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Agency and Governance in Strategic Entrepreneurship

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This paper aims to highlight the opportunity to contribute to our understanding of strategic entrepreneurship by exploring the construct through the lens of agency theory. In particular, we claim a fundamental link between a new venture's control of critical resources and the distribution of equity between the principal and agent. According to agency theory, assigning top executives ownership in the firm provides arrangements that are compatible with the incentives of the owners of the firm. This paper suggests that agency theory has special relevance when considered in a strategic entrepreneurship context. This is because the function of managers in entrepreneurial new ventures is fundamentally different from their counterparts in large established, incumbent corporations. While both types of managers have to provide managerial and organizational expertise, managers in entrepreneurial new ventures have an additional function that is essential to the competitive advantage and performance of the new venture—providing knowledge and human capital, which, in many cases, is intrinsically linked to the capital resources of the new venture. Our framework is tested using patent ownership as a proxy for both relationship-specific investments and indispensable human capital of the top manager of the new venture. The empirical results support the main hypotheses posited by the entrepreneurial governance model. In particular, patent ownership of the top manager significantly increases the percentage of equity held, while the number of patents held by the firm significantly decreases the percentage of ownership.

Introduction

Strategic entrepreneurship involves simultaneous opportunity-seeking (i.e., entrepreneurial) and advantage-seeking (i.e., strategic) behaviors (Ireland, Hitt, & Sirmon, 2003). As the introduction to this special issue suggests, strategic entrepreneurship includes those "organizationally consequential" innovations, "representing the means through which opportunity is capitalized upon" while "in pursuit of competitive advantage." The innovations made possible by strategic entrepreneurship are manifest in either the basis by which a firm differentiates itself competitively from its industry rivals or changes from the firm's past organizational structure and/or business model. In the case of the latter, a new firm's transition from a private to a public equity structure by means of an initial public

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offering (IPO) constitutes a setting rife with strategic entrepreneurship implications (Certo, Covin, Daily, & Dalton, 2001).[1]

Among the implications is the ownership and control of valuable resources used in pursuit of a given opportunity. As Ireland et al. (2003) contend, much of the firm's ability to seek opportunity and competitive advantage depends largely on the resources *owned or controlled by the firm* and the capacity to manage them effectively. In fact, in addition to an entrepreneurial mindset, entrepreneurial culture, and entrepreneurial leadership, "managing organizational resources provides the *foundation* for the firm's opportunity-seeking and advantage-seeking behaviors (Ireland et al., p. 967, emphasis added). We have no dispute with this perspective, and accept, as Mosakowski (2002) suggests, that a unique strength of strategic entrepreneurship is the firm's ability to develop new advantage-granting resources through an entrepreneurial process.

We are instead intrigued by the premise that a firm may need to control resources it does not own. A pivotal question that arises is how, and with what implications for strategic entrepreneurship does a firm gain control over resources owned by others? In this vein, we confine our focus to those cases in which *individuals within a new firm—the chief executive in particular—own the key resources the firm seeks to control.* This is particularly relevant for strategic entrepreneurship in which the top executive is expected to provide inputs (e.g., knowledge and human capital) critical to opportunity seeking in addition to managerial (i.e., advantage-seeking) expertise.[2] A useful framework for answering this question comes from economic theories of the firm, including property rights and agency theory (Hart, 1995; Jensen & Meckling, 1976). Here, the premise is that the firm seeks control of the assets held by the top executive by aligning her interests with those of the firm's principals.

What makes this an interesting question is that the instances where a top manager owns a key resource may exacerbate the agency problem that otherwise inhibits the firm's ability to engage effectively in strategic entrepreneurship behaviors. That is, in these cases, not only must the new venture's governance structure align managers' interests with those of shareholders, it must also establish safeguards against contractual hazards (i.e., the hold-up problem) in the controlling arrangements for resources held by the manager. In this context, the contractual arrangements over the *control* rights of such resources—i.e., the right of the owner to grant the firm the use of a resource—are the matter of concern (Hart, 1995). As a result, among the many determinants of equity ownership (Agarwal & Samwick, 1999; Bitler, Moskowitz, & Vissing-Jörgensen, 2006; Himmelberg, Hubbard, & Palia, 1999), one would expect larger equity shares for those managers owning valuable resources upon which the firm depends.

Thus, the purpose of this paper is to suggest a view of agency theory that considers the governance of entrepreneurial new ventures within a strategic entrepreneurship context. This view revolves around the entrepreneur's dual role of providing both managerial expertise, as well as knowledge inputs to knowledge-based new ventures. In particular, we surmise that in addition to aligning the top manager's (i.e., chief executive officer [CEO]'s) interests with those of the firm's principals by means of equity ownership, the *ex-post* bargaining position of the top executive owning needed knowledge inputs—

1. For comparable perspectives, see Beatty and Zajac (1994); Brunninge, Nordqvist, and Wiklund (2007); Uhlaner, Wright, and Huse (2007); and Zahra, Neubaum, and Naldi (2007).

2. In a large incumbent firm, many of these knowledge inputs emerge from the firm's formal opportunity-seeking activities in the form of research and development (R&D). The situation with younger, more entrepreneurial firms, which presumably have no such formal R&D, suggests that the need for controlling knowledge inputs not owned by the firm would seem particularly acute.

captured by patents in this study—leads to her holding a larger share of equity than she would otherwise. Conversely, when it is the firm that owns the knowledge inputs (i.e., the patents are held by the firm), the superior *ex-post* bargaining position of the firm's principals leads to the top executive holding a smaller share of equity than she would otherwise.

Given this, the paper flows as follows: in the next section of this paper, we explain how the door is open, as it were, for applying agency theory to advance our understanding of strategic entrepreneurship. After that, we discuss the extent to which agency theory lends itself to the question of how a firm might gain control over resources it does not own. This leads to the fourth section of this paper where we develop the two main hypotheses linking managerial equity ownership with the holding of assets or inputs needed by the firm. The fifth section details the research design and methodology of this study, and the sixth section reports the results. The final section discusses the results and offers some concluding comments.

Resource Ownership and Control in Strategic Entrepreneurship

As a conceptual framework, strategic entrepreneurship—encompassing simultaneous opportunity-seeking (i.e., entrepreneurial) and advantage-seeking (i.e., strategic) behaviors (Ireland et al., 2003)—offers a more expansive perspective on the wealth creation and maximization of firms than do the constructs of strategic management and entrepreneurship individually. As Hitt, Ireland, Camp, and Sexton (2002) suggest, firms able to identify, yet incapable of exploiting entrepreneurial opportunities, cannot realize their full wealth-creation potential. Similarly, firms with current competitive advantages—no matter how sustainable—lacking the ability to identity and pursue new opportunities expose their investors to greater risk and diminished rates of return. Thus, provocatively, the claim is that "wealth is created *only* when firms combine effective opportunity-seeking behavior (i.e., entrepreneurship) with effective advantage-seeking behavior (i.e., strategic management)" (Ireland et al., p. 966, emphasis added).

Pivotal to this view of strategic entrepreneurship is the entrepreneurial leader's ability to manage—i.e., structure, bundle, and leverage—the firm's resource portfolio. Indeed, in addition to fostering a collective entrepreneurial mindset and culture, the entrepreneurial leader's function of "managing organizational resources provides *the foundation* for the firm's opportunity-seeking and advantage-seeking behaviors" (Ireland et al., 2003, p. 967, emphasis added). Thus, contained in this conception is the premise that the behaviors that constitute strategic entrepreneurship cross at least three levels of analysis—the leadership, capabilities, and human capital of *individuals*; the operational structure, collective mindset, and culture within *firms*; and the availability of advantage-granting resources and new market opportunities from the firm's external *environment*.

With this in mind, we are particularly intrigued by two key questions to strategic entrepreneurship posed by Ireland et al. (2003, pp. 983–984): First, how do entrepreneurial leaders within firms manage resources strategically to create competitive advantage, and, second, how are the firm's resource bundles (i.e., capabilities) leveraged in the identification and exploitation of new market opportunities? However, we also recognize that much of the discussion leading to these questions hinges on the assumption that "differences in firm performance are affected by both *owned or controlled* resources as well as how *the firm* manages those resources" (Ireland et al., p. 977, emphasis added). Thus, reframing the questions above, we ask, how does the firm come to control resources *it does not own* and manage them for entrepreneurship ends (Audretsch & Lehmann, 2006)?

One issue in answering this question, as we see it, is that when viewed across multiple levels of analysis, firms *per se* neither control nor own resources in any strict meaning. Instead, it is the individual managers (i.e., *agents*) hired by the owners of the resources that comprise the firm (i.e., *the principals*) that provide the management of organizational resources. Indeed, from this perspective, the phrase "owned by the firm" can be taken to mean "owned by the principal(s)." Thus, the problems associated with the separation of ownership and control and the accompanying agency costs are very much at play in strategic entrepreneurship. Indeed, if managing or controlling resources provides the "foundation" for the firm's strategic entrepreneurship behaviors, we suggest that it is particularly important to get the governance structures "right" to mitigate the agency problem.

Despite this observation, we find little reference to the agency problem or agency theory in the current conversation of strategic entrepreneurship. An exception is given by Michael, Storey, and Thomas (2002). They argue that in a strategic entrepreneurship setting, top managers provide expertise in the form of entrepreneurial management (i.e., expertise in the identification and recognition of opportunities) *and* administrative management (i.e., expertise in the operational coordination and loss prevention of the firm's activities). It is their contention that agency costs associated with administrative management are "solved" by proper compensation incentives, such as stock option awards. Given incomplete theoretical and empirical treatment of the matter, however, it is not clear that such incentives also resolve any agency costs associated with the agent's provision of entrepreneurial management.

Our key point here is not to claim that the strategic entrepreneurship construct is somehow a house of cards, because it does not explicitly encompass or invoke agency theory as a cornerstone. Instead, in recognizing that the concept of strategic entrepreneurship already builds on an array of theoretical perspectives including, among others, the resource-based view, real options, corporate entrepreneurship, and innovation (Hitt et al., 2002), we aim only to highlight the opportunity to advance strategic entrepreneurship by exploring aspects of it through the lens of agency theory. In particular, a central focus of such work should be to explore the governance structures that enable the ownership or control of those resources needed for both advantage-seeking and opportunity-seeking behaviors. Nevertheless, even if there seems to be room for agency theory in strategic entrepreneurship, the next question is whether agency theory lends itself to such application.

Agency Theory as a Strategic Entrepreneurship Lens

Agency theory is typically applied in the context of large and diversified firms as described by Chandler (1990). As such, competitive advantage often derives in terms of scale and scope. These economies of scale and scope make the firm too large to have ownership rest only in the hands of management, so outside investors are needed to finance assets and to bear the risk associated with such large ownership stakes (Rajan & Zingales, 2000). Competitive advantages arise through large size and extensive brand image from mass advertising to pose formidable barriers to competition from new entrants. The only critical resource is to raise money from the capital market to finance size and brand image. In providing the capital, outside owners delegate the control to salaried managers, which then leads to the logical outcome of the separation of ownership and control and the potential for disinterested managers to appropriate corporate resources for their own benefit at the expense of the shareholders.

In contrast, the competitive advantage of new knowledge-based ventures is less the result of scale and scope and more from building complementarities between resources and capabilities. We follow recent research that has emphasized the importance of intangible assets and human capital in entrepreneurial new ventures as their main source of competitive advantages (Audretsch, Keilbach, & Lehmann, 2006; Rajan & Zingales, 1998, 2000, 2001a,b). In these new ventures, equity ownership may not only serve as a mechanism to ensure managerial effort or to internalize the costs of misbehavior (Jensen & Meckling, 1976), it also provides incentives for the top executive to make firm-specific investments beyond their managerial expertise. Equity ownership of the firm's assets provides parties with bargaining power in negotiations after they have made investments in their relationships with new ventures. Especially in human capital intense firms, strategic advantages stem from specializing human capital to the firm's assets. Thus, the study of governance in a strategic entrepreneurship context has to go beyond the Jensen and Meckling framework.

In its simplest form, agency theory focuses on the internal incentives between the owners of the firm's assets (principals) and the managers (agents) hired to run it. Thus, the agency problem—and the costs associated with it—lies in the misalignment between the interests of the asset owners and the hired managers. To solve the problem, the principal searches for a perfect contract to align the managers' interests to her own (see Fiegener, Brown, Dreux, & Dennis, 2000). Theoretically, the efficient way to resolve the agency problem is to optimize not just the compensation contract between principal and agent, but also optimize the agent's equity ownership. In particular, because the future value of the firm's assets is not contractible, having the agent own a portion of the firm's assets can provide incentives for maximizing the firm's performance in a way that cannot be replicated via contract. Thus, the agent's ownership of firm equity not only helps solve the incentive problem, it also influences the strategic decisions made by the agent to the benefit of the firm.

With that said, empirical findings of top manager ownership, particularly those studies grounded in agency theory, are remarkably inconsistent (Daily & Dalton, 1993; Daily, Dalton, & Rajagopalan, 2003; Dalton, Daily, Certo, & Roengpita, 2003; Himmelberg et al., 1999). This is most likely because strategic decisions are based on expected returns *in the future*. In agency theory, both the decision of which strategy to pursue and the incentive to implement this strategy derives from the prospect of being paid out of the firm's future returns. While an agent's ownership of assets suggests that both the strategic decision and her incentives are interdependent (see Gibbons, 2004, Kräkel, 2004), the uncertainty associated with these future returns—along with other factors—leads to the problem of incomplete contracts between principal and agent.

Incomplete contracts lead to an additional problem. In their seminal papers, Grossman and Hart (1986) and Hart and Moore (1990) develop a property-rights framework for examining how changes in the distribution of asset ownership affects the incentives of the individuals who work with those tangible and physical assets. They highlight the central role of nonhuman (e.g., physical) assets because these can be owned and more readily traded compared with human assets (or human capital). Brynjolfsson (1994) extended the Grossman–Hart–Moore framework by including productive knowledge and information as an intangible asset that affects agents' marginal product when they have access to it.

The main result of the Grossman–Hart–Moore framework is that the allocation of ownership rights of the nonhuman assets has an important effect on the bargaining position of the parties after they have made firm-specific investments. In the absence of comprehensive contracts, property rights over the firm's physical assets largely determine which *ex-post* bargaining position—the agent's or the principal's—will prevail. In fact, because future returns are uncertain, ownership arrangements over nonhuman assets are

routinely renegotiated *ex-post* after the agent or principal has made *ex-ante* relationship-specific investments. Thus, as Mahoney (2005, pp. 135, 136) summarizes, since "a firm's nonhuman assets represent the glue that keeps the firm together," it follows that "control over economically relevant nonhuman resources leads to control over human resources."

Mahoney's (2005) summation nicely encapsulates our claim that in a strategic entrepreneurship context, agency theory has a role in explaining how a firm gains control of resources, especially those that it does not own. In particular, a resource can be controlled if the firm (or principal) owns resources or assets complementary to the given resource. Despite this point, the question remains whether such an agency perspective is valid in a strategic entrepreneurship context. Michael et al. (2002) contend that it is a valid lens for exploring questions specific to strategic entrepreneurship. In particular, it has already been applied extensively to matters pertaining to strategic management (Mahoney), and is equally applicable to questions specific to entrepreneurship, especially if one adopts a view of entrepreneurship in which the key function of the entrepreneurial process is the coordination of resources (Casson, 2003).

To accentuate this point, we offer an example of how agency theory may be applied to strategic entrepreneurship questions. In particular, we focus on the question of how a firm (i.e., owners) manages and controls resources it does not own. Thus, for the remainder of this paper, we focus our attention on the relationship between the agent's and owner's residual claims on knowledge assets (i.e., the owning of patents) and the prevailing equity ownership shares that result from *ex-post* bargaining. We assume that the number of patents owned by the top manager is a reasonable proxy for her relationship-specific investment and indispensable human capital.[3] In doing so, we assume that two assets are necessary for the production process, patents, and physical assets.

Agency, Resource Control, and Equity Ownership

Revealed in the discussion of agency theory is a natural tension in the effect of equity ownership: on the one hand, granting agents ownership of the firm's resources—and thus residual claims on future returns—aligns their interests with those of the principals and maximizes the profit incentives for both parties. On the other hand, according to the Grossman–Hart–Moore framework, granting agents ownership also implies that principals lose authority and control over their hired managers (Mahoney, 2005). Thus, while *ex-ante* (i.e., hiring) negotiations presumably result in an initial distribution of equity ownership that optimizes each party's profit incentives, repeated *ex-post* bargaining results in "adjustments" to the ownership distribution as a function of whose bargaining position prevails. In other words, in the case of the agent, she can expect to receive compensation commensurate with the performance of the firm *plus* some adjustment to her equity position reflecting the value of the assets she owns.

Does this have relevance in a strategic entrepreneurship context? According to Ireland et al. (2003), for example, newer ventures relative to established firms tend to excel at

3. Patents are less than ideal as measures of firm or industry-level intangible asset stocks (Cockburn & Griliches, 1988; Griliches, 1990). Patents, on the other hand, by granting an inventor monopoly rights over a given idea (itself being unique and non obvious), are a reasonable measure of the intangible assets owned by an individual. Indeed, given the assumptions of our framework, CEO-owned patents indicate her investment of codified knowledge assets specific to the new venture and—since the accompanying tacit knowledge is necessary for successful use of the codified knowledge (Mowery, Oxley, & Silverman, 1996; Patel & Pavitt, 1997)—her contribution of indispensible human capital.

Table 1

Patent Ownership, Equity Ownership, and Hold-Up

	Patents owned by the CEO	Patents owned by the firm
Equity ownership of the CEO is high	Residual control rights, with the CEO as the inventor Strategic advantage (I)	Hold-up problem through the CEO Strategic advantage (II)
Equity ownership of the CEO is low (zero)	Hold-up problem through the shareholder(s) Strategic advantage (III)	Residual control rights, with the shareholders Strategic advantage (IV)

CEO, chief executive officer.

opportunity-seeking behaviors, but tend to rely largely on the availability of resources external to the firm. As a result, the top manager of such a firm is expected to provide not only managerial expertise that emphasizes advantage-seeking behaviors, but also the capacity for acquiring external resources, including financial, human, and social capital (Ireland et al.). This is especially true for knowledge-intensive (i.e., technology-based) ventures. The problem is that the growth and performance of knowledge-based ventures depends largely on *intangible* human and nonhuman assets. As a result, because the value of intangible assets is difficult to assess, one could argue that in this particular case, the logic of agency theory breaks down.

Indeed, as Mahoney (2005) contends, absent the dependence on nonhuman assets common with more traditional manufacturing firms, such as machinery or buildings, the question is what stops workers in a knowledge-intensive firm from quitting entirely (to act as a contractor) or leaving to form their own firms? According to agency theory (Mahoney), the answer lies in the value of the firm's other nonhuman and intangible assets, such as its reputation or explicit intellectual property (i.e., patents, trademarks, or copyrights). These intangible resources are more difficult to assess, especially in terms of future expected value, and thus tend to exacerbate the problem of optimizing the agent's ownership of the firm's assets. Indeed, on its face, the premise that "control over economically relevant nonhuman resources leads to control over human resources" seems less viable in a knowledge-based venture since in these instances, the firm's intangible resources, and not its physical assets, are weaker in function as the organizational "glue" for the firm.

Thus, since it is not readily evident that an agent's share of equity is greater when she holds valuable assets the firm seeks to control, we suggest a governance framework applicable to a strategic entrepreneurship context as summarized in Table 1.[4] As Audretsch et al. (2006) show, the competitive advantage of a knowledge-based new venture is typically bestowed by the human capital and knowledge capabilities of the top executive, who may or may not be the founder. If the critical resources are the human capital of the top executive *and* her contribution of a venture-specific resource, then equity ownership giving her residual rights grants her power in any negotiations over the use of

4. For purposes of this study, the level of equity ownership—either high or low in Table 1—is taken as the dependent variable. As such, we assume an optimal distribution of equity based on whether the firm or the agent owns patents. We leave exploration of the performance ramifications of the CEO's equity ownership being "too high" or "too low" for future study.

the resource. Given this, if the top manager is the owner of the patents, but has no power over the use and access to this critical resource expressed by low or no equity ownership of the firm, the firm may be at a strategic disadvantage. Thus, given the need to align the agent's interests with those of the principals and her *ex-post* bargaining position, the amount of equity ownership held by the entrepreneur or top manager is greater when she also owns an intangible resource (i.e., a patent) the principals of the firm seek to control. In contrast, the equity ownership held by the agent is less when the firm owns the intangible resource (i.e., patent) given the prevailing *ex-post* bargaining position of the principals.

If this argument holds, we expect that equity ownership of the firm and the ownership of knowledge assets are strong complementarities. In particular, if the agent owns critical assets and thus has the option of acting as an independent contractor (Hart, 1995), she receives compensation based not only on the firm's performance, but also on the resource's value after production occurs. Thus, in *ex-post* bargaining, she has two sources of incentives to invest in future projects (i.e., remain with the firm) and maintain the competitive advantage of the firm. Conversely, disadvantages occur when the incentives are misaligned in the sense that she owns a critical resource—like patents or specific human capital—but has weakened bargaining power because her equity stake is too low to motivate her to invest in future projects with the firm. Thus, our model assumes there is an optimal fit between equity ownership and intangible assets that circumvents under-investment decisions (see Gibbons, 2004; Rajan & Zingales, 1998, 2000, 2001a,b). Correspondingly, we also assume that a firms' competitive advantage is determined by its equity ownership structure, given the *ex-post* bargaining position of the party's holding intangible knowledge assets.

Given this, we assume that patents are a proxy of both knowledge assets and specific human capital as critical resources held by and embodied in the top manager and/or the employees of a firm. As a result, an individual person—in our case, the agent, or the firm's shareholders—could own the patents used in the production process.[5] In the first scenario, the top manager personally owns at least one patent. If she owns no equity shares of the firm, and if her cooperation is necessary to the production process, she risks going uncompensated for work that is not specifically stipulated in an explicit contract. However, if she owns at least some of the firm's equity, she will be in a position to reap at least some of the benefits accruing from the relationship-specific investments she makes. Indeed, her *ex-post* bargaining position derives from her ability to "veto" any allocation of the residual rewards that she considers to be unfavorable by threatening to withdraw the patents from the production process. Equity ownership of the firm's assets therefore leads to *ex-post* bargaining power and thus mitigates the hold-up problem, enabling the agent's interest in maximizing the firm's competitive advantage.

Moreover, it may also be possible for her to sell her patents or allow other firms to use the patents she holds. This kind of threat is only credible if the agent has outside opportunities. One outside opportunity is the ability to raise money to invest in new production technologies. This, however, leads to the same agency problem if she needs other sources of equity financing. That is, she still needs a comprehensive contract that specifies all the relevant circumstances for these outside opportunities. If such a contract is feasible, the question arises why she needs some ownership of the physical asset to protect and ensure her relationship-specific investments. Following the Grossman–Hart–

5. For underinvestment and other incentive problems in firms when employees are the inventors but not the patent holders, see Harhoff and Hoisl (2004).

Moore framework, it follows that the agent should own a share of equity as a function of her owning a needed resource in the form of a patent. Thus,

Hypothesis 1: The share of equity held by the agent (i.e., the CEO) increases with the number of patents she owns.

The second case is when the firm as a legal entity owns the patents. The essential claim is that, in this instance, it is the principal's *ex-post* bargaining position that is strengthened. This premise assumes that as long as the knowledge resources in question are tied to the assets of the firm (i.e., the value of the agent's knowledge assets is determined by the extent to which they complement the firm's assets), the resources remain relatively immobile (Barney, 1986; Barney & Clark, 2007). As long as this assumption holds, if the firm owns a share of the knowledge resources employed, the principals are granted power over the use and misuse of the patents owned by the agent. In other words, the agent's ability to hold-up other shareholders by applying the patents to outside opportunities is curtailed, and her optimum equity stake in the firm is now less than it would be, all things equal (see Brynjolfsson, 1994, p. 1651). This suggests the second hypothesis,

Hypothesis 2: The share of equity held by the agent (i.e., the CEO) decreases with the number of patents owned by the firm.

Although not explicitly tested here, these hypotheses are in sharp contrast to the usual predictions of agency theory and empirical evidence on corporate governance in larger established firms (see, e.g., Himmelberg et al. [1999] or Bitler et al. [2006]). In particular, if the economic value of patents is associated with high risk, the equity ownership held by the top manager as a patent holder should *decrease* with the number of her patents. Indeed, for a risk averse top manager, it should be optimal to cash out (at IPO) and diversify her risk. This disparity between the results commonly verifying corporate governance in the agency theory and the arguments in this paper based on our framework of entrepreneurial governance suggests that the governance in a strategic entrepreneurship context may be markedly different and even contrary to what by now constitutes conventional wisdom concerning the governance of large incumbent corporations.

Research Design

We test the hypotheses regarding the link between managerial equity ownership and patents using a unique dataset consisting of all of the knowledge-based and high-technology German IPO firms that were publicly listed between 1997 and 2002. We excluded all firms located outside Germany, as well as holding companies, resulting in an underlying dataset consisting of 285 publicly listed German firms. We collected information from the IPO prospectuses and combined it with publicly available information from online data sources, including the *Deutsche Boerse AG* (http://www.deutsche-boerse.com). This database includes firms in high-technology sectors including biotechnology, medical devices, life sciences, e-commerce, and other high-technology industries. From this dataset, we excluded all the firms older than 8 years at the time of the IPO, resulting in a sample 127 "new ventures." All data are taken at the time of IPO.

For empirical purposes, we equate the top manager with the person identified in the prospectus as the CEO. The share of equity ownership as the dependent variable is measured by the percentage of firm assets owned by the CEO at the time of the IPO. While there is no minimum percentage the CEO must own following the IPO, regulations limit the maximum percentage of CEO ownership following the IPO to 75%. The truncated

variable suggests our use of Tobit estimation as a complement to the ordinary least squares (OLS) estimates, as discussed below. For the key independent variables, the number of patents owned by the CEO and the number of patents owned by the firm are taken from the German patent database. The skewed distribution of these variables suggests that we also report quantile regression estimates to further validate the OLS results is also discussed below.

In addition to the patent variables, we also include several control variables. First, evidence shows that the percentage of equity shares held by a CEO is shaped both by firm size and firm age (Audretsch & Lehmann, 2005; Daily, Dalton, & Cannella, 2003; Fiegener et al., 2000; Huse, 2000). According to Agarwal and Samwick (1999), firm size is a proxy for firm risk. They found a significant negative relationship between firm size and the amount of equity held by managers. They interpret their findings as being in line with the predictions from agency theory that the amount of variable compensation as equity shares is negatively affected by firm risk. Firm size is measured by the number of employees.

Second, as with firm size, research examining the survival of new ventures has shown that firm age is a proxy for firm risk. One interpretation of the negative relationship between new venture age and the likelihood of survival is that the entrepreneur and managers of the new venture are uncertain about their capabilities, the underlying production technology, or market conditions. As the new venture matures and gains experience, the degree of entrepreneurial uncertainty increases (Audretsch et al., 2006; Jovanovic, 1982). Moreover, there is a pure evolutionary argument: the older a firm, the longer it has survived on the market and thus the lower is the associated risk (Audretsch & Lehmann, 2005). Firm age is measured in years founded prior to the IPO. We also included dummy variables to control for the year of the IPO.

Finally, in our estimates, we control for specific industry effects by including dummy variables based on recently improved *Deutsche Börse AG* classifications of the following high-technology industries: medicine technology; information and communication technology; nano-, micro-, and optical technologies; biotechnology; chemistry; software development; computer technologies; and solar energy technology. As mentioned, we include a set of dummies to control for any effects specific to the year of the IPO. Having done so, we are concerned that the IPO and industry dummies are not independent; however, there is no clear theoretical argument that an interaction of these two effects should depend on the number of patents.[6]

To ensure the robustness of our findings, we use different estimation techniques to alternatively analyze CEO-owned and firm-owned patents as determinants of equity ownership by the CEO. First, to establish our base results, we report simple OLS estimates. In particular, we estimate the following model,

$$y(\text{CEO ownership}) = f(\text{CEO patents, new venture patents, firm size, firm age, control dummies}) + u. \quad (1)$$

Second, since the dependent variable is truncated at low and high values (minimum 0% equity ownership and a maximum at 75%), the Tobit model produces results preferable to

6. Given our data, we could not derive a valid chi-square test of the independence of the IPO and industry dummies. As a result, our assumption of the independence of the control dummies could not be validated empirically. We also cannot deny that some industry effects may remain, but the estimates do not show robust effects of one or more industries across all the results.

the OLS approach. Thus, let $y_i^* = \beta' x_i + u_i$, with y_i^* as the latent variable, which represents the desired or potential equity holding by the CEO. Further, x_i is a vector of exogenous variables, including the number of patents of the CEO and those of the new venture, and u_i are disturbances with $E(u_i) = 0$. The observed variable y_i is given by

$$y_i = \begin{cases} \underline{c}_i & \text{if } y_i^* \le \underline{c}_i \\ y_i^* & \text{if } \underline{c}_i < y_i^* < \overline{c}_i \\ \overline{c}_i & \text{if } \underline{c}_i < y_i^* \end{cases} \tag{2}$$

where $\underline{c}_i, \overline{c}_i$ are fixed numbers representing the censoring points of equity ownership by a CEO (0 and 75%). We use the same model specification as used for the OLS estimates.

Finally, a concern in estimating the above regression model is the degree to which the variables are highly skewed. As examples from the labor market literature show (Buchinsky, 1998; Koenker & Hallock, 2001), the method of quantile regression estimation is appropriate in the case of such highly skewed endogenous variables. This semiparametric technique provides a general class of models in which the conditional quantiles have a linear form. In its simplest form, the least absolute deviation estimator fits medians to a linear function of covariates. The method of quantile regression is potentially attractive for the same reason that the median or other quantiles are a better measure of location than the mean. This technique also has the useful feature of being robust against outliers while using the likelihood estimator, which are in general more efficient than the least squares estimator.[7]

Let (y_i, x_i), $i = 1, \ldots, n$, be a sample of new ventures, where x_i is a *Kx1* vector of regressors. Assume that $Quant_\theta(y_i, x_i)$ devotes the conditional quantile of y_i, conditional on the regressor vector x_i. The distribution of the error term $\mu_{\theta i}$ satisfies the quantile restriction $Quant_\theta(\mu_{\theta i}, x_i) = 0$. Thus, $y_i = Quant_\theta(y_i, x_i) + \mu_{\theta i}$ or $y_i = Quant_\theta(y_i, x_i) = x_i'\beta_\theta$ is estimated. We again estimate the model consistent with the OLS and Tobit specifications:

$$\begin{aligned} Quant(\text{CEO ownership}) = f(&\text{CEO patents, new venture patents, firm size,} \\ &\text{firm age, control dummies}) + u. \end{aligned} \tag{3}$$

Results

Tables 2 and 3 report the descriptive and correlation statistics, respectively. On average, 33.6% of the asset of the firms in the sample are owned by the CEO. In half of the firms, the CEO owns more than about one quarter of the firm (25%). In these cases, it would seem the owners of the firm other than the CEO retain the capacity to block the strategic decisions of the CEO and thus hold significant power in *ex-post* bargaining position. As Table 2 also shows, on average, each CEO owns one patent. However, the number of patents is highly skewed in the dataset with a maximum of a CEO holding 49 patents. The same holds for the number of patents owned by a new venture. On average, a new ventures holds four patents, with a maximum of one firm owning 96 patents. The firms differ in their age and especially in their size as measured by the number of employees. While the median firm is about 3 years old and has about 66.5 employees, the

7. See Buchinsky (1998) for a survey of the method and some applications in the labor market.

Table 2

Descriptive Statistics ($N = 127$)

	Mean	SD	Min	Max	Median
CEO equity after IPO	33.68	30.20	0	75.0	25.45
Patents owned by the CEO	1.01	4.78	0	49	0
Patents owned by the firm	4.053	15.381	0	96	0
Firm age (years)	3.2	2.258	1	7	3
Firm size (no. of employees)	143.494	227.627	2	1,400	66.5

SD, standard deviation; CEO, chief executive officer; IPO, initial public offering.

Table 3

Correlation Matrix ($N = 127$)

	CEO patents	Firm patents	Firm age	Firm size
CEO equity ownership	.0352	–.1133	.1132	–.1157
Firm size	–.0135	.119	–.0653	—
Firm age	–.0062	–.0828	—	—
Firm patents	.2314	—	—	—

CEO, chief executive officer.

average age is about 3 years, and employs on average about 143 employees. The correlation matrix in Table 3 indicates little concern for multicollinearity.

The estimation results provided in Table 4 support both hypotheses 1 and 2. The first row shows the results from the OLS estimation. As the positive and statistically significant coefficient of the number of patents held by the manager suggests, the greater the number of patents held by the CEO, the greater is the share of her equity ownership. In contrast, the number of patents owned by the firm shows the statistically significant negative impact on the share of equity held by the CEO. As the positive and statistically significant coefficient of firm age suggests, the share of equity ownership by managers tends to increase as the new ventures becomes more mature. By contrast, a firm size as measured by the number of employees has no significant effect on the shares of ownership held by the CEO. This also seems to support the two hypotheses, albeit indirectly. Power from ownership results from voting power, which is expressed by the percentage of shares held by the CEO. In contrast, a risk-averse CEO may have an incentive to diversify her risk, and thus we would expect that the percentage of ownership would decrease with firm size.

The second row of Table 4 shows the results from estimating the regression model using the Tobit regression method. The results are strikingly similar to those obtained from OLS estimation. Both regression estimation methods confirm the two hypotheses that the percentage of equity held by a CEO is positively influenced by the number of

Table 4

Regression Results Estimating CEO Equity Ownership ($N = 127$)

	CEO patents	Firm patents	LNSize	LNAge	Industry dummies	IPO dummies	Constant	Pseudo R^2
OLS	.6324 (2.61)***	−.5418 (3.3.1)***	−.3030 (.26)	2.440 (1.98)*	Insig.	1997 (+)	23.275 (2.71)**	.1413
Tobit	.9421 (1.77)*	−.676 (2.21)**	.2259 (.14)	3.007 (2.04)**	Insig.	1997 (+)	18.984 (1.46)	.0201
.2 quantile	.6273 (15.94)***	−.187 (6.81)***	−.004 (.01)	.803 (4.33)***	Technology (+), software (+)	1999 (+)	3.130 (1.71)*	.050
.3 quantile	.338 (3.02)***	−.214 (2.98)***	−.005 (.01)	1.758 (3.85)***	Insig.	1997 (+), 1998 (−)	14.496 (2.43)**	.093
.4 quantile	.281 (1.61)*	−.223 (−1.19)	−.01 (.01)	3.572 (3.26)	Insig.	1998 (−)	17.735 (1.67)*	.115
.5 quantile	.501 (1.63)*	−.263 (.53)	−.435 (.14)	3.091 (1.07)	Insig.	Insig.	22.623 (.92)	.126
.6 quantile	.544 (1.71)*	−.394 (1.75)*	.619 (.18)	1.587 (.49)	Insig.	Insig.	31.693 (1.15)	.103
.7 quantile	.596 (2.18)**	−.521 (2.46)**	−.337 (.16)	3.556 (1.90)*	Medtec (+)	Insig.	33.412 (2.11)**	.124
.8 quantile	.561 (1.80)*	−.484 (1.63)*	.225 (.09)	4.506 (2.05)**	Medtec (+)	Insig.	28.372 (1.66)*	.144
.9 quantile	.525 (1.53)	−.475 (−1.46)	.397 (.06)	7.169 (.90)	Insig.	Insig.	11.569 (.30)	.211

* statistically significant at the 10% level; ** statistically significant at the 5% level; *** statistically significant at the 1% level.
CEO, chief executive officer; IPO, initial public offering; OLS, ordinary least squares; Insig., insignificant; Medtec, medical technology.

patents she owns and is negatively influenced by the number of patents owned by the firm. The third and subsequent rows report the results from the quantile regressions. For all quantiles between the .2 quantile and the .8 quantile, the percentage of equity held by the CEO increases with the number of patents owned by the CEO. In contrast, the number of patents held by the firm is negative and significant in only five of the quantiles. Thus, the results continue to support the two hypotheses, but they also indicate a nonlinearity between ownership and patents.

According to our theoretical framework, granting equity ownership is a means for new ventures to gain control of key resources owned by individuals—in this case, the CEO or entrepreneur. In other words, if the intellectual property of the entrepreneur or CEO in the form of a patented invention is essential for production because of complementarities with her expertise, then she is effectively indispensable to the new venture.[8] Thus, the above empirical results may explain why an entrepreneur or CEO holding assets essential to the success of the new venture is likely to own more of the new venture relative to other shareholders. However, if it is the firm that holds the intellectual property assets, then the bargaining position of the CEO is weakened, and thus her ownership of the firm is less. Thus, the empirical results provide compelling evidence for the two hypotheses posited earlier in this paper.

Two important qualifications regarding the results presented in Table 4 must be considered. First, empirical studies—including this one—on corporate governance may suffer from reverse causality and heterogeneity (see Börsch-Supan & Köke, 2002; Himmelberg et al., 1999). The problem of reverse causality may exist to the degree that patents are influenced by CEO ownership of the physical assets. However, as Holmström (1999) shows by analyzing the costs and benefits of litigation, such reverse causality is more likely to apply to established large corporations than for small and new ventures. Second, no information was available to determine if the CEO was also the firm's founder and thus presumably a principal. Certo et al. (2001) find that investment banking firms are less likely to underprice a firm's stock if the top manager is a "professional manager" as opposed to the firm's founder. Thus, because investors may value the founder's managerial expertise less than that of a professional manager, it is possible that the founder–CEO holds a smaller equity share following the IPO on this basis. With this said, since our model emphasizes the *ex-post adjustments* to equity distributions, this issue does not inherently invalidate our results.

Discussion and Conclusion

This paper has suggested that agency theory is readily applicable to the development and improvement of strategic entrepreneurship as a theoretical construct by introducing analysis at the level of the individual within the firm. In particular, a strategic entrepreneurship perspective of agency theory is offered to explain the link between the agent's share of equity ownership and the critical knowledge assets she may own. According to our framework, the boundaries of the new venture define the allocation of residual control rights. If contracts are incomplete as is typical, then managerial equity ownership serves not just as a mechanism to render managerial incentives compatible with the owners' goals, as agency theory predicts, but more importantly, also as an instrument enabling residual control rights in ongoing negotiations between principal and agent. The ability to

8. Hart and Moore (1990) emphasized this.

exercise residual control rights improves the *ex-post* bargaining position of the CEO as an asset owner, thereby increasing her incentive to make investments that are specific to the new venture.

Our framework of entrepreneurial governance was tested using patent ownership as a proxy for both relationship-specific investments and indispensable human capital of the CEO. The empirical results confirm the main hypotheses posited by our model. In particular, patent ownership of the CEO significantly increases the percentage of equity held, while the number of patents held by the firm significantly decreases the percentage of ownership. As a result, the findings of this paper imply that strategic decisions involving the governance of new ventures do not mirror the conventional wisdom already established for large incumbent corporations. Rather, the decision to provide equity ownership to managers of new ventures, especially in small and high-tech new ventures, is not entirely explained by agency theory, as suggested by Bitler et al. (2006), among others. More importantly, we are able to conclude that a firm (or its shareholders) can gain control of a resource by making the owner of the resource an owner of the firm.

One implication of our arguments is that resolving the agency problem is particularly crucial in a strategic entrepreneurship setting. In particular, optimizing the governance structure through equity ownership serves not only to align the interests of principal and agent; it also serves as a mechanism for effectively managing and leveraging the firm's resources. Beyond this point, it is also seems likely that any such equity arrangements are pivotal in allowing the *collective* entrepreneurial mindset and entrepreneurial culture upon which strategic entrepreneurship is grounded (Ireland et al., 2003). How, we wonder, can a setting conducive to entrepreneurial thinking and collective action emerge if the interests of principal and agent are in conflict? In short, we suggest that resolving any misalignments in incentives and equity structures serves many (perhaps conflicting) ends, with implications beyond the management of resources alone. Indeed, it implies a two-way street in which agency theory informs strategic entrepreneurship and vice versa, given a unique context for considering matters of governance.

We readily acknowledge that there may be other theoretical explanations for our results, that our analysis warrants further exploration with alternative specifications and variables—particularly the founder status of the CEO—and that our sample frame may not constitute a valid strategic entrepreneurship context.[9] Nonetheless, we contend that these and other qualifications—which are themselves quite valid and in need of exploration—reinforce our point that applying agency theory to strategic entrepreneurship questions contributes to our understanding of the field by raising new questions and helping us understand what strategic entrepreneurship *is* or *is not.* Indeed, among the most pressing questions our study appears to highlight is how best to represent empirically not only the strategic entrepreneurship context, but also how to measure or observe at the individual level when top managers are engaged in advantage-seeking versus opportunity-seeking behaviors. Given the set up of our model, we have in effect assumed the importance of this distinction away.

In addition to such empirical matters, future research should incorporate the role of other stakeholders who own resources the firm needs to control (see Demougin & Fabel, 2006). Ownership of the firm's assets may have little value for these stakeholders, since the expectation that they provide expertise and knowledge inputs akin to the CEO may not hold. A candidate stakeholder for such analysis is the venture capitalist (VC), since, in

9. We gratefully acknowledge a reviewer of this manuscript for raising these issues.

addition to their provision of financial capital, VCs often also invest their specialized human capital and capabilities in the new venture. This dual role of the VC—like the dual role of the top executive of a new venture—may exacerbate the "double moral hazard" problem associated especially with new ventures (Demougin & Fabel).[10] Then, the ownership rights of both patents and the firm's assets may be part of the agency problem as well as a mechanism to mitigate it.

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10. A VC faces moral hazard in the entrepreneur's "behaviors" that determine the return on investment. VCs, however, also contribute managerial and consulting services to the new venture. Thus, the moral hazard problem is "double-sided" in that the return on investment is affected by the behaviors of both the entrepreneur and the VC.

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