033	0.102	0.063	0.032

Notes: INV_{apply}, APP_{apply}, and DES_{apply} represent the number of patent applications for invention, utility model and design, respectively. The numbers in parentheses are *t*-values. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

5. Discussion and conclusion

Using data of Chinese listed family firms from 2008 to 2016, we focus on whether and how family involvement impacts firm innovation and the moderating effect of family member composition. First, a noteworthy finding is that family involvement has negative effects on innovation efficiency, leading to the reduction of innovation input and output. Second, the diversification of kinship involved in management yields a high level of governance efficiency. The negative effect of family involvement on innovation output is weakened when the kinship of family member composition is richer. Third, the negative effect of family involvement on innovation output mainly contributes to the reduction of invention patent applications, whereas the adverse effects gradually weaken as the kinship of family members involved in management becomes richer. The findings are robust regarding endogeneity problems, alternative measures of variables, alternative definition of family firms, and one-year lagged independent and control variables. In summary, family firms prefer family interest to corporate interest, meaning that they do not maximize firm value but rather attempt to realize non-economic goals such as socioemotional wealth. These findings suggest that to ensure long-term survival, the actual controllers of family firms should establish the idea of a firm-centered standard instead of a family-centered standard, avoid the typical preference for short-term and irrational behavior, and optimize the governance structure.

The contributions of our study to the current family firm literature may be summarized as follows. First, our study highlights the differences among family firms. Although the importance of innovation has been well recognized in the family firm literature, most of the current research focuses on differences between family firms and non-family firms and regards family members as highly homogeneous. Our study provides empirical evidence for the kinship between family members and the actual controllers, thus enhancing our knowledge of the relationship between family involvement and innovation efficiency. Second, our study examines Chinese listed family firms, which provide a unique context to further test the influence of family involvement on innovation. In terms of the Chinese unique patent system, we further examine the family's influence on each category of innovation output, even strategy, which provides additional empirical evidence of and new perspectives on family firm innovation and enriches the existing literature. Third, our study has practical significance for research on the innovation effects of family involvement, and provides important evidence to further promote governance efficiency, maintain long-term competitiveness, and realize the sustainable development of family firms.

Aside from its contributions, our study has several limitations that represent opportunities for future research. First, each family member composition includes various forms of kinship. The diversity of kinship of family members and its influence on the results of the innovation process is only partially addressed in the literature. Further research is needed to study in detail and explore how various relatives interact and distribute their roles with respect to innovation. Second, family involvement is not only in ownership and management, but also in other dimensions, such as family spirite and intergenerational inheritance (Yang and Li, 2009). Further research should measure the family's influence on these different aspects.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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