Value Creation and Value Appropriation in Innovation Process in Publicly-Traded Family Firms

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Abstract:

Purpose
– The purpose of this paper is to examine the generational differences among publicly traded family firms in regards to value creation and value appropriation in the innovation process by drawing upon the knowledge-based view (KBV) and family business literature with a focus on socioemotional wealth perspective.

Design/methodology/approach
– The authors tests the hypotheses via longitudinal regression analyses based on 285 yearly cross-firm S & P 500 firm observations.

Findings
– First, the authors found that family ownership with second or later generation's majority exhibits lower levels of value creation capabilities compared to non-family firms, whereas there is no difference between those of the firms with family ownership with a first generation's majority and non-family firms. Second, the authors also found that family owned firms with a first generation's majority have higher value appropriation abilities compared to nonfamily firms, while there is no significant difference in value appropriation between the later generation family firms and non-family firms.

Research limitations/implications

– The study help scholars, family business members, and investors better understand family involvement, and how it impacts firm performance through value creation and value appropriation.

Originality/value
– The paper contributes to the family business, innovation, and KBV literature in several ways. While previous family business studies drawing upon resource-based view and KBV often focus on the value creation in family governance, the authors investigate both value creation and value appropriation phases of innovation process.

Keywords: Innovation | Family firms

Article:

1. Introduction

Family firms are the dominant form of business organization around the world (La Porta *et al.*, 1999; Tagiuri and Davis, 1996; Zahra and Sharma, 2004). Many large publicly traded corporations are controlled by founding families (Villalonga and Amit, 2006, 2009). Family involvement occurs when a family exerts control over the firm through ownership and management (Chrisman *et al.*, 2004). Accordingly, family controlled publicly traded firms are those in which the founders or family members are officers, directors, or block holders, either individually or as a group (Villalonga and Amit, 2009). When family involvement leads to the pursuit of particularistic goals and strategies (Carney, 2005), family firm behavior is expected to be distinct from those in non-family firms. Despite the inherent differences between family and nonfamily firms and among family firms themselves, family involvement is under researched in innovation studies, which limits the generalization of findings and leads to theoretical ambiguity (Chrisman *et al.*, 2012; Dyer, 2003).

Strategic decisions concerning the innovations may be the key in understanding differences between publicly traded family and non-family firms. Among all, technological innovation in family business has become an ascending research area (De Massis *et al.*, 2012). Studies often highlight family firms' limitations in innovativeness (e.g. Block, 2012), although family firms also vary in their willingness to invest in innovation activities as well as the capability to create value through innovations (De Massis *et al.*, 2015).

Nevertheless, current family business studies do not differentiate between value creation (i.e. developing new ways of doing things by using new methods, new technologies, and/or new forms of raw materials) (Lepak *et al.*, 2007) and value appropriation (i.e. capturing value by the use of resources with attributes that make them difficult to imitate by competitors through the use of innovation and resource management) (Lepak *et al.*, 2007; Sirmon *et al.*, 2007) in the innovation process. The former denotes activities that create customer value by turning innovation input into innovation output, whereas the latter focusses on the extraction of profits from innovation (Alvarez and Barney, 2004; Arbussa and Coenders, 2007; Harabi, 1995; Hurmelinna-Laukkanen and Puumalainen, 2007; Teece, 1986, 1996, 2000, 2006).

Value creation alone is insufficient to achieve superior firm performance because performance is also contingent upon a firm's ability to restrict competitive forces (e.g. erect barriers to knowledge spillover) so as to be able to appropriate value (Mizik and Jacobson, 2003; Lepak *et al.*, 2007; Reitzig and Puranam, 2009). At both value creation and value appropriation stages of the innovation process, knowledge itself as a critical intangible resource (Felin and Hesterly, 2007), and knowledge management are expected to play an important role. According to Sirmon *et al.* (2007), resource management is a complex process involving multiple activities such as structuring (i.e. acquiring, accumulating, and divesting), bundling (i.e. stabilizing, enriching, and pioneering), and leveraging (i.e. mobilizing, coordinating, and deploying) resources. Nevertheless, such a knowledge-based generational view has rarely been adopted in studying value creation in family business, and to our knowledge, there is no study exploring knowledge-based generational differences in value appropriation in innovation and to date, different generations' knowledge management in family firms have not been explored.

It should be noted that family business is a unique organizational context for studying value creation and value appropriation owing to the co-existence and trade-offs between economic and family centered non-economic goals (e.g. preservation of family values, harmony, social capital, and reputation, as well as the ability to behave altruistically toward family members) (Chrisman *et al.*, 2012, 2014; Gómez-Mejía *et al.*, 2007). The particularistic pursuit and attainment of family centered non-economic goals (Carney, 2005) can lead to socioemotional wealth (SEW) (Berrone *et al.*, 2012; Gómez-Mejía *et al.*, 2007). Gómez-Mejía *et al.* (2007) show that a desire to create and preserve SEW may result in family firms' accepting or avoiding risk to their financial performance. The authors attribute this to family business owners' being loss averse with respect to their SEW. Generally, this leads family firms to follow risk averse strategies in order to protect SEW but when firm performance is relatively lower than the aspirations, preference reversal may occur and family firms become risk-seeking (Berrone *et al.*, 2012; Gomez-Mejia *et al.*, 2010), such as in R & D investment (Chrisman and Patel, 2012). Accordingly, family firms are concerned with the trade-offs between economic and non-economic goals that are necessary to maximize their overall utility (Chrisman *et al.*, 2014).

In this regard, more research is needed regarding the role generational differences play in family firms' innovation for several reasons. First, the family business field has recognized that one fundamental difference between family and non-family firms is that family decision makers have the power and legitimacy to make decisions according to their personalized and particularized willingness (Carney, 2005), which makes the effects of knowledge attributes more salient. Second, a SEW perspective in the family business literature suggests that family firms differ from non-family firms in terms of their knowledge and knowledge management. Together with the first point, family business marks an organizational context that social interactions among its members not only create more valuable knowledge, but is also more likely to accumulate and retain created knowledge within the organization (Cummings and Teng, 2003; Lepak *et al.*, 2007). Third, the family business literature also notices that the nature of knowledge in family firms differs from non-family firms, as the former is characterized by more tacit and implicit knowledge (Cabrera-Suárez *et al.*, 2001). In this regard, tacit and implicit knowledge has been highlighted as an important isolation mechanism in value appropriation that prevents the knowledge spillover and imitation by competitors (Reitzig and Puranam, 2009). Additionally,

family firms are not only different from non-family firms, but also heterogeneous among themselves (Melin and Nordqvist, 2007). Family firms in various generations may have different knowledge management, including knowledge coordination as well as the nature of knowledge within firms (Gersick *et al.*, 1997). Hence, there may be barriers for knowledge transfer from the founding generation to the later generation in family firms (Cabrera-Suárez *et al.*, 2001); such that later generations may have more difficulty in obtaining, absorbing, and retaining knowledge which is crucial for innovations. In addition, due to the endowment of SEW, the founding generation often has more incentive for better knowledge management compared to later generations. Finally, the nature of knowledge in the founding generation is often implicit and tacit hence harder to be imitated, which can prevent or limit knowledge spillovers to competitors. However, the second generation is more likely to use formal approaches and routines and therefore utilize more explicit knowledge in strategic decisions and operations (Gersick *et al.*, 1997), which can result in more knowledge spillovers than that in the first generation. Overall, the family business setting provides a unique opportunity to study value creation and value appropriation from a knowledge-based SEW view within the context of generational differences.

This study attempts to fill these gaps in the literature. First, by drawing upon the knowledge-based generational view, we operationalize the registration number of patents of public-traded firms as a substantial innovation output, and explore the value creation process where R & D intensity (innovation input) is transformed into registered patents (innovation output). In addition, we also explore the value appropriation link between the number of patents (innovation output) and Tobin's *Q* (firm performance) (Lawson *et al.*, 2012). Differently from prior studies in the family business literature (e.g. Block *et al.*, 2013), we consider first and second generation family ownership as a moderator in the R & D intensity-patent relationship and the patent-performance relationship. Hence, we are not exploring whether family business innovates more or less (e.g. Block *et al.*, 2013; De Massis *et al.*, 2012). Instead, we suggest that family business is a unique organizational context that may have idiosyncratic effects on how firms transform innovation input into output and how innovation outputs may lead to firm performance. Second, we distinguish between dividing family ownership with the founding generation's majority and family ownership with the second or later generation's majority for the purpose of analyzing their distinctive moderation effects on the value-creation and value-appropriation processes in innovation in publicly traded family firms. Most importantly, our framework suggests that preservation of SEW is not only a goal that impacts strategic decisions, but also a source of resources which are non-imitable and non-substitutable compared to other organizational resources and capabilities.

Longitudinal regression analyses based on 285 yearly cross-firm S & P 500 observations yield two insights. First, family ownership with the second or later generation's majority demonstrates lower levels of value creation capabilities compared to non-family firms, whereas there is no difference between those firms with family ownership with the first generation's majority and non-family firms. Second, family ownership with the first generation's majority has higher value appropriation capabilities with higher profits from patenting compared to non-family firms. However, family firms with family ownership with a second or later generation's majority are not different from non-family firms in terms of value appropriation.

This study contributes to the family business, innovation management, and knowledge-based view (KBV) literatures in several ways. First, we emphasize both value creation and value appropriation in the innovation process in family firms which provides a better and more comprehensive understanding of the innovation processes in family firms. Second, we apply a SEW perspective in the KBV in family business. Indeed, SEW is the single most important feature of a family firm's essence that separates it from non-family firms (Berrone *et al.*, 2012) and requires research attention in innovation field and KBV. The SEW perspective suggests that certain emotional and social attributes among family members cannot only create knowledge, but also protect knowledge from spillovers or being imitated by competitors. Third, our findings suggest that a generational difference in family owned firms not only manifests itself in value creation, but also in value appropriation owing to their variant knowledge management abilities. Forth, we demonstrate the role of family ownership with generational differences (i.e. majority of first generation vs second or later generation) plays in family firm performance, as the results show that the family owned firms with a first generation's majority are more successful than the family owned firms with a second or later generation's majority in both value creation and value appropriation. Fifth, our findings also suggest that although, in general, family firms may be inferior in creating values in innovation, at least some family owned firms especially those with first generation's majority have advantages in appropriating profits from innovation activities. These inform the innovation and KBV fields also by demonstrating the generational differences in intra-firm knowledge transfer and management in publicly traded family firms where strategies and actions tend to be idiosyncratically influenced by SEW concerns of the controlling families.

In the remainder of this paper, we provide a theoretical overview, hypotheses, methodology, and results, followed by a discussion of the limitations and implications of our study for future research and practice.

2. Theoretical Overview

2.1 Value create and value appropriation

Complementing Schumpeter's (1934) study drawing attention to innovation as the source of value-creation, Teece (1986, 1996, 2000, 2006) emphasizes the importance of obtaining significant economic rents from the innovation, namely, the value appropriation. According to Teece (1986), value appropriation is a firm's capability to capture profits after value creation. Thereby, superior performance can be achieved by not only creating value through innovation, but also protecting and leveraging the innovation by creating barriers to imitating or substituting behaviors in market competition (Alvarez, 2007; Alvarez and Barney, 2004, 2005; Dutta *et al.*, 2003; Lepak *et al.*, 2007; Jacobides *et al.*, 2006; Mizik and Jacobson, 2003; Teece, 2000).

Within the framework of the resource-based view (RBV), a firm is a bundle of resources and capabilities (Penrose, 1959). Combining those resources and capabilities particularly knowledge-based ones that are valuable, rare, not imitable, and not substitutable may lead to sustained competitive advantages (Amit and Zott, 2001; Barney, 1991; Baldwin and Henkel, 2012; Henkel and Baldwin, 2009; Wernerfelt, 1984). It should be noted that the RBV literature has explicitly differentiated value creation from value appropriation. For instance, Barney (1991, p.

102) explains sustainable competitive advantage as the following: "a firm is said to have a sustained competitive advantage when it is implementing a value creation strategy […] and when those other firms are unable to duplicate the benefits of this strategy." Here, Barney clearly draws a distinction between value creation (i.e. a firm's capabilities to generate value based upon the development and accumulation of competitive resources) and value appropriation, denoting to a firm's capability to prevent competitors' imitating and substituting behaviors so that created value can lead to firm performance (Dierickx and Cool, 1989).

In this paper, we conceptualize value creation as part of the innovation process where innovation input is transformed into innovation output, and value appropriation as the process in which innovation output turns into firm performance (Alvarez and Barney, 2004). Accordingly, value creation and value appropriation are theorized as firm's efficiencies of transformations in these two processes. Empirically, any organizational feature that improves the transformation should positively moderate the link in either process as the originally positive connection becomes stronger, whereas any obstacle that mitigates the capability should negatively moderate the link such that the connection becomes weaker.

The literature has narrated that there are distinctive market, organizational, and individual sources that may contribute to value creation and value appropriation (Lepak *et al.*, 2007). In terms of value creation, the literature has highlighted the role of market competition (Schumpeter, 1934), government policy (Porter, 1990), technological and market innovation (Porter, 1985), external social network (Smith *et al.*, 2005), internal social connections (Nahapiet and Ghoshal, 1998) as well as the creativity of managers and entrepreneurs in firms (Brown and Eisenhardt, 1998). Concerning value appropriation, the literature has highlighted firm-level isolation mechanisms, such as patents and reputation (Jacobides *et al.* 2006; Reitzig and Puranam, 2009), which can prevent the direct imitation by competitors. Research also highlights the importance of tacit knowledge as well as social complexity and causal ambiguity, which in combination prevents the knowledge spillover to competitors (Felin and Hesterly, 2007; Lepak *et al.*, 2007).

2.2. Value creation and value appropriation in KBV

An important extension of RBV is the KBV, which considers knowledge as the most strategically significant resource within a firm (Kogut and Zander, 1992). According to Leonard and Sensiper (1998), organizational knowledge is more than the sum of individual members' knowledge; rather it is an organizational phenomenon that stems from the exchange and integration of many individuals' knowledge (Nahapiet and Ghoshal, 1998). Since organizational knowledge aggregates and enriches individual members' knowledge, it can increase a firm's capacity for innovation and strategic differentiation (Subramanian and Youndt, 2005), which eventually leads to value creation and value capture in organizational settings (Lepak *et al.*, 2007).

It should be noted that the extant KBV literature has already recognized the salient role of knowledge in both value creation and value appropriation. On one hand, the literature highlights that firms vary in their sharing, coordinating, and integrating knowledge among its members (Lepak *et al.*, 2007). In this regard, firm tasks, routines, and divisions are heterogeneous in terms of their knowledge management (e.g. the creation of new knowledge, the acquisition of existing

knowledge, and the storage of old knowledge), and creating value requires firms to develop abilities to coordinate and integrate knowledge in variant areas (Amit and Zott, 2001; Eisenhardt and Martin, 2000; Sirmon *et al.*, 2007; Teece *et al.*, 1997). Nahapiet and Ghoshal (1998) further suggest that the social connections of individuals within the firm will provide greater information and knowledge that can be used to create new organizational knowledge, which is positively related to value creation (Smith *et al.*, 2005). In this regard, organizations that can effectively integrate and coordinate knowledge among organizational members can be superior in knowledge coordination and integration.

On the other hand, the literature also highlights the nature of knowledge as well as the mobility of key individuals in the organizations as important antecedents of value appropriation. This line of research suggests that value appropriation can be developed via creating and accumulating tacit knowledge (Dierickx and Cool, 1989; Lippman and Rumelt, 1982) and/or building mechanisms to reduce the mobility of the knowledge (Campbell *et al.*, 2012; Rumelt, 1984). Here, tacit knowledge is differentiated from explicit knowledge as the former is less codifiable and formalized (Polanyi, 1962; Alvarez and Barney, 2004). Tacit knowledge is often idiosyncratic to the organization and requires social interaction for transmission (Szulanski, 1996), thereby making competitor's imitation difficult (Kogut and Zander, 1992; Zander and Kogut, 1995). In addition, an isolating mechanism refers to the imposed constraint on knowledge diffusion such as policies that limit the mobility of key decision makers and experts in the firm (Campbell *et al.*, 2012; Rumelt, 1984). Given the existence of tacit knowledge and the isolating mechanism(s), firm knowledge is less likely to spill into competitors, hence more likely to be appropriated into firm profits (Alvarez and Barney, 2004).

It should be noted that effective intra-firm knowledge transfer is also a factor which can impact value creation and value appropriation. Knowledge transfer is important to value creation and appropriation. This is because socially formed and accumulated knowledge is not perfectly transferable, and tacit knowledge is more likely to develop through learning-by-doing schema. Szulanksi (1996) further suggests that the characteristics of knowledge (i.e. causal ambiguity and unprovenness), source (i.e. lack of motivation and reliability), recipient (i.e. lack of motivation, absorptive capacity, and retentive capacity), and context (i.e. barren context with formalized structure and systems and arduous relationships with limited communication, exchanges, and interactions) can prevent or restrict knowledge transfer in organizations. The author also shows that the recipient's lack of absorptive capacity, causal ambiguity, and an arduous relationship between source and recipient are the most important barriers for knowledge transfer.

In sum, while the RBV literature clearly draws a distinction between value creation and value appropriation, KBV scholars extend this line of research by arguing that the abilities of value creation and value appropriation stem from the distinctive characteristics of knowledge and attributes of the organization. Overall, the proponents argue that a firm's knowledge, partially impacted by the organization, can determine a firm's abilities in creating and appropriating values from economic activities (Conner and Prahalad, 1996). As we will further argue in the following sections, we suggest that a comprehensive understanding of innovation in family firms must consider the family firm-specific phenomena, particularly SEW, which not only distinguishes family firms from non-family firms, but also creates generational differences

among family firms. Indeed, SEW concerns in family firms are likely to affect knowledge transfer and management in different generations.

2.3. KBV and SEW in family firms

This section addresses the question of what role SEW plays in knowledge creation, transfer, and management in family firms, which can shape value creation and value appropriation. RBV theorists argue that family firms differ from non-family firms as well as other family firms by the levels and types of the involvement they exert on firm capabilities (Habberson *et al.*, 2003). This is because capabilities in family firms result from the idiosyncratic interactions between the family, its individual members, and the business (Sirmon and Hitt, 2003). One important way that family firms build competitive capabilities is through family centered family firm-specific knowledge (Cabrera-Suárez *et al.*, 2001). It has been argued that the long-term intertwining between family and business systems helps to create and accumulate family centered family firm-specific knowledge (Gedajlovic and Carney, 2010; Zahra *et al.*, 2007). In this paper, built upon prevailing SEW view, we further argue that value creation and value appropriation of knowledge in family firms are also driven by the presence of family centered SEW.

At the margin, family owners are expected to attach greater weight to family centered SEW (Chrisman *et al.*, 2012) than economic goals (e.g. Zellweger and Astrachan, 2008) because the achievement of the former creates SEW for the family whereas the loss of SEW can result in diminished intimacy, lowered status, and inability to meet family expectations (Berrone *et al.*, 2012; Gómez-Mejía*et al.*, 2007, 2010). The literature has recognized that the intention to preserve SEW tends to cause unique firm behaviors, such as the tendency to avoid R & D investment (Chrisman and Patel, 2012; Block, 2012) and international diversification (Gomez-Mejia *et al.*, 2010). Paradoxically, family firms increase their R & D investments when their firm's survival, and therefore all their SEW, is at risk (Chrisman and Patel, 2012).

Nevertheless, SEW is also a unique firm attribute that may impact the value creation and value appropriation in firms. This is mainly due to the fact that SEW involving binding social ties can foster interactions among both family and non-family members, which in turn nurtures value creation through generating family firm-specific tacit knowledge and prevents knowledge spillovers, which are crucial for value appropriation (Berrone *et al.*, 2012). In this regard, SEW (Berrone *et al.*, 2012) involving family control and influence, binding social ties, emotional attachment, family members' identification with the firm, and renewal of family bonds to the firm through dynastic succession are relevant to the generational KBV of family firms we are suggesting.

Family control and influence are integral in family's ability to exercise authority and pursue family centered goals within the firm. Emotional attachment refers to the role of emotions in building and maintaining binding family as well as social ties. Emotional attachment and connections among family members may help overcome information asymmetries of idiosyncratic knowledge through close contacts (Lee *et al.*, 2003), hence make the coordination and integration of variant knowledge relatively easier under family governance. In addition, emotional attachment can help strengthen family members' commitment to the business; hence family members are less likely to leave the organization, further preventing the mobility of the

knowledge. Similarly, family identification refers to the close identification of family members with the firm. In organizations where families identify with their firms, there is a longer history of knowledge creation in terms of shared experiences and past events that converge to influence and shape current activities, events, and relationships. This suggests that knowledge development in family firms are largely family firm-specific and tacit in nature, and not likely to be replicated and used in other organizations, and hence knowledge spillovers from family to non-family firms become less likely, while the intra-firm knowledge transfer can be easier within the same generation. Although in general, family firms may have advantages in coordinating knowledge as well as preventing the mobility of knowledge, scholars also argue that trans-generational succession in family governance may bring in difficulties; hence knowledge in family firms may be heterogeneous among different generations (Chirico and Salvato, 2008). As will be further discussed in the following section, we suggest that there is a generational difference regarding the nature and structure of knowledge as well as the propensity to manage knowledge through coordinating, integrating, and transferring within the firm and preventing knowledge spillovers. Hence, family firms' capabilities in value creation as well as value appropriation are expected to differ among family firms from different generations and from non-family firms.

3. Hypothesis development

According to the KBV as aforementioned, a firm's capability of value creation is primarily determined by firm's capabilities to manage (i.e. coordinate and integrate) knowledge in variant areas. Nevertheless, a firm's capability of value appropriation is mainly determined by the nature of the knowledge and the strength of isolating mechanisms. In this section, based on the SEW perspective, we further develop hypotheses by arguing that founding and later generations of family firms differ from not only non-family firms, but also each other in terms of both value creation and value appropriation.

3.1. Value creation in publicly traded family firms

The founders of family firms have been identified by their critical role in the continuity and sustainability of the business (Salvato *et al.*, 2010; Zellweger *et al.*, 2011). The literature recognizes that family leaders significantly affect strategic decisions of the firm as they have the power, authority, and legitimacy to do so (Carney, 2003; Chrisman *et al.*, 2012; Zahra, 2003). The literature also highlights that when business governance is led by the founding generation, the effectiveness of implementation increases while its cost decreases, meaning more values are created (Habberson and Williams, 1999).

One of the reasons for value creation process, where innovation inputs (i.e. R & D intensity) are turned into outputs (i.e. patents), to be potentially more successful in family firms with the founding generation's majority than that in non-family firms is that founding-generation family firms are better in coordinating and integrating knowledge from different tasks, routines, divisions, or departments in the firm compared to non-family firms. One critical condition of knowledge coordination and integration is the extent that the members of the organization communicate without triggering relational conflict (Eddleston and Kellermanns, 2007; Steier, 2001). In this regard, the founding generation exhibit advantages over non-family firms through components of SEW, such as close monitoring and control by the family, binding ties, emotional

attachment, and identification with the firm for several reasons. First, the family can enjoy exercising authority through family control and influence over the business. Effective monitoring and control by the family can enhance the focus on tasks and self-serving behaviors can be restricted by family control. Second, shared experiences through working together in the entrepreneurial and adolescence stages of the firm helps build high levels of cohesiveness and emotional attachment among family members (Gersick *et al.*, 1997).

Furthermore, in a newly founded family business, family business members tend to share the common goal of keeping the family together in the business, and accordingly the business is perceived as an extension of the family (Berrone *et al.*, 2012; Steier and Miller, 2010) through identification with the firm. This often motivates family members to place a higher priority on the common goals rather than their self-serving interests (Corbetta and Salvato, 2004), unlike in non-family firms, and accordingly mitigates the relational conflict among family members (Eddleston and Kellermanns, 2007) and enhances the focus on communicating, sharing, and integrating knowledge, further enhancing value creation process. Moreover, future generations in mind, the founding generation is motivated and obligated to ensure value creation by effectively turning firm inputs into fruitful outcomes in order to pass a successful business onto offspring. This long-term orientation beyond the founder's career and life time is unique to family firms.

In sum, compared to managers in non-family firms, the founding generation driven by SEW concerns has the incentive to effectively coordinate and integrate knowledge from variant areas in the organization to enhance success in value creation process. Hence:
H1. First generation's majority in ownership moderates the link between innovation input (R & D intensity) and output (patents), such that the positive relationship becomes stronger in family firms with first generation's majority compared to non-family firms.

Nevertheless, the above advantages contributing to the preservation of SEW as well as the coordination and integration of knowledge in family firms, tend to diminish in later generations. This is because family influence diminishes in later generations (Gómez-Mejía *et al.*, 2007). When family influence and control are reduced through dispersed ownership, the preservation of SEW becomes less of a concern in later generations (Berrone *et al.*, 2012). Accordingly, lower levels of SEW concerns may harm the value creation process by reducing coordination and integration of knowledge. Additionally, relational conflict is more likely to arise in second or later generations, further weakening emotional attachment, identification with the firm, family bonds, and social ties. These can interfere with the coordination and integration of knowledge. Indeed, the founding-generation's legitimate power can help direct the focus toward firm performance, whereas descendants may be preoccupied with engaging in power contests individually or through forming family coalitions, shifting the focus from value creation to politics, which can foster relational conflict (Eddleston and Kellermanns, 2007; Kellermanns and Eddleston, 2004) and harm the value creation process.

Even when the family exhibits harmony, the transition from founding family control to the descendant family control leads to dispersed family ownership and reduced concerns for SEW. This may result in the pursuit of self-centered individual interests rather than the common goals and collectivistic behaviors among family members (Gómez-Mejía *et al.*, 2007), which can

further influence the value creation process negatively through retarding firm-wide coordination and integration of knowledge.

In addition, intra-firm knowledge transfer from first generation to later generation can be hindered when the later generation is not compatible with the first generation in terms of the level of motivation, knowledge, experiences, and skills (Szulanski, 1996). For example, the later generation may be content with the inherited wealth and lack the motivation to learn new knowledge. If the later generation also holds poor absorptive and retentive capacities, this can limit knowledge transfer from first generation to later generation. Furthermore, formal structures and systems established over time owing to growth and larger firm size, can restrict the knowledge transfer from one generation to the other. Additionally, in case of relational conflict, arduous relationships prevent effective knowledge transfer from first generation to the later generations.

As a result, we expect that the advantages of knowledge coordination and integration start to decrease in the second or later generation family firms and intra-firm knowledge transfer from first generation to later generation becomes harder with the rise of relational conflict and diminished concerns for the preservation of SEW. This can interfere with value creation-the transformation from innovation input to innovation output in the second or later generation compared to non-family firms. As such:

H2. Second or later generation's majority in ownership negatively moderates the link between innovation input (R & D intensity) and output (patents), such that the positive relationship becomes weaker in family firms with second generation's majority compared to non-family firms.

3.2. Value appropriation in publicly traded family firms

As we discussed earlier, value creation is not sufficient for superior performance (Mizik and Jacobson, 2003). A firm can appropriate profits on innovations only when it can restrict competition by creating barriers to imitation. The key to value appropriation is either to create and accumulate tacit knowledge so that competitors cannot imitate or to restrict the mobility of organizational employees so that the key experts are less likely to be recruited by competitors (Alvarez and Barney, 2004; Arbussa and Coenders, 2007; Harabi, 1995; Hurmelinna-Laukkanen and Puumalainen, 2007).

The components of SEW are expected to play an important role in the value appropriation process as that in value creation. This is because family control over the business, intentions for intra-family succession that serve the renewal of family bonds, strong identification with the family business, and binding family ties can help build tacit and family business-specific knowledge and emotional attachment can help prevent the mobility of family business members and knowledge spillovers to competitors. In this regard, we expect that the founding generation can enhance value appropriation process in family firms unlike that in non-family firms for two reasons.

First, the nature of knowledge in newly founded firms is more tacit and less formalized, hence less likely to be imitated by competitors compared to that in non-family firms. The knowledge management literature differentiates between explicit and tacit knowledge as the former is less context-dependent and more likely to be transferred via systematized language or code (Polanyi, 1966). In contrast, tacit knowledge can hardly be expressed or formalized because it appears and develops through the interaction between an individual and the situation, becoming context and time specific (Kogut and Zander, 1992; Zander and Kogut, 1995).

In addition, the founding generation family members often work together as a team in order to discover and exploit entrepreneurial opportunities (Shane, 2000). Hence, founders often accumulate knowledge via previous collaborative working experiences. Nevertheless, this knowledge is relatively hard to be directly learned because the accumulation is contingent upon the specific collaborative working and/or timing conditions, which is deeply impacted by the socioemotional concerns such as bonding ties with customers or emotional attachment with other founders. Differently put, knowledge created by the founding generation is largely socially based and hence tacit in nature, meaning direct imitation from competitors becomes less likely.

Second, the founding generation in a family business also has the advantage in developing isolating mechanisms by reducing the mobility of experts and employees, unlike in non-family firms. In family firms, greater employee care, and loyalty (Donckels and Frohlich, 1991; Habberson and Williams, 1999; Ward, 1988) provided by family firm founders can uniquely limit the mobility of employees and consequent knowledge spillovers to competitors. According to Miller and Le Breton-Miller (2005, p. 521), since controlling "families so cherish the firm, they also treasure those who staff it and sustain it." Hence, particularly family business founders with higher levels of influence, control, commitment, and attachment to the firm than second or later generations generally treat their employees well. In return, employees stay loyal to the firm, facilitating preservation of tacit knowledge associated with the innovations within the family firm. These are all expected to enhance the success of the value appropriation process in family firms compared to that non-family firms:

H3. First generation's majority in ownership positively moderates the link between innovation output (patents) and firm performance (Tobin's Q), such that the positive relationship becomes stronger in family firms with first generation's majority compared to non-family firms.

However, owing to the diminished family influence in second and later generations (Schulze *et al.*, 2003; Gómez-Mejía *et al.*, 2007), the family firms with second or later generation's majority are likely to use formal procedures and routines developed and established over time owing to growth and larger firm size, which can reduce their advantages in value appropriation, as in value creation. We expect this to happen for several reasons.

First, although the family business literature has recognized that family firms may have competitive advantages over non-family businesses owing to the tacit knowledge stemming from the shared history and daily interactions among family, and business and family members (Habberson and Williams, 1999), "(tacit) information about the familiness bundle is frequently embedded in certain individuals, generally the entrepreneur/family business founder" (Cabrera-Suárez *et al.*, 2001, p. 39). One of the reasons is that the tacit knowledge, as created and

accumulated by the first generation, is hard to be transferred to later generations, owing to causal ambiguity, recipient generation's lower levels of motivation, absorptive and retentive capacity by relying upon the inherited wealth, and less intimacy among dispersed owners. Tacit knowledge is closely related to unique work experiences (Polanyi, 1966) and therefore less likely to be diffused given the situation that the successor often has been brought up "within" and lived with the business. The explicit and codifiable knowledge and routines utilized by the second or later generation can be learned by the competitors easily and the innovations can be substantially imitated, restricting the value appropriation. Additionally, expanded networks developed over time can result in more knowledge spillovers than in the past.

Second, although given passive roles in the transfer of tacit knowledge, late-generation family members are not always passive recipients of knowledge in the family business (Cabrera-Suárez et al., 2001; Lee et al., 2003; Steier, 2001). Later generation family members often get professional business education in order to become qualified as family business successors and are expected to utilize professional norms and routines (Chung and Yuen, 2003; Santiago, 2000). In this regard, later generation family members may introduce explicit routines and norms into organizational knowledge of family firms, which may not be consistent with earlier tacit knowledge such as family values and traditions (Chua et al., 2009; Gedajlovic et al., 2004). For example, research shows that successors can take positive parts in the process of professionalization, in which family firms abandon certain traditions inconsistent with professional and social norms (Parada et al., 2010). This can limit knowledge transfer from first generation to later generation.

Aside from less tacit knowledge, second or later generation family businesses have disadvantages in restricting mobility of non-family managers and employees. For instance, non-family managers and employees may perceive exclusive treatment of second or later generation family members who may lack necessary qualifications (Chrisman et al., 2014). Indeed, as an important component of SEW, the first generation's desire to renew family bonds through dynastic succession tends to result in exclusive employment and treatment of family members (Barnett and Kellermanns, 2006; Berrone et al., 2012). These may lower the loyalty among non-family employees toward the firm and increase their perceptions of injustice and propensity to leave (Barnett and Kellermanns, 2006;Memili and Barnett, 2008), resulting in knowledge spillovers to competitors from the family firm. This increases imitability of innovations, resulting in the innovator family firm's having to share the profits with the follower/imitator competitors. Second or later generation family business members themselves also may seek career opportunities in other firms owing to less identification with the firm, weaker family ties, emotional attachment, and commitment to the family firm. These can result in even more knowledge spillover to competitors, limiting profits on innovations in publicly traded family firms with second or a later generation's majority:

H4. Second generation's majority in ownership negatively moderates the link between innovation output (patents) and firm performance (Tobin's *Q*), such that the positive relationship becomes weaker in family firms with later generation's majority compared to non-family firms.

In the following Methodology section, we examine the moderation effects of different generations' majority in ownership on value creation (innovation input (R & D

intensity)→innovation output (patent)) and value appropriation (innovation output (patent)→firm performance) processes that constitute the critical stages of innovation process (Figure 1)
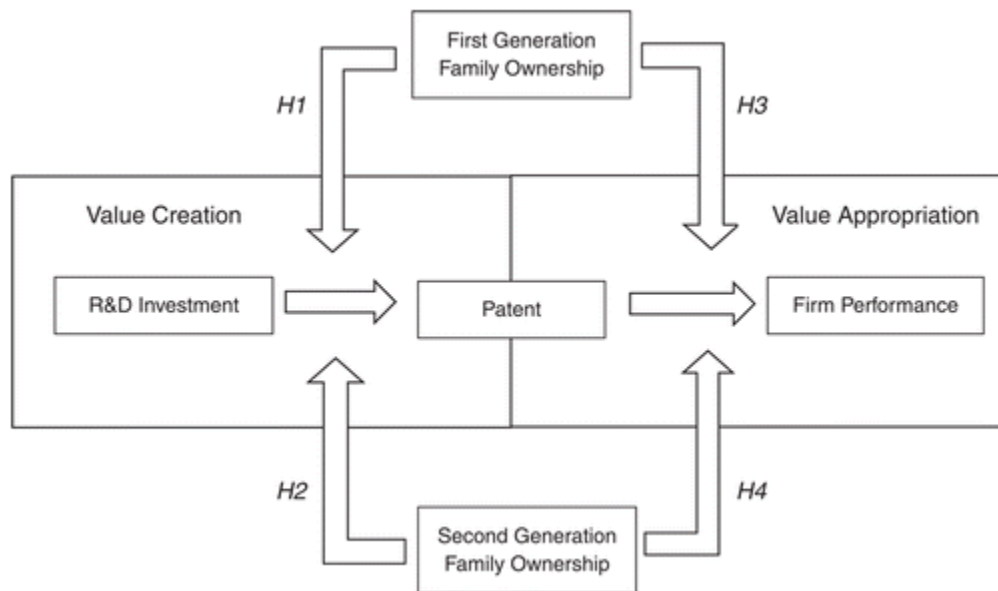

Figure 1 Theoretical model

4. Methodology

4.1 Data

Consistent with previous studies investigating publicly traded family firms, the sample came from the S & P 500 (e.g. Anderson and Reeb, 2003a, b, 2004; Short *et al.*, 2009; Combs *et al.*, 2010). The S & P 500 stock market index is maintained by Standard & Poor's and involves 500 large-cap US firms covering about 75 percent of the US equity market. This sample is selected for a number of reasons. First, this sample includes both family and nonfamily firms. Anderson and Reeb (2003a) suggest that families are present in one-third of the S & P 500. Second, family firms among the population are likely to have substantial number of nonfamily shareholders unlike privately held firms. Hence, this sample is representative of the publicly traded family and nonfamily firm population. Finally this sample has been used in studying innovation in family business in terms of R & D investment and patents (Block *et al.*, 2013). To conclude, we believe this sample is appropriate for the purpose of this study.

We design our study based on observations of the S & P 500 firms from 2002 to 2006. The primary data sources are Thompson Reuters Thompson One and US Patent and Trademark Office (USPTO) patent full-text and image database. Accounting, market, ownership, and management data are largely obtained from Thompson Reuters Thompson One Corporate Development database. Family business members, including their generations and their involvement in management, are identified by using the Hoover's database and annual reports in Mergent Online. Patent data were collected from USPTO database which records the annual

patent applications in the office. Instrumental variables concerning governance provision are obtained from a larger project designed to investigate all the companies incorporated in the USA in the Investor Responsibility Research Center books investigated in terms of their usage of 24 control enhancing governance mechanisms (Gompers *et al.*, 2003). Due to the fact that there are two years lag in two models, and provision database has a number of missing data, our sample is largely limited. Overall, we have 285 firm-year observations for further analysis.

We control for one year lag between dependent variables and others to recognize the fact that both value creation (innovation input to innovation output) and value appropriation (innovation output to firm performance) occurs over time. In addition, to acknowledge the fact that fact that value creation is prior to value appropriation, we control for one year time lag between these two models.

4.2. Variables

Family ownership: two types of family ownership-founding family ownership and second or later generation family ownership-are measured as the percentage of ownership that the either the founding generation or later generation exhibits. It should be noted that founder ownership is theoretically distinctive from first-generation family ownership (Gedajlovic *et al.*, 2004). In addition, founder owned and family owned enterprises – including both first-generation and second-generation – tend to perform differently (Miller *et al.*, 2007). Indeed, the effect of founder ownership on innovation has been recognized in the family business literature (Block, 2012;Block *et al.*, 2013), while the generational difference has been often ignored. We follow Miller and colleagues in classifying family business as those with no less than 5 percent family ownership and at least one family member in Top Management Team (TMT). Accordingly, the first generation family ownership is measured as the percentage of family ownership in family business when only the first generation is involved in its TMT, whereas the second generation family ownership is measured as the percentage of family ownership in family business when there is second or later generation involved in family business TMT (Miller *et al.*, 2007). This measurement reflects the fact that the extent that family ownership may impact firm decision making is largely through family's involvement in business.

Innovation input (R & D intensity) and output (patent): we operationalize innovation input as innovation intensity as a percentage. (i.e. R & D expenditure divided by total sales) (Block *et al.*, 2013; Miller *et al.*, 2007). Patents are measured as the absolute number of patents the focal firm has registered in USPTO. It should be noted that we intend to use patent as the DV in regressing value creation and IV in regressing value appropriation, because patents have been largely used in the innovation literature as one important innovation output. In addition, publicly traded firms in the USA do not typically report other innovation outputs, like the situation of smaller sized counterparts. Furthermore, patents by themselves have been studied as an isolation mechanism that can prevent knowledge mobility and facilitate knowledge appropriation (Reitzig and Puranam, 2009). This indicates that our study does not focus on the isolating effect of patents per se (which is likely to be captured by the single variable of the patent), but rather we try to capture the additional value appropriation effects captured by the interactions between family ownership in different generations and patents.

Different from prior studies in family business (e.g. Block *et al.*, 2013), we intend to use patent rather than patent citation as a measure of innovation output for two reasons. First, patent citation is impacted by competitors and other forces in the market, while the application and registration of patents are largely initiated and completed by the focal firms. Hence, as this paper intends to build a firm level theory, we choose to use variable that is consistent with this focus. In addition, part of the argument in this paper is to conceptualize patent as an isolation mechanism, which may limit the competitive behaviors from other market parties. Patent citation may reflect the importance of innovation output (e.g. Block *et al.*, 2013), but does not necessarily relate to the isolation effect that patent can create.

Firm Performance: firm performance is measured via Tobin's *Q* (Chung and Pruitt, 1994) with accounting data provided by Thomson Reuters. The use of this firm performance measurement in this study followed Anderson and Reeb (2004), Villalonga and Amit (2006a, b, 2009), and Miller *et al.* (2007). Tobin's *Q* is a market based measure of firm performance incorporating current operations, potential growth opportunities, and future operating performance (Anderson and Reeb, 2004). Hence, it reflects both current and anticipated profitability. Additionally, this market-based measure of firm performance is reflective of shareholder wealth creation, which suits the main concerns of this paper. Tobin's *Q* is the ratio of the firm's market value to the replacement value of its assets (Villalonga and Amit, 2006a; Miller *et al.*, 2007; Richard *et al.*, 2009). The formula for Tobin's *Q* (Miller *et al.*, 2007) is as follows: ((common shares outstanding×calendar year closing price)+(current liabilities-current assets)+(long-term debt)+(liquidating value of preferred stock)/total assets).

Controls: we add a number of control variables in the analysis. We control for family management by the percentage of family members in TMT and the absolute number of family managers in TMT divided by log of annual sales. The second variable intends to control for family's management over firm's daily operation. We control for non-family insider ownership measured as a percentage, institutional ownership measured as a percentage of overall institutional ownership of voting shares outstanding (Anderson and Reeb, 2004). To account for the fact that firms are heterogeneous, we control for firm size (i.e. log of the number of employees) (Dewar and Dutton, 1986), firm age (i.e. the number of years the firm has been in existence since founding), firm risk (the standard deviation of stock returns for the previous 60 months) (Anderson and Reeb, 2003a, 2004) and prior firm performance (Tobin's *Q* in prior year). Following prior studies (e.g. Block *et al.*, 2013), we also control for firm leverage and firm liquidity. Firm leverage is measured using debt-to-equity ratio, measured as a percentage. Firm liquidity is measured as the current ratio, i.e. current assets divided by current liabilities calculated by percentage. The current ratio is an indication of a firm's market liquidity and ability to meet creditor's demands. We control for internationalization (i.e. percentage of sales from foreign domain) and primary firm industries (i.e. retail, service, manufacturing and other sectors, measured by using three dummies of retail, service and manufacturing industries). We also adjust dependent variables (innovation output and firm performance) in regression models by industrial average in SIC 2-digits as another control of industrial effects.

Table I summarizes the descriptive statistics regarding the difference between first generation majority family business, second generation majority family business, and nonfamily

business. Table II reports descriptives and correlations. First generation family ownership majority does not appear to outperform nonfamily firms (-0.03, $p > 0.05$), while second generation family ownership majority is negatively and significantly correlated to firm performance (-0.11, $p < 0.05$). Innovation is found positively and significantly to be correlated to firm performance (0.24, $p < 0.01$). Non-family insider ownership is found to be positively and significantly correlated to firm performance (0.11, $p < 0.05$). Both firm age (-0.12, $p < 0.05$) and firm size (-0.30, $p < 0.01$) are found negatively correlated with firm performance. Regarding R & D investment and patents, first and second family ownership majority does not appear to be significantly different from non-family firms. In addition, both first (0.28, $p < 0.01$) and second family ownership majority (0.30, $p < 0.01$) are positively and significantly correlated to family management. We also calculate the variance inflation factors (VIF) to examine whether the results were subject to the threat of multicollinearity. VIF values were all lower than 5, indicating that estimations were free of any significant multicollinearity bias.

	First generation majority family business[a] 11			Second generation majority family business 34			Non-family business 240	
Sample size	Mean	SD	Difference[b]	Mean	SD	Difference[c]	Mean	SD
Tobin's Q	1.20	0.70	−0.63	1.48	1.07	−0.36	1.83	2.00
R&D investment	0.00	0.01	−0.04***	0.03	0.06	−0.01	0.04	0.07
Patent	26.36	68.77	−26.12	33.56	76.26	−18.93	52.49	161.31
Family management percentage	0.04	0.07	0.03	0.02	0.05	0.01	0.01	0.04
Family management adjusted by firm size	0.13	0.22	0.11*	0.24	0.23	0.22*	0.02	0.11
Nonfamily insider ownership %	1.13	1.18	−3.45	1.98	4.31	−2.61*	4.59	6.97
Institutional ownership %	28.81	12.52	−5.64***	35.81	15.68	1.36	34.45	9.28
Firm age	42.09	35.26	−16.56	71.09	34.77	12.44	58.65	42.92
Firm size	4.10	0.57	−0.13	4.27	0.45	0.03	4.24	0.54
Firm risk	50.41	42.60	5.75	38.31	41.68	−6.34	44.65	35.51
Internationalization %	44.34	31.08	8.30	35.78	26.21	−0.26	36.05	20.47
Current ratio %	155.52	86.22	−0.63	235.46	134.83	79.31****	156.15	998.21
Debt-to-equity ratio %	129.15	344.96	−59.02	137.92	252.84	−50.25	188.17	702.54
Retail	0.27	0.47	0.23**	0.09	0.29	0.04	0.05	0.21
Service	0.18	0.40	−0.10	0.12	0.33	−0.16*	0.28	0.45
Manufacturing	0.27	0.47	−0.15	0.62	0.49	0.20*	0.42	0.49

Notes: [a]First generation majority family business is operationalized as firms with salient first generation's ownership and first generation's ownership is bigger than second generation's ownership; second generation majority family business is operationalized as firms with salient second generation's ownership and the second generation's ownership is bigger than first generation's ownership; [b]difference refers to the mean difference between first generation majority family business and nonfamily business; [c]difference refers to the mean difference between second generation majority family business and nonfamily business. *,**,***,****Significant at 0.10, 0.05, 0.01 and 0.001 levels, respectively

Table I Descriptives of first generation majority, second generation majority, and nonfamily firms

	Mean	SD	VIF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Firm performance	1.77	1.89	1.03	1.00																		
2. Patent	49.22	150.99	3.94	−0.02	1.00																	
3. 1st generation Majority	0.30	3.07	1.73	−0.03	−0.02	1.00																
4. 2nd generation majority	0.69	3.82	1.59	−0.11	0.01	−0.02	1.00															
5. R&D intensity %	0.04	0.08	1.99	0.24	−0.05	−0.04	−0.08	1.00														
6. Family management (%)	1.67	4.14	1.15	0.05	−0.12	0.04	0.23	−0.04	1.00													
7. Family management (size)	0.05	0.15	1.17	0.06	−0.05	−0.14	0.25	0.40	−0.01	1.00												
8. Nonfamily insider ownership %	4.14	6.64	1.17	0.11	0.02	−0.06	−0.09	−0.04	−0.15	−0.16	1.00											
9. Institutional ownership %	34.40	10.39	1.31	0.04	−0.07	−0.19	−0.09	0.10	−0.09	−0.12	−0.08	1.00										
10. Firm age	59.49	41.99	1.53	−0.12	0.07	−0.10	0.03	−0.18	0.03	0.03	−0.12	−0.18	1.00									
11. Firm size	4.23	0.53	1.33	−0.30	0.04	0.06	−0.03	−0.29	0.10	0.07	−0.18	−0.15	0.23	1.00								
12. Firm risk	44.12	36.51	1.03	0.12	−0.07	0.16	0.05	0.32	−0.03	−0.03	0.08	0.00	−0.29	−0.16	1.00							
13. Prior firm performance	1.99	3.43	1.16	0.97	−0.03	0.16	−0.02	−0.07	0.08	0.07	0.02	−0.06	−0.08	−0.14	0.06	1.00						
14. Current ratio %	166.68	915.23	1.07	0.03	−0.01	0.10	−0.01	0.02	0.02	0.01	−0.06	0.03	0.05	0.12	−0.18	0.03	1.00					
15. Debt-to-equity ratio %	177.11	650.98	1.22	0.68	0.01	−0.09	−0.06	−0.01	0.01	0.10	−0.03	−0.12	−0.01	0.05	−0.04	0.68	0.00	1.00				
16. Internationalization %	36.34	21.66	1.13	−0.10	0.02	0.16	0.09	0.02	0.03	0.03	0.05	−0.08	−0.03	0.03	0.01	−0.04	0.68	0.00	1.00			
17. Retail	0.06	0.24	1.50	0.08	−0.08	0.10	−0.02	−0.03	0.06	0.04	0.12	0.02	−0.16	0.06	−0.01	0.01	−0.08	−0.06	−0.09	1.00		
18. Service	0.26	0.44	1.82	0.11	−0.04	−0.06	−0.01	−0.19	−0.01	−0.01	0.02	0.11	−0.09	0.08	−0.03	0.00	0.01	0.03	−0.03	−0.15	1.00	
19. Manufacturing	0.44	0.50	2.24	0.02	−0.02	0.05	0.03	0.32	0.06	0.08	−0.04	−0.01	0.09	0.14	0.12	−0.05	0.14	−0.02	0.05	−0.22	−0.52	1.00

Note: Correlations $\geqslant |0.11|$ are significant at $p < 0.05$

Table II Descriptives and correlations

4.3. Analyses

Due to the longitudinal data structure, OLS regression may generate biased estimates. Fixed effects panel regression can control for unobservable cross-sectional characteristics (Frye, 2004), and it has been applied in previous family business studies (Chen and Hsu, 2009). At the five percent level of significance, The Hausman test suggests that fixed effects GLS panel model is more appropriate than random effects for both value creation models (Model 1 and 2) and value appropriation models (Model 3 and 4). Hence, we used fixed effect longitudinal regression analysis to test all hypotheses. We also used the Huber-White sandwich estimator (clustered at the firm level) to control for potential serial correlation and heteroscedasticity (Arellano, 2003).

Endogeneity

To control for the possible endogeneity of family ownership due to unobservable organizational or environmental characteristics that are not captured in the control variables, we implement the Heckman's (1979) two-stage technique (see Gómez-Mejía *et al.*, 2007). Using Heckman's two-stage procedure, we first estimate two probit models for each period. In the first model, first family generation majority (=1) vs non-family firm (=0) is the endogenous variable, and estimate the inverse Mills ratio. In the second model, second generation majority (=1) vs non-family firm (=0) is the endogenous variable, and estimate the inverse Mills ratio. We then estimate the regression of value creation and value appropriation using two inverse Mills ratios from the two probit models as additional controls. It should be noted that this approach can also control for self-selection of independent variables. In this regard, the possible selecting effect of controls (firm age, firm size, etc.) on family ownership variables will be blocked from the analyses.

In the first-stage model, we use five instrumental variables that may affect the likelihood of family control, but are not correlated to firm innovation, patent or firm performance. All five instrumental variables relate to governance provisions. Data regarding governance provisions usage was obtained from a larger project designed to investigate all the companies incorporated in the USA in the Investor Responsibility Research Center books (Gompers *et al.*, 2003). The

provisions we chose are related to status, voting rights, legal protection, monetary protection, and protection of positions. All the provisions are measured by five-point Likert scales in which 1 represents the weakest and 5 means the strongest. It should be noted that family owners are inclined to set up governance provisions that best represent their interests. Nevertheless, there is no theoretical basis to link governance provisions directly with either firm innovation performance (patent) or firm performance.

Model specification

As mentioned above, we intend to control for one year lag between dependent variable and all others to test each hypothesis. In addition, to account for the temporal distance between the stage of value creation and the stage of value appropriation, we control for one-year lag between these two stages. Put differently, the dependent variable and others are controlled in $t-1$ and $t-2$ terms in the model of value creation, while the dependent variable and others are controlled in t and $t-1$ terms in the model of value appropriation. To control for the nature of endogenous development of innovation in organizations, we add patent and R & D intensity in $t-2$ term in testing for value appropriation. Our hypotheses also suggest that patent mediates the causal relationship between R & D intensity and firm performance. Given this fact, we also test for the mediation effect. Overall, estimation equations of regression analysis include value creation and appropriation.

Value creation

Model 1: Patent$_{t-1}$ (adjusted by SIC2 industrial average)=Constant+R & D Intensity$_{t-2}$+1st Generation Majority$_{t-2}$+2nd Generation Majority$_{t-2}$+Family Management Percentage$_{t-2}$+Family Management adjusted by Firm Size$_{t-2}$+Nonfamily Insider Ownership$_{t-2}$+Institutional Ownership$_{t-2}$+Firm Size$_{t-2}$+Firm Age$_{t-2}$+Firm Risk$_{t-2}$+Prior Firm Performance$_{t-2}$+Current Ratio$_{t-2}$+Debt-to-Equity Ratio$_{t-2}$+Internationalization$_{t-2}$+Retail$_{t-2}$+Service$_{t-2}$+Manufacturing$_{t-2}$+Inverse Mill Ratio (first family generation)+Inverse Mill Ratio (second family generation)

Model 2: Patent$_{t-1}$ (adjusted by SIC2 industrial average)=Constant+R & D Intensity$_{t-2}$+1st Generation Majority$_{t-2}$+2nd Generation Majority$_{t-2}$+1st Generation Majority$_{t-2} \times$ R & D Intensity$_{t-2}$+2nd Generation Majority$_{t-2} \times$ R & D Intensity$_{t-2}$+Family Management Percentage$_{t-2}$+Family Management adjusted by Firm Size$_{t-2}$+Nonfamily Insider Ownership$_{t-2}$+Institutional Ownership$_{t-2}$+Firm Size$_{t-2}$+Firm Age$_{t-2}$+Firm Risk$_{t-2}$+Prior Firm Performance$_{t-2}$+Current Ratio$_{t-2}$+Debt-to-Equity Ratio$_{t-2}$+Internationalization$_{t-2}$+Retail$_{t-2}$+Service$_{t-2}$+Manufacturing$_{t-2}$+Inverse Mill Ratio (first family generation)+Inverse Mill Ratio (second family generation)

Value appropriation

Model 3: Tobin's Q_t (adjusted by SIC2 industrial average)=Constant+Patent$_{t-1}$+R & D Intensity$_{t-2}$+1st Generation Majority$_{t-1}$+2nd Generation Majority$_{t-1}$+R & D Intensity$_{t-1}$+Patent$_{t-2}$+Family Management Percentage$_{t-1}$+Family Management adjusted by Firm Size$_{t-1}$+Nonfamily Insider Ownership$_{t-1}$+Institutional Ownership$_{t-1}$+Firm Size$_{t-1}$+Firm Age$_{t-1}$+Firm Risk$_{t-1}$+Prior Firm Performance$_{t-1}$+Current Ratio$_{t-1}$+Debt-to-Equity

Ratio$_{t-1}$+Internationalization$_{t-1}$+Retail$_{t-1}$+Service$_{t-1}$+Manufacturing$_{t-1}$+Inverse Mill Ratio (first family generation)+Inverse Mill Ratio (second family generation)

Model 4: Tobin's Q_t (adjusted by SIC2 industrial average)=Constant + Patent$_{t-1}$ + R & D Intensity$_{t-2}$ + 1st Generation Majority$_{t-1}$ + 2nd Generation Majority$_{t-1}$ + Patent$_{t-1}$ × 1st Generation Majority$_{t-1}$ + Patent$_{t-1}$ × 2nd Generation Majority$_{t-1}$ + R & D Intensity$_{t-2}$ × 1st Generation Majority$_{t-1}$ + R & D Intensity$_{t-2}$ × 2nd Generation Majority$_{t-1}$ + R & D Intensity$_{t-1}$ + Patent$_{t-2}$ + Family Management Percentage$_{t-1}$ + Family Management adjusted by Firm Size$_{t-1}$ + Nonfamily Insider Ownership$_{t-1}$ + Institutional Ownership$_{t-1}$ + Firm Size$_{t-1}$ + Firm Age$_{t-1}$ + Firm Risk$_{t-1}$ + Prior Firm Performance$_{t-1}$ + Current Ratio$_{t-1}$ + Debt-to-Equity Ratio$_{t-1}$ + Internationalization$_{t-1}$ + Retail$_{t-1}$ + Service$_{t-1}$ + Manufacturing$_{t-1}$ + Inverse Mill Ratio (first family generation) + Inverse Mill Ratio (second family generation)

Models 1 and 3 are set as the baseline, while interactions are added in Models 2 and 4. In addition, we test for the mediation effect of patent in Model 4 by entering the individual term of R & D intensity and the interactions between R & D intensity and family ownership by generations.

Analysis

Tables III and IV shows the regression results. *H1* argued that the founding generation's majority in family ownership positively moderates the value creation link between innovation input and innovation output as the positive link becomes stronger in family firms with the founding generation's majority compared to non-family firms. *H2* suggested that the family firms with second or later generation's majority negatively moderates the value creation link as the positive link becomes weaker in the family firms with second or later generation's majority compared to non-family firms. In the first model of value creation (Model 1, Table III), the estimated coefficient of R & D intensity is negative and insignificant ($B=-21.41$; $p > 0.10$), suggesting that, in general, investment in innovation input does not significantly contribute to value creation in innovation output by itself. We enter interactions in Model 2,Table III. *H1* is not supported as the interaction between first generation family ownership and R & D intensity is insignificant ($B=83.69$; $p > 0.10$). However, *H2* is supported as the interaction between the second and later generation family ownership and R & D intensity is negative and significant ($\beta=-117.46$; $p < 0.001$).

Dependent variable	Patent (adjusted by industrial average) in $t-1$	
	Model 1	Model 2
Constant	34.79	28.45*
1st generation majority$_{t-2}$	1.05***	1.29***
2nd generation majority$_{t-2}$	0.91	5.34***
R&D intensity$_{t-2}$	−21.41	−19.86
1st generation majority$_{t-2}$×R&D intensity$_{t-2}$		83.69
2nd generation majority$_{t-2}$×R&D intensity$_{t-2}$		−117.46***
Family management (%)$_{t-2}$	36.04	18.64
Family management (size)$_{t-2}$	−145.71*	−324.97
Nonfamily insider ownership$_{t-2}$	−1.37	−1.44****
Institutional ownership$_{t-2}$	−0.59	−0.55
Firm age$_{t-2}$	0.03*	0.05***
Firm size$_{t-2}$	−4.21****	−2.78
Firm risk$_{t-2}$	0.05	0.03
Prior firm performance$_{t-2}$	−0.91	0.61
Internationalization$_{t-2}$	0.16**	0.16**
Current ratio %$_{t-2}$	0.00***	0.001***
Debt-to-equity ratio %$_{t-2}$	0.01	0.01
Retail	−0.06	−6.43***
Service	7.61***	8.68***
Manufacturing	−1.37	−1.65****
Inverse Mill ratio (first and second generation)	Yes	Yes
R^2	0.113	0.097
F	2.808***	2.720***

Notes: Unstandardized coefficients are reported. *,**,***,****Significant at 0.10, 0.05, 0.01 and 0.001 levels, respectively

Table III Fixed effects longitudinal regression analysis of value creation

Dependent variable	Tobin's Q (adjusted by industrial average) in t	
	Model 3	Model 4
Constant	−1.15	−0.97
1st generation majority$_{t-1}$	−0.06***	−0.19*
2nd generation majority$_{t-1}$	−0.01****	−0.01
Patent$_{t-1}$	0.001****	0.00
Patent$_{t-2}$	0.002***	0.002***
1st generation majority × Patent$_{t-1}$		0.004*
2nd generation majority × Patent$_{t-1}$		0.0001
R&D intensity$_{t-1}$	−2.46	−2.62
R&D intensity$_{t-2}$	2.26****	2.15****
1st generation majority × R&D intensity$_{t-2}$		4.68
2nd generation majority$_{t-2}$ × R&D intensity$_{t-2}$		−0.57****
Family management (%)$_{t-1}$	−1.58	−1.44
Family management (size)$_{t-1}$	0.12	0.06*
Non-family insider ownership$_{t-1}$	−0.02	−0.02
Institutional ownership$_{t-1}$	0.00	0.00
Firm age$_{t-1}$	0.00	0.00
Firm size$_{t-1}$	−0.02	−0.07
Firm risk$_{t-1}$	0.01*	0.01**
Prior firm performance$_{t-1}$	0.56***	0.56***
Internationalization$_{t-1}$	−0.01	0.00
Current ratio %$_{t-1}$	−0.02	−0.02
Debt-to-equity ratio %$_{t-1}$	0.00	0.00
Retail	0.82****	0.61
Service	0.12	0.16
Manufacturing	0.18	0.24
Inverse Mill ratio (first and second generation)	Yes	Yes
R^2	0.204	0.223
F	19.10***	18.72***

Notes: Unstandardized coefficients are reported. *,**,***,****Significant at 0.10, 0.05, 0.01 and 0.001 levels, respectively

Table IV Fixed effects longitudinal regression analysis of value appropriation

We test value appropriation in family business vie Models 3 and 4 in Table IV. *H3* argued that the founding generation's majority in family ownership positively moderates the value appropriation link between innovation output and firm performance as the positive link becomes stronger in family firms with founding generation's majority compared to non-family firms. *H4* suggested that second or later generation's majority negatively moderates the value appropriation link as the positive link becomes weaker in family firms with the second or later generation's majority compared to non-family firms.

In the first model of value appropriation (Model 3, Table IV), the estimated coefficient of patents in $t-1$ term is positive and marginally significant ($B=0.001$; $p < 0.10$), meaning that, in general, innovation output positively contributes to firm performance. In addition, the estimated coefficient of R & D intensity in $t-2$ team is positive and marginally significant ($B=2.26$; $p < 0.10$). Combined, it seems like that R & D intensity has a positive effect on firm performance not fully mediated by patent. *H3* is supported as the interaction between first generation family ownership and patents is positive and significant ($B=0.004$; $p < 0.05$). *H4* is not supported as the interaction between the second and later generation family ownership and patents is negative but insignificant ($B=0.0001$; $p > 0.10$). In addition, the interaction between the second and later

generation family ownership and R & D intensity in $t-2$ term is negative and marginally significant ($B=-0.57$; $p < 0.05$). This would suggest that regarding the effect on firm performance, second or later generation family owners may have weaker externalities of R & D intensity not captured by patent in comparison to nonfamily owners. Combined with what we have found in Table III, it seems like that second generation family owners are inferior in value creation as well as the externalities of R & D investment not captured through the mechanism of patent.

Robustness test

To ensure our results are not artificial, we run two additional tests to ensure the robustness of our results. First, we replace our DV in Models 3 and 4 into Return on Equity. Again this variable is adjusted by SIC2 industrial average. The regression results remain the same as *H2* and *H3* are supported while *H1* and *H4* are not. Second, for all models, we set the time lag between dependent variable and others into two years. This reflects the fact that both value creation and value appropriation take time. Indeed, the process to transfer R & D investment into patent and the process to transfer patent into firm performance may take more than one-year. Again regression results are consistent with our primary findings. We conclude our results are robust.

5. Discussion

We extend the family business studies on innovation by distinguishing between two important stages, namely, the value creation and value appropriation in publicly traded family firms. First, we operationalize the registration number of patents of public-traded firms as the innovation output and explore the value creation process where R & D intensity (innovation input) is transformed into registered patents (innovation output). Then, we explore the value appropriation process by investigating the link between number of patents (innovation output) and Tobin's *Q* (firm performance) (Lawson *et al.*, 2012). Furthermore, we differentiate between family ownership with the founding generation's majority and family ownership with the second or later generation's majority and examine their distinctive capabilities on value-creation and value-appropriation processes in innovation in publicly traded family firms.

Longitudinal regression analyses based on 285 yearly cross-firm S & P 500 observations yields several insights. First, we found that family ownership with second or later generation's majority exhibits lower levels of value creation capabilities compared to non-family firms, whereas there is no difference between those of the firms with family ownership with a first generation's majority and non-family firms. This is in contrast with the simplistic view suggesting that family firms start resembling non-family firms in later generations. According to our findings, the diminishing family influence in later generation family firms make them behave differently than both the first generation family firms and non-family firms. Hence, diminishing family influence in second or later generations does not automatically make them resemble non-family firms. Instead, both the first generation and the second or later generation publicly traded family firms may have similarities and differences from non-family publicly traded firms in their strategic decisions and implementation based on the level of SEW concerns and the nature of family influence. Second, we also found that family owned firms with a first generation's majority have

higher value appropriation abilities compared to non-family firms, while there is no significant difference in value appropriation between the later generation family firms and non-family firms.

It should be noted that *H1* suggests that founding generation family businesses are more capable of creating values in innovation compared to non-family firms. This hypothesis is not supported by our regression results as the founding generation and non-family firms have no significant difference in value creation. It appears that when the founding generation family firms and non-family firms invest into R & D, family influence and SEW concerns do not play a substantial role in creating value.

It is equally important to acknowledge that *H4* is not supported as we did not find any significant difference between second or later generation family firms and non-family firms in value appropriation. This may be because of later generation family firms' short-term orientation similar to that in non-family firms owing to less SEW concerns and family influence over the business, whereas founding generation family firms, with long-term orientation and intentions to pass a successful business onto future generations, may place more value on turning innovation output into profits.

Our paper contributes to the family business, innovation, and KBV literature in several ways. First, previous family business studies drawing upon RBV and KBV often focus on the value creation based on bundles of valuable, rare, non-imitable, and non-substitutable resources or capabilities in family governance. While we generally agree with the direction of this prominent stream of research, we also suggest that the characteristics of knowledge in family governance may grant family firms certain advantages or disadvantages in value appropriation. Value appropriation is important as it reflects a firm's capabilities in restricting competitors' imitations hence help extract profits based on competitive resources. Nevertheless, to date, there is no other family business study investigating the innovation process comprehensively involving both value creation and appropriation stages. Overlooking the value appropriation phase may suggest that established family businesses' competitive advantages are only temporary and non-sustainable in the long term.

Second, our model extends the strategy literature on family firms by suggesting that the performance differences between family and non-family firms and the variance within the family business population are not only rooted in family firms' propensity to establish certain strategies (e.g. Chrisman and Patel, 2012), but also stem from the family firm's capabilities in implementing strategies and turning strategies into firm performance. Indeed, overlooking the latter may imply that once a strategy is established, its consequences are the same in both family and non-family firms. We suggest a two-stage system regarding how an innovation strategy (R & D investment) may lead to certain innovation output, which further contributes to the accumulation of firm performance. Indeed, we believe that the consequences of this strategy in family business (i.e. the link between strategy formulation and firm performance), is an under researched yet promising area that demands more research attention in future.

Third, we intentionally build our theory by drawing upon SEW. SEW is often conceptualized as family centered goals that may have direct impact upon family firm strategies (Gómez-Mejía *et al.*, 2007; Berrone *et al.*, 2012). Nevertheless, we argue that the SEW can also be an underlying

factor in value creation as well as the value retention and prevention from spillover or imitation from competitors. This perspective enriches our understanding of the SEW perspective in family business, as our framework suggests that SEW is not only a goal but also a source of resources and capabilities that are non-imitable and non-substitutable.

Fourth, our findings suggest that generational differences in family owned firms not only influence value creation, but also value appropriation. Previous studies on generational differences often highlight the fact that founding- and second or later-generations vary according to their SEW concerns, hence founding and later generations differ in their formulation of strategies as certain strategies may potentially mitigate or enhance the SEW of the owning family. Our study extends this line of research by arguing that generations also differ regarding their characteristics of knowledge embedded in the family governance, which may facilitate or hinder the realization of financial wealth. In particular, our results show that the family owned firms with first generation's majority are more successful than the family owned firms with second or later generation's majority in both value creation and value appropriation. This is in line with research suggesting that some dynastic wealthy families develop more interest in maintaining the status quo through preserving old capital rather than being innovative and actively participating in the political arena to influence public policies, which consequently prevent capital mobility and retard economic growth in a broader sense (Morck *et al.*, 1998;Morck and Yeung, 2003; Morck and Steier, 2005). After an optimum level of wealth has been achieved over generations, family business members belonging to the second or later generation may prefer to pursue the private benefits of control, rather than economic goals, such as profitability on innovations. Therefore, publicly traded family firms are not only different from non-family publicly traded family firms, but also other publicly traded family firms.

Fifth, our findings also suggest that although, in general, family firms may have disadvantages in creating value in innovation, at least some family owned firms, especially those with first generation's majority, have advantages in appropriating profits from innovation activities. Similarly, our results imply that inferior performance in second or later generation family firms may stem from their limitations in value creation and value appropriation.

5.1. Limitations

Although this paper may contribute to the family business literature in several ways, it is also important to state its limitations. First, this study is limited by its sample in analysis. We used a sample of firms listed in the S & P 500 from 2002 to 2006, suggesting that our US data may restrict the generalizability of our findings in a global context. It has been noted that the spillover of knowledge and mobility of employees are both determined by contextual conditions (Campbell *et al.*, 2012), meaning that relationship we found may be contingent upon the external environment. Hence, future research needs to examine our model across countries.

Second, we operationalize the family firm variable using two types of family ownership. However, it is likely that the owning family's impact also stems from a day-to-day involvement in business besides the influence in the dominant coalition. Although we intend to control for the number of family members in management and the board, more insights may be gained by

exploring the format and pattern that family managers actually follow to make decisions in value creation and value appropriation.

Third, we conceptualize capabilities as the efficiencies of transforming innovation input into innovation output and transforming innovation output into firm performance. Accordingly, we explore the moderating roles of founding- and later- generation family businesses in value creation and value appropriation. It should be mentioned that innovation can be measured in alternative approaches, such as an innovation index (Hoffman *et al.*, 1998), although these measures are often found positively correlated to innovation input and output (Romijn and Albaladejo, 2002). It would be helpful if future studies may apply different conceptualizations and accordingly, different measures of innovation to test the validity of our study.

The limitations of this paper can also lead to a number of future research directions. First, as stated above, the regulatory context can affect the observed relationships and generalizability to the corporations around the world since the sample included S & P 500 firms headquartered in the USA. Even though increased globalization tends to cause similarities in business conduct in world economies, different legal regimes (e.g. common vs civil law) in different countries can result in differences in value creation and value appropriation. For example, the legal system in the USA has placed a longstanding importance on intellectual property protection, whereas the legal system in other countries may not provide the regulations and protection available in the USA. This may further limit value creation and appropriation in those countries for both family and non-family firms. Hence, since the legal context may be influential on the findings of this paper, future studies can test or extend the model in other countries with different legal systems.

Similarly, despite the panel data analyses examining multiple years, the findings may vary in other time periods owing to the changes in the legal system regarding intellectual property protection and economic conditions which may affect the filing of patents due to cost. Therefore, future research can investigate different time periods than in our study.

5.2. Other implications for future research

Aside from the future research directions suggested in the discussion of findings and limitations, there may be other factors that may affect the value creation and value appropriation in publicly traded family firms. The imminence of succession (Chua *et al.*, 2003) and succession planning are some of them. Furthermore, the effects of generational differences on value creation and appropriation might vary in family firms depending upon diversification (Anderson and Reeb, 2003b; Jones *et al.*, 2008), entrepreneurial orientation (Dess and Lumpkin, 2005; Lumpkin and Dess, 1996, 2001), corporate entrepreneurship (Dess *et al.*, 1999; Lumpkin *et al.*, 2005), and life-cycle phases. All these contingencies suggest additional applications of RBV and KBV to the study of family businesses.

Furthermore, value creation and value appropriation might vary in family firms depending upon the TMT characteristics (i.e. heterogeneous vs homogeneous), board composition (i.e. proportion of insiders, outsiders, and related outsiders) (Anderson and Reeb, 2004), board independence (Klein *et al.*, 2005), CEO duality (Zahra, 2003), leadership styles of family managers and directors (Bass, 1990), social capital (Sirmon and Hitt, 2003), strategic networks (Arregle *et al.*,

2007), image concerns (Memili *et al.*, 2010a, b), and life-cycle phases. All these factors suggest additional applications of RBV and KBV to the study of family businesses.

5.3. Implications for practice

The transgenerational success of publicly traded family firms depends on transgenerational value creation as well as value appropriation. First generation family firms that are successful in both value creation and value appropriation through effective knowledge management also hold the dual duty of fostering a learning culture to reduce the knowledge gap between generations and helping future successors develop absorptive and retentive capacities to facilitate knowledge transfer from one generation to the other. Both structured and less structured knowledge transfer processes may be necessary to facilitate exchanges, interactions, and ease of communication within the context of publicly traded family firms. Furthermore, intra-firm causal ambiguity of knowledge can be lowered through first generation family business leaders' articulating to younger generation. Accordingly, intra-family succession plans need to involve knowledge transfer and management guidance as well. These can be facilitated by Human Resource Management activities in the forms of formal training programs with the participation of the active (and retired) senior generation management and the formal assignment of senior generation mentors (as well as informal mentoring) to the managers from later generation. Thereby, the senior generation managers can guide the younger generation managers and transmit critical information concerning innovation during and after their term of active duty.

If publicly traded family firms can elevate the positive effects of generational differences and mitigate the negative effects, they can achieve long-term competitive advantages and superior performance. Publicly traded family firms concerned with maximizing shareholder value through both value creation and appropriation in innovation will be sought after by investors and reap the benefits of positive corporate publicity.

6. Conclusion

In conclusion, this paper provides the RBV and the KBV perspectives to generational differences and innovation in publicly traded family firms. The differences between family and non-family firms as well as among family firms themselves presented in this paper can help scholars, family business members, and investors better understand family involvement, and how it impacts firm performance through value creation and value appropriation.

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