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Jongkuk Lee, Glenn Hoetker, William Qualls

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Alliance Experience and Governance Flexibility

Jongkuk Lee
Ewha School of Business, Ewha Womans University, Seoul 120-750 Korea, jongkuk@ewha.ac.kr
Glenn Hoetker
W. P. Carey School of Business, Arizona State University, Tempe, Arizona 85287, glenn.hoetker@asu.edu
William Qualls
University of Illinois and Hunan University, Champaign, Illinois 61820, wqualls@illinois.edu

Prior work has mapped the transaction at the heart of an alliance to the risks of opportunism inherent in that alliance and, ultimately, to how the alliance is structured and governed. We extend this approach by noting that the parties in an alliance do not necessarily perceive the same hazards as predominant and thus may have different preferences for how the alliance is structured. Nevertheless, it is in each party's best interest to find a structure that protects its interests, while also allowing its partner to protect its interests sufficiently. Drawing from the alliance management capabilities literature, we argue that firms with more alliance experience are better able to protect their interests under any given alliance structure, making the choice of structure less consequential to them. The resulting governance versatility provides a competitive advantage by enabling firms to form advantageous alliances that are less available to inexperienced competitors. Our study of innovative alliances in biopharmaceutical industry lends support to the hypotheses, allowing us to advance the literature on governance choice in alliances, the literature on alliance management, and their intersection.

Keywords: strategic alliances; innovation; alliance experience; alliance capabilities; governance flexibility; pharmaceutical industry
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Introduction

Firms form alliances to "pool imperfectly tradable resources in order to gain greater efficiency in the use of existing resources as well as opportunities to create new resources" (Mitchell et al. 2002, p. 207). Although both firms in an alliance strive to achieve an effective combination of their productive resources, each firm must also mitigate the risk of opportunistic behavior from their partner (Nickerson and Zenger 2004). An extensive literature drawing largely from transaction cost economics has mapped the characteristics of the transaction at the heart of the alliance to the risks of opportunism and, ultimately, to how the alliance is optimally structured and governed. In a canonical example (e.g., Williamson 1991), alliances imbued with high asset specificity create a higher risk of hold-up and, thus, favor structures that protect against that hazard, e.g., an equity alliance.

As powerful as these insights have been both theoretically and empirically, they leave three inter-related points under-explored. First, the parties in an alliance do not necessarily perceive the same hazards as predominating in the alliance. Thus, we examine this tension in the oft-studied context of research-and-development (R&D) alliances in the biopharmaceutical industry, in which the predominant hazard from the perspective of client firms is the loss of flexibility in their search for knowledge while the predominant hazard from the perspective of target firms is the possible leakage and misappropriation of their knowledge. As we detail below, a *client firm* is a technology recipient that accesses the *target firm's* knowledge or capabilities through the alliance (Robinson and Stuart 2007b). We investigate situations in which the safeguards demanded by one party are inconsistent with those demanded by the other.

Second, to the degree that firms perceive different hazards as predominant, they may have different preferences for how the alliance is structured and governed. Furthermore, a given characteristic of the alliance may push the firm's preferences in opposite directions. Thus, we focus on the choice between an equity and nonequity (purely contractual) alliance structure, which has been broadly studied because it sets the overarching framework under which all subsequent governance activities will occur (e.g., Gulati 1995). We posit that the inclusion of pooled R&D activities in an alliance shifts the preferences of the target firm toward the inclusion of equity in the alliance, while shifting the preference of the client firm toward a nonequity, purely contractual, alliance.

Despite these potentially contrasting preferences for the alliance structure, it is in each firm's ultimate interest to find an arrangement that protects its own interests while also allowing its partner to sufficiently protect its own. This leads to the third point, which draws from the literature on alliance management capabilities: firms differ in their ability to protect their interests under

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any given governance structure. Alliance experience provides learning across multiple stages of the alliance process, including selecting collaborators, negotiating terms and conditions, monitoring and managing the collaboration, and recognizing the optimal time to terminate a collaboration (Simonin 1997). As a result, more experienced firms have more tools to protect their interests and thus depend less on the protection provided by their preferred governance structure. Governance structure is less consequential to experienced firms because they have greater versatility in the structure of their alliances.

These three points collectively lead to a more extensive view of governance choice in alliances. Moving beyond viewing governance mode as a function of the characteristics of the transaction alone, we further consider the potentially distinct impact of transaction characteristics on each party and the ability of each party to respond to that impact under different governance arrangements. Conceiving of governance choice as the outcome of the possibly conflicting concerns and abilities of the alliance partners reflects the reality that governance choices derive from the interplay of each firm's efforts to create and claim value in the relationship. Thus, the association between transactional hazards and specific governance modes (e.g., equity) is contingent, rather than universal.

This more extensive view and our empirical validation of it enable three contributions. First, we advance the alliance capabilities literature by introducing governance versatility as an aspect of alliance capabilities developed through experience. Achieving the firm's desired governance structure may be costly in terms of time, managerial attention, or goodwill. Indeed, doing so may not even be feasible because of institutional, Financial, or other strategic constraints. Thus, a firm with the versatility to proceed in an alliance even without its optimal governance structure, relying on its alliance management capabilities to protect its interests and claim value, can gain competitive advantage by forming alliances that are less available (or not available at all) to less able competitors. Our results help link the strand of the alliance management capability literature that focuses on skills critical to managing ongoing alliances with the strand that focuses on skills related to the initial formation of an alliance (see Schreiner et al. 2009).

Second, we contribute to the strategic theory of firm integrating transaction costs and resource-based theories, which emphasizes a triangular alignment among the characteristics of transaction, resource, and governance structure to take into account both transaction efficiency and competitive advantage (Ghosh and John 1999, 2005; Madhok 2002).

Third, we offer a model for incorporating the insights of the alliance management literature into the literature on governance choice in alliances. This model is amenable to including many aspects of both literature streams, opening multiple research vistas. For example, it complements Diestre and Rajagopalan (2012), which examined the different incentives and capabilities for value creation and appropriation of pharmaceutical and biotechnology firm alliances.

These contributions have broad applications, as many alliances are between parties with potentially asymmetric preferences and differential alliance management capabilities. Examples include alliances between established firms and small entrepreneurial firms, as well as international alliances between local and foreign firms. The concept of governance versatility also extends beyond the initial choice of governance structure to the full range of alliance terms.

Theory and Hypotheses

Many aspects of how an alliance is arranged bear on the ability of each firm to mitigate potential hazards. In this study, we examine the governance structure of the alliance, specifically, whether the alliance included a minority equity investment or was purely contractual. In addition to being highly visible, the equity/nonequity decision sets the overarching framework under which all subsequent governance activities will occur (Gulati 1995). As a result, it has been extensively studied, providing a well-established basis for our hypotheses.

Innovation alliances involving a *target firm*, a technology holder that shares its knowledge or capabilities with a client firm, and a *client firm*, a technology recipient that accesses the target firm's knowledge or capabilities through the alliance (Robinson and Stuart 2007b), are an ideal setting in which to study the equity/nonequity decision. The distinction between the target and the client reflects the nature of knowledge each party brings. The target contributes more basic knowledge, such as materials or compound, to make technological breakthroughs in the innovation alliance, whereas the client contributes more application-oriented knowledge to test and covert the target's technological knowledge to specific applications (Robinson and Stuart 2007b). In accordance with the flow of basic knowledge from the target to the client in the innovation alliance, the client often provides financial supports in such forms of mile stone payments or running loyalties to the client (Lerner and Merges 1998).

As we detail subsequently, the predominant hazards for target and client firms differ, meaning that firm's preferences for the use or nonuse of equity in response to given situations may differ. Although the client/target distinction is particularly well established in the biopharmaceutical industry (e.g, Filson and Morales 2006, Lerner and Merges 1998, Robinson and Stuart 2007b), the challenge of managing contrasting preferences generalizes broadly.

Our conceptual and empirical strategy builds on these contrasting preferences. We draw from an extensive literature that posits that the use of equity is in response to

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the target's concerns about knowledge leakage, whereas the nonuse of equity is in response to the client's concerns about flexibility. Both concerns are amplified when research and development (R&D) activities are pooled in an alliance, versus when they are not. Thus, the inclusion of pooled R&D activities, in which the parties are coinvolved at the same stage of the innovation process, shifts the preferences of the target and client in opposite directions—making equity relatively more attractive to targets and relatively less attractive to clients. Therefore, when alliances with pooled R&D activities are more strongly associated with the use of equity than those without pooled R&D activities, it reflects a stronger alignment between the chosen structure and the target's shifted preferences than the client's preferences. A weaker relationship between the inclusion of pooled R&D activities and the use of equity reflects the reverse.

Thus, by observing the strength of the association between pooled R&D activities and the use of equity under different conditions, we can determine conditions under which firms are more willing to accept a structure that is less optimal given the predominant hazard they face—that is, when firms are more versatile vis-à-vis governance structure. We next develop this logic and then examine the role of alliance experience in enabling governance versatility.

Resource Integration and Governance Choice

Alliances involve the process of combining intangible, knowledge-based resources between legally independent entities (Dussauge et al. 2000, Wang and Zajac 2007). An important decision in forming an alliance is the way such knowledge-based resources are integrated or shared between partners (Das and Teng 2000). In particular, research has distinguished between link and scale alliances (Hennart 1988). Link alliances involve exchanging resources without resource pooling between partners by performing different functions across the value chain (Kalaignanam et al. 2007). In scale alliances, the client and target firms "contribute similar resources pertaining to the same stage or stages in the value-chain" (Dussauge et al. 2000, p. 102). Within the context of innovation alliances involving target and client firms, this distinction corresponds to alliances in which R&D activities are pooled (scale) to create new knowledge or capabilities by jointly building on the target firm's technological resources and to those in which they are not pooled (link), such as the client firm outsourcing R&D to the target firm.[1]

The alliance between Bristol-Myers Squibb and Epitome Biosystems is an example of an alliance that did not involve pooled R&D activities. Bristol-Myers Squibb, the client firm, outsourced a product development project to Epitome Biosystems, the target firm:

> Epitome Biosystems announced that it has signed a technology access and product development agreement with Bristol-Myers Squibb Co. for use of Epitome's proprietary EpiTag protein measurement platform. Epitome will develop custom antibody arrays for quantitative and high-throughput measurement of proteins specified by Bristol-Myers Squibb to accelerate introduction of newly discovered biomarkers into clinical development programs. Under the terms of the agreement, Epitome will receive development funding and license fees from Bristol-Myers Squibb . . . . (PR Newswire 2006)

The alliance between Merck & Co. and Alnylam provides an example of an alliance that involved pooled R&D. Here, Merck & Co., the client firm, jointly developed an advanced technology by pooling resources with Alnylam, the target firm, based on Alnylam's intellectual property, technology, and expertise.

> Merck & Co., Inc. and Alnylam Holding Co., the leading therapeutic RNA interference (RNAi) company, announced today that they have entered into a multi-year collaboration to develop RNAi-based technology and therapeutics, which uses a natural biological mechanism to inhibit the expression of disease-causing genes and viruses, and jointly apply the technology to develop RNAi-based therapeutics that selectively target human diseases . . . . Merck will provide Alnylam with a series of proprietary drug targets that have well-validated roles in disease and are attractive candidates for a new therapeutic approach using RNAi. Alnylam will develop RNAi compounds against these targets and advance RNAi-based drug candidates through preclinical development . . . . For technology development, Merck and Alnylam will each commit significant resources and expertise to the collaborative development of advanced RNAi technology, building on Alnylam's leading position in intellectual property, technology and know-how for RNAi-based therapeutics . . . . (PR Newswire 2003)

In this alliance agreement, Alnylam (as a target firm) provides more basic, scientific knowledge for RNAi technology, which uses a natural biological mechanism to inhibit the expression of disease-causing genes and viruses, and Merck (as a client firm) provides drug targets, application-oriented knowledge, to jointly apply the RNAi technology to develop RNAi-based therapeutics that selectively target human diseases. As the client with a problem to solve (addressing a set of drug targets), Merck made a series of payments to obtain access to the scientific knowledge Alnylam has developed.

The pooling or nonpooling of R&D creates different types of interdependence between partners (Thompson 1967). When R&D is not pooled, the alliance involves serial interdependence, which requires coordination of the activities of partners across separate stages of the value chain (Gulati and Singh 1998). Serial coordination can be accomplished by each partner making many of the decisions within stages for which they are responsible independently. Moreover, the contributions of partners tend to be clearly distinguished in an alliance that

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does not involve pooled R&D, as the stages of the innovation process in which each party's main contributions occur are distinguished in the alliance.

In contrast, the pooling of R&D creates much more interdependence between the partners. The need for mutual adjustment requires more comprehensive and involved coordination (Gerwin 2004). Moreover, the contributions of partners are less clearly distinguished in alliances involving resource pooling because their resources are integrated for the same stages in the innovation process (Park and Russo 1996).

These differences mean that the inclusion of pooled R&D raises different concerns for target and client firms. For the target firm, the primary concern amplified by the inclusion of pooled R&D is the greater potential for unintended knowledge leakage. The extensive interdependence and frequent interactions between partners in alliances with pooled R&D provide the client firm more opportunities to observe the target firm beyond the scope of activities agreed on at the time the alliance was formed (Oxley 1997). The client could then apply the knowledge outside of the alliance without making further payment (Arrow 1974). Furthermore, the need to make mutual adjustments or joint decisions in pooling R&D activities may require additional disclosure of information to their partners (Thompson 1967). Thus, pooled R&D increases the target firm's vulnerability to unintended knowledge leakage (Gulati and Singh 1998). Additionally, since knowledge resources from each firm were integrated within the same function, third parties such as the courts may be unable to ascertain if misappropriation of knowledge has occurred (Schwartz 1992). Further limiting the value of recourse to the courts is the limited range of potential remedies. Firms can be forced to return property, but it is difficult to force the client firm's employees to unlearn the knowledge once transferred (Hoetker and Mellewigt 2009). Therefore, the target firm will have a greater need for a governance structure that protects its technological resources in alliances with pooled R&D than in those without pooled R&D.

The inclusion of an equity investment in the target firm by the client firm helps provide that protection (Teece 1992). The usefulness of equity in governing such alliances is long established (Gulati and Singh 1998, Kale and Puranam 2004), although prior work has not generally distinguished the differential interests of the target and the client in having equity. An equity stake helps align the interests of the parties (Pisano 1989, Teece 1992). In particular, it assures that both parties have a financial stake in the success of the target firm (Gulati and Singh 1998). So, relative to an alliance without pooled R&D, the inclusion of pooled R&D induces a stronger preference on the part of the target firm for an equity-based alliance and the incentive alignment and dispute resolution mechanisms equity provides.

For the client firm, the predominant hazard amplified by inclusion of pooled R&D activities is the loss of flexibility (Balakrishnan and Wernerfelt 1986, Folta 1998). In developing new products, multiple options often coexist for feasible designs or technologies, and these compete to dominate other options (Osborn and Baughn 1990). For example, pharmaceutical firms typically search through more than 5,000 compounds to develop a single new drug (Giovannetti and Morrison 2000). Furthermore, delays or failures in the development of complementary technologies can render a potential technology application irrelevant or impossible (Santoro and McGill 2005). As a result, an alliance may fail to achieve its goals despite the best efforts of both parties. This possibility requires clients to maintain flexibility in monitoring technological changes in the industry and in forming and dissolving collaborative interfirm relationships, i.e., search flexibility (Hansen 1999, Rowley et al. 2000).

Flexibility is a concern for clients in all alliances. However, alliances involving pooled R&D activities restrict search flexibility to a greater degree than alliances without pooled R&D activities because the managerial resources required to coordinate the resulting extensive interdependence, interactions, and mutual adjustment between partners are not available to monitor or develop alternatives (Gerwin 2004, Park and Russo 1996). Furthermore, should the firm wish to terminate or downgrade the focal alliance, the necessity of separating pooled activities—including determining value and ownership of outputs generated—makes doing so more complex.[2]

Clients in alliances with pooled R&D activities are therefore anxious to avoid further reducing their search flexibility. This shifts their preferences away from equity because equity limits flexibility through commitment to a long-term relationship, significant demands on managerial effort, and difficulties of unwinding the investment (Das and Teng 2000, Li et al. 2010). Therefore, relative to alliances without pooled R&D, alliances with pooled R&D induce a preference on the part of client firms to avoid equity.

Alliance Experience and Flexibility in Governance Choice

The inclusion of pooled R&D activities exacerbates the target's concerns about knowledge leakage and the client's concerns about flexibility. The use of equity is responsive to the target's concerns about knowledge leakage, while the nonuse of equity is responsive to the client's concerns about flexibility. For the alliance to proceed, however, the firms must agree on a structure under which each firm feels it can adequately protect its interests.

Efforts by each firm to achieve its desired governance structure may be costly in terms of time, managerial

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attention, or goodwill. Indeed, a given governance structure may not even be feasible because of institutional, financial, or other strategic constraints. A firm may find itself missing opportunities if it insists on its preferred governance structure. Therefore, a firm may choose to proceed under the governance structure that responds primarily to the other firm's concerns, *if and only if* it can adequately protect its interests despite doing so.

Prior research suggests that a key determinant of a firm's ability to do so is their past experience with alliances. With experience, firms learn to manage multiple aspects of collaborative interfirm relationships (Ahuja 2000, Anand and Khanna 2000, Gulati et al. 2000). As a result, experienced firms can rely on their alliance capabilities (Kale and Singh 2007) to mitigate threats to their interests and to claim value from the alliance despite a governance structure that is, from their viewpoint, suboptimal. That is, experienced firms have greater versatility in the structure of their alliances.

As a target firm accumulates alliance experience, it learns about situations that lead to unintended knowledge leakage or misappropriation and develops expertise in crafting contractual terms to help reduce or mitigate such occurrences (Argyres and Mayer 2007, Mayer and Argyres 2004, Ryall and Sampson 2009), e.g., better specification of intellectual property rights, clearer delineation of knowledge boundaries, constraints on cross-firm interaction, and effective monitoring procedures. It can also better anticipate and respond to contingencies that cannot be prespecified in a formal contract (Anand and Khanna 2000). Furthermore, firms frequently engaging in alliances often develop internal organizations dedicated to managing alliance activities (Kale et al. 2002), which proactively monitor and manage the flow of knowledge.

Therefore, an experienced target firm perceives the inclusion of pooled R&D as a less elevated threat for knowledge leakage and has less need for equity as protection. Because it is better able to protect itself against knowledge leakage under any governance structure—even nonequity—an experienced target firm will be more versatile in its choice of governance structure given pooled R&D. We observe this enhanced versatility as a weaker relationship between the inclusion of pooled R&D and the use of equity.

Hypothesis 1. *The greater the alliance experience of the target firm, the weaker the association between the inclusion of pooled R&D activities and the use of equity in an alliance.*

As a client firm accumulates alliance experience, it develops a network of relationships from past collaborations that become a source of flexibility in monitoring and capturing new technological or business opportunities (Ahuja 2000). By engaging in various alliance activities over time, a client firm has more opportunities to access diverse information and learn about the reliability and capability of potential partners (Powell et al. 1996). It also becomes more skilled in identifying when and how to terminate a collaboration (Simonin 1997). Accordingly, alliance experience reduces the marginal effect of pooled R&D and equity on a client's search flexibility.

Therefore, a more experienced client will be more versatile in the choice of governance structure given the presence of pooled R&D. Such enhanced versatility weakens the shift toward nonequity, thus leading a stronger relationship between the inclusion of pooled R&D and the use of equity in an alliance.

Hypothesis 2. *The greater the alliance experience of the client firm, the stronger the association between the inclusion of pooled R&D activities and the use of equity in an alliance.*

Additional insights are possible by considering the impact of the client and target's relative alliance experience. Doing so enables us to explore situations in which one firm is much more versatile in the set of governance structures under which it can function than the other.

When both client and target have low levels of experience, the ability of each firm to protect its interests depends heavily on attaining its preferred governance structure. Conversely, if each firm has a great deal of alliance experience, each can protect its interests even under a governance structure that responds primarily to the other's concerns. In either situation, there is no clear systematic prediction for which party's preference would ultimately dominate.

In contrast, consider the situation in which the partners have substantially asymmetric alliance experience, in which one firm has extensive alliance experience and the other has little experience. The less experienced firm's ability to protect its interests depends heavily on attaining its preferred governance structure, while the more experienced firm is better able to protect its interests under either governance structure. This circumstance maximizes the gap between the versatility of the two firms vis-à-vis governance structure. For the more experienced firm, the choice of governance structure as less consequential, while its potential partner will strive to keep its preferred governance structure. Accordingly, we predict that asymmetry in alliance experience maximizes the degree to which the chosen governance structure will predominantly reflect the preferences of the less experienced firm.

Hypothesis 3. *The association between the inclusion of pooled R&D activities and the use of equity in an alliance is weakest when the target firm has considerable alliance experience and the client firm has little alliance experience.*

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HYPOTHESIS 4. *The association between the inclusion of pooled R&D activities and the use of equity is strongest when the client firm has considerable alliance experience and the target firm has little alliance experience.*

All four hypotheses reflect our core proposition: alliance experience makes a firm more versatile in the governance structures under which it can protect its interests. The final two hypotheses provide particular insight because they reflect situations in which this versatility is the most germane.

Research Methods

We tested the hypotheses with R&D alliances initiated in the biotechnology and pharmaceutical industries. The biotechnology and pharmaceutical industries are knowledge-rich sectors in which alliances are widely used for product innovations (Powell et al. 1996, Rothaermel and Deeds 2004). Moreover, advances in biotechnology since the mid-1970s have brought extensive alliances between firms with advanced biotechnology and firms with the capability of developing and commercializing specific applications (Rothaermel and Hess 2007).

We gathered data on alliance formation between 2002 and 2006 from the Deloitte Recap database, a leading commercial database of alliance agreements dedicated to the biotechnology and pharmaceutical industries (Hoang and Rothaermel 2010). This database covers all R&D agreements from mid-1980s and provides information on the identity of the parties to the agreement and the nature of the agreement, such as functional activities to be performed and the way partners combined their resources. ReCap uses multiple data sources to ensure the accuracy of its database: trade literature, press releases, and its close links and interactions with experts involved in biotechnology and pharmaceutical industries.

To examine the formation of alliances for product innovations, we focused on alliances that included R&D as a part of the alliance agreements. We omitted pure licensing agreements because licensing occurs to buy or sell the output of fully developed innovations (i.e., a technology or product), rather than to cooperate in the innovation process to create such outputs. We also omitted alliances involving universities or firms outside the biotechnology and pharmaceutical industries. These selection criteria led to 2,184 alliance agreements.

In line with common perception (see, e.g., Wuyts et al. 2004), alliances in which a pharmaceutical firm acts as the client and a biotechnological firm acts as the target are frequent, constituting 46.3% of all observations. However, we observe other combinations: 49.5% of our observations were between biotechnology firms and 4.2% were between pharmaceutical firms.

Because firms from both industries can serve as either target or client firms, we characterized a firm's role as target or client in the context of each alliance (Filson and Morales 2006, Lerner and Merges 1998, Robinson and Stuart 2007b). We base this characterization on ReCap's classification, which defines the client company as "The party in the alliance that is gaining access to a technology developed by the R&D partner," and the R&D company ("target firm" in our terminology) as "The party in the alliance associated with the technology's research and development." The target/client distinction is well established in both practitioner (Edwards 2007) and scholarly (Filson and Morales 2006; Higgins 2007; Robinson and Stuart 2007a, b) research on alliances in the bio-pharmaceutical industry.

Examination of a subset of alliance announcements confirmed ReCap's classification. In particular, it confirmed that it was possible to identify one firm as the target even in alliances involving joint R&D, as one firm's material or knowledge was clearly the foundation for the technology around which the alliance was formed.

Contrary to a commonly held perception, target firms were not limited to small start-ups. Fifty-three percent of the alliances involved publicly traded target firms, meaning that they had at least reached the initial public offering stage. Among targets, private firms averaged 252 employees and public firms averaged 2,323 employees. Many prominent firms were targets in one or more alliances including Sumitomo Pharmaceuticals, Abbott and Schering-Plough. Of the 1,627 firms in our data, 30.6% were the client in every alliance, 47.6% appeared as the target in every alliance, and 21.8% were the client in some alliances and the target in others.

Variables

The key variables for this study included whether an alliance was equity or nonequity, whether an alliance included pooled R&D activities or not, and each partner firm's alliance experience. Our measures are consistent with prior literature and based on ReCap's definitions and classifications ensuring they are objective and reflect the judgment of industry experts (Filson and Morales 2006, Wuyts et al. 2004).

Equity alliance is a dichotomous variable set to 1 for alliances meeting ReCap's definition of an equity agreement, alliances involving "the issuance of a minority share (<50%) of legal ownership interest in an entity."The variable was set to 0 for alliances not involving the issuance of legal ownership interest. This coding matches prior research (Gulati and Singh 1998, Pisano 1989). Equity investments were by the client firm in the target firm. Our data included only eight joint ventures, which we treated as equity alliances (Gulati 1995). Omitting these observations did not substantively change our results.

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Pooled R&D activities is a dichotomous variable set to 1 for alliances that ReCap characterized as "Collaboration" ("…two or more parties perform research and/or development activities in a single R&D program") or "Co-Development" ("both parties participate to some degree in the clinical development of a compound or project"). Either characterization describes a situation in which the parties are coinvolved at the same stage of the innovation process. We set the variable to 0 for alliances in which that was not the case: those that ReCap characterized as Research ("a sponsoring party engages another party to perform R&D services in the discovery and/or lead stages of an R&D project.") or Development ("a sponsoring party engages another party to perform R&D services beyond the stage of lead generation."). Thus, this variable applies Kalaignanam et al. (2007) and the Dussauge et al. (2000) broader distinction between link and scale alliances to the context of innovation alliances. By comparing alliances with and without pooled R&D, we were able to account for factors that might make a target or client favor or disfavor equity, independent of the type of resource integration occurring, e.g., a need for cash, a desire to retain control of equity, or perceived post initial public offering payoff.

Drawing from prior literature, we also controlled for various factors that might affect the choice of alliance governance structure. *Alliance experience* for a client or target firm is the number of alliances the firm had initiated in the last five years (Ahuja 2000). Measuring alliance experience with a six- and seven-year window as a robustness check provided consistent results. Following (Sampson 2005, p. 1016), we assumed that "Coordination across firm boundaries is always challenging and, therefore, skills gained in improving this coordination likely are gained from any type of alliance," and thus did not distinguish between prior alliances with and without pooled R&D activities in measuring alliance experience. In robustness checks discussed below, we examined whether they had differential effects.

Equity-sharing experience takes into account partner firms' overall orientation toward and its cumulated expertise in deploying equity in forming alliances. We measured equity-sharing experience of the target (client) firm by the number of alliances initiated in the last five years in which the target (client) firm used equity sharing (Oxley 1999). Because repeated partnering between the same partners can generate trust between these partners, affecting the choice of governance structure (Gulati and Singh 1998, Hoetker 2005), we included the *number of alliances* between the firms initiated in the prior five years. *Alliance scope* refers to the breadth of functional activities that partners agreed to perform as part of the alliance (Varadarajan and Cunningham 1995). Broad-scope alliances require more coordination across different stages in the innovation process, increasing the complexity of communication and coordination and creating more risk of knowledge leakage (Oxley and Sampson 2004). Consistent with previous studies, e.g., Kalaignanam et al. (2007), we measured alliance scope by the number of functional activities covered by a collaboration agreement, including research, development, manufacturing, and marketing. The indicator variable, *international alliance*, is set to one if the partner's headquarters are located in different countries, since alliances involving partners from different countries can incur additional risks associated with different cultural, legal, or political environments compared with those between partners from the same country (Lavie and Miller 2008).

We included several variables that might reflect differences in bargaining power (Lerner and Merges 1998), among other effects. We coded *alliances between biotechnology and pharmaceutical firms* with a dichotomous variable set to 1 for alliances between biotechnology and pharmaceutical firms and set to 0 for alliances between either biotechnology firms or pharmaceutical firms (Santoro and McGill 2005). *Public target* (*or client*) *firm* were coded with two indicator variables, respectively, set to 1 if the target and/or client firm were public (Rothaermel and Deeds 2006). We followed Rothaermel and Deeds (2004) and McNamara and Baden-Fuller (2007) in coding the *stage of the innovation process* at which the alliance was initiated from 1 to 8 (1 discovery, 2 lead molecule, 3 preclinical, 4 formulation, 5 phase 1, 6 phase 2, 7 phase 3, and 8: Biologics License agreement/New Drug Application filing and FDA approval), since different stages involve different task characteristics and may affect relative bargaining power (Adegbesan and Higgins 2011). Lastly, we also included indicator variables for *alliance formation year* (Sampson 2007).

Statistical Model

Our dependent variable was the binary choice of governance structure. Although the logit model is standard in the governance choice literature, it makes it more challenging to detect the moderating effect of alliance experience. Because the logit model is nonlinear, the significance of the interaction effect cannot be determined simply by the significance of the interaction effect and the sign of the coefficient may not even indicate the direction of the interaction effect.

For ease of accurate interpretation, we therefore divided the sample into two subgroups based on the median value of the target (client) firm's alliance experience (Hoetker 2007). We estimated models separately for each group and compared the coefficient for *pooled R&D activities* across groups in three ways. First, we simply compared the statistical significance of the coefficient in each subsample. Second, we compared the

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coefficient, β, across subsamples using the Wald chi-square statistic (Greene 2003):

$$\frac{(\beta_1 - \beta_2)^2}{\sigma_{\beta_1}^2 + \sigma_{\beta_2}^2},$$

where β_i $(i = 1, 2)$ is the estimated coefficient for group i, $\sigma_{\beta_i}^2$ is the estimated standard error, and the degree of freedom is 1. However, the estimated coefficients, β, may not be directly comparable across groups because $\beta = \alpha/\sigma$, where σ is the standard deviation of the error term, ε, that is, the unobserved heterogeneity across subsamples. Any difference in coefficients can be caused by the difference in σ, even when α, the effect of a variable on the propensity to form an equity alliance, is not different across groups. Therefore, before applying the Wald test, we tested for equivalence of unobservable heterogeneity across groups using the method suggested by Allison (1999). Doing so revealed no evidence that unobservable heterogeneity varied meaningfully across subsamples in any of our models, indicating that the Wald test was valid.

Third, we used the comparison of coefficient ratios technique suggested by Train (1998). Calculating the ratio of any two coefficients, β_k/β_j, removes the impact of the unobserved variation, σ, which is constant within each subsample. The ratio β_k/β_j can therefore be compared across subsamples without regard to the unobserved heterogeneity in each (Train 1998, p. 43). We compared the ratio of the coefficient for pooled R&D activities to the coefficient for alliance scope, expressing the impact of including pooled R&D activities as a function of the impact of increasing alliance scope by one function.[3] Lastly, we also supplied graphical interpretations of our results.

Our sample included multiple alliances initiated by the same firms. In particular, client firms, such as pharmaceutical or large biotechnology firms, were typically engaged in multiple alliances simultaneously to access diverse technological and new product opportunities. We therefore used robust standard errors, clustered by client firms (Rogers 1993).

Table 1 presents descriptive statistics and correlations between variables. The mean variance inflation factor was 1.56 and the maximum 3.10, indicating no evidence of multicolinearity in our sample.

Results

We first examine the moderating effect of the target firm's alliance experience (Table 2), finding strong support for Hypothesis 1. Model 1 indicates a significant and positive association between the inclusion of pooled R&D activities and the use of equity in an alliance when the target firm had a low level of alliance experience ($\beta = 0.579$, $p = 0.03$). In contrast, Model 2 shows that when the target firm had a high level of

Table 1 Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. *Equity alliance*	1.00																
2. *Year 2003*	−0.06	1.00															
3. *Year 2004*	0.04	−0.24	1.00														
4. *Year 2005*	−0.04	−0.25	−0.24	1.00													
5. *Year 2006*	0.05	−0.25	−0.24	−0.25	1.00												
6. *Alliance between biotech and pharma*	0.04	0.01	0.02	0.01	0.01	1.00											
7. *Public client*	0.07	0.05	0.03	−0.05	−0.04	0.30	1.00										
8. *Public target*	0.08	−0.01	0.01	−0.02	0.00	0.08	0.08	1.00									
9. *Client's equity sharing experience*	0.09	0.11	−0.05	−0.05	−0.07	0.29	0.32	0.06	1.00								
10. *Target's equity sharing experience*	0.00	0.04	0.02	−0.03	−0.07	0.02	0.04	0.23	0.05	1.00							
11. *International alliance*	−0.06	−0.02	−0.02	0.00	0.04	0.09	−0.02	−0.01	−0.06	−0.07	1.00						
12. *Alliance scope*	0.10	−0.06	0.00	0.04	0.06	−0.06	0.04	0.20	0.01	0.09	0.02	1.00					
13. *Repeated partnering*	0.01	0.01	0.00	0.02	0.00	0.15	0.07	0.09	0.14	0.12	0.00	0.02	1.00				
14. *Stage in the innovation process*	0.08	−0.07	0.03	0.05	0.06	−0.04	0.05	0.26	−0.03	0.01	0.04	0.29	−0.08	1.00			
15. *Client's alliance experience*	0.08	0.04	−0.01	0.02	0.00	0.46	0.37	0.07	0.77	0.06	−0.08	0.00	0.23	−0.07	1.00		
16. *Target's alliance experience*	−0.05	0.04	0.06	−0.01	−0.05	0.04	0.04	0.29	0.06	0.67	−0.02	0.06	0.18	−0.07	0.10	1.00	
17. *Pooled R&D activities*	0.01	−0.04	0.09	0.09	−0.03	0.00	−0.01	−0.04	0.00	0.01	0.01	0.03	0.02	−0.21	0.04	0.08	1.00
Mean	0.08	0.20	0.19	0.20	0.20	0.46	0.76	0.53	2.15	0.54	0.56	1.50	0.08	2.42	18.54	5.64	0.71
Std. dev.	0.27	0.40	0.39	0.40	0.40	0.50	0.43	0.50	3.46	1.42	0.50	0.64	0.31	2.09	22.08	8.70	0.45
Min	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Max	1	1	1	1	1	1	1	1	26	12	1	4	4	8	97	77	1

Note. $N = 2{,}184$.

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Table 2 Impact of Alliance Experience on the Pooled R&D/Equity Relationship

	Model 1	Model 2	Model 3	Model 4
	Low-experience target	High-experience target	Low-experience client	High-experience client
Constant	−4.145*** (0.469)	−3.771*** (0.654)	−3.200*** (0.487)	−4.628*** (0.820)
Year 2003	−0.700** (0.350)	−0.573 (0.392)	−0.299 (0.418)	−0.781** (0.357)
Year 2004	0.202 (0.307)	0.147 (0.414)	0.405 (0.368)	0.128 (0.332)
Year 2005	−0.673* (0.354)	−0.187 (0.457)	−0.715 (0.468)	−0.209 (0.342)
Year 2006	−0.009 (0.326)	0.645* (0.348)	0.123 (0.387)	0.364 (0.341)
Alliance between biotech and pharma	0.086 (0.248)	0.196 (0.314)	0.103 (0.302)	0.202 (0.263)
Public client	0.671** (0.328)	0.001 (0.396)	0.381 (0.291)	0.649 (0.721)
Public target	0.109 (0.234)	1.055*** (0.374)	0.268 (0.264)	0.810*** (0.251)
Client's equity sharing experience	0.084*** (0.032)	0.089** (0.042)	0.235 (0.153)	0.087*** (0.022)
Target's equity sharing experience	0.347 (0.273)	−0.084* (0.049)	0.434*** (0.143)	−0.025 (0.081)
International alliance	−0.549** (0.238)	−0.380 (0.234)	−0.641** (0.252)	−0.375* (0.208)
Alliance scope	0.295* (0.164)	0.472** (0.201)	0.201 (0.209)	0.517*** (0.163)
Repeated partnering	0.660 (0.505)	−0.141 (0.233)	1.103* (0.632)	0.036 (0.233)
Stage in the innovation process	0.148*** (0.050)	−0.031 (0.057)	0.106* (0.058)	0.015 (0.044)
Client's alliance experience	0.001 (0.007)	−0.003 (0.008)		
Target's alliance experience			−0.097*** (0.028)	−0.052** (0.024)
Pooled R&D activities	0.579** (0.265)	−0.335 (0.261)	−0.008 (0.276)	0.479* (0.264)
Observations	1,255	929	1,123	1,061
Pseudo-R^2 (McFadden's)	0.087	0.083	0.079	0.104

Notes. Groups divided based on median value of the alliance experience (target firm = 3, client firm = 9). Standard errors in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (two-tailed tests).

alliance experience, the relationship was insignificant ($\beta = -0.335$, $p = 0.20$). This contrast indicates that alliances involving more experienced targets were less strongly associated with the structure responsive to the target's increased preference for equity caused by the presence of pooled R&D activities.

To further investigate these results, we applied the second and third tests discussed previously. Having failed to reject ($p = 0.49$) the null hypothesis of equal unobservable variations across the subsamples (see Allison 1999), we compared the coefficient for pooled R&D activities across the low-experience and high-experience subsamples using a Wald test. We found a significant difference in the coefficient across the two groups ($p = 0.01$) in support of Hypothesis 1. Lastly, we performed a group comparison based on the ratio of coefficients (Hoetker 2007, Train 1998). Taking the ratio of pooled R&D activities to alliance scope in each subsample yielded a ratio of 1.96 and −0.71 for low- and high-experience target firms respectively. The difference between these ratios was significant ($p = 0.04$) in support of Hypothesis 1. Thus, support for Hypothesis 1 was consistent across the three tests.

Figure 1(a) illustrates these results. The inclusion of pooled R&D shifts the target's preference toward equity, while shifting the client's preference in the opposite direction. When the target has little experience, we observe a corresponding upward shift in the probability of equity. Conversely, experienced targets have other means of dealing with the amplified risk of knowledge leakage that accompanies pooled R&D and are better able to adapt to the absence of nonequity. Thus, in alliances with experienced targets we observe a downward shift in the probability of equity. The statistical significance of the difference in the line's slopes is confirmed by the prior tests of whether the coefficient for "Pooled R&D activities" differs for low- and high-experience targets.

Models 3 and 4 examine the moderating effect of the client firm's alliance experience. Consistent with Hypothesis 2, Model 4 indicates a positive association between the inclusion of pooled R&D activities and the use of equity when the client firm had a high level of experience ($\beta = 0.479$, $p = 0.07$), but the association is negative and insignificant for client firms with a low level of experience ($\beta = -0.008$, $p = 0.98$). More experienced clients demonstrated greater governance versatility and were more willing to accept the target firm's increased preference for equity caused by the presence of pooled R&D activities. However, the difference between the coefficients was not statistically significant according to either the Wald chi-square statistic ($p = 0.20$, after failing to reject the hypothesis of equal unobserved variation across groups, $p = 0.39$) or a comparison of the ratio of the coefficients for pooled R&D activities and alliance scope ($p = 0.54$).

Figure 1(b) confirms this impression. The difference in the slopes shows that alliances involving high-experience clients (upward sloping line) are more willing to reflect the target's increased preference for equity given the inclusion of pooled R&D activities, but alliances with low-experience clients are not (flat line).

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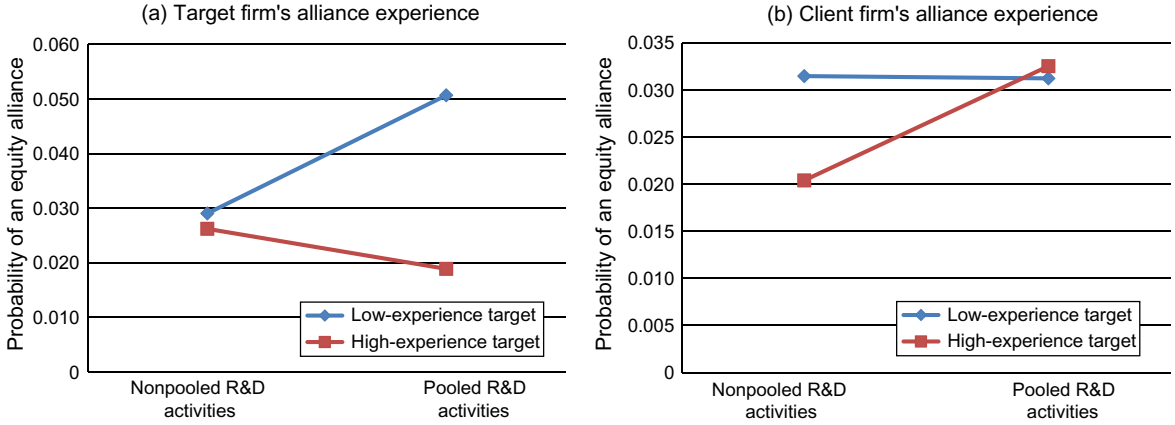
Figure 1 (Color online) The Effect of Partner Firms' Alliance Experience on the Pooled R&D/Equity Relationship



Note. Year 2005 = 1, Public client firm = 1, Public target firm = 0, Alliance between biotech and pharma = 1, International alliance = 1, and mean value for the other variables.

Although this pattern is consistent with Hypothesis 2, the nonsignificant difference in the coefficient for pooled R&D indicates that the slopes does not differ between low- and high-experience clients at conventional significance levels.

Thus, evidence in support of Hypothesis 2 was weak at best. As we discuss subsequently, however, the results for alliances with asymmetric experience support the underlying assumption of this hypothesis—alliance experience makes a client firm more versatile in the governance structures it will accept.

Table 3 presents the effects of the different combinations of the target and client firms' experience. Comparing the cases with greatest asymmetry (high-experience client/low-experience target versus low-experience client/high-experience target), Hypotheses 3 and 4 were supported. The relationship between the pooling of R&D and the use of equity was the most positive when the client firm had a high level and the target firm had a low level of alliance experience ($\beta = 0.921$, $p = 0.02$, Model 5). In contrast, this relationship was the most negative when the client firm had a low level and the target firm a high level of alliance experience ($\beta = -0.480$, $p = 0.26$, Model 8).

Examining whether these coefficients differed significantly across subsamples provides additional insights. Finding no evidence of meaningful differences in unobservable variation across each pair of subsamples (p-values ranged between 0.28 and 0.98), we used the Wald chi-square statistic for group comparison. The coefficient for pooled R&D activities was significantly higher ($p = 0.02$) for high-experience client/low-experience target (Model 5) than for low-experience client/high-experience target (Model 8).

Comparisons with intermediate cases—both partners with low experience or high experience—were less definite, as we would expect. The coefficient for pooled R&D activities was significantly higher for high-experience clients/low-experience targets than when both partners were high-experience ($p = 0.04$), but not significantly different than when both parties were low-experience ($p = 0.18$). The coefficient for pooled R&D activities was insignificantly lower for low-experience client/high-experience target than when both parties had low levels of alliance experience ($p = 0.24$) or both parties had high levels of alliance experience ($p = 0.50$). Table 4 provides a summary of group comparisons.

Figure 2 illustrates our results. When high-experience clients ally with low-experience targets (steeply upward sloping line), the inclusion of pooled R&D increases the probability that equity will be used, reflecting the shift in the target's preferences. Conversely, when low-experience clients partner with high-experience targets (steeply downward sloping line), the inclusion of pooled R&D decreases the probability that equity will be used, reflecting the shift in the client's preference. The relatively flat slopes of the lines for the two symmetric cases reflect no clear pattern. Thus, alliances involving partners with asymmetric experience are likely to reflect governance structure preferred by the less experienced, and thus less versatile, partner.

These results extend the findings of Hypotheses 1 and 2 in two ways. First, both targets and clients demonstrated greater flexibility in the choice of governance structure when they had an asymmetrically high amount of alliance experience, demonstrating that experience provides both targets and clients with the ability to protect their interests under a wide range of governance structures. The fact that our earlier results only found this effect for target firms suggests that client firms were more reluctant to put this versatility into practice. That is, they only did so when there was significant asymmetry and they were more experienced than their partners, as Models 5 and 7 show. This could be because clients

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Table 3 Impact of Client and Target Firm Alliance on the Pooled R&D/Equity Relationship

	Model 5	Model 6	Model 7	Model 8
	High-experience client/low-experience target	Low-experience client/low-experience target	High-experience client/high-experience target	Low-experience client/high-experience target
Constant	−4.943*** (1.002)	−3.615*** (0.597)	−5.294*** (0.947)	−3.088*** (0.788)
Year 2003	−0.772 (0.476)	−0.542 (0.493)	−1.070** (0.466)	0.176 (0.760)
Year 2004	0.357 (0.476)	0.054 (0.451)	−0.268 (0.512)	0.767 (0.679)
Year 2005	−0.010 (0.440)	−1.492** (0.683)	−0.655 (0.573)	0.236 (0.781)
Year 2006	0.117 (0.491)	−0.193 (0.480)	0.434 (0.362)	0.832 (0.735)
Alliance between biotech and pharma	0.109 (0.304)	0.133 (0.358)	0.366 (0.475)	0.213 (0.512)
Public client	0.809 (0.920)	0.530 (0.372)	0.616 (0.609)	0.156 (0.485)
Public target	0.484 (0.350)	−0.216 (0.317)	1.586*** (0.458)	0.378 (0.550)
Client's equity sharing experience	0.087*** (0.022)	0.302 (0.184)	0.110*** (0.035)	−0.143 (0.373)
Target's equity sharing experience	−0.007 (0.419)	0.864** (0.405)	−0.133** (0.062)	−0.015 (0.086)
International alliance	−0.475 (0.346)	−0.644** (0.308)	−0.244 (0.273)	−0.879** (0.417)
Alliance scope	0.376* (0.199)	0.261 (0.270)	0.651*** (0.247)	0.184 (0.323)
Repeated partnering	0.684 (0.607)	0.492 (1.002)	−0.249 (0.267)	1.077 (0.868)
Stage in the innovation process	0.123* (0.068)	0.172** (0.072)	−0.122** (0.053)	0.097 (0.100)
Pooled R&D activities	0.921** (0.389)	0.195 (0.377)	−0.113 (0.334)	−0.480 (0.428)
Observations	519	736	542	387
Pseudo-R^2 (McFadden's)	0.098	0.098	0.150	0.064

Notes. Groups divided based on median values of the target and client firms' alliance experience (= 3 and 9, respectively). Standard errors in parentheses.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (two-tailed tests for all variables).

find it particularly difficult to maintain search flexibility and thus are willing to incur the additional challenges of operating in an equity alliance only when there was considerable asymmetry. So, we observed an effect consistent with Hypothesis 2. Second, firms demonstrated more versatility in terms of governance structure when their partners had low levels of experience and were thus less versatile. They appear to have been more likely to incur the burden of accepting the governance structure preferred by their partner when their partner's lack of experience made the partner more insistent on the alliance adopting their preferred governance structure, meaning it would be slower, costlier, or perhaps even impossible to consummate the alliance under the structure preferred by the more experienced partner.

Overall, the results summarized in Table 4 strongly support our hypotheses. The relationship between pooled R&D activities and the use or nonuse of equity was contingent on the partner firms' alliance experience. Firms with more alliance experience are more versatile in the choice of governance structure. Experience had the greatest effect when partner firms had asymmetric alliance experience.

Robustness Checks

We performed multiple robustness checks. Regarding measurement, we confirmed that splitting the samples at the mean values of client and target firms' alliance experience rather than median value yielded substantively similar results. We also modeled experience with

Table 4 Comparison of the Effect of Alliance Type on the Probability of an Equity Alliance

Hypothesis	Criterion for grouping	Group comparison	Hypothesis test result
Hypothesis 1	Target firm's alliance experience	Model 1 > Model 2**	Supported
Hypothesis 2	Client firm's alliance experience	Not significant between Models 3 and 4	Not supported
Hypothesis 3	Target and client firms' alliance experience	Model 5 > Model 7** Model 5 > Model 8** Joint test: Model 5 > Models 6, 7, and 8*	Supported
Hypothesis 4	Target and client firms' alliance experience	Model 8 < Model 5** Joint test: Model 8 < Models 5, 6, and 7*	Supported

*$p < 0.1$; **$p < 0.05$ (tests with Wald chi-square statistic).

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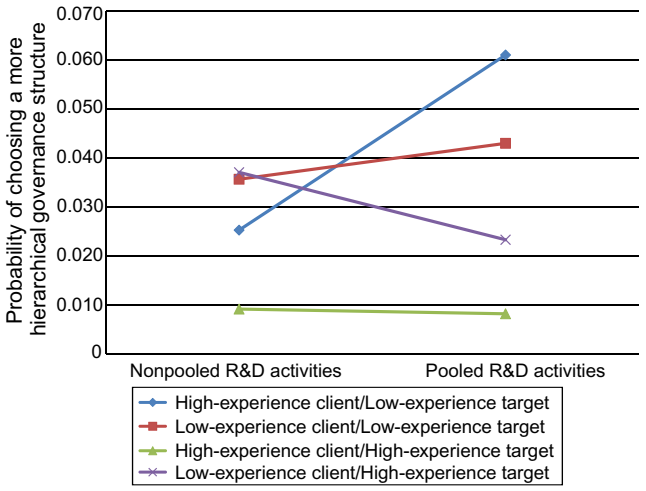
Figure 2 (Color online) The Effect of Asymmetric Alliance Experience on the Pooled R&D/Equity Relationship



Note. Year 2005 = 1, Public client firm = 1, Public target firm = 0, Alliance between biotech and pharma = 1, International alliance = 1, and mean value for the other variables.

alliances containing pooled R&D activities and with alliances not containing pooled R&D activities separately. Results were consistent with the results for total alliance experience, with two exceptions. Both regard comparisons with intermediate models in Table 3. For alliances with pooled R&D, the Model 5 to Model 6 comparison gained significance, whereas for alliances without pooled R&D, the Model 5 to Model 7 comparison lost significance. Our central proposition holds strongly: experience leads to governance versatility, particularly when experience is asymmetric.

There were a substantial minority of private firms, for which time varying data on firm size was unavailable. Rerunning our analysis with nontime-invariant size data from various sources for as many private firms as possible yielded substantively similar conclusions. Lastly, although our use of a dichotomous measure for R&D pooling was consistent with existing work, we additionally constructed a finer grained measure of pooling, "Proportion of R&D pooling," as the ratio of the number of R&D activities that involve pooled effort (collaboration, codevelopment) in an alliance to the total number of R&D activities (collaboration, codevelopment, research, development) in an alliance. Results using this measure are substantively unchanged from those using the dichotomous measure.

The inclusion of pooled R&D activities is potentially nonrandom, although the nature of the innovative challenge to be solved may constrain the range of feasible arrangements (Khanna 1998). We explored the robustness of our results to this possibility in three ways. First, following Hoetker and Agarwal (2007), we examined whether the experience of either the target or client was related to a systematic difference in the observable characteristics of alliances with and without pooled R&D. Analysis of variance (ANOVA) testing revealed no statistically significant difference between target/client experience, pooling of R&D, and a wide variety of observable characteristics including stage in the innovation process, international experience, alliance scope, and cross-industry alliances. Although limited to observable variables, these results provide some reassurance for the comparability of alliances chosen by experienced versus nonexperienced firms and against endogeneity in the experience—alliance characteristics—R&D pooling relationship. Second, we used inverse propensity weighted regression (Tan 2010), weighting each observation by its probability of including pooled R&D as predicted by the set of explanatory variables listed above, which yielded results consistent with our original model.

However, these results depend on the assumption that the choice of pooling is dependent on observable variables, that is, conditional mean independence. So, we also used instrumental variable estimation, using as instruments the client and target's experience with alliances *not* containing pooled R&D. Although this might influence their relative preferences regarding pooled versus nonpooled R&D, it should be irrelevant to the choice of equity versus nonequity *in alliances containing pooled R&D*. The instruments were jointly significant in predicting a pooled alliance at $p < 0.10$ for each model except in the case of a low-experience client, which has a p-value of 0.12. Not only were our results consistent with the original models, the null hypothesis of exogeneity was only rejected for high-experience targets.

Discussion and Conclusion

An extensive literature has demonstrated that the choice of governance structure in alliances is shaped by the characteristics of the underlying transactions, e.g., the specificity of the underlying assets, the uncertainty surrounding the outcome, etc. The idea that a given set of characteristics suggests an optimal governance structure sets aside an important question, however, "Optimal for whom?" Drawing on well-established insights, we have posited that the dominant concerns of firms that play different roles in an alliance may well differ, leading to different perceptions of the optimal governance structure for an alliance. As neither firm will enter the alliance unless it feels it can protect its interests under the chosen governance structure, these conflicting preferences must be reconciled for the alliance to proceed. The more smoothly reconciliation occurs, the more likely that the alliance will be able to advance with sufficient speed, goodwill, and low enough costs to achieve its desired strategic goals. This creates a competitive advantage for

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a firm that is more versatile in the governance structures under which it can effectively operate. The more versatile a firm is in the governance structures it can accept, the easier the process of reaching a mutually acceptable governance structure with a potential partner.

Drawing on the literature on alliance capabilities, we have argued that governance versatility results from alliance experience. As firms gain experience through multiple alliances, they develop better skills in selecting collaborators, negotiating terms and conditions, monitoring and managing the collaboration, and optimally terminating a collaboration. These skills make the choice of governance structure less consequential, as the firm can adequately protect its interests under a broader range of governance structures.

We found empirical evidence of this behavior within alliances. Specifically, alliance experience weakened the relationship between factors shifting a firm's preferences toward or away from equity and the governance structure under which the alliance ultimately proceeded.

In this way, we have extended transaction cost economics' focus on the characteristics of the transaction underpinning an alliance to also consider the potentially distinct impact of those characteristics on each party and the ability of each party to respond to that impact under different governance structures. Doing so allows us to make three primary contributions.

First, we advance the literature on alliance management capabilities literature by introducing governance versatility as an important capability. Previous work has demonstrated firms learn about each stage of the alliance process through experience. As a result, alliance experience is often associated with superior alliance performance (Anand and Khanna 2000, Hoang and Rothaermel 2005, Simonin 1997, Zollo et al. 2002), as experienced firms are better at many specific aspects of managing the alliance, such as protecting proprietary knowledge. Governance versatility extends insights about the direct advantages of these improved capabilities by suggesting that they provide an additional competitive advantage by giving a firm greater versatility in how it forms alliances. A firm that can more easily reconcile its governance needs with arrangements that suit its potential partners, as well as institutional, financial, and strategic constraints, should be able to form alliances with greater speed and lower costs than less versatile competitors. By doing so, we help link the strand of the alliance management capability literature that has focused on skills critical to managing ongoing alliances and the strand that has focused on skills related to the initial formation of an alliance (see Schreiner et al. 2009).

Second, this study contributes to research integrating transaction costs and resource-based theories (Ghosh and John 1999, 2005; Madhok 2002). The strategic theory of firm emphasizes a triangular alignment among the characteristics of transaction, resource, and governance structure, in the search for collaboration arrangements that take into account both transaction efficiency and competitive advantage building on firm resources and capabilities (Madhok 2002). This study presents a specific form of such a triangular alignment by showing how the knowledge-based resources resulting from alliance experience interact with the transaction characteristics, pooled or nonpooled R&D, and how firms choose to govern it as a result.

Third, we offer a model that incorporates the insights of the alliance management literature into the literature on governance choice in alliances. This model takes into account many aspects of both literature streams, opening multiple research vistas.

As with any study, we are aware of several limitations that future work could gainfully address. Our focus on innovation alliances in a single industry allowed us to build on an extensive theoretical and empirical literature and to use a more detailed database than would be available for alliances in general. R&D alliances in the biopharmaceutical industry were particularly appropriate because previous empirical and theoretical work has established clear expectations for the dominant concerns of the easily identifiable client and target firms. However, we believe that governance versatility is a feature of many alliances and that our theory has general applicability. Of course, each partner's concerns and thus the degree of versatility required and the form it takes may differ across settings. Further studies in diverse contexts would elaborate our findings and provide opportunities to identify other important boundary conditions.

As part of these studies, it could be valuable to move beyond the dichotomous measure of pooling used in the current literature. In our setting, participation in the same stage of the innovation process represents a step function increase in the potential for knowledge spillover, the risk of disputes over intellectual property, and the need for managerial involvement as a response. However, pooling in an alliance can involve none, some, or all of the activities involved. In some contexts, studying the proportion and mix of pooled activities might provide important insights. In particular, it is possible that alliance experience helps firms determine a priori which activities could be pooled at less risk, which would be consistent with our fundamental argument that firms learn about the challenges of managing alliances through experience. We found no evidence of such an effect in our setting, but it merits investigation in other settings.

Consistent with existing literature, we used a simple count measure for alliance experience. However, alliances may differ in the capabilities they generate. In particular, one could go beyond our controls and robustness checks to develop more sophisticated theory on the differential experience generated by equity versus

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nonequity and scale versus link alliances. It may be easier to be versatile when working with a partner viewed as trustworthy because of close ties and/or a past history of transacting (Gulati 1995, Uzzi 1996). We controlled for repeated partnering, but a finer grained exploration of its relationship to governance versatility, if any, would be informative. One could also move beyond the dichotomous equity/nonequity distinction as a dependent variable to examine how governance versatility is associated with the distribution of equity between the partners (see Kale and Puranam 2004).

Lastly, the role of governance flexibility in the broader distribution of control rights would be interesting to explore. Lerner and Merges (1998) and subsequent work examined the accumulation of control rights by each partner. Although we ask a different question—under what conditions firms will yield one of the fundamental mechanisms through which they can protect their interests, the (non)inclusion of equity—future work may be able to draw upon both sets of insights. Experience may shape firms' understanding of which control rights are most important in a given situation, skill in crafting contractual provisions, and advantages outside of control rights, thus driving the mix of control rights they seek and their willingness to accept other arrangements.

We believe that governance versatility applies to many aspects of interfirm relationships. In addition to affecting decisions about high-level governance structures, it may influence lower level ex ante decisions, such as the specification of contract terms. It likely plays an important role ex post also, shaping dispute resolution, renegotiation, and other elements of governance throughout the duration of the alliance. Doubtlessly, the various aspects of versatility have distinct boundary conditions and distinct impacts on the performance of alliances and their member firms.

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Endnotes

[1]Our use of "pooled" describes the organization of activities across the partners and is separate from Thompson's (1967) use of the term "pooled" to describe the interdependencies between processes.

[2]Contracts in this industry generally include specific field(s) of application. So, the target naturally retains flexibility to pursue unforeseen applications of its technology, without losing the value of—or needing to terminate—the focal relationship (Edwards 2007).

[3]We do not use a direct computation of interactions suggested by Norton et al. (2004), given concerns raised by several highly influential papers, including Puhani (2012), Berry et al. (2010), and Greene (2010, p. 295), who suggests that their approach, while mathematically accurate, provides "generally uninformative and sometimes contradictory and misleading results."

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Jongkuk Lee is assistant professor at Ewha School of Business, Ewha Womans University. He received his Ph.D. from University of Illinois at Urbana–Champaign. His research interests include interorganizational relationships, business customer analytics, and new product innovations.

Glenn Hoetker is professor and Dean's Council Distinguished Scholar at the W. P. Carey School of Business, Arizona State of Business, where he also holds appointments in the Sandra Day O'Conner College of Law and the Julie Ann Wrigley Global Institute of Sustainability. He received his Ph.D. from the University of Michigan. His research interests include interorganizational relationships and the management of innovation, particularly in the context of sustainability.

William Qualls is professor of marketing in the College of Business at the University of Illinois Urbana–Champaign and foreign expert scholar at Hunan University, Changsha China. His research interests focuses on innovation, new product development, and interorganizational marketing relationships.

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