TO PATENT OR NOT TO PATENT: THAT IS THE QUESTION. INTELLECTUAL PROPERTY PROTECTION IN FAMILY FIRMS

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ABSTRACT

This study examines family firms' propensity to protect their intellectual property through patents. Building on the mixed gamble logic of the behavioral agency model, we theorize that family ownership has a U-shaped relationship with firm propensity to patent. Specifically, we argue that family firms' desire to prevent losses of *current* socioemotional wealth inhibits their propensity to patent until a threshold level of family ownership, beyond which the family's socioemotional wealth is secured and a greater focus on *prospective* financial gains attainable through patents is possible. We also suggest that environmental munificence moderates this nonlinear relationship such that a low-munificent environment accentuates the potentially detrimental (beneficial) effects of low-to-medium (medium-to-high) levels of family ownership on patents. We test our hypotheses on a sample of 4,198 small- and medium-sized family firms.

KEYWORDS: Intellectual property protection, patent, innovation, environmental munificence, family firms

INTRODUCTION

The innovation strategies of family firms involve the consideration of gains and losses, not only in financial terms but also in relation to socioemotional wealth (SEW) (e.g., Chrisman & Patel, 2012; Gomez-Mejia et al., 2014). For example, prior studies have shown that family firms' aversion to SEW losses reduces their propensity to make risky R&D investments (Chrisman & Patel, 2012; Patel & Chrisman, 2014), acquire external technology (e.g., Kotlar, De Massis, Frattini, Bianchi, & Fang, 2013) or develop radical innovations (e.g., Nieto, Santamaria, & Fernandez, 2015). This line of research has provided a wealth of important insights into the impact of SEW on family firms' value creation activities, such as R&D and new product development. However, the question of whether and how SEW also affects family firms' differential propensity to capture value from innovation has received scarce theoretical and empirical attention.

Some studies have examined the relationship between family ownership and firm propensity to patent (e.g., Bannò, 2016; Block, 2012; Jell, Block, Henkel, Spiegel, & Zischka, 2015), albeit yielding mixed results. However, most of the existing studies conceptualized patents simply as a proxy for innovation outputs (e.g., Duran, Kammerlander, Van Essen, & Zellweger, 2016) and thus largely overlooked the strategic implications of patenting in family firms. In contrast, innovation scholars have emphasized patenting as a central aspect of a firm's innovation strategy (e.g., Leiponen & Byma, 2009), as patents can help appropriate greater returns from innovation by legally excluding competitors from using a firm's underlying knowledge (e.g., Somaya, 2012). This literature suggested that patents can lead to superior financial returns but can also entail significant costs (e.g., Bloom & Van Reenen, 2002; Ernst, 2001; Mann & Sager, 2007). Nevertheless, the innovation literature has provided only a limited account of the firm-internal drivers of patenting decisions, limited to financial considerations (e.g., Blind, Edler, Frietsch, & Schmoch, 2006; Reitzig & Puranam, 2009). In family firms, the decision to patent is further complicated by the possibility that patenting comes at the expense of SEW losses for the family, such as diverting resources from traditional lines of business, disclosing tacit knowledge, increasing reputational risks, or creating dependence on external sources of finance and specialized human capital. Considered together, this discussion suggests that the trade-offs between financial wealth and SEW are an important, yet little understood, internal driver of heterogeneity in firms' patenting activities.

To explain these trade-offs, we rely on the mixed gamble logic of the behavioral agency model (BAM) (Gomez-Mejia et al., 2014; Gomez-Mejia, Patel, & Zellweger, 2018; Martin, Gomez-Mejia, & Wiseman, 2013). Specifically, we argue that IP protection through patents implies a trade-off between: (1) *benefits* in terms of gains in *prospective* financial wealth and (2)

costs in terms of losses in the family's *current* SEW. We theorize that family firms frame the value of benefits and costs of patenting differently, depending on the degree of family ownership (Gomez-Mejia, Cruz, Berrone, & De Castro, 2011; Zellweger, Kellermanns, Chrisman, & Chua, 2012), with family firms' propensity to patent initially decreasing at low-to-medium levels of family ownership to protect current SEW but then increasing beyond a threshold level when current SEW is safe, and prospective financial gains can be prioritized. Thus, we hypothesize a U-shaped relationship between family ownership and patents. Moreover, we introduce a further theoretical refinement by examining the role of environmental munificence (i.e., the availability of critical external resources; Moss, Payne, & Moore, 2014; Sirmon, Hitt, & Ireland, 2007) as an important external factor within the behavioral theory model (e.g., Greve & Teh, 2018). We argue that family firms' framing of gains and losses in mixed gambles varies across contexts such that the trade-off between financial wealth and SEW is more stringent in less munificent environments, strengthening the negative (positive) effects of low-to-medium (medium-to-high) levels of family ownership on firms' propensity to patent.

Our analysis of 4,198 small- and medium-sized family firms (family SMEs) supports our hypotheses. These results make three important contributions toward a better understanding of innovation strategy in family firms. First, our study elucidates the role of SEW in family firms' strategies for capturing value from innovations, thereby complementing existing research that has largely focused on value creation activities and disclosing the strategic implications of patenting in family firms. Second, it elucidates the trade-offs between financial wealth and SEW underlying patenting decisions in family firms. Specifically, our study reconciles previous conflicting findings, suggesting that the framing and evaluation of patenting choices in family firms change depending on the level of family ownership, leading to a U-shaped relationship

between family ownership and patents. Relatedly, our study shows the value of a new analytical approach (Haans, Pieters, & He, 2016) to identify a "win/win" situation in which both financial and SEW goals are aligned and work in *tandem* (Gomez-Mejia et al., 2018), leading to greater propensity to patent. Finally, our results introduce environmental munificence as an important contingency factor influencing the aforementioned trade-off between the desire to preserve the family's current SEW and the desire to enhance prospective financial wealth when choosing whether to protect IP through patents, illuminating an important boundary condition for BAM as applied to family firm innovation strategy (e.g., Chrisman & Patel, 2012; Gomez-Mejia, Makri, & Kintana, 2010).

CONCEPTUAL BACKGROUND

Intellectual Property Protection through Patents

A firm's ability to benefit from investments in knowledge creation is a central concern in innovation and technology policy (Leiponen & Byma, 2009). The opportunity to appropriate returns from innovation is one of the key incentives for innovation investments (Levin, Klevorick, Nelson, & Winter, 1987) and a justification for the IP rights system itself (Gallini, 2002; Kultti, Takalo, & Toikka, 2006). Among different appropriation strategies, patenting is one of the most frequently used (see, e.g., Somaya, 2012). For example, Makri, Hitt, and Lane (2010) emphasized that any innovation derives from "the development of a new idea", which requires "the establishment of property rights on that idea" (p. 603), i.e., patents, representing the new knowledge that the firm is acknowledged as having created (Ahuja & Katila, 2001).

Thus, while patents represent advances in technology and are useful indicators of underlying value-creation activities, their primary purpose is to denote a property right conferred

to a firm and to preclude third parties from using the protected technology. As such, they require convincing a patent examiner of the sufficiently useful, novel, and nontrivial nature of the invention, as well as its commercial viability (Markman, Espina, & Phan, 2004; Reitzig & Puranam, 2009). In other words, obtaining patent protection is an instance of firms appropriating returns from their innovations by detailing the sophistication of their inventions (Guellec & Potterie, 2000; Makri, Lane, & Gomez-Mejia, 2006). Relatedly, research has shown that firms patent to prevent imitation from competitors, to constrain the R&D and patenting efforts of other firms, to earn licensing income, and to gain a stronger position in negotiations (Cohen, Nelson, & Walsh, 2000). Firms are also motivated to patent their intellectual properties to attract investors, build their images and reputations, and gain legitimacy in the market (Cohen et al., 2000). As such, IP protection through patents can lead to various benefits – including isolating mechanisms, quality signals, economies of scope, commercialization, or licensing (Helfat, 1997; Hsu & Ziedonis, 2013).

However, patenting also requires uncertain and significant investments that, as we detail later, also play important roles in firms' propensity to patent (see, e.g., Foss & Foss, 2005; Hanel, 2008; Hsu & Ziedonis, 2013). In fact, patenting entails several direct and indirect costs related to developing, attaining, and maintaining patent protection (Cohen et al., 2000). As Grube (2009) explained, a firm must add legal expenditures, such as patent application fees, renewal fees, and court costs in cases of infringement, to the internal R&D costs for developing the innovation. Other costs can be related to prototyping, supporting marketing initiatives, and the indirect costs of disclosing to competitors the knowledge that the firm is currently developing. In some cases, IP protection through patents can even have a detrimental effect on a firm's competitive position because it requires disclosing the underlying technology, which in turn can

increase competitors' knowledge and awareness of the firm's R&D efforts (Arundel, 2001). Relatedly, research also questions the effectiveness of patents as an IP protection mechanism, indicating the difficulties in assessing a patent's exact value, rendering it a rather illiquid asset (De Rassenfosse, 2012), if not a waste of money.

In summary, the innovation literature suggests that patenting is both important and challenging (Chirico & Salvato, 2016; Dougherty & Hardy, 1996), and innovation scholars have shown increasing interest in understanding the sources of heterogeneity in firms' propensity to patent (Blind et al., 2006). The existing research has paid special attention to exogenous factors, such as the intellectual property rights regime and industry structure (e.g., Cohen et al., 2000), but innovation scholars have also observed significant variations among firms operating in the same environment, suggesting that firm-level factors are likely to play an important role (Reitzig & Puranam, 2009).

Patenting in Family Firms

Prior research has indicated that family ownership is an important driver of firms' innovation strategies, although most of the existing literature on this topic has focused on value creation, rather than value capture (e.g., Chirico & Salvato, 2016; Duran et al., 2016). In fact, the few studies examining the link between family ownership and patenting behavior have provided somewhat mixed insights.

On the one hand, some scholars have suggested that family ownership can enable firms to mobilize internal and external resource stocks for patenting purposes (cf. Terziovski, 2010). For example, De Massis, Frattini, Pizzurno, and Cassia (2015) showed that patenting in family firms is facilitated by access to external sources of knowledge due to their unique social contexts, the family's long-term orientation, and the use of patient and survivability capitals. Accordingly,

Duran et al. (2016) and Matzler, Veider, Hautz, and Stadler (2015) found that family involvement enhances firm propensity to patent (see also Jell et al., 2015; Liang, Li, Yang, Lin, & Zheng, 2013), especially in first generation family firms (Memili, Fang, & Welsh, 2015). In contrast, other scholars (e.g., Anderson, Duru, & Reeb, 2012; Bannò, 2016; Block, Miller, Jaskiewicz, & Spiegel, 2013; Czarnitzki & Kraft, 2009; Tognazzo, Destro, & Gubitta, 2013) have suggested that the family is a liability that limits patenting activities because, as Classen, Carree, Van Gils, and Peters (2014) noted, family firms can select modest investment strategies that do not challenge their status quo. For example, Czarnitzki and Kraft (2009) showed that firms with concentrated ownership, such as family firms, tend to file fewer patent applications (see also Anderson et al., 2012; Block et al., 2013).

Unfortunately, existing research has commonly conceptualized patents simply as a proxy for innovation outputs (e.g., Block, 2012; Duran et al., 2016), largely overlooking the difficult and important trade-offs underlying family firms' patenting decisions. Family firms' innovation strategies are complicated by family owners' focus on nonfinancial goals, in addition to economic returns, as family owners tend to value both financial and socioemotional outcomes in their strategic decisions (Gómez-Mejia, Haynes, Núñez-Nickel, Jacobson, & Moyano-Fuentes, 2007; Gomez-Mejia et al., 2011, 2014; Gomez-Mejia, Neacsu, & Martin, 2017). This focus in turn suggests that fully appreciating the strategic implications of patenting behavior in family firms requires examining the potential gains and losses of patenting, compared to both financial wealth and SEW.

As noted earlier, a patenting strategy can offer the prospect of important financial gains for family firms. First, patents can be an important source of sustained economic gains over a long period of time, which are crucial to sustaining a family firm's competitive advantage across

generations (e.g., Hauck & Prügl, 2015; Jaskiewicz, Combs, & Rau, 2015). Research has shown, for example, that patents create options for expanding into new areas (Hsu & Ziedonis, 2013), which is important for allowing a family firm to grow into a multigenerational business (Ward, 2016). Second, patents constitute an isolation mechanism that prevents imitation and shields the firm from competitors (Barney, 1991), leading to greater returns from research investments, conferring technology-based first-mover advantages, affirming the family's name in the market and ensuring a continuous stream of financial wealth for family business owners and their descendants (Duran et al., 2016; Kellermanns, Eddleston, Barnett, & Pearson, 2008; Zahra, 2005). Third, numerous scholars have found that patent rights are important for financing activities, serving as a quality signal to potential investors (Hsu & Ziedonis, 2013) and customers (Gick, 2008), thus reinforcing the family owners' beliefs about the potential financial advantages of patenting.

Ideally, patenting can also offer family firms the prospect of potential gains in SEW for family owners since, for example, successful patents can have a positive impact on the family firms' identity and reputation. However, patenting also involves significant risks of SEW losses that can ultimately reduce family firms' propensity to patent. First, patenting requires firms to invest in innovations that are novel and sufficiently original to be worthy of patenting, but such breakthrough inventions are very rare and difficult to achieve (Dosi, 1982; Nelson & Winter, 1982). For example, patenting requires searching for ideas beyond the firm's existing knowledge boundaries (e.g., Jung & Lee, 2016), which might require family firms to de-emphasize the historic foundations of the firm and to divert resources away from their traditional business lines (Patel & Chrisman, 2014). Second, patenting entails disclosing information on the research conducted and new knowledge created (Ahuja & Katila, 2001; Long, 2002), which can lead to

losses of critical tacit knowledge that is an important source of survivability capital and a critical condition for successful generational succession (e.g., Cabrera-Suárez, De Saá-Pérez, & García-Almeida, 2001; Sirmon, Arregle, Hitt, & Webb, 2008).

Third, patents may be subject to legal challenges (Levin et al., 1987), which might negatively affect the family's image. Fourth, patenting is highly expensive and resource intensive because of the procedural costs involved (e.g., application and renewal costs, high-level fees, costs to fight patent infringements, litigation costs, patent lawyer costs; Cohen et al., 2000; Foss & Foss, 2005; Hanel, 2008; Hsu & Ziedonis, 2013; Somaya, 2012). These costs can require family firms to source external financial capital, thereby diluting the family's ownership stake in the firm, accepting restrictive covenants and reporting requirements that reduce the family's decision-making discretion, and increasing the risk of bankruptcy, which would entail the loss of all SEW. Finally, patenting activities entail the greater involvement of specialized human capital, managerial talent and expertise commonly not available within the family (e.g., Chrisman, Memili, & Misra, 2014; Verbeke & Kano, 2012), thereby reducing the family business owners' ability to exercise unconstrained authority, influence, and power (Cruz, Gómez-Mejia, & Becerra, 2010; Schulze, Lubatkin, & Dino, 2003).

Most of the above considerations taken as a whole could induce the family to experience a sense of control loss, which is one of the key elements of SEW (Berrone, Cruz, & Gomez-Mejia, 2012). Thus, family firms' aversion to accepting SEW losses is likely to prevail over their desire to gain financial wealth, leading to a lower propensity to patent.[1] However, patenting decisions

[1] We do not exclude the possibility that patents can enhance both financial wealth and SEW for family owners. However, although patenting can lead to some SEW gains, these gains are unlikely to counterbalance the potential losses associated with patenting. For example, a patent offers the prospect of reputational gains, which constitute a dimension of SEW, but these benefits are likely to be realized only if the patent is very successful, which is statistically unlikely. Conversely, the likelihood of an unsuccessful patent is much greater, implying that potential SEW losses outweigh potential SEW gains.

in family firms are rather complex as a result of their dual implications for family owners' financial wealth and SEW; hence, there might be specific conditions that favor an "interest alignment" between family firms' multiple goals *or* compatibility between SEW and economic utilities. In summary, a more complete understanding of family firms' propensity to patent requires explaining these trade-offs and identifying the conditions under which family firms are more or less likely to pursue the financial and nonfinancial benefits of patenting, despite the inherent risk of SEW losses.

Environmental Munificence

Behavioral theorists have recently acknowledged the complementary role of firm-internal drivers (e.g., performance-aspiration gaps) and external drivers of strategic decisions (for a recent review, see Greve & Teh, 2018). Accordingly, fully understanding family firms' patenting behaviors also requires considering the context in which they operate (e.g., Wright, Chrisman, Chua, & Steier, 2014). Organizations depend on their environments to provide resources to fulfill their missions and to operate their various systems (Pfeffer & Salancik, 1978). In turn, environments vary with respect to the types and amounts of resources available to a firm (Dess & Beard, 1984). Sirmon et al. (2007), for instance, considered environmental munificence "an important contingency factor in managing resources" (p. 278) for achieving competitive advantage. Munificence is the abundance or scarcity of critical resources within an environment, often associated with the growth opportunities in an industry (Castrogiovanni, 1991; Yasai-Ardekani, 1989). High-munificence environments tend to be associated with high-growth industries, characterized by reduced resource dependency and greater opportunities for growth (Brauer & Wiersema, 2012; Dess & Beard, 1984). In contrast, low-munificence (or constrained) environments are more closely associated with industries with declining demand, increasing

competition for a limited set of resources, and higher risks (Rajagopalan, Rasheed, & Datta, 1993). Such environments are often referred to as "tough environments where fewer opportunities are available" (Bradley, Shepherd, & Wiklund, 2011, p. 1071) and where firms might be "constrained in their ability to pursue activities that will enhance firm value" (Brauer & Wiersema, 2012, p. 1477).

Prior studies have indicated that environmental munificence is an important contextual variable explaining a firm's strategic choices (Karaevli, 2007; McArthur & Nystrom, 1991). However, patenting under different levels of environmental munificence remains poorly understood. Intuitively, high environmental munificence facilitates access to resources (such as raw materials, financial capital, and customers) that could support the pursuit of novel opportunities and thus promote innovation activities (e.g., Dess & Beard, 1984; Hitt, Ireland, Sirmon, & Trahms, 2011). However, tough (low-munificence) environments might provide few incentives for firms to favor familiar or mature solutions and strategies, instead encouraging them to adopt an innovative posture (see Jaskiewicz, Combs, Ketchen, & Ireland, 2016; Pearce, John, Fritz, & Davis, 2010). In other words, as Sirmon et al. (2007) theorized, low-munificence environments can increase the importance of managing resources effectively, as these resources might not be readily available to the firm when needed.

THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

To integrate the conceptual insights discussed above and to advance our understanding of patenting behavior in family firms, we rely on the behavioral agency model (BAM) of Wiseman and Gomez-Mejia (1998), which proposes that a decision maker's risk preferences change with the framing of problems. BAM suggests that firms' strategic decisions critically depend on problem framing, that is, whether decision makers frame problems as positive or negative, using

a reference point to compare anticipated outcomes with available options. Thus, "decision makers exhibit risk-averse preferences when selecting among positively framed prospects and exhibit risk-seeking preferences when selecting among identical but negatively framed prospects" (Wiseman & Gomez-Mejia, 1998, p. 135). More recently, building on the mixed gamble logic, Martin et al. (2013) extended BAM by arguing that decision makers are guided by the desire to preserve the firm's current wealth endowment; however, this desire can be reversed if prospective (future) wealth exceeds current wealth. In family firms, this endowment includes financial wealth, as well as a nonfinancial form of wealth, namely SEW, i.e., socioemotional wealth or affective wealth at risk, such as family control of, perpetuation of, and identification with the business (Gómez-Mejia et al., 2007). SEW thus represents an important affective stock that family firms are highly motivated to protect, even at the expense of forgoing significant financial gains (for a review, see Gomez-Mejia et al., 2011; Hoskisson, Chirico, Zyung, & Gambeta, 2017).

BAM and the mixed gamble logic emerged as important theoretical paradigms to explain trade-offs between financial wealth and SEW in family firms' strategic decisions (e.g., Gomez-Mejia et al., 2014, 2017, 2018; Kotlar, Signori, De Massis, & Vismara, 2018). As Gomez-Mejia et al. (2018, p. 1370) explained, "The financial and socioemotional utility dimensions are not fully fungible, and a change in one utility dimension often leads to an opposite change in the other utility dimension". For example, to protect the family's current SEW, a firm might perpetuate the family business owners' direct control over the firm's affairs and accept losses to the firm's prospective financial wellbeing. However, although family control through firm ownership is a necessary condition for the family to develop SEW, such control can have a threshold effect on SEW. That is, family ownership can increase loss aversion with respect to

current SEW up to a threshold level, but family ownership beyond this threshold might not further increase loss aversion (as the family gains more control, enjoying a secure position) and might thus stimulate strategic choices to maximize prospective financial wealth (Zellweger et al., 2012). In other words, higher levels of family ownership can induce family owners to focus more on enhancing prospective financial gains (Gomez-Mejia et al., 2014, 2017, 2018; Martinet al., 2013).

Based on this research, we contend that clarifying the link between the mixed gamble BAM logic and IP protection through patents can provide a better understanding of the role of family ownership in fostering or hindering the propensity to patent. Moreover, as discussed above, the importance and trade-off between SEW and financial utilities can also differ among family firms, depending not only on the internal level of family ownership but also on the external environmental conditions. In the following sections, we build on these arguments to develop our hypotheses on how family ownership can impact a firm's choice to undertake IP protection through patents and how environmental munificence can moderate this relationship.

Family Ownership and Intellectual Property Protection through Patents

We propose that family control through a family's ownership stake in the firm influences a family firm's propensity to patent, and the direction of this effect depends on the degree of family ownership. The decision to protect a firm's IP through patents is dictated by the perceived benefits and costs of such decisions, in turn relating to the financial and socioemotional endowments of the family firm. Therefore, we argue that the benefit and cost functions of patenting are likely to vary for different levels of family ownership.

As the level of family ownership increases *from low to medium*, we expect that the perceived prospective financial-related benefits of patenting (e.g., new revenue streams and

stronger market position; Duran et al., 2016) remain uncertain, while the perceived current SEW-related costs of patenting tend to increase considerably. In fact, in this situation, family owners will perceive that patenting activities can pose a serious hazard to the family's *current SEW* in terms of diverting resources from traditional business lines, disclosing tacit knowledge, increasing reputational risks, and creating dependence on external sources of finance and specialized human capital otherwise not available within the family group. Patenting is thus likely to be perceived from a loss/cost perspective (placing current SEW at risk, while also requiring significant resource commitments with uncertain financial returns) rather than a gain/benefit perspective (the potential to enhance both SEW and financial wealth). Using the terminology of the mixed gamble BAM logic (Gomez-Mejia et al., 2014, 2017, 2018; Martin et al., 2013), given the potential loss of current SEW and the insecure family ownership position to defend it, family owners are more likely to sacrifice potential yet uncertain prospective (financial) wealth to preserve current SEW.

However, as the level of family ownership increases further *from medium to high*, which implies a secured threshold level of family ownership in the firm, we predict that the family owners' concerns about potential losses of current SEW are likely to diminish due to their safe and tight control over the business. With a secure level of SEW, family firms with a higher degree of family ownership beyond a certain threshold can accrue some SEW utilities from patenting (as discussed earlier, such as a positive identity and an enhanced image, without a concomitant decrease in family control). Thus, patenting becomes an appealing strategic choice with a high upside in terms of prospective financial gains and a low downside in terms of current SEW losses. More specifically, first, family owners will perceive that patenting will provide sustainable sources of advantage, creating potential financial growth options for the future of the

business (Hall, 1992), thereby ensuring continuity of the family dynasty. Hence, under higher family ownership, patenting efforts will be perceived as having positive long-term effects on the family's prospective financial wealth and the related future SEW by increasing the family's reputation and image, ensuring the preservation of the family dynasty, securing additional resources to invest in identity-enhancing community projects, providing job opportunities for family members in various positions and so on. In short, applying a mixed gamble BAM logic (Gomez-Mejia et al., 2018), increased ownership from medium to high in the hands of the family allows the firm to focus more on patenting activities, as these efforts are unlikely to damage the family's current socioemotional endowment while strengthening the distinct possibility that the family will be able to garner dual financial-SEW prospective gains. This situation creates alignment or compatibility between SEW and financial returns (Martin & Gomez-Mejia, 2016).

In summary, the mixed gamble BAM logic suggests that the relationship between family ownership and IP protection through patents is a function of both prospective financial gains and potential SEW losses. Our theoretical analysis is illustrated in Figure 1, which plots the potential financial benefits of patenting for future financial wealth along with its inherent costs for current SEW, thereby enabling a combined analysis of their net effects (Haans et al., 2016). Our analysis suggests that, as family ownership increases, the perceived patenting-related benefits in terms of future financial gains are believed to increase substantially only beyond an ownership threshold level (Figure 1a), whereas perceived patenting-related costs in terms of potential losses to current SEW are believed to increase substantially but with diminishing returns beyond an ownership threshold level (Figure 1b). Thus, we argue that, as family ownership increases, family firms must balance the (increasing) benefits of patenting in terms of prospective financial wealth against the (decreasing) costs of patenting in terms of potential losses of current SEW.

Subtracting the perceived patenting-related costs from the perceived patenting-related benefits, we expect that there will be a threshold level of family ownership beyond which the perceived costs will outweigh the perceived benefits of patenting (Figure 1c). Specifically, we believe that patenting will not further increase loss aversion to current SEW when the family has greater ownership control over the business; thus, a threshold level of SEW is secured, and a focus on future gains is more likely. That is, the costs of patenting on current SEW will taper off, while the benefits of patenting on future financial wealth will increase substantially after a certain family ownership level (from medium to high). In this situation, the family might perceive IP protection through patents as a "win/win" strategy, whereby both future financial welfare and SEW are enhanced in tandem, thus stimulating family firms' propensity to patent[2].

Insert Figure 1 about here

Together, these two predictions suggest that the least advantageous combination of the costs and benefits of patenting in relation to family ownership will predominate at intermediate levels of family ownership such that the combined effects will result in a U-shaped relationship (Haans et al., 2016) between family ownership and IP protection through patents (Figure 1c). Formally:

> **Hypothesis 1**: *There is a U-shaped relationship between family ownership and IP protection through patents.*

The Moderating Role of Environmental Munificence

Hypothesis 1 establishes a baseline for understanding family firms' propensity to patent, based on the inherent trade-off between financial gains and SEW losses. However, advancing our understanding of the role of family ownership in enhancing or hindering firm patenting requires considering the role of the context in which such trade-offs are framed and evaluated.

[2] This notion is in line with Zellweger et al.'s (2012) arguments that family ownership increases loss aversion with respect to current SEW up to a threshold level, beyond which such a threshold will no longer increase loss aversion.

Therefore, we analyze the contingency role of environmental munificence, which we predict influences how family owners perceive losses and gains linked to IP protection through patents. Specifically, we propose that the U-shaped relationship between family ownership and patent activities is moderated by environmental munificence. That is, a low-munificence environment accentuates both the potential detrimental effects of low-to-medium levels of family ownership on patents and the potential beneficial effects of medium-to-high levels of family ownership on patents.

From *low-to-medium levels* of family ownership, a low-munificence environment will render the current family's perceived SEW-related costs of patenting more pronounced (vis-à-vis high-munificent environments) and the perceived potential prospective financial-related benefits of patenting less likely. In other words, the combination of unsecured family ownership and a tougher environment renders the negative effects of family ownership on IP protection through patents more negative. In fact, in such a context, as competition for resources intensifies, it becomes more difficult (and expensive) for family firms to obtain funding to finance investments and the additional costs of patenting (Foss & Foss, 2005), indicating that lenders are likely to have asymmetric power relative to the firm (Desa & Basu, 2013) and will be able to impose more restrictive covenants and requirements that family owners will perceive as hazardous to their SEW. In a low-munificence environment, it is also more difficult to find specialized human capital, managerial talent and expertise to support patenting (Bannò, 2016), as competition for human resources intensifies. For instance, prior research has shown that it is difficult for firms to extract quality resources, such as labor and skills, from a low-munificence environment (Desa & Basu, 2013). Thus, when facing external pressures and weak internal family power (see Lumpkin & Brigham, 2011; Nordqvist, Habbershon, & Melin, 2008) maintaining the status quo (a course

of action that does not require debate and provides familiarity for family owners; Chirico, Sirmon, Sciascia & Mazzola, 2011) becomes the likely strategic choice to protect the current family's SEW. In short, higher perceived losses of current SEW compared to the unlikely perceived gains of future financial wealth shift the decision of family firms with low-to-medium levels of family ownership toward patenting even less than in a low-munificence environment.

However, with *medium-to-high levels* of family ownership, a low-munificence environment will render the perceived prospective financial-related benefits of patenting more prominent and the current family's perceived SEW-related costs of patenting less relevant. Specifically, when a certain level of family ownership is secured, and the business is facing an environment characterized by decreased profitability, reduced access to key resources, and threats to the survival of the business, family owners might perceive greater value of the potential benefits of patenting to increase future financial gains while reversing the decline in profitability. That is, the likelihood that SEW considerations take precedence over economic considerations will further decrease from medium-to-high levels of family ownership when the firm faces economic hazards (Gómez-Mejia et al., 2007, 2010), as in the case of low-munificence environments. For example, Lumpkin, Brigham, and Moss (2010) suggested that a fully family-owned firm with a long-term orientation is more likely to take initiative and explore new opportunities in uncertain environments in an attempt to revitalize the business and mitigate the risk of losing it altogether (cf. Bradley et al., 2011). Additionally, Dyer and Mortensen (2005) and Moss et al. (2014) argued that hostile environments pressure wholly owned family firms to change strategic direction, enabling them to outperform their nonfamily firm counterparts by exploring multiple options needed to survive. In so doing, their members will mitigate the risk of negative outcomes and focus more on enhancing the prospective potential

financial gains (perceived benefits) of IP protection through patents and less on the current potential SEW losses (perceived costs). In other words, following the mixed gamble logic, when environmental munificence is low, making firm failure a distinct possibility, family owners with a secured family ownership level in the firm will more likely engage in patenting activities to enhance prospective wealth while ensuring the family dynasty for the future. Thus, under adverse conditions, family owners will become more aware of the need to patent their innovations to sustain the family firm's future competitiveness. As Gomez-Mejia et al. (2010) explained, "If the firm fails to survive, SEW would be completely lost, and given this possibility [which would be perceived as more likely in difficult scenarios] the relative utility of preserving [current] SEW at the expense of bearing higher business risk should decline accordingly" (p. 232). Therefore, we hypothesize the following:

> **Hypothesis 2:** *Environmental munificence moderates the U-shaped relationship between family ownership and IP protection through patents in such a way that the negative effects of low-to-medium levels of family ownership will become more negative and the positive effects of medium-to-high levels of family ownership will become more positive, resulting in a steeper U-shaped relationship when environmental munificence is low compared to high.*

METHODOLOGY

Sample

We used secondary data obtained from the ORBIS database of Bureau Van Dijk to test our hypotheses. To ensure that patenting is relevant to the companies, we relied on a sample of Italian private family SMEs operating in medium- to high-tech industries. In particular, we considered the mechanical sector, which is one of the most innovative and profitable industries in the Italian market (ISTAT, 2013a). Moreover, the mechanical sector ranks first in Italy in terms of exports (ISTAT, 2013b) and is one of the main bearers of the *Made in Italy* designation (ISTAT, 2010). We focused on companies in which the majority of equity is owned by a family

compared to other shareholders and with at least one family member serving on the board of directors (see also Chrisman & Patel, 2012; Gomez-Mejia, Larraza-Kintana, & Makri, 2003; Patel & Chrisman, 2014). Following previous studies (e.g., Gomez-Mejia, Nunez-Nickel, & Gutierrez, 2001; Miller, Minichilli, & Corbetta, 2013), we identified family relationships and the related family actors through the family name. In this manner, we obtained a sample of 4,198 family firms with complete information on the corporate governance structures, ownership, and financial and patent indicators.

Variables

We measured our dependent variable, *IP protection through patents*, as the sum of patent applications of a family firm over a 5-year period (2007-2011) (e.g., Makri et al., 2010; Shan, Walker, & Kogut, 1994). Following previous studies (Heeley & Jacobson, 2008), we focused on the level of technological activity, considering the patent's application date.

We lagged the independent variables by a one-year period (Hansen & Hill, 1991; Hirshleifer, Low, & Teoh, 2012) to better capture the potential effects on patents at time t and to help establish the direction of causality. Following previous studies (Chrisman & Patel, 2012), we used a continuous measure of *family ownership* in terms of family ownership percentage. We measured family ownership as the total voting rights held by the family. The ORBIS database allowed us to track both the direct and the indirect ownership structures of family firms (Faccio, Larry, & Young, 2001; La Porta, Lopez-de-Silanes, & Shleifer, 1999; Villalonga & Amit, 2006).

We operationalized the moderating variable *environmental munificence* – defined as the abundance of resources in the environment – by using a standardized measure of industry sales growth over a five-year period (2006-2010). Following the previous literature, we regressed time against the natural log of sales in each industry (four-digit NACE code). We then measured

munificence by the standardized value of the antilog of the regression slope coefficient (see Fernhaber & Patel, 2012; Keats & Hitt, 1988; Wales, Patel, Parida, & Kreiser, 2013).

We used several variables to control for alternative explanations of the findings (e.g., firm age, firm size, R&D expenditures, internationalization, performance, slack, environmental dynamism, size of competitors, and industry)[3]. First, we controlled for a firm's *age* by measuring the number of years that the firm had been in existence since a firm's age can affect its patenting decisions[4] (Kotha, Zheng, & George, 2011). Second, we controlled for firm size as the sum of the standardized values of number of employees and sales since this number can influence patenting (Gomez-Mejia, Tosi, & Hinkin, 1987; Scherer, 1965). Third, we controlled for firm performance by constructing two measures: *historic performance* and *social performance* (Chrisman & Patel, 2012; Greve, 1998). Historic performance is the firm's performance at t-1 relative to performance at t-2. Social *performance* is the discrepancy in firm performance at t-1 relative to the performance of competitors at t-2. For competitors' performance, we measured the mean performance of firms in the relevant three-digit NACE category at t-1. Fourth, we controlled for slack, which can support patenting activities (Foss & Foss, 2005). We measured a*bsorbed slack* as the ratio of selling, general, and administrative expenses to sales (Iyer & Miller, 2008). We measured *unabsorbed slack* as the ratio of current assets to current liabilities (Iyer & Miller, 2008). We calculated slack as the deviation from the mean of each of the subindustries (4-digit NACE code) (2006-2010) (George, 2005). Following Chen (2008), we

[3] Additional control variables that we considered in our analyses were firm performance, measured as return on assets (ROA); environmental density, measured as the standardized value of the number of competing firms in the same industry; and environmental complexity, operationalized using the standardized value of the inverse of Herfindahl's index as a measure of the concentration of sales in an industry. However, these variables were not included in the final analyses due to their strong correlations with the other control variables selected for the analyses.

[4] We also ran our analysis by controlling for the generation in charge, which did not change our results. As an additional check, we again ran the analysis excluding firm age while keeping the generation in charge. Again, the results remained substantially similar. However, given the strong correlation between firm age and the generation in charge (.74), we only kept firm age in the model, which is generally deemed a better proxy for the passage of time (see De Massis, Chirico, Kotlar & Naldi, 2014).

standardized these two measures and totaled them to obtain a general slack index. This procedure provided a close estimate of excess resources available as innovation input. Fifth, we controlled for the log of *R&D expenditures*, as this variable is a proxy of a firm's long-term economic orientation toward patenting and innovation (Duran et al., 2016). R&D expenditure is a composite measure that averages R&D expenditures based on the firm's size and industry (2006-2010). Data were available from the Italian Institute of Statistics (ISTAT, 2013c). Sixth, we controlled for *internationalization* through a proxy based on the number of markets in which the company owns a subsidiary (2006-2010) (Gomez-Mejia & Palich, 1997; Sullivan, 1994). Seventh, we controlled for *environmental dynamism* and s*ize of competitors* since these factors can affect a firm's innovation output (2006-2010) (Jansen, Van Den Bosch, & Volberda, 2006). We measured *dynamism* – defined as the amount of uncertainty, complexity, and change emanating from the external environment – as the standardized value of the antilog of the standard error of each regression slope coefficient from the equations used to calculate the munificence in each industry (e.g., Keats & Hitt, 1988). We operationalized *competitors' size* as the log of sales for firms in the same industry. Finally, we captured unobserved industry characteristics that might determine the abundance of entrepreneurial opportunities (Brauer & Wiersema, 2012) using dummy variables at the three-digit NACE code level.

Controlling for Endogeneity

It is possible that patenting is endogenous to family ownership. In other words, factors that might influence the propensity to patent could also influence the desirability of keeping the firm's ownership within the family (Chrisman & Patel, 2012). Furthermore, the curvilinear relationship that we observed between family ownership and patents might be subject to a reverse causality interpretation. It could be that the family – for reputational or other reasons – is

interested only in being involved in family firms that patent a great deal. Thus, while medium-to-high levels of patents might offer the family incentives to increase its control in the firm, low levels could reduce these incentives. For instance, younger family members could be more interested in being involved in their parents' businesses if the firms are highly innovative, and descendants might be more willing to succeed founders when the firms invest in patenting activities. These endogenous effects could account for our results.

Although we lagged the independent variables by one year, to test for endogeneity, we used a two-stage least-squares (2SLS) approach in Stata, with multiple instrumental variables (Sirmon & Hitt, 2009). The key to testing for endogeneity is choosing instruments that are correlated with the independent variable but not with the dependent variable. Thus, we selected the following two instruments that met these criteria: (1) the number of family firms in the firm's location and (2) the number of family firms in the firm's industry. In fact, the literature on institutional pressure suggests that families might be more likely to maintain control of their firms if located in an area with a higher concentration of family-controlled firms and if family controlled firms are common in their industry (Greenwood & Suddaby, 2006). However, both factors might not directly affect their patenting activities (Duran et al., 2016). However, the results of Stata's *ivendog* command, which tests for endogeneity through the Durbin–Wu–Hausman chi-square test and the Wu-Hausman F-test (Kennedy, 2008), indicate that endogeneity is not a concern in our study (Durbin–Wu–Hausman chi-square test: 1.18 $\chi^2(1)$, p-value = 0.27; Wu-Hausman F-test: 1.19 F[1], p-value = 0.28).

RESULTS

The descriptive statistics and correlations of the variables analyzed are presented in Table 1. An inspection of the VIFs revealed that multicollinearity is not a concern (Kutner,

Nachtsheim, & Neter, 2004). Given the characteristics of our dependent variable (i.e., a count variable that allows zeros), count models are the most appropriate. There are different types of count models, and their use depends on the actual distribution of the dependent variable. We ran three tests to check which model best fits our data. First, the Vuong test is significant ($p = 0.00$), indicating that a zero-inflated negative binomial (ZINB) should be preferred over a standard negative binomial regression (NBR) model. Second, a likelihood ratio test comparing the ZINB model with the zero-inflated Poisson (ZIP) model also confirms the superiority of the ZINB model ($p = 0.00$). Third, the dispersion parameter α is significantly positive ($p = 0.00$), confirming overdispersion[5]. These three tests confirm the appropriateness of the ZINB model, which we thus used to test our hypotheses (Greene, 2012; Long, 1997; Long & Freese, 2006). We used the amount of *intangible fixed assets* owned by the firm as the inflate parameter in our model. The amount of intangible fixed assets is a proxy for knowledge capital, constituting an indirect measure of innovation output. As such, it is likely to influence the probability that a firm continues to produce a nonzero number of patents in the future.

We tested the hypotheses using six models with a ZINB in two stages, reported in Table 2 (logit in Model 1; nbreg in Models 2-6). In the second stage, we first considered the control variables (Model 2) and then added the independent variables of interest: family ownership and environmental munificence (Model 3). In Model 4, we computed the squared value of family ownership to assess the curvilinear effects. In Models 5 and 6, we tested the interaction effects of environmental munificence with family ownership and its squared term.

Insert Table 1 and Table 2 about here

Hypothesis 1 argues that a U-shaped relationship exists between family ownership and IP protection through patents in family firms. The analytical results support our first hypothesis,

[5] These analyses are also confirmed by the Stata command *countfit* (Long & Freese, 2006).

whereas family ownership is negative and significantly related to family firm patenting, its squared term is positive and statistically significant (see Model 4). Hypothesis 2 suggests that environmental munificence moderates the hypothesized curvilinear relationship. We also ran the margins, and the results confirmed the moderation effect. We plotted the results in Figure 2 through the Stata command *surface* (+/- 2 s.d.)[6] to fully interpret our empirical findings. The results are discussed in the concluding section.

Insert Figure 2 about here

Robustness Tests

In accordance with previous studies (e.g., Wales et al., 2013), we drew on the tests of Lind and Mehlum (2010) and followed the recommendations of Haans et al. (2016) to further assess the validity of the U-shaped relationship between family ownership and IP protection through patents. Without these tests, it would be difficult to determine whether the extreme point (or the inflection point) is within the bounds of the data. First, we began with the Wald test to assess the joint significance of the direct and squared terms of family ownership on the dependent variable. The results confirmed that both terms are jointly statistically significant [chi2(2) = 8.28; Prob > chi2 = 0.01]. Second, we estimated the directions of the slopes at low and high values of family ownership. If the slope at the low value of family ownership is negative, and the slope at the high value of family ownership is positive, the relationship likely exhibits a U shape. It is necessary to test slopes at these bounds to ensure that the U-shaped relationship is representative of the data and is not a statistical artifact. The preliminary evidence suggested the presence of a U-shaped relationship (see below). Third, we used the Sasabuchi test (Sasabuchi, 1980) to assess whether: (1) the effect of family ownership on IP protection through patents

[6] The scale of the predicted number of events in IP protection through patents is based on the results of the second stage of the ZINB regression model.

decreases at low values of family ownership; and (2) the effect of family ownership on IP protection through patents increases at high values of family ownership. Significant values, as in our case, indicate the presence of a U-shaped relationship (*lower bound slope*=-4.86; t-value=-2.73; P>|t|=0.00; *upper bound slope*=.04; t-value=3.54; P>|t|=0.00; *overall test*: t-value=2.73; P>|t|=0.00).

To further assess whether the extreme point is within the upper and lower bounds of family ownership, Lind and Mehlum (2010) proposed the Fieller approach to estimate confidence intervals around extreme points. If the confidence intervals are within the bounds of the low and high values of family ownership, it provides further evidence of the U-shaped relationship in the data. In our analysis, the estimated extreme point was .73, which is within the upper and lower bounds of family ownership (95% Fieller interval for extreme point: [.63; .77]).

We further conducted the U-shaped test for high and low values of environmental munificence (see Haans et al., 2016; Lind & Mehlum, 2010). In line with our Hypothesis 2, the values of the lower and upper bounds of the slopes confirmed the related results shown in Figure 2 for low environmental munificence (*lower bound slope*=-7.93; t-value=-2.44; P>|t|=0.00; *upper bound slope*=6.66; t-value=3.25; P>|t|=0.00; *overall test*: t-value=2.44; P>|t|=0.00) and high environmental munificence (*lower bound slope*=-2.47; t-value=-1.25; P>|t|=0.11; *upper bound slope*=1.94; t-value=1.51; P>|t|=0.07; *overall test*: t-value=1.25; P>|t|=0.11), with no change in the estimated extreme point (see Haans et al., 2016). Table 3 summarizes the results of our tests.

Insert Table 3 about here

We also conducted various additional analyses to further verify our research findings. First, we used a continuous measure of family ownership in absolute terms. When considering initial levels of at least 5, 10, 20, and 30% of family ownership, the results remained consistent

with our main findings. Second, we allowed for greater flexibility in the curve by including the cubed term of family ownership, which as expected was not significant, thus providing evidence that a U-shaped relationship better fits the data than other specifications (Mihalache, Jansen, Van Den Bosch, & Volberda, 2012). These results provide additional evidence in support of our findings.

Third, because it is difficult to determine whether the observed overdispersion is due to the distribution of the data or is an artifact of the regime-splitting mechanism employed (Greene, 2012), we also estimated a ZIP model, instead of a ZINB model, to ensure that the hypotheses would hold even if the counts were generated due to a Poisson process (Kapoor & Lim, 2007). Again, the results did not change substantially. Finally, to check whether our theoretical model holds true with a measure of product innovation – the commercialization of patents (see Makri et al., 2010) – we tested it in another sample for which a measure of innovation was available. Specifically, we relied on the EU-EFIGE/Bruegel-Unicredit dataset (Altomonte & Aquilante, 2012), which provides harmonized data on a representative sample of manufacturing firms in seven European countries (Austria, France, Germany, Hungary, Italy, Spain, and the UK) with information on firms' innovation activities, combined with data on ownership and financial/firm indicators. We used as a dependent variable whether the firm conducted any product innovation activity in the last 3 years, which could be considered innovative not only for the firm itself but also with respect to the market (cf. Duran et al., 2016). Based on the data available, our final sample consisted of 5,736 family firms. The results with this new dependent variable supported our theoretical model (H1: family involvement: β=-0.104, $p<0.001$; family involvement squared: β=0.112, $p<0.001$; H2: family involvement * munificence: β=0.024, $p<0.05$; family involvement squared * munificence: β=-0.059, $p<0.01$).

DISCUSSION

Drawing on the mixed gamble BAM logic (Martin et al., 2013) and the SEW perspective (Gomez-Mejia et al., 2011), we explain the role of family ownership as an important driver of a family firm's propensity to protect its IP through patents. We recognize the inherent complexity of patenting decisions in family firms due to their dual financial and SEW considerations. Patenting-related (prospective) financial benefits are deemed to increase, whereas patenting-related (current) SEW costs are deemed to increase with diminishing returns as family ownership increases (Figure 1). Subtracting patenting-related costs from patenting-related benefits (Haans et al., 2016), we theorize and show that the costs outweigh the benefits of patenting from low-to-medium levels of family ownership, whereas the benefits outweigh the costs for medium-to-high levels of family ownership, resulting in a U-shaped relationship between family ownership and patenting. Interestingly, as the level of family ownership increases beyond a threshold level, family firms' propensity increases significantly, indicating that secured family control creates a situation in which SEW and financial returns become aligned and compatible with one another (Martin & Gomez-Mejia, 2016).

Our results also provide evidence that environmental munificence moderates the U-shaped relationship between family ownership and IP protection through patents. When munificence is low, family owners' concerns about SEW preservation costs further inhibit patenting activities when their ownership is not substantial, and SEW is unsecured. However, when the family exercises substantial ownership control over the business (at least 74%; see Table 3 and Figure 2), low environmental munificence enhances family owners' consideration of the potential prospective financial gains attainable through patenting. Conversely, when environmental munificence is highest, the relationship becomes linear negative, suggesting that

family owners' concerns about potential SEW losses inhibit their propensity to patent. As indicated by Casillas, Moreno, and Barbero (2010) and Moss et al. (2014), family firms in stable environments tend to maintain their positions within traditional businesses and remain consistent with their strategies, thus avoiding the risk of engaging in unrelated business and innovation activities (see also Lumpkin & Brigham, 2011; Nordqvist et al., 2008).

Contributions to the Literature

Our study offers several important contributions. First, our theory and evidence complement existing research on family firm innovation, which thus far has largely focused on value creation activities, such as R&D (e.g., Chrisman & Patel, 2012; Gomez-Mejia et al., 2014), technology acquisition (e.g., Kotlar et al., 2013), and new product development (e.g., Chirico & Salvato, 2014), by elucidating family firms' strategies for capturing value from innovations. Specifically, our study highlights an additional layer of complexity in family firms' patenting decisions stemming from the dual consideration of financial wealth and SEW. The literature on IP protection has argued that firms use patents to shelter their intellectual assets against competition and to maximize rents from innovation activity (Kultti et al., 2006; Peeters & Potterie, 2006), suggesting that patenting might be conceived as a risk-averse behavior. Interestingly, our study suggests that, in family firms, IP protection can be considered instead a risk-taking choice vis-à-vis avoiding the risk of SEW losses, such as diverting resources from traditional business lines, disclosing tacit knowledge, increasing reputational risks, and creating dependence on external sources of finance and specialized human capital otherwise not available within the family group.

Relatedly, by theorizing and showing a nonlinear relationship, our study helps to reconcile previous conflicting findings on the relationship between family ownership and patents

(e.g., Anderson et al., 2012; Bannò, 2016; Block et al., 2013; Duran et al., 2016; Jell et al., 2015; Matzler et al., 2015; Tognazzo et al., 2013). Our study reveals that previous contradictory perspectives on family firms' patenting behavior could be valid but under different conditions (O'Boyle, Pollack, & Rutherford, 2012). Specifically, it suggests that the framing and the evaluation of patenting choices in family firms change depending on the level of family ownership and the underlying emphasis on financial gains or SEW losses. In this respect, our study demonstrates that the analytical approach that Haans et al. (2016) recently advanced can be fruitfully applied to explain the weight that family firms attribute to multiple utility functions (i.e., the future financial wealth function and the current SEW function) in their decision making. By combining these two utility functions, we successfully predicted the resulting combined function underlying the relationship between family ownership and IP protection through patents, revealing that, when family control is uncertain, i.e., with low-to-medium levels of family ownership, family firms are less likely to use IP protection through patents. However, when a certain threshold of SEW is secured, family firms are instead more likely to focus on perspective financial gains, thus patenting more.

Second, the SEW model has traditionally been used to distinguish family-owned firms' behaviors and strategic choices from those of other types of organizations in multiple situations, such as the decision to join cooperatives (Gómez-Mejia et al., 2007), diversification and internationalization (Gomez-Mejia et al., 2010), environmental policies (Berrone, Cruz, Gomez-Mejia, & Larraza-Kintana, 2010), firm valuation (Zellweger et al., 2012), IPO pricing (Kotlar et al., 2018), and R&D investments (Chrisman & Patel, 2012; Gomez-Mejia et al., 2014). Notably, none of these studies explored the possibility of nonlinear effects. In this study, in contrast, we expand on the SEW construct through a focus on firms that differ in degree of family ownership,

pointing to a U-shaped relationship between family ownership and family firms' propensity to patent. As Berrone et al. (2012) argued, the family business literature has "emphasized existing differences within family firms [but] these differences have not been linked to SEW issues" (p. 270). In this regard, our study responds to Berrone et al.'s (2012) call for research attention to be paid to the negative implications of SEW, as existing "studies are mainly focused on discussing positive aspects of SEW", whereas family owners also "experience negative aspects related to their affective experiences" (p. 269). By elucidating both the financial benefits and potential SEW losses associated with family firms' propensity to patent, the present study identifies the point at which the mixed gamble logic shifts family owners' focus from the preservation of current (socioemotional) wealth to the attainment of prospective (financial) wealth. Thus, by clarifying the "family firm owners' dilemma" of whether to engage in patenting in the pursuit of future financial gains or to refrain from it to preserve current SEW, our study enhances the behavioral agency formulation (Gomez-Mejia, Welbourne, & Wiseman, 2000; Wiseman & Gomez-Mejia, 1998) and extends the mixed gamble BAM logic beyond the compensation domain (Hoskisson et al., 2017).

Relatedly, our results also inform the literature on goals and goal conflicts in family firms (e.g., Kotlar & De Massis, 2013). Kotlar and De Massis (2013, p. 1264) argued that "the relationship between family ownership and the adoption of family-centered goals is likely to be complex". Our study provides the first empirical evidence of a potential nonlinear relationship between family ownership and family owners' attitudes toward financial and/or nonfinancial goals. Moreover, different from previous studies assuming that family firms are either concerned with SEW or financial wealth under specific situations (Chrisman & Patel, 2012; Gomez-Mejia et al., 2010; Patel & Chrisman, 2014), our study reveals the conditions under which family firms

are able to reconcile the two goals (financial and nonfinancial), thereby illuminating a "win/win" situation – namely, when the family has a secure majority ownership position – in which both future financial and SEW goals are aligned and compatible and thus work in *tandem* (Gomez-Mejia et al., 2018). Relatedly, this study also deepens our understanding of the existence of two forms of current and prospective wealth and the related threshold levels of gains and losses in the relationships among family ownership, financial and SEW considerations, and patenting. Other than the recent works of Gomez-Mejia et al. (2014, 2018), this study is one of the few addressing a recent call for research to "build more fully on the mixed gamble logic to explain how risk taking may vary in family-owned firms … with the goal of protecting current and/or maximizing future financial and nonfinancial wealth" (Hoskisson et al., 2017, p. 148).

Finally, our study introduces an important boundary condition to the behavioral agency model as applied to family firms' strategic decision making, namely the role of environmental munificence. Recently, behavioral theorists have issued resounding calls to integrate external factors within the behavioral theory framework (e.g., Greve & Teh, 2018) and to deepen our understanding of family firms' decisions in context (e.g., Wright et al., 2014). However, the existing research has largely focused on internal factors, such as variations in firm performance (Gomez-Mejia et al., 2010). We address these calls by focusing on various degrees of environmental munificence, and we offer arguments on how they moderate the nonlinear relationship between family ownership and IP protection through patents. As such, we corroborate the proposition of Gomez-Mejia et al. (2007) that "effective analyses of the risk aversion [or taking] of a family firm must also consider the environment in which the family firm acts" (Hiebl, 2012, p. 61), thus further contributing to the SEW framework, which to date has been mainly internally focused.

Limitations and Future Research Directions

Despite its contributions, this work is not without limitations that open important opportunities for further research. First, like recent studies (Berrone et al., 2010; Chrisman & Patel, 2012; Gomez-Mejia et al., 2007, 2010, 2014, 2015; Patel & Chrisman, 2014), we use family ownership as a proxy for the relative weights of financial and SEW considerations in family firms' decision making. Thus, we can infer, but cannot conclusively demonstrate, that SEW affects IP protection through patents. Directly measuring the subdimensions of SEW (e.g., Berrone et al., 2012) and the related noneconomic goals pursued by family owners (e.g., Kotlar & De Massis, 2013) would open several important research opportunities. For instance, unpacking the SEW construct would allow for future studies to explore how family firms balance financial wealth considerations with distinct subdimensions of SEW, such as reputation, stakeholder ties and transgenerational control, as well as how their interactions shape family firms' patenting decisions. Exploring these effects on patenting activities, as well as other aspects of family firms' innovation strategies, constitutes an important path for future research. This path, of course, is also a major challenge, given the paucity of archival information to conduct this type of research, which would require extensive collection of primary data and unprecedented access to a large number of firms with varying degrees of family ownership. Including nonfamily firms in the analyses might also be an interesting future path for investigation.

Second, our study of SMEs complements existing research on firm patents focused on larger and more-established US-based publicly traded firms. Interestingly, prior studies have shown mixed evidence for the effect of firm size on patent propensity (see Gick, 2008; Holgersson, 2013). Thus, future research is needed that more specifically examines the effects of

family ownership on patenting in small vs. large family firms, as well as their differences and similarities with respect to nonfamily firms of similar sizes. Third, although the patent system is one of the most frequently used IP protection tools, especially in the mechanical sector considered in this study, some innovations might remain unpatented, either because they are unpatentable (e.g., an algorithm) or because a firm prefers secrecy or uses other mechanisms to protect its IP (see Arundel, 2001). Thus, future research should examine family firms' patenting behaviors in different industries and consider multiple strategies to capture value from innovation.

Another important caveat to our theory and results relates to our focus on patenting as a deliberate strategic decision. In other words, our theorizing focuses on family firms' propensity or *willingness* to patent, but it does not address the question of whether family firms are more or less *able* to register new patents. Following De Massis et al. (2014), future work could extend our model by incorporating ability-related factors (e.g., factors related to family managers' power to influence decisions and the resources necessary to execute such decisions) and examining how willingness- and ability-related factors interact in determining the observed patenting behaviors among family firms. Relatedly, although we controlled for innovation input (R&D spending), our analysis could not address the link between patents and innovation output (e.g., new product introductions). Unpacking the (potentially dynamic) relationships between innovation inputs and innovation outputs in family firms emerges as an interesting future research direction.

Finally, our data were collected in Europe, thereby limiting the possibility of generalizing our findings to other continents. Patenting and environmental munificence could be specifically

bound to cultural contingencies; thus, future research is needed to generalize our findings across different economic, institutional, and cultural contexts.

Managerial Implications

Considered together, our theory and empirical evidence indicate that family firms' propensity to patent might be biased by their emphasis on SEW considerations, but they could reconcile the inherent trade-off between financial and socioemotional wealth by securing a high level of family control through majority family ownership. Thus, while the prior research has encouraged family firms to open up their innovation processes to facilitate value creation (e.g., Chrisman & Patel, 2012; Kotlar et al., 2013), our study rather encourages family owners to acquire or preserve a stronger controlling position in their respective firms to deploy more effective strategies for capturing value from innovations. This recommendation is likely to apply particularly in industries characterized by low environmental munificence, as the family's emphasis on the perceived SEW-related costs of patenting might become more pronounced vis-à-vis high-munificent environments. Thus, the negative effect of unsecured family control could become more prominent as their competitive environments become tougher.

CONCLUSION

In conclusion, this study helps to reconcile previous conflicting results on the patenting behaviors of family firms, showing that the level of family ownership is an important driver of heterogeneity in family firms' propensity to patent and introducing the role of environmental munificence as an important boundary condition of the weight that family firms attribute to the potential benefits and costs of patenting. More broadly, we hope that our study offers a new analytical foundation for sharpening the current understanding of the roles of financial wealth and SEW considerations in family firms' strategic decision making.

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Table 1. Means, Standard Deviations, and Correlations.

	Mean	S.D.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Number of patents	1.08	4.24												
2. Family ownership (%)	0.86	0.18	0.04											
3. Munificence	0.99	0.03	-0.04	-0.01										
4. Firm's age	23.85	14.31	0.05	0.03	-0.07									
5. Firm's size	-0.01	1.91	0.22	0.06	-0.02	0.21								
6. Historical performance	0.89	5.43	-0.00	-0.01	-0.02	0.03	-0.01							
7. Social performance	1.60	5.58	-0.00	-0.01	0.01	-0.05	0.01	0.35						
8. Slack	-24.06	32.94	-0.00	0.00	0.01	0.04	-0.00	0.00	0.06					
9. R&D expenditures (log)	6.78	6.47	0.23	0.01	-0.08	0.05	0.19	-0.00	-0.05	-0.00				
10. Internationalization	0.26	0.93	0.24	0.02	-0.01	0.10	0.41	0.01	-0.01	-0.00	0.15			
11. Environmental dynamism	0.07	0.23	0.01	0.01	0.10	0.01	0.03	0.02	0.01	0.02	-0.01	0.00		
12. Size of competitors	9.65	0.55	-0.02	0.03	0.03	0.00	0.05	0.02	0.04	0.02	-0.02	-0.02	0.30	
13. Intangible fixed assets (log)	3.50	2.02	0.22	0.04	-0.01	0.04	0.38	0.02	-0.13	-0.05	0.16	0.27	0.03	0.06

N = 4,198; Correlations with values of |.03| or greater are significant at $p < .05$; industry dummies are not reported due to space limitations.

Table 2. Results of the Zero-Inflated Negative Binomial Regression on IP Protection through Patents.

	First stage (logit)	Second stage (nbreg)				
	1.	2.	3.	4.	5.	6.
Firm's age	0.005	0.003	0.002	0.002	0.002	0.001
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Firm's size	0.002	0.159***	0.156***	0.150***	0.152***	0.151***
	(0.022)	(0.040)	(0.039)	(0.039)	(0.038)	(0.038)
Historical performance	-0.012	-0.014	-0.015	-0.015	-0.015	-0.017
	(0.010)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Social performance	0.023*	0.013	0.013	0.014	0.015	0.015
	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Slack	0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
R&D expenditures	0.133***	0.151***	0.150***	0.148***	0.147***	0.149***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Internationalization	0.317***	0.138**	0.138**	0.135**	0.140**	0.144**
	(0.048)	(0.049)	(0.049)	(0.048)	(0.048)	(0.048)
Environmental dynamism	-0.086	0.113	0.160	0.174	0.193	0.153
	(0.271)	(0.286)	(0.291)	(0.288)	(0.285)	(0.287)
Size of competitors	0.106	0.117	0.096	0.121	0.112	0.120
	(0.151)	(0.175)	(0.179)	(0.178)	(0.176)	(0.177)
Intangible fixed assets	0.314***					
	(0.028)					
Family ownership (FO)			0.149	-1.663*	-1.745*	-1.758*
			(0.124)	(0.723)	(0.724)	(0.714)
Munificence			-0.019	-0.009	0.251	-0.401
			(0.081)	(0.081)	(0.162)	(0.315)
FO^2				0.979*	1.028**	1.044**
				(0.381)	(0.381)	(0.377)
FO x Munificence					-0.224+	1.604*
					(0.122)	(0.755)
FO^2 x Munificence						-0.972*
						(0.395)
Inflate (Intangible fixed assets)		-0.541***	-0.538***	-0.521***	-0.520***	-0.520***
		(0.063)	(0.063)	(0.059)	(0.058)	(0.058)
lnalpha		1.136***	1.121***	1.041***	1.030***	1.032***
		(0.168)	(0.171)	(0.179)	(0.179)	(0.177)
Chi2	774.979	411.358	412.900	419.454	422.760	428.854
Prob > Chi2	0.000	0.000	0.000	0.000	0.000	0.000
N	4,198	4,198	4,198	4,198	4,198	4,198

+ $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$; industry dummies are not reported due to space limitations.

Table 3. Test of the U-Shaped Relationship between Family Ownership and IP Protection.

		Direct effect of family ownership	Low munificence: Direct effect of family ownership	High munificence: Direct effect of family ownership
Test of joint significance of family ownership [FO and FO^2] (p-value)		0.01	0.00	0.72
Slope at FO_{low}		– 4.86***	– 7.93**	– 2.47
Slope at FO_{high}		4.04***	6.66***	1.94+
Sasabuchi test of U shape in family ownership (p-value)		0.00	0.00	0.05
Estimated extreme point (or inflection point)		0.73	0.74	0.74
95% confidence interval (CI) – Fieller method	LowCI	0.63	0.59	$-\infty$
	HighCI	0.77	0.78	$+\infty$
Test of joint significance of control variables (p-value)		0.00	0.00	0.11

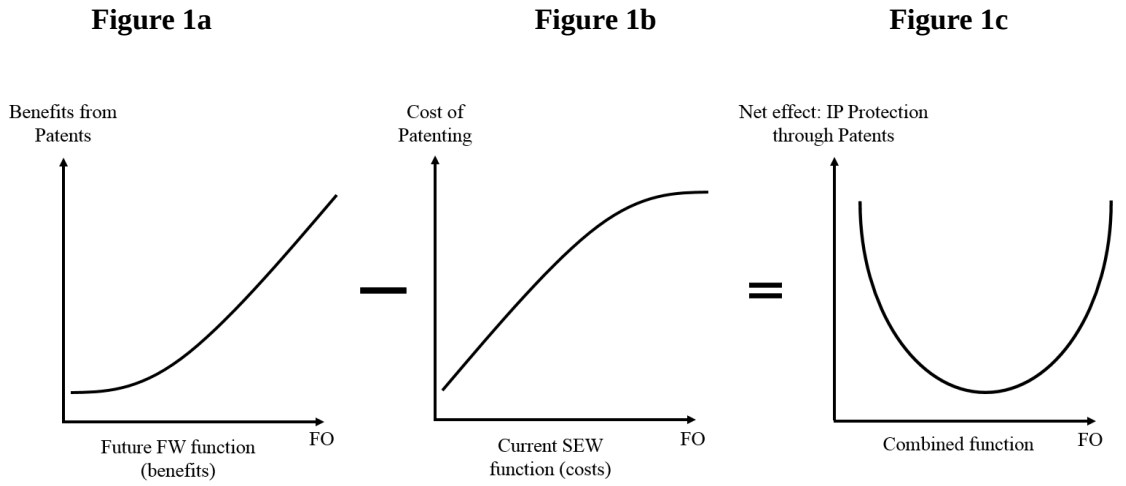

Figure 1. Theoretical Model: The Predicted Pattern of Family Firm IP Protection through Patents as a Function of Family Ownership (FO).

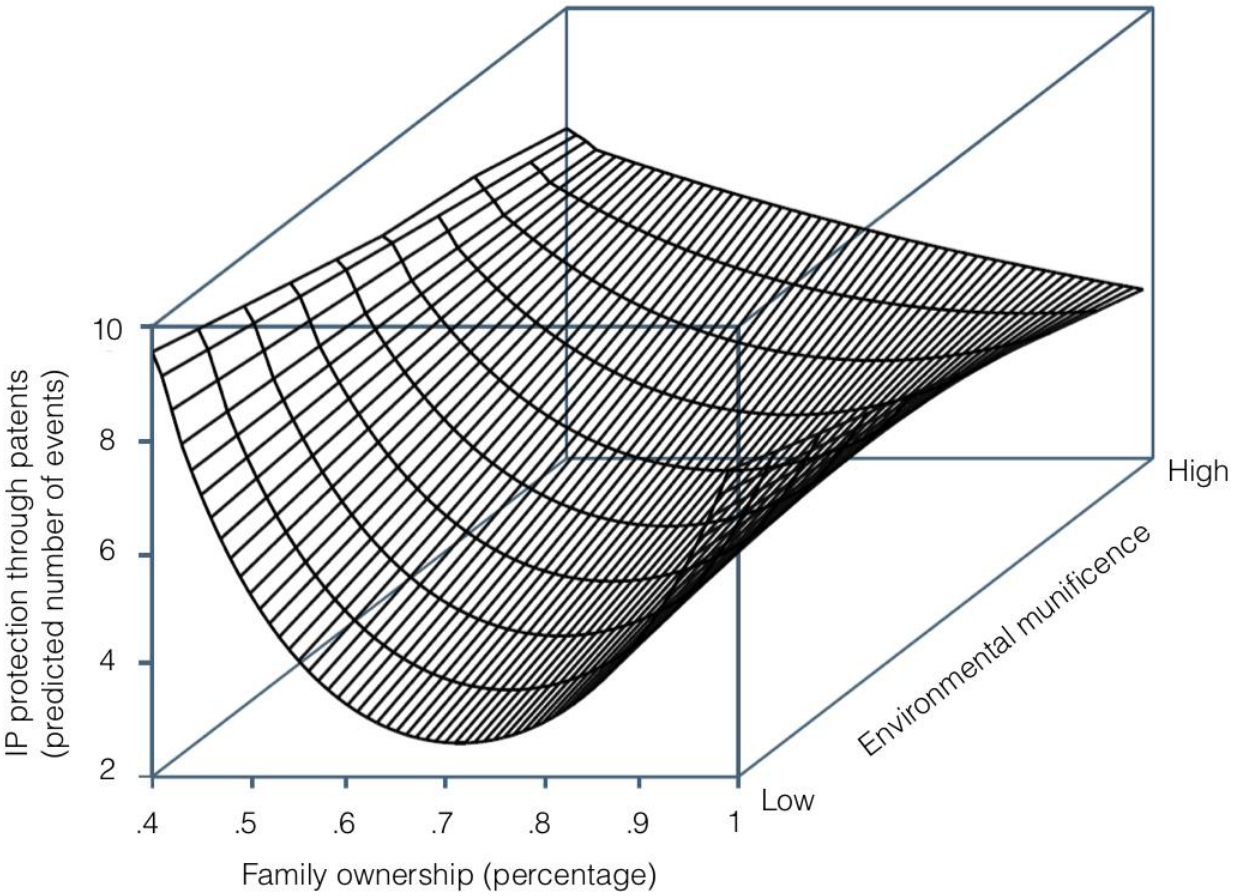

Figure 2. Family Ownership, Patents, and the Moderating Role of Environmental Munificence.