

Exploring the Family Effect on Innovative Capacity and Earnings Management

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ARTICLE INFO	ABSTRACT
Article History	Purpose: This study examines whether family businesses (FBs) differ from non-FBs with regard to innovative strategies, and whether their innovation is a reflection of earnings management behavior.
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JEL Classifications M41	Design/methodology/approach: This study extended research into the issue of FBs by investigating innovation capacity and earnings management. We adopted the electronics industry in Taiwan (between 2010 and 2015) as a research sample to determine (1) whether family effects influence innovation performance at the firm level; (2) whether the innovation performance of FBs is an indication of earnings management behavior; and (3) the effects of family involvement and CEO-duality in FBs.
Keywords: family business; family involvement; CEO-duality; innovation; earnings management	Finding: Our results show that FBs are less likely than non-FBs to devote resources to increasing innovation. However, managerial participation of family members and a uniform CEO-duality leadership was shown to strengthen efficiency and flexibility in decision-making, thereby enhancing innovation capacity. We also found that FBs with higher innovation capacity are less likely to window-dress earnings. This association is more pronounced in cases of CEO-duality leadership, which implies that FBs' innovative ambitions and duality leadership had greatly advanced in operating performance and corporate governance, and thus restrain managerial self-interested behavior. Research limitations/implications: This study had a number of limitations. First is the measure of innovative capacity. There are a number of ways of measuring innovation, and we posit that patents are superior to R&D investment when investigating innovation capacity. Second, our results may have been affected by other determinants of innovation capacity, despite the fact that we adopted several control variables, such as financial characteristics, which may be correlated with innovation outcomes. Third, we used discretionary accruals as a proxy for earnings management; however, this does not necessarily reflect actual practices of earnings management. Although such proxies have been consistently used in previous research, may provide rich insights into earnings management behavior. Despite the noted limitations, our evidence clearly suggests the following: (1) FBs with strong family involvement in management and CEO-duality leadership tend to have higher innovation capacity; and (2) FBs with quality innovation capacity are less likely to engage in earnings management. Originality/value: This study fills a gap in the research on FBs by providing evidence concerning the effects of family on innovation and earnings management. Our findings have important implications for future research as well as the establishment of regulations and standards. Our findings provide evidence of a positive association between family effects and innovation capacity, which depends on the degree of family involvement in management and leadership structure. We found that family governance has a significantly positive impact on the competitive advantage of FBs. We also found that the innovation capacity of FBs is negatively associated with earnings management behavior. This study also re-examines the apparent contradictions in previous findings related to earnings management among FBs, while contributing to the literature linking family effects and governance mechanisms to earnings management behavior.

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1. Introduction

FBS play a critical role in the economies of East Asia.¹ The special ownership structure and features of FBS has been attracting considerable attention in the light of recent economic and financial crises.² FBS represent an organizational structure that are particularly resilient to disruptive economic shocks (Chrisman, Chua, & Steier, 2011; Sraer & Thesmar, 2007; Villalonga & Amit, 2010). As a result, FBS tend to financially outperform non-FBS during financial crises (Kachaner, Stalk, & Bloch, 2012; Liu, Yang, & Zhang, 2012; Mazzi, 2011; van Essen, Strike, Carney, & Sapp, 2015b). FBS tend to focus on resilience and long-term objectives in order to safeguard their survivability (Gentry, Dibrell, & Kim, 2016; Lumpkin & Dess, 2013; Wilson, Wright, & Scholes, 2013), and forgo excess returns during good economic times in order to increase their odds of survival during slumps. In other words, FBS commonly have slightly lower profits during good economic times, but they outperform their peers during slumps (Kachaner et al., 2012). These imply that the inherent toughness of FB structure seems to have highly stress resistant. Unfortunately, the debate on family governance and the effects of this structure have revealed a number of glaring empirical inconsistencies in recent research³ (Carney, van Essen, Gedajlovic, & Heugens, 2015; van Essen, Carney, Gedajlovic, & Heugens, 2015a; van Essen et al., 2015b). Up to now, these inconsistencies in previous studies ever increase mystique of family-controlled structure. This study seeks to examine whether FBS' performance are influenced by how business strategies are managed in a FB structure. We hopefully help to fill the gap in the corporate governance debate on FBS and will examine the economic consequences of family governance. This study is not merely academically interesting but can also inspire the practical design of family governance for the efficiency and flexibility of managerial strategies.

FBS often give the public the impression of paternalism, risk aversion, and isolation from real-world trends (De Massis, Di Minin, & Frattini, 2015). Increasingly competitive markets are driving the need for innovation, as the only strategy capable of achieving sustainable competitive advantage (Porter, 1990). Previous studies have reported that FBS are less innovative than conventional firms (e.g., De Massis et al., 2015; Matzler, Veider, Hautz, & Stadler, 2015); however, other studies have found that FBS can be leaders in innovation (e.g., Bennedsen, 2015; Duran, Kammerlander, van Essen, & Zellweger, 2016; Santos, 2015). This raises the question of whether and how the capacity for innovation is influenced by the form of governance found in FBS. Innovation requires financial support, such that the quality of financial reporting becomes an important role, which helps raise external funding for innovative activities. The quality of financial reporting is of a major concern to investors and creditors, such that earnings management may take place for firms with greater need for funds to perform innovative decisions (Igartua, Garrigós, & Hervas-Oliver, 2010; Kouaib & Jarboui, 2016; Markarian, Pozza, & Prencipe, 2008; Raman & Shahrur, 2008). Additionally, innovative strategies will alter along with leadership styles in FBS, then affecting the demand for funds and the possible strategic devices for window-dressing. Further, this study sought to determine whether any link exists between earnings management behavior and the innovation capacity⁴ of FBS.

This study collected 3,641 firm-years observations from the Taiwan Stock Exchange (*TES*) for the period from 2010 to 2015. Our results indicate that family effects are significantly negatively associated with innovation capacity, which suggests that the structure of FBS greatly hampers innovative decision-making. However, CEO-duality leadership was shown to strengthen efficiency and flexibility in decision-making, thereby enhancing innovation capacity. We also found that the innovation capacity of FBS is significantly negatively associated with earnings management, which suggests that FBS with higher innovation capacity are less likely to window-dress earnings. This association is more pronounced in cases of CEO-duality leadership, which implies that FBS' innovative ambitions and duality leadership have greatly advanced in operating performance and corporate governance, and thus restrain managerial self-interested behavior. We conclude that family effects are more likely to enhance innovation capacity and restrain earnings management behavior when family members are directly involved in management and particularly in cases on CEO-duality leadership.

This study fills a gap in the research on FBS by providing evidence concerning the effects of family on innovation and earnings management. Our findings have important implications for future research as well as the establishment of regulations and standards. Our findings provide evidence of a positive association between family effects and innovation capacity, which depends on the degree of family involvement in management and leadership structure (e.g., Lam & Lee, 2012; Miralles-Marcelo, Miralles-Quirós, & Lisboa, 2014; Prencipe & Bar-Yosef, 2011; San Martin-Reyna & Duran-Encalada, 2015). We found that family governance has a significantly positive impact on the competitive advantage of FBS. We also found that the innovation capacity of FBS is negatively associated with earnings

¹ Several of FBS are outstandingly in East Asia; for instance Samsung (Korea), Toyota (Japan), Formosa Plastic (Taiwan), and Hong Leong (Singapore). These FBS usually are leading firms and contribute to a large proportion of their countries' GDP.

² Please refer to Singh (2013) for a discussion of causes and consequences of global economic and financial crises.

³ These empirical inconsistencies stem from competing views about the efficacy of managerial ownership: agency vs. stewardship; and alignment vs. entrenchment. Please refer to Section 2 for a discussion of empirical inconsistencies in FB research.

⁴ Innovative capacity means different types of patent outputs: invention, utility model and design. In this study, we are interested in different types of patent outputs, we don't focus on numbers of patent outputs. Under Taiwan's Patent Act, in terms of features the patents can classify into three types: invention, utility model and design. Invention patent is granted for technological innovations, that invents over the prior art and possesses practical applicability. Utility model patent is granted for new technical solutions relating to the form, construction or installation of an object. Design patent is granted for original designs relating to the shape, pattern, color or a combination of an object through eye appeal. Additionally, there are differences in terms of its ways of examination and patent terms for invention, utility model and design. An invention patent requires to conduct substantive examination and has a patent term of 20 years. Whereas a utility model patent only require formality examination and has a patent term of 10 years. A design patent also requires substantive examination but it merely covers those innovations made in respect of the shape, pattern, color or a combination of an object and has a patent term of 12 years. In general, invention patents are deemed as having higher innovative quality than utility model and design patents.

management behavior. This study also re-examines the apparent contradictions in previous findings related to earnings management among FBs (e.g., Ali, Chen, & Radhakrishnan, 2007; Bekiris, 2013; Cziraki, Renneboog, & Szilagyi, 2010; Firth, Fung, & Rui, 2007), while contributing to the literature linking family effects and governance mechanisms to earnings management behavior.

The study is organized as follows: Section 2 reviews the previous literature regarding our research questions. Section 3 describes the sample and the research method used for examining research questions previously discussed. Section 4 presents our empirical results. Section 5 draws conclusions and discusses the limitations of the analysis.

2. Literature Review and Research Questions

FBs play an important role in Asian economies. Their concentrated ownership (La Porta, Lopez-de-Silanes, & Shleifer, 1999; Villalonga & Amit, 2009), family culture (Duh, Belak, & Milfelner, 2010; Eddleston, Kellermanns, & Sarathy, 2008), conservative strategies (Miller, Le Breton-Miller, & Lester, 2011; Pindado, Requejo, & de la Torre, 2011; Zellweger, Nason, & Nordqvist, 2012), financial constraints (Andres, 2011), and lower agency costs (Blanco-Mazagatos, de Quevedo-Puente, & Castrillo, 2007; Chrisman, Chua, Kellermanns, & Chang, 2007) have attracted the interest of scholars since the 1980s. Mainstream research on FBs has focused on their special governance (Chrisman, Chua, Pearson, & Barnett, 2012; Miller, Minichilli, Corbetta, 2013; Miller, Le Breton-Miller, Minichilli, Corbetta, & Pittino, 2014; Simsek, 2015) and links to performance (Cascino, Pugliese, Mussolini, & Sansone, 2010; Patel & Chrisman, 2014; Prencipe, Bar-Yosef, Mazzola, & Pozza, 2011; van Essen et al., 2015b). This study extends this work in two ways: (1) From the perspective of inputs, we analyze whether family effects (including family involvement and CEO-duality leadership) affect decisions pertaining to innovation, and whether this affects innovation performance. (2) From the perspective of outputs, we examine whether the innovation outputs of FBs are an indication of earnings management behavior.

2.1 Family Businesses and Innovation Capacity

Innovation is a powerful strategic tool capable of ensuring a sustainable competitive advantage (Porter, 1990); however, it imposes inherent risks, unpredictable outcomes, and significant investments of time and money. Innovation in FBs relies on family resources, which can atrophy and stifle innovation, rather than stimulating it. FBs are commonly regarded as conservative and risk-averse, when compared to their non-FB counterparts (De Massis et al., 2015; Matzler et al., 2015). This is because FBs usually invest large parts of their private wealth in the firm, and thereby concern with the firm's survivability and increase the aversion to risks. However, in the long-term innovative strategies, the role of risk-taking may well be not only a prerequisite for the creation and securing of family wealth (Rogoff & Heck, 2003) but also for the competitive advantage maintained (Porter, 1990). Therefore, FBs may have risk-taking incentives to encourage innovation. When FBs engage in innovative activities, they tend to have greater discretion with regard to the pushing of risky ideas and combining resources to promote innovation (Arregle, Naldi, Nordqvist, & Hitt, 2012; Barnett, Long, & Marler, 2012). In recent years, scholars have paid increasing attention to innovation management in FBs because of innovation importance and FB ubiquity, but their findings are inconsistent. Some previous studies have provided empirical evidence of a negative association between family effects and innovation (Block, 2012; Chrisman & Patel, 2012; De Massis et al., 2015; Matzler et al., 2015; Munari, Oriani, & Sobrero, 2010; Sirmon, Hitt, Ireland, & Gilbert, 2011), others have reported a positive association (Arregle et al., 2012; Barnett et al., 2012; Duran et al., 2016; Kammerlander, Dessi, Bird, Floris, & Murru, 2015; Llach & Nordqvist, 2010; Patel & Chrisman, 2014; Spriggs, Yu, Deeds, & Sorenson, 2013), and still others have observed both (Kraiczy, 2013; Kellermanns, Eddleston, Sarathy, & Murphy, 2012; Shi, Shepherd, & Schmidts, 2015). One possible explanation for mixed results may be due to the fact that prior studies use various measures for innovative performance.⁵ Additionally, we argue that prior research ignores the fact that FBs have different characteristics and may make various impacts on innovative decisions. This fact gives us the opportunity to understand the innovation in FBs because prior studies mentioned above have reported inconclusive findings thus far. Thus, our first research question is as follows:

RQ1: Whether and how FBs undertake innovations differently from non-FBs.

We conjecture that there is a positive (negative) relationship between innovations and FBs, emphasizing the role of FBs in encouraging (discouraging) innovative activities. Noteworthily, encouraging or discouraging different types of innovative activities may imply that FBs attempt to manage their innovative portfolio in maintaining innovative quality at a specific level. This study then includes different types of innovative outputs (invention, utility model and design patents) to proxy for different levels of innovative quality.

Family Involvement

Previous research on FBs has indicated that family involvement plays a critical role in the decision-making process (Shi, 2014); however, there are two opposing perspectives related to family involvement in management (Wang, 2006). From the alignment perspective, family involvement is seen to positively influence performance by mitigating agency problems (Anderson & Reeb, 2003; Arregle, Hitt, Sirmon, & Very, 2007; Minichilli, Corbetta, & MacMillan, 2010; San Martin-Reyna & Duran-Encalada, 2015; Villalonga & Amit, 2006). For instance, some studies indicate that family involvement in management may encourage innovative behavior and eventually lead to higher firm

⁵ In the above-mentioned literature on measures of innovative aspects, some studies focus on patent citations (Matzler et al., 2015; Duran et al., 2016) or creative processes (Spriggs et al., 2013; Kellermanns et al., 2012; Shi et al., 2015) while others focus on R&D intensity.

performance (Craig & Moores, 2006; Gudmundson, Tower, & Hartman, 2003; Hsu & Chang, 2011; Wu, 2008; Zahra, 2005). From the entrenchment perspective, family involvement is seen to negatively affect performance due to the entrenchment of resources for the personal benefit of family members (Chirico, Sirmon, Sciascia, & Mazzola, 2011; Cucculellia & Micucci, 2008; Kowalewski, Talavera, & Stetsyuk, 2010; Miralles-Marcelo et al., 2014; Schulze, Lubatkin, & Dino, 2003; Sciascia & Mazzola, 2008). For instance, some studies indicate that family involvement discourages innovative investments and affects firm performance (Block, 2012; Chen & Hsu, 2009; Duran et al., 2016). So far research on FB remains inconclusive on the role of family involvement. Given such contradictory findings in the extant literature, we clearly need to deep into these inconsistencies in order to understand what conditions/effects cause these inconsistencies. In response to the above-mentioned inconsistencies between family involvement and innovation, we argue that (1) previous studies ignore the influence of differences between Eastern and Western culture,⁶ (2) most such research has been adopted using a survey questionnaire to gather information about family involvement and innovation, and such information from questionnaire responses is more likely to lack objectivity and effectiveness, and (3) family involvement usually accompanies other features of FBs (e.g., CEO duality, insider ratio, board monotony), but these features of FBs are ignored. This gives this study a chance to reexamine whether and how different levels of family involvement in management exert on innovative outcomes of FBs.

CEO-duality Effects

CEO-duality⁷ leadership is more common in FBs than in non-FB firms (Masulis, Pham, & Zein, 2011). Despite intensive research for more than 20 years (Krause, Semadeni, & Cannella, 2014), the effects of this leadership structure on FBs remains an issue of contention, based on the tenets of stewardship theory as opposed to agency theory (Krause et al., 2014). Stewardship theory posits that CEO-duality provides a unified and strong leadership based on family. Agency theory posits that CEO-duality increases the risk of CEO entrenchment. Some studies have reported that CEO-duality encourages innovation (García-Ramos & García-Olalla, 2011; Lam & Lee, 2012; Yasser, Entebang, & Mansor, 2011), other studies have reported that CEO-duality discourages innovation (Lam & Lee, 2008; Prencipe & Bar-Yosef, 2011), and still other studies observed no link between the two (Adnan, Htay, Rashid, & Meera, 2011; Cooper, 2009; Valenti, Luce, & Mayfield, 2011). For instance, Kor (2006) and van Essen, Heugens, Otten, & van Oosterhout (2012) find that CEO-duality leadership creates a clear sense of innovation strategic decision and encourages innovative activities of FBs. In contrast, Chen & Hsu (2009) and Zona (2014) find that FBs invest less in innovation than other firms when CEO-duality leadership is present. We argue that CEO-duality leadership is a necessary complement to family involvement, and they should not discussed separately. In FBs, family involvement play a crucial role when examining the relationship between CEO-duality leadership and decision making because of the fact that CEO-duality leadership is more common in FBs than in non-FB firms (Masulis, Pham, & Zein, 2011) and such leadership structure is close related to the level of family involvement. If prior studies could consider FBs' features in examining CEO-duality effects, a better understanding about how CEO-duality leadership affects firm decisions could be obtained. This study thus makes an attempt to explore and reexamine CEO-duality effects on innovative decisions of FBs.

2.2 The Innovative Capacity of Family Business and Earnings Management

Although innovations are costly and risky, they are one of the major sources for enhancing firm's competitive advantage. Innovative firms need to spend substantial resources to perform innovative decisions, such that external funds play an important role in supporting innovations. Firms with quality financial reporting are more likely to obtain external funding, such that innovative firms may window-dress earnings to portray a more favorable earnings picture. Previous researchers (Kouaib & Jarboui, 2016; Markarian, Pozza, & Prencipe, 2008; Raman & Shahru, 2008) have reported that investment in innovation is positively associated with earnings management. Innovative firms tend to have the motivation and capacity to indulge in earnings management. In the context of FBs, there are two competing theories to explain the effects of family on earnings management behavior: entrenchment effects and alignment effects (Ali et al., 2007; Bona-Sánchez, Pérez-Alemán, & Santana-Martín, 2011; Wang, 2006; Yeo, Tan, Ho, & Chen, 2002). From the perspective of entrenchment, FBs are more likely to through managerial entrenchment to manage earnings for their private benefits (Ali et al., 2007; Firth et al., 2007; Wang, 2006). From the perspective of alignment, FBs are less likely to engage in opportunistic behavior because the agency problem is less severe (Ali et al., 2007; Bekiris, 2013; Cascino et al., 2010; Chen, Chen, & Cheng, 2008; Cziraki et al., 2010; Wang, 2006). Unlike previous studies that discussed the relationship between innovation and earnings management,⁸ we sought insight into whether innovation in FBs plays a role in motivating earnings management behavior. We conjecture that FBs with innovative capacity are less likely to indulge in earnings management because innovative outcomes enhance the profitability of firms and thereby promote earnings quality. Contrarily, FBs with innovative capacity are more likely to indulge in earnings management because innovative activities increase external funding needs and thereby promote window-dressing of financial statements. Based on the above discussion, our second research question is as follows:

⁶ In the family-controlled structure, Eastern culture emphasizes the concept of "family" while Western culture emphasizes the concept of "business". Cultural differences between Eastern and Western are likely to result in inconsistent results of FB studies. In the above-mentioned literature, some studies focus on Eastern FBs (Hsu & Chang, 2011; Wu, 2008; Chen & Hsu, 2009) while others focus on Western FBs. Additionally, studies of Western FBs are usually adopting questionnaires to gather information about family involvement and innovation.

⁷ CEO-duality means the situation when the CEO is simultaneously the chairman of the board.

⁸ Prior studies mainly focus on examining the association between R&D investments and earnings management and demonstrate that R&D activities provide an opportunity for earnings to be managed (Bartov, 1993; Bens, Nagar, & Wong, 2002; Bens, Nagar, Skinner, & Wong, 2003; Bushee, 1998; Burgstahler & Dichev, 1997; Cohen, Dey, & Lys, 2008; Dechow & Sloan, 1991; Roychowdhury, 2006).

RQ2: Whether and how innovative outcomes of FBs reflect earnings management behavior differently from non-FBs.

As discussed previously, the fact that CEO-duality represents unambiguous leadership in FBs leads to effective decision-making, superior performance (Chiang & Lin, 2007; Guillet, Seo, Kucukusta, & Lee, 2013; Krause & Semadeni, 2013), and a reduced likelihood of earnings management. In contrast, CEO-duality practices in FBs would result in a higher likelihood of self-interested behavior of earnings management activities (Chi, Hung, Cheng, & Lieu, 2015; Stockmans, Lybaert, & Voordeckers, 2013). We conjecture that CEO-duality remains in its unambiguous leadership as a monitoring role of strengthening decision-making efficiency and supervising performance, thereby reducing the possibility of earnings management. Contrarily, CEO-duality remains in its predominant leadership as an entrenchment role of selecting self-interested plans and portraying favorable performance, thereby increasing the possibility of earnings management. We further consider CEO-duality effects to examine the association between innovative capacity of FB and earnings management behavior.

3. Research Method

3.1 Sample Description

We began our sample selection process by identifying electronics firms listed on the *TSE* for the period from 2010 to 2015. We focused on the electronic industry in order to keep the sample size manageable. Furthermore, electronics firms survive on patents, which makes innovation a necessity. Thus, we also manually collected patent-related data from the Taiwan Patent Search System (*TPSS*), which resulted in 4,994 preliminary firm-year observations during our sample period. We began by eliminating 410 observations that lacked patent-related information. Our empirical analysis dealt with the effects of family ownership on innovation capacity and earnings management; therefore, we required information pertaining to the ownership structure of every electronics firm included in the study. Thus, we eliminated 762 observations that lacked information of ownership structure. We also eliminated 181 observations due to a lack of requisite financial data in the Taiwan Economic Journal (*TEJ*) database.⁹ Finally, the final sample comprised 3,641 firm-year observations (See Panel A of Table 1).

Panel B shows that approximately 56.17% of the final sample obtained new patents. Panel C illustrates the distribution of ownership structure and patent information among firm-year observations, showing that approximately 53.04% of the final sample (in which approximately 52.46% of FBs obtained new patents) were FBs.¹⁰ This indicates that more than 50% of the family-controlled electronics firms are willing to accept the risks involved in promoting innovation. This appears to be consistent with recent reports by Kammerlander and van Essen (2017) and PwC (2016), indicating that family-owned businesses are among the most innovative in their industries.

Table 1 Sample Distribution

Panel A : Sample selection criteria

Firm-year observations of electronics industry from 2010-2015	4,994
Less: observations for which patent data were not available in TPSS	(410)
Less: observations for which ownership structure were not available in TEJ	(762)
Less: observations for which financial data were not available in TEJ	(181)
Final firm-year observations	3,641

Panel B : Distribution of patent information by year

Year \ Patent ^a	2010	2011	2012	2013	2014	2015	Total
Patent	324	317	345	359	347	353	2,045(56.17%)
No Patent	275	284	262	248	264	263	1,596(43.83%)
Total	599(16.45%)	601(16.51%)	607(16.67%)	607(16.67%)	611(16.78%)	616(16.92%)	3,641

Panel C : Distribution of ownership structure and patent information

Patent Ownership ^b	Patent	No Patent	Total
Family	1,013(27.82%)	918(25.21%)	1,931(53.03%)
Non-Family	1,032(28.35%)	678(18.62%)	1,710(46.97%)
Total	2,045(56.17%)	1,596(43.83%)	3,641(100.00%)

^a Patent denotes companies obtained new patents, but not vice-versa.

^b Family denotes companies belong to family businesses, but not versa. The information of family businesses is as defined in *TEJ*.

⁹ The *TEJ* database in Taiwan closely resembles *CRSP* and *COMPUSTAT* databases in the United States of America.

¹⁰ In 2015, 62.77% of listed firms in Taiwan are FBs, and the percentage of FBs in the Taiwan electronic industry is 53.03%.

3.2 Research Design

In this section, we first describe the empirical models used to address research issues, followed by a discussion of the variables. We estimate Equations (1) and (2) using a pooled probit model to examine the association between family business and innovative capacity. The pooled OLS model of Equation (3) is used to examine the association between innovative capacity of family business and earnings management. We also include year fixed effects in all research models and adopt clustering by firms plus White's heteroskedasticity-adjusted standard errors (Boone et al. 2013; Gow et al. 2010; Petersen 2009).

3.2.1 Family Business and Innovation Capacity

To test whether FBs affect patent-related innovation, we first estimate Equation (1). We further estimate Equation (2) to determine whether innovation capacity is affected by the degree of family involvement in management.

$$\begin{aligned} INNOVATION = & \gamma_0 + \gamma_1 FAMILY + \gamma_2 LOSS + \gamma_3 LEV + \gamma_4 GROWTH + \gamma_5 ROA + \gamma_6 FCF + \gamma_7 SIZE \\ & + \varphi YEAR + \varepsilon \end{aligned} \quad (1)$$

$$\begin{aligned} INNOVATION = & \gamma_0 + \gamma_1 FAMILY + \gamma_2 LEVEL + \gamma_3 FAMILY \times LEVEL + \gamma_4 LOSS + \gamma_5 LEV \\ & + \gamma_6 GROWTH + \gamma_7 ROA + \gamma_8 FCF + \gamma_9 SIZE + \varphi YEAR + \varepsilon \end{aligned} \quad (2)$$

Where *INNOVATION* is the innovative capacity, we following prior studies (Cornaggia, Mao, Tian, & Wolfe, 2015; Fang, Tian, & Tices, 2014; He & Tian, 2013; Hirshleifer, Low, & Teoh, 2012; Tian & Wang, 2014) use four measures of patent-related innovation as proxies for it: *INN*, *INNINV*, *INNUM*, and *INNDES*.¹¹ *INN* equals 1 if the firm obtained new patents, else 0;¹² *INNINV* equals 1 if the firm obtained new invention patents, else 0; *INNUM* equals 1 if the firm obtained new utility model patents, else 0; *INNDES* equals 1 if the firm obtained new design patents, else 0; *FAMILY* equals 1 if the firm belongs to FBs, else 0;¹³ *LEVEL*, the level of management involvement, equals the number of managers of internal parts (including the internalization of the board, general manager, treasurer of internalization) divided by the number of directors concurrently act as managers; *FAMILY* × *LEVEL*, the level of family involvement in management, equals an interaction between *FAMILY* and *LEVEL*; *LOSS* equals 1 if operating income is less than zero, else 0; *LEV* equals long-term debt divided by total assets; *GROWTH* equals percentage growth in sales; *ROA* equals net income divided by total assets; *FCF* equals cash flow from operations minus cash dividends divided by total assets; *SIZE* equals the natural log of total assets; and *YEAR* equals dummy variables controlling for years.

In Equation (1), we use four dependent variables as proxies for innovative capacity: *INN*, *INNINV*, *INNUM*, and *INNDES*. *FAMILY* is test variable as proxy for family effects. If family effects contribute to patent-related innovation, then γ_1 should be positive, but not vice-verse. We further include *LEVEL* and its interaction with *FAMILY* into Equation (2). By examining the significance of the coefficient of *FAMILY* × *LEVEL*, we can shed light on the association between levels of family involvement in management and innovative capacity. Our control variables include factors considered major determinants affecting firms' innovative capacity. For example, firm's financial condition plays an important role in affecting innovative decisions and following innovative capacity. According to previous studies (Cornaggia et al., 2015; Fang et al., 2014; He & Tian, 2013; Hirshleifer et al., 2012; Jouber, 2013; Merkley, 2014; Tian & Wang, 2014), we consider five proxies for a firm's financial condition: performance (*ROA* and *LOSS*), sales growth (*GROWTH*), cash flow (*FCF*), and leverage (*LEV*). We predict that the coefficients of *ROA* and *GROWTH*(or *LOSS*) to be positive (or negative) because profitable (or unprofitable) firms are more (or less) likely to be financially-profited and more (or less) likely to make investments in innovation. Similarly, we expect the coefficient of *FCF* (or *LEV*) to be positive (or negative) because firms with (without) financial flexibility appear less (or more) financially-constrained and more (or less) likely to deploy financial resources for innovative projects. As in previous studies (Eberhart, Maxwell, & Siddique 2008; Pandit, Wasley, & Zach, 2011), we controlled for R&D activities (*RD*) because may has a positive effect on innovative capacity. We included firm size (*SIZE*) as a control variable to control for the firms' size effect (Ettredge, Johnstone, Stone, & Wang, 2011; Bens et al. 2011), because the firm size could be used to capture firm-specific risk on innovative investments. We also included *YEAR* as dummy variables in Equations to mitigate the problem of omitted variables in model estimation (Bentley, Omer, & Sharp, 2013; Chandra, 2011). In sum, we expect firms perform better (*ROA*), less loss (*LOSS*), have higher cash flows (*FCF*) and sales growth (*GROWTH*), have less debt (*LEV*), have higher R&D spending (*RD*), and have larger size (*SIZE*) are associated with higher innovative capacity.

3.2.2 Innovation Capacity of Family Business and Earnings Management

To determine whether the innovation capacity of FBs is associated with earnings management, we implemented the following regression model:

¹¹ We use patents as measures of firm's innovative capacity because patents can reflect innovative outputs and future perspectives directly.

¹² In terms of features the patents can classify into three types: invention, utility model and design. The innovative quality of invention patents is higher than utility model and design patents.

¹³ *FAMILY* follows the definition of the *TEJ* database: (1) both the board chair and the CEO are members of same family group; or (2) family members occupy over 50% of the board seats while affiliated firms and outside directors occupy less than 33% of the board seats; or (3) family members occupy over 33% of the board seats and at least three family members are board directors, supervisors, and managers; or (4) the family holds control rights exceeding critical control rights.

$$(3) \quad DA = \gamma_0 + \gamma_1 FAMILY + \gamma_2 INNOVATION + \gamma_3 FAMILY \times INNOVATION + \gamma_4 LOSS + \gamma_5 LEV \\ + \gamma_6 GROWTH + \gamma_7 ROA + \gamma_8 SIZE + \gamma_9 QUICK + \gamma_{10} OCF + \varphi YEAR + \varepsilon$$

Where DA equals discretionary accruals from the cross-sectional Modified Jones Model¹⁴ (Dechow, Sloan, & Sweeney, 1995); $QUICK$ equals current assets (less inventories) divided by current liabilities; and OCF equals cash flow from operations divided by total assets. Other control variables are the same as previously mentioned in Equation (1).

Earnings management occurs when managers make permitted discretionary judgments in measuring and recognizing specific accruals in financial reporting to reach the desired objectives. Thus, discretionary accruals play an important role in detecting earning management and affecting earnings quality. Using accrual models can help us to distinguish discretionary and non-discretionary accrals in determining the degree of earnings management because the distinction between discretionary and non-discretionary accrals is difficult to distinguish. Therefore, we follow prior studies (Brousseau & Gu, 2013; Dechow et al., 1995; Dechow, Ge, & Schrand, 2010; Ogneva, 2012; Perotti & Wagenhofer, 2014) to employ discretionary accrals to proxy for earnings management behavior (DA). We include family effects ($FAMILY$) and its interaction with innovative outputs ($INNOVATION$) into Equation (3). By examining the significance of the coefficient of $FAMILY \times INNOVATION$, we can shed light on whether and how innovative effects of FBs affect earnings quality. If innovative outputs of FBs contribute to high-quality earnings, then γ_3 should be negative, but not vice-verse. Following prior research (Chen, Cheng, & Wang, 2015; Chi, Lisic, & Pevzner, 2011; Choi, Kim, & Lee, 2011; Dee, Lulseged, & Zhang, 2015; Gerakos, 2012; Othman & Zeghal, 2006; Gaio, 2010; Barton & Simko, 2002), our control variables include major determinants affecting firms' earnings management behavior. To control for the influences of firm performance, we consider three proxies for a firm's profitability: performance (ROA and $LOSS$), and sales growth ($GROWTH$). We predict that the coefficients of ROA and $GROWTH$ (or $LOSS$) to be positive (or negative) because profitable (or unprofitable) firms have more (or less) capacity to use accrals in managing. Contrarily, we predict that the coefficients of ROA and $GROWTH$ (or $LOSS$) to be negative (or positive) because profitable (or unprofitable) firms are more (or less) likely to be financially-profited and less (or more) likely to exercise discretion over certain accounting decisions. Firm's capital structure is associated with earnings management behavior, we thus include four proxies for a firm's financial status: leverage (LEV), cash flow (OCF), quick ratio ($QUICK$), and firm size ($SIZE$). We predict that the coefficients of OCF and $QUICK$ to be negative because firms with financial flexibility appear less financially-constrained and less likely to engage in earnings management. On the contrary, firms with financial flexibility have more capacity to manipulate earnings. Similarly, we expect the coefficient of LEV to be positive because high leverage firms are more likely to avoid debt covenant violations by engaging in earnings manipulation. Conversely, we expect the coefficient of LEV to be negative because high leverage firms are more likely to face financial difficulties and they have less capacity to exercise discretion in reporting earnings. We expect the coefficient of $SIZE$ to be negative because the hefty reputational costs likely to be incurred if larger firms engage in earnings management. Conversely, we expect the coefficient of $SIZE$ to be positive because larger firms face greater pressure to meet or beat expectations by market participants. As mention before, we also included $YEAR$ as dummy variables in Equation (3).

4. Empirical Results

4.1 Descriptive Statistics and Univariate Tests

Table 2 presents descriptive statistics¹⁵ for our sample of non-FBs ($n = 1,710$), as compared to FBs ($n = 1,931$). Means and medians of innovative capacity (INN , $INNINV$, and $INNUM$) are statistically smaller for FBs, except for $INNDES$. This preliminary result suggests that FBs seem to play a constricting role in firms' innovative decisions. Means and medians of management involvement ($LEVEL$) are statistically larger for FBs, suggesting that members of FBs have significantly higher percentage of management involvement. FBs have significantly higher leverage ratios (LEV) and lower quick ratio ($QUICK$) than non-FBs and are more likely to report current year losses ($LOSS$). Additionally, FBs have smaller size than non-FBs.

¹⁴ Most the models for the detection of earnings management have been developed and applied. The most commonly used model is the Modified Jones Model, because it provides the most powerful test of earnings management (Brousseau & Gu, 2013; Dechow et al., 1995; Dechow, Ge, & Schrand, 2010; Ogneva, 2012; Perotti & Wagenhofer, 2014). Therefore, we use the Modified Jones Model to estimate discretionary accrals, this model is described in the following description:

First, the Modified Jones Model discretionary accrual is estimated cross-sectionally each year using all firm-year observations in the same two-digit SIC code.

$$TA_i = \beta_1(1/ASSETS_{i,t}) + \beta_2(\Delta REV_{i,t} - \Delta REC_{i,t}) + \beta_3 PPE_{i,t} + \varepsilon_i$$

where TA_i , total accrals at year t for company i , is the change in non-cash current assets minus the change in current liabilities excluding the current portion of long-term debt, minus depreciation and amortization, scaled by lagged total assets. $\Delta REV_{i,t}$ is change in revenues scaled by lagged total assets, $ASSETS_{i,t}$, $\Delta REC_{i,t}$ is change in receivables scaled by $ASSETS_{i,t}$, and $PPE_{i,t}$ is net property, plant and equipment scaled by $ASSETS_{i,t}$. Second, using coefficients b_1 to b_3 estimated from the OLS regression by industry and year, we estimate discretionary accrals (DA) for each sample firm as:

$$DA_i = TA_i - \{b_1(1/ASSETS_{i,t}) + b_2(\Delta REV_{i,t} - \Delta REC_{i,t}) + b_3 PPE_{i,t}\}$$

¹⁵ To control for outliers, we winsorized all continuous variables at the 1st and 99th percentiles.

Table 2 Descriptive Statistics

Variables ^a	Non-Family ^b (n = 1,710)			Family (n = 1,931)			Test of Differences ^c	
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	t-test	Wilcoxon
<i>INN</i>	0.6035	1	0.4893	0.5246	1	0.4995	4.80***	4.79***
<i>INNINV</i>	0.4468	0	0.4973	0.3485	0	0.4766	6.08***	6.05***
<i>INNUM</i>	0.4064	0	0.4913	0.3573	0	0.4973	3.05***	3.05***
<i>INNDES</i>	0.1012	0	0.3016	0.1113	0	0.3146	-0.99	-0.99
<i>LEVEL</i>	0.4177	0.25	0.4986	0.5122	0.5	0.5330	-5.51***	-5.69***
<i>DA</i>	0.0031	0.0085	0.1107	0.0069	0.0069	0.1007	-1.09	0.23
<i>LOSS</i>	0.2281	0	0.4197	0.2574	0	0.4373	-2.06**	-2.06**
<i>LEV</i>	0.0485	0.0067	0.0732	0.0601	0.0164	0.0845	-4.38***	-2.96***
<i>GROWTH</i>	0.0579	0.0170	0.2833	0.0489	0.0129	0.2956	0.94	1.66*
<i>ROA</i>	0.0360	0.0463	0.0869	0.0343	0.0388	0.0846	0.60	1.94*
<i>FCF</i>	0.0308	0.0356	0.0884	0.0322	0.0367	0.0846	-0.49	-0.48
<i>SIZE</i>	15.2513	15.0320	1.4231	15.1547	14.9731	1.4121	2.05**	2.12**
<i>QUICK</i>	2.3377	1.5979	2.1560	2.0940	1.4909	1.8169	3.70***	4.21***
<i>OCF</i>	0.0681	0.0673	0.1088	0.0667	0.0675	0.1049	0.41	0.90

^aThe definition of the variables reported in this table are: *INN* = 1 if the firm obtained new patents, else 0; *INNINV* = 1 if the firm obtained new invention patents, else 0; *INNUM* = 1 if the firm obtained new utility patents, else 0; *INNDES* = 1 if the firm obtained new design patents, else 0; *LEVEL* = the number of managers of internal parts (including the internalization of the board, general manager, treasurer of internalization) divided by the number of directors concurrently act as managers; *DA* = discretionary accruals from the cross-sectional Modified Jones Model (1995); *LOSS* = 1 if operating income is less than zero, else 0; *LEV* = long-term debt divided by total assets; *GROWTH* = percentage growth in sales; *ROA* = equals net income divided by total assets; *FCF* = cash flow from operations minus cash dividends divided by total assets; *SIZE* = equals the natural log of total assets; *QUICK* = current assets (less inventories) divided by current liabilities; *OCF* = cash flow from operations divided by total assets. All continues variables are winsorized at the first and 99th percentiles.

^b Family denotes companies belong to family businesses, but not versa. The information of family businesses is as defined in *TEJ*.

^c Asterisks*, **, ***indicate significance at the 0.10, 0.05, and 0.01 levels, respectively.

Panel A of Table 3 presents the Pearson correlation matrix for all variables included in Equations (1) and (2). Panel A indicates that the degree of correlation between innovative capacity (*INN*, *INNINV*, *INNUM*) and family effects (*FAMILY*) is significantly negative (between -0.0505 and -0.1003). We note that the correlation between the control variables are mostly not very high, except for those between *ROA* and *LOSS*. Panel B of Table 3 presents the Pearson correlations among the variables included in Equation (3). Panel B shows that the correlation between earnings management (*DA*) and innovative capacity (*INN*) is significantly positive, indicating that firms with stronger innovative capacity seem more likely to manage their earnings. Control variables of Panel B are highly correlated with our earnings management measures, and the correlations between our control variables are mostly not very high, except for those between *ROA* and *OCF*. We also estimate variance inflation factors (VIF) for all models and find that the average VIF is less than 1.9 and none of the VIFs exceeded 10, suggesting that multicollinearity is unlikely to be a serious problem (Kennedy, 1998).

Table 3 Pearson Correlation Matrix

Panel A : Family Business and Innovative Capacity												
Variables ^a	INN	INNINV	INNUM	INNDES	FAMILY	FAMILYIN	LOSS	LEV	GROWTH	ROA	FCF	
INNINV	0.7133											
INNUM		0.6922	0.2794									
INNDES			0.3051	0.2820	0.3014							
FAMILY				-0.0794	-0.1003	-0.0505	0.0165					
LEVEL					0.0278	-0.0240	0.0456	0.0117	0.0909			
LOSS						-0.0802	-0.0629	-0.0743	-0.0405	0.0341	0.0209	
LEV							0.0336	0.0609	0.0256	0.0537	0.0724	
GROWTH								-0.0158		0.1141		
ROA									-0.2793	0.0047		
FCF										-0.7388	-0.1427	
SIZE										0.3814		
	0.1188	0.1130	0.0751	0.0182	0.0081	-0.0185			-0.2450	0.0749	0.0424	
	0.3207	0.4021	0.1930	0.2896	-0.0340	-0.0999			-0.2246	0.2562	0.0843	
										0.2103	0.2474	
Panel B : The Innovative Capacity of Family Business and Earnings Management												
Variables ^a	DA	FAMILY	INN	INNINV	INNUM	INNDES	LOSS	LEV	GROWTH	ROA	SIZE	QUICK
FAMILY	0.0180											
INN		0.0448	-0.0794									
INNINV			0.0247	-0.1003	0.7133							
INNUM				0.0277	-0.0505	0.6922	0.2794					
INNDES					-0.0292	0.0165	0.3051	0.2820	0.3014			
LOSS						-0.3629	0.0341	-0.0802	-0.0629	-0.0743	-0.0405	
LEV							-0.1631	0.0724	0.0336	0.0609	0.0256	0.0537
GROWTH								-0.1061	-0.0156	0.0198	0.0089	0.0344
ROA									-0.0005	-0.2793	0.0047	
SIZE										-0.7388	-0.1427	0.3814
QUICK											0.2103	
OCF												0.1152
	0.1350	-0.0068	0.1349	0.1248	0.0678	0.0058		-0.3829	-0.0129	0.1619	0.5804	0.2330
												0.0772

^aThe definition of the variables reported in this table are: *INN* = 1 if the firm obtained new patents, else 0; *INNINV* = 1 if the firm obtained new invention patents, else 0; *INNUM* = 1 if the firm obtained new utility patents, else 0; *INNDES* = 1 if the firm obtained new design patents, else 0; *DA* = discretionary accruals from the cross-sectional Modified Jones Model (1995); *FAMILY* = 1 if the firm belongs to family businesses, else 0; *LEVEL* = the number of managers of internal parts (including the internalization of the board, general manager, treasurer of internalization) divided by the number of directors concurrently act as managers; *LOSS* = 1 if operating income is less than zero, else 0; *LEV* = long-term debt divided by total assets; *GROWTH* = percentage growth in sales; *ROA* = equals net income divided by total assets; *FCF* = cash flow from operations minus cash dividends divided by total assets; *SIZE* = equals the natural log of total assets; *QUICK* = current assets (less inventories) divided by current liabilities; *OCF* = cash flow from operations divided by total assets. All continues variables are winsorized at the first and 99th percentiles.

4.2 Multivariate Analysis

4.2.1 Family Business and Innovation Capacity

Table 4 lists the estimated results from the probit regression in Equation (1). Our first question focuses on whether the coefficient of *FAMILY* captures the effects of family ownership on innovation capacity. In column (1), the reported coefficient of *FAMILY* is negative and statistically significant ($t = -4.27$ at the 1% level of significance), which suggests that FBs are less likely to devote resources to increase innovation than are non-FBs. Our results imply that the conservative behavior of FBs tends to hamper innovation. Various measures of patent output were used as dependent variables in examining the first research question. We found that the coefficient of *FAMILY* in columns (2)

and (3) is significantly negative, whereas in column (4), it is positive but does not reach the level of significance. These results strongly suggest that FBs play a significant role in constraining invention and utility patents; however, they appear to encourage innovation in design patents. This may be due to the fact that the uncertainty in obtaining invention and utility patents is likely to increase the perceived risk. Our results imply that FBs are conservative and stable, which means that they are less likely to make risky decisions. Our overall empirical results suggest that family effects reduce innovation capacity. For control variables, the coefficient related to a firm's leverage (*LEV*) was significantly negative, whereas the coefficients of cash flow (*FCF*) and firm size (*SIZE*) were significantly positive.

Table 4 Family Effect and Innovative Capacity

Variables ^a	Pred. Sign	(1) Dep. Var. = <i>INN</i>		(2) Dep. Var. = <i>INNINV</i>		(3) Dep. Var. = <i>INNUM</i>		(4) Dep. Var. = <i>INNDES</i>	
		Coef.	z-value ^b	Coef.	z-value	Coef.	z-value	Coef.	z-value
<i>CONSTANT</i>		-4.8535	-16.58***	-6.5691	-21.72***	-2.8977	-11.09***	-6.5289	-18.65***
<i>FAMILY</i>	?	-0.1869	-4.27***	-0.2612	-5.78***	-0.1072	-2.49**	0.1361	2.25**
<i>LOSS</i>	-	0.0065	0.09	0.0962	1.22	-0.1367	-1.82**	-0.1706	-1.60*
<i>LEV</i>	-	-0.9451	-3.18***	-0.8918	-2.91***	-0.3975	-1.37*	-0.6367	-1.62*
<i>GROWTH</i>	+	-0.0225	-0.26	-0.0079	-0.09	0.0607	0.70	-0.0736	-0.57
<i>ROA</i>	+	-0.2824	-0.69	-0.3165	-0.73	-0.5551	-1.35*	-1.5150	-2.50***
<i>FCF</i>	+	0.7400	2.69***	0.4763	1.62*	0.5528	1.98**	-0.8195	-1.99**
<i>SIZE</i>	+	0.3406	17.79***	0.4318	21.91***	0.1721	10.29***	0.3411	15.73***
<i>YEAR</i>		Included		Included		Included		Included	
Pseudo R ²		9.12%		14.50%		3.26%		11.89%	
N		3,641		3,641		3,641		3,641	

^a The definition of the variables reported in this table are: *FAMILY* = 1 if the firm belongs to family businesses, else 0; *LOSS* = 1 if operating income is less than zero, else 0; *LEV* = long-term debt divided by total assets; *GROWTH* = percentage growth in sales; *ROA* = equals net income divided by total assets; *FCF* = cash flow from operations minus cash dividends divided by total assets; *SIZE* = equals the natural log of total assets; *YEAR* = dummy variables controlling for years. All continuous variables are winsorized at the first and 99th percentiles.

^b Asterisks*, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

Family Involvement

Family involvement may play a critical decision-making role in innovation, and this may be determined by the degree of family involvement in management. In the following, we seek to determine whether family involvement plays a critical role in promoting the innovation capacity of FBs. Table 5 lists the estimation results obtained using Equation (2). In columns (1), (3), (5), and (7), the results of coefficient on *FAMILY* is similar to those documented in Table 4, showing that FBs have lower innovative capacity; moreover, the coefficient of *LEVEL* is significantly positive (at least at the 5% significance level), except for the results in column (3), implying that firms with higher management involvement are more likely to encourage innovative behavior. In columns (2), (4), (6), and (8), we include the interaction term between *FAMILY* and *LEVEL*. The coefficient of *FAMILY* × *LEVEL* is insignificant and positive (*z* = 1.25) in columns (2), indicating that there is essentially no relationship between performance in innovation and family involvement. Considering various types of patent-related innovations, we found that the coefficient of *FAMILY* × *LEVEL* is only significant and positive (*z* = 1.97 and significant at the 5% level) in column (4), whereas it is insignificant and negative in columns (6) and (8). These results suggest that FBs with greater involvement in management are more likely to invest in the development of new patents, which implies that these firms are ambitious and willing to accept the implied challenges. Our results indicate that, on the positive side, FBs encourage participation in developing long-term goals and strategies (Carnes & Ireland, 2013; Upton, Teal, & Felan, 2001), and strong family involvement in management appears to benefit innovation by helping firms to identify and understand the challenges and opportunities they face (Chrisman, Chua, & Steier, 2002; Craig & Dibrell, 2006; Mitra, 2013; Zahra, 2005).

Table 5 Family Involvement and Innovative Capacity

Variables ^a	Pred. Sign	(1) Dep. Var. = INN		(2) Dep. Var. = INN		(3) Dep. Var. = INNINV		(4) Dep. Var. = INNINV		(5) Dep. Var. = INNUM		(6) Dep. Var. = INNUM		(7) Dep. Var. = INNDES		(8) Dep. Var. = INNDES	
		Coef.	z-value ^b	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value
CONSTANT		-5.0174	-16.96***	-4.9873	-16.81***	-6.6400	-21.72***	-6.5959	-21.52***	-3.0926	-11.65***	-3.0990	-11.62***	-6.8314	-18.79***	-6.8350	-18.70***
FAMILY	?	-0.2021	-4.60***	-0.2512	-4.26***	-0.2679	-5.90***	-0.3480	-5.70***	-0.1241	-2.86***	-0.1136	-1.95*	0.1187	1.95*	0.1241	1.50
LEVEL	?	0.1702	4.05***	0.1096	1.71*	0.0703	1.63	-0.0248	-0.38	0.1831	4.41***	0.1956	3.14***	0.2076	3.62***	0.2140	2.43**
FAMILY×LEVEL	?			0.1058	1.25			0.1708	1.97**			-0.0223	-0.27			-0.0109	-0.10
LOSS	-	-0.0001	-0.01	-0.0050	-0.07	0.0930	1.18	0.0863	1.09	-0.1483	-1.96**	-0.1474	-1.95**	-0.1901	-1.78**	-0.1897	-1.77**
LEV	-	-0.9714	-3.27***	-0.9692	-3.26***	-0.9018	-2.94***	-0.8972	-2.93***	-0.4156	-1.43*	-0.4163	-1.43*	-0.6486	-1.65**	-0.6488	-1.65**
GROWTH	+	-0.0214	-0.25	-0.0176	-0.20	-0.0075	-0.08	-0.0018	-0.02	0.0616	0.71	0.0609	0.70	-0.0819	-0.63	-0.0823	-0.63
ROA	+	-0.3549	-0.86	-0.3631	-0.88	-0.3473	-0.80	-0.3623	-0.83	-0.6540	-1.58*	-0.6527	-1.57*	-1.6822	-2.75***	-1.6822	-2.75***
FCF	+	0.7645	2.77***	0.7656	2.77***	0.4821	1.64*	0.4819	1.64*	0.5785	2.06**	0.5786	2.06**	-0.7782	-1.87**	-0.7783	-1.87**
SIZE	+	0.3470	18.06***	0.3467	18.04***	0.4347	21.96***	0.4345	21.94***	0.1802	10.69***	0.1802	10.69***	0.3550	15.99***	0.3551	15.99***
YEAR		Included		Included		Included		Included		Included		Included		Included		Included	
Pseudo R ²		9.44%		9.48%		14.55%		14.63%		3.66%		3.66%		12.41%		12.41%	
N		3,641		3,641		3,641		3,641		3,641		3,641		3,641		3,641	

^aThe definition of the variables reported in this table are: *FAMILY* = 1 if the firm belongs to family businesses, else 0; *LEVEL* = the number of managers of internal parts (including the internalization of the board, general manager, treasurer of internalization) divided by the number of directors concurrently act as managers; *LOSS* = 1 if operating income is less than zero, else 0; *LEV* = long-term debt divided by total assets; *GROWTH* = percentage growth in sales; *ROA* = equals net income divided by total assets; *FCF* = cash flow from operations minus cash dividends divided by total assets; *SIZE* = equals the natural log of total assets; *YEAR* = dummy variables controlling for years. All continues variables are winsorized at the first and 99th percentiles.

^bAsterisks*, **, ***indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

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CEO-duality Effects

We also took CEO-duality effects into account in exploring the relationship between family involvement in management and innovation capacity. The results are presented in Table 6. In columns (1), (3), (5), and (7) of Panel A, the coefficient of *FAMILY* is insignificant and negative, except for the results in column (7); moreover, the coefficient of *LEVEL* is significant and positive, except for the results in columns (3) and (5). In columns (1), (3), (5), and (7) of Panel B, the result of coefficients on *FAMILY* and *LEVEL* is similar to those reported in Table 5. These results seem to imply that CEO's duality brings positive effects in mitigating the negative effects of family business on innovative capacity. After including the interaction term between *FAMILY* and *LEVEL*, most of the coefficients on the interaction terms and the *LEVEL* variables in each panel have opposite signs. We further found that the coefficients of *FAMILY* × *LEVEL* in Panel A are significant and positive (at least at the 5% significance level), whereas most of coefficients of *FAMILY* × *LEVEL* in Panel B are significant and negative. It was noted that most of the coefficients on the interaction terms and the *LEVEL* variables in each panel have opposite signs. These results indicate that only CEO-duality firms with family involvement in management are likely to excel in innovation. This result appears consistent with stewardship theory, which states that CEO-duality enhances the uniformity of leadership and enables prompt decision-making (Bennington, 2010; Boyd, Haynes, & Zona, 2011; Daily & Dalton, 1993; Krause et al., 2014; Ramdani & Van Witteloostuijn, 2010).

Overall, our results suggest that FBs are more likely to hamper the development of patent-related innovations than are non-FBs. However, performance in patent-related innovation is enhanced when the family is more involved in management and when the firm has a CEO-duality structure. Our results imply that managerial efforts of family members and uniform CEO-duality leadership strengthen decision-making efficiency and flexibility of innovative decisions and thus enhance their innovative capacity.

4.2.2 Innovation Capacity of Family Business and Earnings Management

As previously noted, our results show that family involvement and leadership play important roles in the formation of strategies related to innovation, which ultimately affects patent-related outcomes. Our second question focuses on the coefficient of *FAMILY* × *INNOVATION*, and whether the innovation strategies of FBs contribute to earnings management. Table 7 presents the estimation results. In columns (1), (3), (5), and (7), the coefficient of *FAMILY* is insignificant and positive; moreover, the coefficients of *INNOVATION* (*INN*, *INNINV*, and *INNUM*) are significant and positive, except for the coefficient of *INNDES*. These results imply that FBs' earnings quality is slightly lower, and firms with patent-related innovation seems to be more likely to manage earnings through innovative activities. After including the interaction term between *FAMILY* and *INN* in column (2), the coefficients of *FAMILY* and *INN* are both significantly positive, indicating that FBs engage in more opportunistic reporting behaviour (Cascino et al., 2010; Chi et al., 2015; Ding, Qu, & Zhuang, 2011; Gopalan & Jayaraman, 2012) or that firms focusing on innovation are more likely to engage in earnings management (Mizik, 2010; Osma & Young, 2009; Pandit, Wasley, & Zach, 2011; Shust, 2015). Notably, the coefficient of *FAMILY* × *INN* is significantly negative, suggesting that FBs with higher innovation capacity are less likely to window-dress earnings. Our results imply that FBs with higher innovation capacity are less likely to indulge in earnings management. We also classified patent-related innovation into three categories and included the interaction term between *FAMILY* and *INNOVATION* (*INNINV*, *INNUM*, and *INNDES*) in columns (4), (6), and (8). We found that the coefficient of *FAMILY* × *INNINV* in column (4) is significant and negative ($t = -2.74$ at significance level of 1%) whereas coefficients of *FAMILY* × *INNNUM* and *FAMILY* × *INNDES* in columns (6) and (8) are insignificant. These results suggest that only FBs with highly innovative "invention patents" exhibit a greater tendency to reduce levels of earnings management, implying that combined effects of FBs and quality innovation enhance competitiveness and performance of such types of FBs and are therefore less likely to engage in earnings management. For control variables, the coefficients related to a firm's leverage (*LEV*), sales growth (*GROWTH*), size (*SIZE*), quick ratio (*QUICK*), and cash flow (*OCF*) were significantly negative, whereas the coefficient of financial performance (*ROA*) was significantly positive.

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Table 6 Family Involvement and Innovative Capacity: Considering the CEO-duality Effect

Panel A : Observations with CEO duality (n=1,594)

Variables ^a	Pred. Sign	(1) Dep. Var. = INN		(2) Dep. Var. = INN		(3) Dep. Var. = INNINN		(4) Dep. Var. = INNINN		(5) Dep. Var. = INNUM		(6) Dep. Var. = INNUM		(7) Dep. Var. = INNDES		(8) Dep. Var. = INNDES	
		Coef.	z-value ^b	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value
CONSTANT		-5.1894	-10.74***	-5.0184	-10.30***	-7.1122	-14.02***	-6.9810	-13.65***	-3.7939	-8.39***	-3.6881	-8.04***	-6.6470	-10.86***	-6.4112	-10.36***
FAMILY	?	-0.0246	-0.37	-0.2449	-2.38**	-0.1043	-1.52	-0.2601	-2.40**	-0.0215	-0.32	-0.1844	-1.78*	0.2115	2.23**	-0.1504	-0.98
LEVEL	?	0.1876	2.76***	-0.0244	-0.24	0.1230	1.74	-0.0246	-0.23	0.1109	1.63	-0.0455	-0.44	0.3047	3.17***	-0.0624	-0.39
FAMILY×LEVEL	?			0.3824	2.79***			0.2669	1.86*			0.2808	2.04**			0.6012	2.99***
LOSS	-	0.1626	1.46*	0.1446	1.29*	0.1985	1.71**	0.1840	1.58*	0.0436	0.39	0.0296	0.26	-0.2101	-1.32*	-0.2474	-1.54*
LEV	-	-1.3714	-3.29***	-1.4280	-3.34***	-1.0363	-2.33***	-1.0797	-2.41***	-0.6526	-1.52*	-0.7043	-1.63*	-0.6014	-1.02	-0.7743	-1.28*
GROWTH	+	0.0807	0.65	0.0924	0.74	-0.0234	-0.18	-0.0175	-0.13	0.1120	0.88	0.1197	0.94	0.2968	1.68**	0.3239	1.84**
ROA	+	-0.3217	-0.52	-0.3292	-0.53	-0.3732	-0.57	-0.3729	-0.57	-0.1733	-0.27	-0.1750	-0.28	-2.8527	-3.00***	-2.9177	-3.06***
FCF	+	1.3549	3.27***	1.3582	3.28***	0.5001	1.13	0.4891	1.11	1.3276	3.09***	1.3171	3.08***	0.4322	0.68	0.4038	0.64
SIZE	+	0.3469	10.99***	0.3437	10.88***	0.4542	13.76***	0.4511	13.65***	0.2173	7.46***	0.2149	7.37***	0.3364	8.78***	0.3352	8.68***
YEAR		Included		Included		Included		Included		Included		Included		Included		Included	
Pseudo R ²		7.87%		8.23%		12.32%		12.48%		4.15%		4.35%		10.43%		11.34%	
N		1,594		1,594		1,594		1,594		1,594		1,594		1,594		1,594	

Panel B : Observations without CEO duality (n=2,047)

Variables ^a	Pred. Sign	(1) Dep. Var. = INN		(2) Dep. Var. = INN		(3) Dep. Var. = INNINN		(4) Dep. Var. = INNINN		(5) Dep. Var. = INNUM		(6) Dep. Var. = INNUM		(7) Dep. Var. = INNDES		(8) Dep. Var. = INNDES	
		Coef.	z-value ^b	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value
CONSTANT		-4.8489	-12.67***	-4.8901	-12.74***	-6.3682	-16.28***	-6.3657	-16.26***	-2.6430	-7.89***	-2.6986	-8.03***	-6.9556	-15.01	-7.0898	-15.13***
FAMILY	?	-0.3591	-6.00***	-0.2870	-3.94***	-0.3993	-6.53***	-0.4057	-5.42***	-0.2066	-3.57***	-0.0977	-1.37	0.0429	0.53	0.2249	2.24**
LEVEL	?	0.1832	3.28***	0.3028	3.38***	0.0422	0.74	0.0327	0.38	0.2385	4.41***	0.4018	4.87***	0.1458	1.93*	0.3897	3.60***
FAMILY×LEVEL	?			-0.1985	-1.73*			0.0168	0.15			-0.2880	-2.63***			-0.4572	-3.03***

<i>LOSS</i>	-	-0.1727	-1.66**	-0.1689	-1.62*	-0.0302	-0.28	-0.0304	-0.28	-0.3085	-2.98***	-0.3045	-2.94***	-0.2125	-1.44*	-0.2150	-1.45*
<i>LEV</i>	-	-0.5433	-1.29*	-0.5692	-1.35*	-0.7407	-1.75**	-0.7380	-1.74**	-0.1373	-0.34	-0.1879	-0.47	-0.5736	-1.08	-0.6888	-1.29*
<i>GROWTH</i>	+	-0.1375	-1.12	-0.1479	-1.21	-0.0027	-0.02	-0.0019	-0.02	0.0014	0.01	-0.0123	-0.10	-0.4615	-2.41**	-0.4849	-2.52***
<i>ROA</i>	+	-0.4517	-0.82	-0.4349	-0.79	-0.4291	-0.73	-0.4310	-0.74	-0.9773	-1.77**	-0.9632	-1.75**	-0.7155	-0.88	-0.7564	-0.93
<i>FCF</i>	+	0.2434	0.65	0.2375	0.64	0.4344	1.10	0.4350	1.10	-0.0387	-0.10	-0.0439	-0.12	-1.7098	-3.07***	-1.7382	-3.10***
<i>SIZE</i>	+	0.3461	13.94***	0.3465	13.95***	0.4259	16.85***	0.4260	16.85***	0.1597	7.57***	0.1601	7.59***	0.3660	13.14***	0.3697	13.18***
<i>YEAR</i>	Included																
Pseudo R ²	11.36%		11.47%		16.62%		16.62%		4.08%		4.33%		15.01%		15.64%		
N	2,047		2,047		2,047		2,047		2,047		2,047		2,047		2,047		

^aThe definition of the variables reported in this table are: *FAMILY* = 1 if the firm belongs to family businesses, else 0; *LEVEL* = the number of managers of internal parts (including the internalization of the board, general manager, treasurer of internalization) divided by the number of directors concurrently act as managers; *LOSS* = 1 if operating income is less than zero, else 0; *LEV* = long-term debt divided by total assets; *GROWTH* = percentage growth in sales; *ROA* = equals net income divided by total assets; *FCF* = cash flow from operations minus cash dividends divided by total assets; *SIZE* = equals the natural log of total assets; *YEAR* = dummy variables controlling for years. All continues variables are winsorized at the first and 99th percentiles.

^bAsterisks*, **, ***indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

Table 7 The Innovative Capacity of Family Business and Earnings Management

Variables ^a	Pred. Sign	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
		Coef.	z-value ^b	Coef.	z-value												
CONSTANT		0.1059	5.98***	0.1022	5.75***	0.1149	6.27***	0.1118	6.09***	0.0945	5.40***	0.0937	5.35***	0.0895	4.97***	0.0895	4.97***
FAMILY	?	0.0043	1.56	0.0131	3.13***	0.0045	1.62	0.0106	2.98***	0.0038	1.37	0.0068	1.93*	0.0035	1.28	0.0035	1.20
INN	+	0.0126	4.31***	0.0211	5.00***												
FAMILY×INN	?			-0.0154	-2.79***												
INNINV	+					0.0126	4.05***	0.0204	4.84***								
FAMILY×INNINV	?							-0.0154	-2.74***								
INNUM	+									0.0063	2.17**	0.0104	2.50***				
FAMILY×INNUM	?											-0.0078	-1.38				
INNDES	+													-0.0029	-0.61	-0.0031	-0.45
FAMILY×INNDE	?															0.0004	0.05
LOSS	-	0.0027	0.56	0.0025	0.52	0.0022	0.47	0.0023	0.48	0.0028	0.59	0.0028	0.58	0.0025	0.51	0.0025	0.51
LEV	-	-0.0499	-2.70***	-0.0501	-2.71***	-0.0512	-2.77***	-0.0505	-2.73***	-0.0524	-2.83***	-0.0521	-2.81***	-0.0542	-2.92***	-0.0542	-2.92***
GROWTH	-	-0.1307	-23.62***	-0.1302	-23.53***	-0.1310	-23.67***	-0.1304	-23.56***	-0.1306	-23.56***	-0.1304	-23.50***	-0.1308	-23.57***	-0.1308	-23.57***
ROA	+	0.9712	34.04***	0.9708	34.06***	0.9721	34.05***	0.9720	34.07***	0.9680	33.88***	0.9681	33.89***	0.9666	33.79***	0.9666	33.78***
SIZE	-	-0.0076	-6.66***	-0.0077	-6.75***	-0.0080	-6.79***	-0.0080	-6.82***	-0.0065	-5.90***	-0.0066	-5.96***	-0.0060	-5.25***	-0.0060	-5.23***
QUICK	-	-0.0016	-2.08**	-0.0015	-2.05**	-0.0018	-2.41***	-0.0018	-2.43***	-0.0014	-1.86**	-0.0013	-1.79**	-0.0016	-2.10**	-0.0016	-2.10**
OCF	-	-0.2393	-14.85***	-0.2395	-14.88***	-0.2378	-14.77***	-0.2369	-14.73***	-0.2352	-14.60***	-0.2357	-14.63***	-0.2345	-14.55***	-0.2345	-14.54***
YEAR		Included		Included		Included		Included		Included		Included		Included		Included	
Adj R ²		39.08%		39.19%		39.05%		39.15%		38.85%		38.86%		38.78%		38.76%	
N		3,641		3,641		3,641		3,641		3,641		3,641		3,641		3,641	

^aThe definition of the variables reported in this table are: FAMILY = 1 if the firm belongs to family businesses, else 0; INN = 1 if the firm obtained new patents, else 0; INNINV = 1 if the firm obtained new invention patents, else 0; INNUM = 1 if the firm obtained new utility patents, else 0; INNDES = 1 if the firm obtained new design patents, else 0; LOSS = 1 if operating income is less than zero, else 0; LEV = long-term debt divided by total assets; GROWTH = percentage growth in sales; ROA = equals net income divided by total assets; SIZE = equals the natural log of total assets; QUICK = current assets (less inventories) divided by current liabilities; OCF = cash flow from operations divided by total assets; YEAR = dummy variables controlling for years. All continues variables are winsorized at the first and 99th percentiles.

^bAsterisks*, **, ***indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

CEO-duality Effects

As discussed above, FBs are more likely to determine a higher presence of CEO-duality (Corbetta & Salvato, 2004), and CEO-duality role is in spirit similar to strong family leadership power. CEO-duality may remain in its unambiguous leadership as a monitoring role of strengthening decision-making efficiency and supervising performance, thereby reducing the possibility of earnings management. Contrarily, CEO-duality may remain in its predominant leadership as an entrenchment role of selecting self-interested plans and portraying favorable performance, thereby increasing the possibility of earnings management. Thus, CEO-duality leadership seems to play a necessary complement to family involvement, and they should not be discussed separately. Next, we took CEO-duality leadership into account to determine whether the innovation outcomes of FBs reflect their earnings management behavior. The results of this investigation are presented in Table 8. In columns (1), (3), (5), and (7) of Panel A and Panel B, the result of coefficients on *FAMILY* and *LEVEL* is similar to those reported in Table 7. We further included the interaction term between *FAMILY* and *INNOVATION* (*INN*, *INNINV*, *INNUM*, and *INNDES*) in columns (2), (4), (6), and (8) and found that the coefficients of *FAMILY* \times *INN* and *FAMILY* \times *INNINV* in Panel A are significantly negative (both at the 1% significance level), whereas all of the coefficients of *FAMILY* \times *INNOVATION* in Panel B are insignificant. We also noted that results in Panel A in Table 8 are similar to those reported in Table 7. These results suggest that CEO-duality is an indication of unambiguous leadership in FBs with good performance in developing invention patents, which promotes effective decision-making, better performance, and reduces the likelihood of engaging in earnings management. Our findings also imply that CEO-duality practices have a positive effect on FBs with valuable innovations and tend to limit earnings management.

Overall, our results suggest that the combined effects of a FB structure and quality innovation helps to mediate opportunistic reporting behavior. Earnings management is also much less frequent among companies with CEO-duality leadership, which implies that FBs' innovative ambitions and duality leadership had greatly advanced in operating performance and corporate governance, and thus restrain managerial self-interested behavior.

4.2.3 Sensitivity Analysis (not tabulated)

We performed four sets of sensitivity analysis to determine the sensitivity of our findings. We first re-ran our analysis using R&D spending as a substitution for *INNOVATION*. Our results indicate that FBs actually invest less in R&D activities (Block, 2012; Gomez-Mejia, Campbell, Martin, & Hoskisson, 2014), and no relation exists among R&D spending, levels of family involvement, and CEO-duality. We also determined that growing FBs with greater involvement in management were more likely to invest in R&D activities, whereas mature FBs were less likely to invest in R&D activities. We also observed that our results were affected by alternative measures of innovation capacity, R&D spending, because R&D investment is highly uncertain and is an innovative input. We used performance-adjusted discretionary accruals as an alternative measure of earnings management by including current ROA in the modified Jones model (Kothari, Leone, & Wasley, 2005; Krishnan, Su, & Zhang, 2011; Trombetta & Imperatore, 2014). We obtained similar results in terms of polarity and significance when we used the alternative measures of earnings management. Changes in the chairman and CEO roles were shown to affect CEO-duality effects and bias empirical findings; therefore, we excluded observations related to changes of chairman and CEO. After re-running the models, our results proved highly robust as long as we excluded firms that changed their chairman or CEO. We excluded observations related to restatements and auditor changes because they were shown to affect measures of earnings management (DeFond & Subramanyam, 1998; Kedia, Koh, & Rajgopal, 2015). Excluding observations with restatements or auditor changes to re-run our analyses, we obtained substantially similar results. Overall, the inference of our results did not change.

Table 8 The Innovative Capacity of Family Business and Earnings Management: Considering the CEO-duality Effect

Panel A : Observations with CEO duality (n=1,594)

Variables ^a	Pred. Sign	(1) Dep. Var. = INN		(2) Dep. Var. = INN		(3) Dep. Var. = INNINV		(4) Dep. Var. = INNINV		(5) Dep. Var. = INNUM		(6) Dep. Var. = INNUM		(7) Dep. Var. = INNDES		(8) Dep. Var. = INNDES	
		Coef.	z-value ^b	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value
CONSTANT		0.1708	6.04***	0.1645	5.81***	0.1823	6.25***	0.1760	6.03***	0.1596	5.68***	0.1588	5.65***	0.1526	5.35***	0.1528	5.35***
FAMILY	?	0.0044	1.11	0.0174	3.01***	0.0047	1.19	0.0134	2.69***	0.0044	1.10	0.0082	1.65*	0.0045	1.13	0.0047	1.13
INN	+	0.0126	3.02***	0.0257	4.32***												
FAMILY×INN	?			-0.0244	-3.08***												
INNINV	+					0.0136	3.04***	0.0259	4.20***								
FAMILY×INNINV	?							-0.0238	-2.89***								
INNUM	+									0.0051	1.20	0.0108	1.76*				
FAMILY×INNUM	?											-0.0107	-1.29				
INNDES	+												-0.0049	-0.71	-0.0035	-0.32	
FAMILY×INNDES	?														-0.0023	-0.17	
LOSS	-	-0.0101	-1.50*	-0.0103	-1.54*	-0.0103	-1.54*	-0.0100	-1.49*	-0.0096	-1.42*	-0.0097	-1.44*	-0.0096	-1.42*	-0.0096	-1.42*
LEV	-	-0.0381	-1.47*	-0.0432	-1.67**	-0.0411	-1.59*	-0.0435	-1.68**	-0.0430	-1.66**	-0.0439	-1.69**	-0.0452	-1.74**	-0.0452	-1.74**
GROWTH	-	-0.1170	-15.50***	-0.1164	-15.46***	-0.1169	-15.48***	-0.1166	-15.48***	-0.1168	-15.44***	-0.1163	-15.36***	-0.1166	-15.40***	-0.1166	-15.39***
ROA	+	0.8616	21.27***	0.8596	21.28***	0.8626	21.29***	0.8634	21.36***	0.8581	21.14***	0.8564	21.09***	0.8560	21.04***	0.8561	21.03***
SIZE	-	-0.0116	-6.30***	-0.0116	-6.33***	-0.0122	-6.42***	-0.0121	-6.37***	-0.0105	-5.82***	-0.0106	-5.87***	-0.0099	-5.39***	-0.0099	-5.39***
QUICK	-	-0.0011	-1.12	-0.0011	-1.14	-0.0014	-1.42*	-0.0015	-1.46*	-0.0012	-1.15	-0.0011	-1.11	-0.0013	-1.32*	-0.0013	-1.32*
OCF	-	-0.2038	-8.88***	-0.2046	-8.93***	-0.2003	-8.77***	-0.2012	-8.82***	-0.1977	-8.63***	-0.1981	-8.65***	-0.1956	-8.55***	-0.1956	-8.55***
YEAR		Included		Included		Included		Included		Included		Included		Included		Included	
Adj R ²		39.40%		39.72%		39.40%		39.68%		39.10%		39.13%		39.07%		39.03%	
N		1,594		1,594		1,594		1,594		1,594		1,594		1,594		1,594	

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Panel B : Observations without CEO duality (n=2,047)

Variables ^a	Pred. Sign	(1) Dep. Var. = INN		(2) Dep. Var. = INN		(3) Dep. Var. = INNINV		(4) Dep. Var. = INNINV		(5) Dep. Var. = INNUM		(6) Dep. Var. = INNUM		(7) Dep. Var. = INNDES		(8) Dep. Var. = INNDES	
		Coef.	z-value ^b	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value
CONSTANT		0.0750	3.19***	0.0730	3.09***	0.0831	3.42***	0.0816	3.35***	0.0630	2.72***	0.0622	2.69***	0.0578	2.41**	0.0575	2.40**
FAMILY	?	0.0042	1.08	0.0087	1.45	0.0042	1.08	0.0073	1.45	0.0033	0.87	0.0058	1.18	0.0028	0.73	0.0024	0.60
INN	+	0.0127	3.11***	0.0170	2.85***												
FAMILY×INN	?			-0.0076	-0.98												
INNINV	+					0.0122	2.84***	0.0159	2.75***								
FAMILY×INNINV	?							-0.0074	-0.96								
INNUM	+									0.0074	1.87**	0.0106	1.88**				
FAMILY×INNUM	?											-0.0062	-0.79				
INNDES	+													-0.0035	-0.56	-0.0052	-0.58
FAMILY×INNDES	?														0.0032	0.27	
LOSS	-	0.0125	1.86**	0.0124	1.84**	0.0119	1.77**	0.0119	1.76**	0.0124	1.83**	0.0123	1.82**	0.0115	1.70**	0.0115	1.70**
LEV	-	-0.0595	-2.27**	-0.0584	-2.22**	-0.0591	-2.25**	-0.0579	-2.20**	-0.0560	-2.28**	-0.0592	-2.25**	-0.0615	-2.34***	-0.0617	-2.34***
GROWTH	-	-0.1433	-17.87***	-0.1429	-17.81***	-0.1440	-17.95***	-0.1435	-17.85***	-0.1433	-17.85***	-0.1431	-17.82***	-0.1437	-17.87***	-0.1437	-17.86***
ROA	+	1.0646	26.71***	1.0648	26.71***	1.0659	26.71***	1.0656	26.70***	1.0617	26.61***	1.0627	26.62***	1.0602	26.55***	1.0601	26.54***
SIZE	-	-0.0057	-3.87***	-0.0058	-3.91***	-0.0061	-3.95***	-0.0062	-3.97***	-0.0047	-3.28***	-0.0047	-3.31***	-0.0041	-2.73***	-0.0040	-2.70***
QUICK	-	-0.0022	-1.97**	-0.0022	-1.94*	-0.0024	-2.14**	-0.0024	-2.14**	-0.0018	-1.65**	-0.0018	-1.60*	-0.0020	-1.81**	-0.0020	-1.82**
OCF	-	-0.2718	-12.04***	-0.2718	-12.04***	-0.2721	-12.04***	-0.2711	-11.99***	-0.2691	-11.91***	-0.2697	-11.93***	-0.2702	-11.92***	-0.2703	-11.92***
YEAR		Included		Included		Included		Included		Included		Included		Included		Included	
Adj R ²		39.14%		39.14%		39.09%		39.09%		38.96%		38.95%		38.86%		38.83%	
N		2,047		2,047		2,047		2,047		2,047		2,047		2,047		2,047	

^a The definition of the variables reported in this table are: FAMILY = 1 if the firm belongs to family businesses, else 0; INN = 1 if the firm obtained new patents, else 0; INNINV = 1 if the firm obtained new invention patents, else 0; INNUM = 1 if the firm obtained new utility patents, else 0; INNDES = 1 if the firm obtained new design patents, else 0; LOSS = 1 if operating income is less than zero, else 0; LEV = long-term debt divided by total assets; GROWTH = percentage growth in sales; ROA = equals net income divided by total assets; SIZE = equals the natural log of total assets; QUICK = current assets (less inventories) divided by current liabilities; OCF = cash flow from operations divided by total assets; YEAR = dummy variables controlling for years. All continues variables are winsorized at the first and 99th percentiles.

^b Asterisks*, **, ***indicate significance at the 0.10, 0.05, and 0.01 levels, respectively. One-tailed for directional expectations, and two-tailed for others.

5. Conclusions

This study extended research into the issue of FBs by investigating innovation capacity and earnings management. We adopted the electronics industry in Taiwan (between 2010 and 2015) as a research sample to determine (1) whether family effects influence innovation performance at the firm level; (2) whether the innovation performance of FBs is an indication of earnings management behavior; and (3) the effects of family involvement and CEO-duality in FBs.

We found that FBs play a significant role in encouraging innovation-related decisions; however, this is the case only when family assumes a greater role in management. We determined that in cases of CEO-duality status, firms are more likely to invest in innovation-related activities. We also found that FBs with quality innovative patents and CEO-duality leadership are less likely to be involved in earnings management. We determined that growing FBs with strong family involvement in management are more likely to invest in valuable innovations. Mature and declining FBs with quality innovations proved less likely to engage in earnings management. This series of sensitivity analyses proved the robustness of our results.

This study had a number of limitations. First is the measure of innovative capacity. There are a number of ways of measuring innovation (Cooper, Knott, & Yang, 2015), and we posit that patents are superior to R&D investment when investigating innovation capacity. Second, our results may have been affected by other determinants of innovation capacity, despite the fact that we adopted several control variables, such as financial characteristics (Cornaggia et al., 2015; Fang et al., 2014; He & Tian, 2013; Hirshleifer et al., 2012; Jouber, 2013; Merkley, 2014; Tian & Wang, 2014), which may be correlated with innovation outcomes. Third, we used discretionary accruals as a proxy for earnings management; however, this does not necessarily reflect actual practices of earnings management. Although such proxies have been consistently used in previous research (Brousseau & Gu, 2013; Dechow et al., 1995; Dechow et al., 2010; Ogneva, 2012; Perotti & Wagenhofer, 2014), may provide rich insights into earnings management behavior. Despite the noted limitations, our evidence clearly suggests the following: (1) FBs with strong family involvement in management and CEO-duality leadership tend to have higher innovation capacity; and (2) FBs with quality innovation capacity are less likely to engage in earnings management.

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