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Experiential Learning, Bargaining Power, and Exclusivity in Technology Licensing

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Licensing has become the central form of interfirm technology transfer and commercialization in the market for inventions. However, despite the large representation and growth of this business model, the resolution of key contractual provisions is still regarded as idiosyncratic, and little is known about how experience with prior relationships or bargaining power position affects contract outcomes. In an attempt to further understand how these transactions unfold, we present and test a theoretical framework disentangling experience benefits and transaction costs associated with licensors' prior involvement in out- versus in-licensing deals and how they affect the important, yet contentious, contractual provision of nonexclusivity. Drawing on transaction cost, experiential learning, and bargaining power theories, we develop new insights explaining when licensors are likely to realize nonexclusive contracts as a function of their prior licensing deals, and when bargaining power moderates the relationships between prior deals and nonexclusivity. Leveraging a 27-year sample of bioscience licensing transactions, this study reveals the dynamic tension between the benefits and transaction costs arising from prior interfirm collaborations, and how a firm's history of collaborations, alongside its bargaining power position, influences contractual outcomes.

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It is quite true what philosophy says; that life must be understood backwards. But then one forgets the other principle: that it must be lived forwards.

—Søren Kierkegaard, Journals IV A 164 (1843)

Technology licensing transactions—defined as a technology owner (licensor) selling the rights to its technology for a fixed fee payment and/or royalties to a sourcing firm (licensee)—have a substantial impact on firms' stock prices (Anand & Khanna, 2000a; Walter, 2012). Moreover, royalty and licensing revenues have risen continuously from $2.8 billion in 1970 to $27 billion in 1990 and $180 billion in 2009 (World Intellectual Property Organization, 2011), with biotech companies brokering 152 licensing deals worth $46.8 billion in 2014 alone (Ernst & Young, 2015). As the central form of exchange in the market for inventions (Arora & Gambardella, 2010; Conti, Gambardella, & Novelli, 2013), licensing agreements represent the act of buying (access to) technology within the classic make-or-buy decision and embody the reconciliation of both arms-length contracting as well as intimate cooperation and knowledge exchange between partners (Parmigiani & Rivera-Santos, 2011; Williamson, 1991). They also tend to be highly idiosyncratic in nature (Aulakh, Jiang, & Li, 2013; Contractor & Woodley, 2015; Oxley, 1997), which leaves the choice of contractual features to govern these relationships largely at the discretion of the partners.

Prior research emphasizes the crucial impact that contractual features can have on competitively sensitive issues, such as knowledge transfer (Link & Scott, 2002), the ongoing coordination between partners (Gulati, Lawrence, & Puranam, 2005), and the success of these agreements (Hoetker & Mellewigt, 2009; Schilke & Lumineau, 2018). Not surprisingly, recent work on technology licensing has focused particularly on the contracts governing these agreements (Adegbesan & Higgins, 2010; Ariño, Reuer, Mayer, & Jané, 2014). Among contractual features, exclusivity has emerged as the most important specification (e.g., Anand & Khanna, 2000a; Arora & Fosfuri, 2003; Aulakh, Jiang, & Pan, 2010; Kim & Vonortas, 2006; Somaya, Kim, & Vonortas, 2011). This is because granting access to one exclusive licensee versus multiple nonexclusive licensees has a significant influence on both transaction costs and the potential revenue that can be realized from a given R&D investment (Aulakh et al., 2013). Granting others exclusive rights affects the concentration of market power and plays a key role in determining industry competition and antitrust policy (Horton, 2005; Lerner & Tirole, 2004); for many markets, exclusivity determines the access that consumers have to licensed products (Scotchmer, 1991).

From a licensor's point of view, exclusivity considerations involve a trade-off: While a nonexclusive license may be the most desirable outcome from a revenue-maximization perspective (Erutku, Priegue Freire, & Richelle, 2007; Jiang, Aulakh, & Pan, 2007; Schmitz, 2007), higher transaction costs associated with multiple nonexclusive licensees may diminish or even outweigh the advantages of multiple revenue streams. Prior work has provided few theoretical and empirical insights into how to resolve this trade-off between revenue-maximization and the handling of associated transaction costs (see Aulakh et al., 2013, for a notable exception).

Licensors should further benefit from having accumulated experience from prior licensing deals, which helps them mitigate transaction costs (Argyres & Mayer, 2007; Mayer & Argyres, 2004; Stuart, Ozdemir, & Ding, 2007) and develop skills to more efficiently and effectively manage these partnerships (Anand & Khanna, 2000a; Gulati, Lavie, & Singh, 2009; Ryall & Sampson, 2006). The experience benefits, in turn, may shift licensors' weighting of revenue versus transaction cost considerations (Argyres & Zenger, 2012) and, hence, affect the attractiveness of a nonexclusive outcome. Despite its proclaimed benefits, however, empirical findings on the impact of prior deals remain inconclusive, with several studies finding no benefits (Aulakh et al., 2010; Somaya et al., 2011), others finding only incremental benefits (Mayer & Argyres, 2004), and yet others suggesting contingencies to any benefits (Anand & Khanna, 2000a; Ariño et al., 2014; Gulati et al., 2009; Hoang & Rothaermel, 2005, 2010; Holloway & Parmigiani, 2016; Sampson, 2005).

In the current study, we explore how firms dynamically reconcile the revenue versus transaction cost trade-off that occurs in licensing deals—that is, we account not only for the focal deal, but also for a firm's history of prior licensing deals (Argyres & Liebeskind, 2002; Argyres & Zenger, 2012). More importantly, we differentiate the roles a firm played in its prior deals according to whether they were acting as licensees (i.e., buying or in-licensing another firm's technology) or licensors (i.e., selling or out-licensing their own technology) in prior deals. By accounting for a firm's role-specific deal experience, we are able to disentangle the experiential learning benefits from prior deals, which tend to result in lower transaction costs going forward, from the accumulated monitoring costs associated with prior out-licensing deals, which tend to persist even beyond the term of the license (Gordanier & Miao, 2011; Williamson, 1991). Given the long shadow cast by prior deals, the accumulation of such costs may outweigh the incremental experience benefits, thereby shaping firms' abilities to obtain preferred licensing outcomes.

Like any other interfirm governance choice, exclusivity is an outcome of the bilateral negotiations between partners (Zajac & Olsen, 1993) and, hence, depends on partners' bargaining power (Ariño, Ragozzino, & Reuer, 2008; Lerner & Merges, 1998). In other words, bargaining power constraints may preclude firms from obtaining preferred contractual terms, irrespective of any effects prior licensing deals have, and therefore represent a crucial contingency in our investigation of contractual outcomes.

Our study offers two main contributions. First, it extends the field's understanding of the influence of prior interfirm collaborations by differentiating firms' roles in prior deals, thereby parsing out direct and indirect experience benefits as well as potential downsides in the form of accumulated, ongoing monitoring costs stemming from prior collaborations. By leveraging the context of technology licensing, which allows us to differentiate prior deal experience, we contribute towards a reconciliation of conflicting arguments and empirical evidence found in the broader literature on the role of experience in interfirm collaborations (Anand & Khanna, 2000a; Ariño et al., 2014; Aulakh et al., 2010; Gulati et al., 2009; Hoang & Rothaermel, 2005, 2010; Mayer & Argyres, 2004; Sampson, 2005; Somaya et al., 2011), which has largely ignored the benefits of indirect experience as well as the potential downside of prior interfirm collaboration experience. Further, our study presents a contingency view by examining whether and how the licensor's bargaining power (Argyres & Liebeskind, 1999; Contractor & Woodley, 2015; Schepker, Oh, Martynov, & Poppo, 2014) moderates the effect of prior licensing deals on the likelihood of nonexclusive deal outcomes. This

contingency approach integrates experiential learning, transaction cost economics (TCE), and bargaining power theories to better explain interfirm contractual outcomes and to clarify when idiosyncratic transaction outcomes can be predicted.

Second, by shedding light on when and how prior deal experience and bargaining power matter for realizing preferential contractual outcomes, our study also advances the burgeoning literature on interfirm contracting (Argyres & Mayer, 2007; Ariño et al., 2014; Mayer & Argyres, 2004; Reuer & Ariño, 2007). Understanding how firm capabilities around contracting develop to affect contractual outcomes has recently been highlighted as a necessary area for future research (Schepker et al., 2014). Building on prior work that differentiates between firms' role-specific experiences (e.g., experience in both making and buying products as discussed in Jacobides & Billinger, 2006; Parmigiani, 2007), our study illustrates how firms build unique contracting capabilities through accumulating role-specific experiences that can alter the likelihood of obtaining a nonexclusive contract. Our study thus complements and extends prior theorizing on how firms *learn to contract* (Argyres, Bercovitz, & Mayer, 2007; Mayer & Argyres, 2004; Schepker et al., 2014), a critical component of firms' alliance capabilities with important implications for both organizational and alliance performance (Adegbesan & Higgins, 2010; Ariño et al., 2014; Hoetker & Mellewigt, 2009; Kale, Dyer, & Singh, 2002; Kale & Singh, 2007).

Our study also extends foundational TCE research in two ways. While the empirical results provide broad support for our hypothesized relationships, they also highlight some idiosyncrasies of interfirm collaborations by delineating the boundaries of the interactive relationship of prior deal experience and bargaining power on the likelihood of nonexclusive deal outcomes. Given the mixed empirical support found within TCE research (see David & Han, 2004, for a review), this study shows how experiential learning theory can further enhance TCE theory. In addition, our study addresses previous calls to account for a dynamic perspective on transaction costs (Argyres & Zenger, 2012), which incorporates firms' contracting histories as well as the implications of prior contractual choices for future interfirm contracting opportunities (Argyres & Liebeskind, 1999; Cassiman & Gambardella, 2009; Holloway & Parmigiani, 2016; Kim & Mahoney, 2010). Such a dynamic perspective on transaction costs allows us to uncover "interdependencies among a series of contracts [that] may be missed or undervalued" in traditional TCE work that "normally examines each trading nexus separately" (Williamson, 1985: 212) and has the potential to address prior criticism that "[w]hat is efficient in the short term may not always coincide with what is efficient in the long term" (Ghoshal & Moran, 1996: 34).

Theoretical Foundations

Technology licensing has become the central form of exchange in the market for inventions (Arora & Gambardella, 2010; Conti et al., 2013). These agreements represent a large and growing share of interfirm alliance agreements (Somaya et al., 2011), and play an essential role in the commercialization of technology (Teece, 1986, 1992). Technology licensing has numerous benefits for licensors, ranging from more reactive advantages, such as reducing product development risks and costs (Lowe & Taylor, 1999) and extracting the remaining value from a mature technology (Telesio, 1979); to more proactive advantages such as leveraging competitive advantages (Kollmer & Dowling, 2004), rapid market penetration (Lei &

Slocum, 1991), commercializing technologies (Arora, Fosfuri, & Gambardella, 2001; Link & Scott, 2002), and obtaining greater dividends from a firm's investment in R&D (McDonald & Leahey, 1985).

Beyond its importance for individual firms, the growth of licensing in industries such as biotechnology has fundamentally altered industry structure by encouraging vertical disintegration (Arora et al., 2001). Moreover, given the importance of access to next-generation and, in the case of pharmaceutical and bioscience industries, life-saving technologies for society as a whole (Scotchmer, 1991), exclusivity in licensing agreements has also become central to antitrust and intellectual property rights policies (Lerner & Tirole, 2004).

It is not surprising, then, that this business model has become particularly prominent in high-technology industries, such as bioscience (Cannady, 2013; Stuart et al., 2007), or that high-profile deals abound.[1] While licenses often entail technology transfer from innovative start-ups to established firms, even established firms sometimes lack complementary capabilities in known markets as well as markets enabled by newly developed technologies (Argyres & Mayer, 2007; Somaya et al., 2011) and, hence, rely on commercialization partners' capabilities via out-licensing. In sum, technology licensing has become not only an important means of knowledge transfer between firms, but also an increasingly critical element to firms' innovation and commercialization strategies (Arora et al., 2001; Link & Scott, 2002; Somaya et al., 2011).

Exclusive Versus Nonexclusive Licenses

An exclusive license grants a licensee the monopoly rights to a licensed technology for a given use, territory, and time period; a nonexclusive license, in contrast, reserves the licensor the right to grant licenses to other additional licensees (Aulakh et al., 2010; Jiang et al., 2007). Most studies have suggested that the choice between exclusivity and nonexclusivity involves strategic considerations, wherein licensors have to manage the trade-off between expected revenues and costs associated with contracting with one versus multiple licensees (Aulakh et al., 2010; Somaya et al., 2011). In the following, we synthesize prior work to better understand how the foundational assumptions drawn from the revenues versus transaction costs trade-off are meaningful to how role-specific deal experience and bargaining power can interactively influence the likelihood of licensors obtaining nonexclusive outcomes.

Licensing revenues. The greatest potential source of revenues from out-licensing a technology is typically the royalties received from the sales of products leveraging the technology (Aulakh et al., 2010; Cannady, 2013). A few prior studies have argued that a sole licensee can generate higher revenues than competitors by possessing monopolistic control of the licensed technology (Arora & Fosfuri, 2003) or creating a contractual hostage for the licensor (Somaya et al., 2011), which may encourage more technology-specific investments towards commercialization. A nonexclusive license, however, allows multiple licensees to commercialize a technology within their respective markets and thereby offers the licensor multiple concurrent revenue streams (Erutku et al., 2007; Schmitz, 2007). More importantly, the competitive pressure stemming from the technology being in the hands of multiple firms as part of a nonexclusive license creates incentives for licensees to act more entrepreneurially in their efforts to commercialize the licensed technology (Aulakh et al., 2010). These efforts

could open up new markets with additional revenue streams and, thereby, make nonexclusive licenses more lucrative overall for the licensor. Granting multiple nonexclusive licenses can further act as a competitive defense, as obtaining a license deters rivals from developing their own competing technologies since they would inherently face more competitors (Hill, 1997). When licensing a technology to multiple downstream partners, there are also fewer opportunities for competitors to get their technologies into product-markets, which further enhances the revenue potential of the licensor's technology.

In sum, while cases exist in which a nonexclusive license can yield less revenue per licensee, the aggregated revenues from a larger number of licensees are likely to outweigh this shortfall.[2] We thus follow the majority view in the literature and expect that, from a revenue maximization perspective, all else equal, licensors favor nonexclusive over exclusive contracts (Erutku et al., 2007; Jiang et al., 2007; Katz & Shapiro, 1986; Schmitz, 2007).

Transaction costs. Like other contractual agreements, licenses are subject to information asymmetries, opportunism, and bounded rationality (Fosfuri, 2006). The revenue-maximization logic discussed above must therefore be supplemented with a consideration of the transaction costs associated with each contractual outcome. First, asymmetric information about prospective licensees gives rise to ex ante (i.e., before the contract is signed) *search and screening costs* to reduce the risk of adverse selection (Williamson, 1987). In particular, the heterogeneity between prospective licensees can be high, especially regarding their commercialization capabilities, technological complementarities, and dedicated effort to ensure the technology's full market potential is reached (Gordanier & Miao, 2011). To find suitable licensees, therefore, multiple prospective candidates need to be screened regardless of the exclusivity choice. In the case of nonexclusive agreements, even when screening multiple prospective licensees simultaneously, the licensor can get caught in the middle between the interests and terms requested by more than one licensee at different points in the screening process (Owen-Smith, 2005). For example, a prospective licensee "may ask the licensor to guarantee that no other third party will receive more favorable terms, or that the licensee will receive notice and the benefit of more favorable terms granted to another licensee" (Hornick & Burns, 1999: 16). Also leading to higher ex ante costs, nonexclusive licenses can present multiple search and screening rounds for new licensees.

Second, licensing deals also involve ex ante *contract development costs*, such as accounting for the future value of a technology as well as determining the appropriate royalty rates and the licensee's acceptable use of the contracted technology in various product-markets or geographic territories (Aulakh et al., 2010; Cannady, 2013). For nonexclusive deals, the licensor must negotiate multiple bilateral agreements with individual licensees, while also considering problematic interdependencies that are posed in any new agreement versus previously settled deals (Owen-Smith, 2005). These situations can create a complex web of negotiations across multiple parties, which increase ex ante costs for nonexclusive licenses (Katz & Shapiro, 1986).

Third, licensing deals also involve ex post (i.e., after the contract is signed) *technology transfer costs* (Madhok & Tallman, 1998), such as the creation of technology-use or sales materials, as well as training licensees and providing technical assistance to ensure that they can effectively absorb the licensed technology (Aulakh et al., 2010; Jiang et al., 2007). While some portion of technology transfer costs may be fixed regardless of the number of licensees,

adapting the knowledge transfer process to licensees with different absorptive capacities (Laursen, Leone, & Torrisi, 2010) entails substantial variable costs (Aulakh et al., 2010; Jiang et al., 2007), which compounds the aggregate costs of nonexclusivity.

And fourth, licensing deals entail ex post *monitoring and enforcement costs* as a result of transaction hazards, such as adverse selection, hold-up, and opportunism (Oxley, 1997). A licensee may turn out to be less capable than assumed (Gordanier & Miao, 2011) or, alternatively, may devote inadequate resources or even act opportunistically (Aulakh et al., 2010; Somaya et al., 2011; Zylbersztajn & Lazzarini, 2005), such as when a licensee becomes a competitor after it has absorbed the technology (Jiang et al., 2007). And while monitoring has been found to promote contract continuity (Zylbersztajn & Lazzarini, 2005), it often comes with a cost. To counter such transaction hazards, licensors engage in ongoing activities to gather information on licensees' contractual performances, renegotiate contracts in light of changes, and monitor any unauthorized use of the technology (Aulakh et al., 2010).

In contrast to the short-term impact of ex ante search and contracting costs, ex post monitoring and enforcement costs occur over an extended period of time (Gordanier & Miao, 2011) and represent the largest burden of transaction costs. In the bioscience industry, the focus of our study, licensing agreements can last up to 17 years due to the time-consuming nature of the drug development process and licensors trying to ensure maximized patent protection (Austin, 2012; Lemley, 2008). Moreover, licensors incur monitoring costs even *after* the contractual relationship has ended since know-how related to the technology transfer cannot necessarily be unlearned by a licensee and can intentionally or unintentionally leak into a licensee's development of other technologies (Wathne & Heide, 2000). This prompts additional costs in order to monitor the licensee even beyond the contract's expiration (Williamson, 1991). For nonexclusive (versus exclusive) licenses, licensors must devote even more time and resources to monitoring licensees.

Despite the caveats discussed, the trade-offs between transaction costs and revenues for nonexclusive versus exclusive licenses can shift when moving beyond static, isolated views of a transaction (Ghoshal & Moran, 1996). By presenting a dynamic framework that accounts for how a licensor's unique licensing history and bargaining power position can affect exclusivity in future licensing deals, we propose how the trade-offs associated with exclusive versus nonexclusive licenses can change, and, hence, affect contractual outcomes.

Hypotheses Development

Licensing Deal Experience

The interfirm contracting literature has long emphasized the necessity of taking "prior commitments into account [to] help predict the allocation of rights in [subsequent] alliance contracts" (Argyres & Liebeskind, 2002: 212). Similarly, the alliance literature has long maintained that firms can learn from their collaborative histories (Anand & Khanna, 2000a; Ariño et al., 2014; Hoang & Rothaermel, 2005, 2010), which helps them develop valuable relational capabilities (Gulati et al., 2009).[3] More specifically, this literature has emphasized that "learning to contract" (Mayer & Argyres, 2004) represents a crucial alliance management capability with important consequences for both the organization's and the alliance's performance (Adegbesan & Higgins, 2010; Ariño et al., 2014; Hoetker & Mellewigt, 2009; Kale et al., 2002; Kale & Singh, 2007). Contractual learning and its associated capabilities

are applied ex ante to the establishment of the deal (Argyres & Mayer, 2007; Reuer & Ariño, 2007) and ex post to alliance management, including monitoring any ongoing deals (Dyer & Singh, 1998; Sabel, 1994). Since transaction costs are driven by recurring types of challenges, such as information asymmetries, opportunism, and bounded rationality, licensors are capable of becoming more deft at both ex ante contracting (e.g., Argyres & Mayer, 2007; Mayer & Argyres, 2004) and ex post managing interfirm contracts (Kale et al., 2002) as they accumulate more experience with contracts. Yet, some alliance studies find inconclusive results for how a firm's experience with prior contracts matter to future outcomes (e.g., Aulakh et al., 2010; Somaya et al., 2011). Given the inherent instability of alliances (Das & Teng, 2000), learning to contract remains a vital capability to understand, particularly in licensing alliances, as it helps firms recognize red flags within deals or steer the agreement's scope and terms towards their best interests (Zylbersztajn & Lazzarini, 2005).

A key feature of alliance agreements, though more observable within licensing alliances, is that partners perform different roles in the relationship, with one being the source, and the other the recipient, of know-how. The accumulation of role-specific deal experience, in turn, yields unique contract capabilities (Laursen et al., 2010; Stuart et al., 2007). Thus, the ambiguity surrounding prior experiential effects in previous studies may be due to (a) not differentiating between a firm's prior roles in licensing and (b) not accounting for the dynamic nature of cumulative experience in different roles at the time of the deal. For instance, these roles are different in that out-licensing requires a more cost-intensive monitoring system as a whole and one that continues to require time and resources for a longer duration, given that spillover learning from the initial licensing deal may prompt future scenarios of competition (Gordanier & Miao, 2011). In-licensing also has ex-post monitoring costs, but given the role-specific situation of the licensee versus the licensor and the direction of technology transfer, the monitoring system is not as cost-intensive (Laursen et al., 2010) and will ultimately go away if the licensee's contract terms or the market value of the technology expire. Further, a firm's accumulation of prior out-licensing deals (wherein the firm assumes the role of licensor) and its accumulation of prior in-licensing deals (with the firm as the licensee) yields different capabilities and different ex post monitoring obligations, which impacts the exclusivity of subsequent contracts. Accounting for both static features of the focal deal and dynamic properties (i.e., time-varying, accumulated, and role-specific) of these transactions, we propose how exclusivity can be reconciled from the licensor's view.

Out-licensing deal experience. There are competing arguments on the effects of prior out-licensing deals on the likelihood of subsequent nonexclusive licenses. On the one hand, prior work has long argued that merely having been involved in prior out-licensing deals can offset transaction costs associated with such agreements (Kim & Vonortas, 2006). That is, the more prior out-licensing deal experience a licensor has, the lower the costs of screening and selecting licensees, designing appropriate contracts, and enforcing the agreement (Kim & Vonortas, 2006). In the more general alliance context, Ryall and Sampson (2006) have found, for instance, that having participated in prior deals allows firms to draft more detailed or customized contracts with subsequent partners, because experience makes such customization become less costly. Greater experience with out-licensing deals should allow licensors to not only make more accurate inferences on or attributions to their partners' capabilities, interests, and motivations, but also to become more apt at identifying those partners with

comparatively higher revenue potential and lower transaction costs. Moreover, it may take a number of prior agreements for licensors to correctly anticipate the contingencies that could have an adverse effect on the agreement. Greater experience with out-licensing deals should therefore allow licensors to learn how to effectively and efficiently plan for and respond to any contingencies arising in a given agreement (Anand & Khanna, 2000a; Sampson, 2005). This can mitigate both ex ante and ex post transaction costs in subsequent out-licensing deals (Arora & Fosfuri, 2003; Kim & Vonortas, 2006).

However, licensing contracts are also highly idiosyncratic (Oxley, 1997), which could make any learning from past deals of only limited relevance to subsequent deals. This is particularly problematic for transfer costs. Some portion of these costs may be fixed regardless of the number of licensees, such as codifying any valuable knowledge related to the licensed technology. However, adapting the knowledge transfer process to idiosyncratic licensees with different absorptive capacities still entails substantial variable costs for the licensor (Aulakh et al., 2010; Jiang et al., 2007). As a result, transfer costs to the licensor are an increasing function of the number of licenses granted (Aulakh et al., 2010). Specifically, with the accumulation of prior out-licensing deals, there is a simultaneous increase in the accumulated monitoring and enforcement costs for a licensor, as more time and resources have to be devoted to monitoring an increasingly large number of licensees. As described above, these monitoring requirements not only cast a long shadow from the deal date forward—for example, up to 17 years for the bioscience industry (Austin, 2012; Lemley, 2008)—but the monitoring requirements persist even beyond the expiration of the licensing contract (Gordanier & Miao, 2011; Williamson, 1991). Thus, while more experienced licensors may be better skilled at managing multiple simultaneous partnerships (Rothaermel & Deeds, 2006), licensors possess limited resources for monitoring, which compromises their ability to add even more partners (Hoang & Rothaermel, 2005).

In sum, we argue that although some degree of experiential learning does occur with each out-licensing experience, the overall efficacy of accumulating out-licensing deals to realizing economies to a firm's licensing strategy cannot keep up with the ongoing costs of accumulated monitoring activities from ongoing and even prior out-licensing deals. When a firm is adding yet another licensing contract to its previous deals, the additional transaction costs that accrue are disproportionate to the incremental benefits of contracting and managing such relationships more efficiently. This scenario decreases the likelihood of obtaining a nonexclusive outcome as such deals would further compound the monitoring challenges through the accrual of ex post transaction costs for the licensor. Formally:

Hypothesis 1a: Greater accumulation of out-licensing deals by the licensor leads to a decreased likelihood of a nonexclusive license.

In-licensing deal experience. In playing the role of the licensee, prior involvement with in-licensing deals allows licensors to put themselves in the licensee's shoes. In particular, the negotiations literature has uncovered that perspective-taking ability, defined as the "cognitive capacity to consider the world from another individual's viewpoint" (Galinsky, Massux, Gilin, & White, 2008: 378), is consistently associated with greater success in bargaining situations (e.g., Galinsky et al., 2008), as it allows negotiators to adopt their contract partners' viewpoints, interests, and intentions and, thereby, to anticipate their behavior (Neale

& Bazerman, 1983). As a result, perspective taking is positively associated with finding a reconciliatory position between one's own and one's partner's interests, which, in turn, is positively associated with more efficient and effective negotiations (Galinsky et al., 2008). Further, there is broad support for the benefits of deal experience on negotiators' perspective-taking abilities with both laboratory and field studies finding prior exposure to and experience with the opposite perspective in a bargaining situation to enhance a negotiator's perspective-taking ability (Neale & Bazerman, 1983).

Extending this logic to licensing, the time and costs associated with searching for and determining the relative fit of prospective partners should be reduced when licensors have acquired a better understanding of licensees' attributes and interests by having previously been exposed to a licensee's perspective (Laursen et al., 2010). Similarly, licensors with such exposure should also have a better comprehension of the short- and long-term challenges prospective licensees pose and, hence, should be more proficient and efficient in developing appropriate and anticipatory contractual frameworks governing a licensing deal (Stuart et al., 2007). This enhanced understanding of their prospective partners' perspectives should further enable licensors to avoid negotiation impasses (Trötschel, Hüffmeier, Loschelder, Schwartz, & Gollwitzer, 2011) and to more effectively and efficiently manage points of negotiating friction that might arise. Thus, having been exposed to more prior in-licensing deals should yield lower ex ante contracting costs.

Even after a deal reaches agreement, understanding the role played by their partners should allow licensors to anticipate and account for short- and long-term relational challenges or risks that can jeopardize the licensed technology's commercialization and manage the alliance relationship more efficiently. This reduced risk, in turn, diminishes ex post transaction costs and thereby increases the likelihood of a nonexclusive license. In contrast to having been involved in a greater number of out-licensing deals, prior involvement with in-licensing deals and its associated experience benefits come without the substantial and long-term requirements to monitor an increasing number of licensees. Thus, we propose:

Hypothesis 1b: Greater accumulation of in-licensing deals by the licensor leads to an increased likelihood of a nonexclusive license.

The Role of Bargaining Power

Beyond the focal firm's licensing deal experience, prior work has emphasized the importance of examining partners' bargaining power—defined as "the ability of one party to a contract to be able to influence the terms and conditions of that contract or subsequent contracts in its own favor" (Argyres & Liebeskind, 1999: 55)—in conjunction with transaction cost considerations to explain the governance of interfirm agreements (Ariño et al., 2008; Lerner & Merges, 1998; Shervani, Frazier, & Challagalla, 2007). Argyres and Liebeskind (1999: 58), for instance, caution that "bargaining power differences can exert important impacts on governance choice on the short and medium term—impacts that researchers and managers cannot afford to ignore." We consider the product-market relevance of the licensed technology (Grégoire & Shepherd, 2012) as an important feature of a licensing relationship that proxies the licensor's bargaining power (Austin, 2012; Erutku et al., 2007; Schmitz, 2007). Market relevance can directly influence the likelihood of a nonexclusive deal outcome, while also interacting with licensing experience to further guide this outcome.

Specifically, in markets for technology, it is the product-market relevance of the licensed technology (Grégoire & Shepherd, 2012) that defines licensors' bargaining power (Erutku et al., 2007; Schmitz, 2007). Thus, we expect technologies intended for more relevant markets—defined as product-markets with more assured and sizeable opportunities (Priem, Li & Carr, 2012)—to directly affect the likelihood of a nonexclusive license, for three reasons.

First, given the challenges of ex ante valuations in technology licensing (Lemley, 2008), a technology that targets more relevant product-markets should allow both licensors and prospective licensees to more accurately estimate its value (Shane, 2000) and, thereby, diminish the associated ex ante contract development costs. Second, while the technological uncertainty associated with a given license may always be present, greater certainty that a sizeable market awaits a market-relevant technology implies less market-based uncertainty and, therefore, less overall risk associated with the technology's commercialization (Cassiman & Gambardella, 2009; Santoro & McGill, 2005). With this risk reduction, both ex ante contract development costs as well as the ex post monitoring and enforcement costs should be diminished (Williamson, 1987). And third, a more market-relevant technology is likely to result in more prospective licensees having a strong interest in licensing this technology (Porter, Sheckler, & Im, 2003), which yields a direct bargaining advantage for the licensor. Ex ante costs are also reduced since the opportunities for market-relevant technologies are more widely understood and recognizable (Grégoire & Shepherd, 2012), and there exists a lower bar of "selling" prospective licensees on the technology's market fit and sales potential. Ex post monitoring costs are diminished as well for these technologies since lower market uncertainty reduces the likelihood of licensees' opportunism (Williamson, 1987). This diminished uncertainty makes it easier for licensors to anticipate and account for the relevant contractual contingencies that could arise (Grossman & Hart, 1986). Beyond the motivation to realize transaction cost economies, there also exists a similarly aligned motivation to expand revenue potential in that, with greater market relevance, technologies may feasibly need nonexclusive access in order to fulfill the ultimate market opportunity that exists. Formally:

Hypothesis 2a: Licensing out a technology of greater market relevance increases the likelihood of a nonexclusive license.

Over and above this direct effect, we expect a licensed technology's market relevance to further influence the effects of prior licensing deals on the likelihood of a nonexclusive outcome. In particular, as outlined above, with greater market relevance for a licensed technology (i.e., lower uncertainty associated with its commercialization), it is easier for licensors to anticipate the relevant contractual contingencies that could arise. This understanding allows licensors to be more comprehensive in securing key deal terms (Grossman & Hart, 1986), which allows them to better protect a licensed technology with a stronger contract, thereby lowering monitoring and enforcement costs arising later. Due to the lower transaction costs associated with licensing market-relevant technologies, firms with more prior out-licensing deals—which would otherwise be inclined to establish an exclusive license in order to manage accumulated ex post monitoring and enforcement costs—may be more inclined to pursue a nonexclusive license. And due to the bargaining power advantage associated with offering market-relevant technologies, licensors are more likely to actually obtain the preferred outcome, a nonexclusive license. Formally:

Hypothesis 2b: The negative relationship between a licensor's prior involvement in out-licensing deals and a nonexclusive license is less likely to occur when licensing out a technology with greater market relevance.

Conversely, we expect the experience benefits of prior in-licensing deals on obtaining a nonexclusive license to be more pronounced with greater market relevance of the licensed technology. In this case, the licensor gains a transaction cost and bargaining advantage in the pursuit of a nonexclusive license from the confluence of three mutually supportive factors: (a) the ability to more easily anticipate and overcome negotiation friction through having a better perspective of the licensee's position through more in-licensing experience (Galinsky et al., 2008; Neale & Bazerman, 1983); (b) the advantage of having a technology with greater market relevance and, thus, less commercial uncertainty (Grossman & Hart, 1986; Santoro & McGill, 2005); and (c) the expanded market opportunity these technologies afford to the licensor and prospective licensees (Grégoire & Shepherd, 2012; Porter et al., 2003). In turn, these factors enable a scenario for licensors to choose from a broader array of commercialization partners, and the ability to deal with these prospective partners with a stronger negotiation position. With greater experience from prior in-licensing deals, a nonexclusive license is even more likely to occur. Formally:

Hypothesis 2c: The positive relationship between a licensor's prior involvement in in-licensing deals and a nonexclusive license is more likely to occur when licensing out a technology with greater market relevance.

Method

We test our hypotheses in the human-therapeutic area of the bioscience industry. This setting offers two main advantages for our analyses. First, licensing represents the most common form of firm-to-firm transactions in this industry (Cannady, 2013; Stuart et al., 2007), resulting in a large number of licensing deals with substantial influence on firms' performance (Anand & Khanna, 2000a; Walter, 2012). Second, bioscience licenses exhibit a broad variety of contractual terms (Austin, 2012), and because consultants, analysts, policy organizations, and media outlets track this industry, there exists more access to contractual details compared to other industries.

Our sample consists of all available licensing contracts in this industry over the period of 1981 to 2007 (inclusive)[4] reported in Recombinant Capital Group's (Recap) database. Recap's coverage of contract information is considered reliable and representative of the industry's alliance activity (Schilling, 2009) and has been used in previous studies of interfirm collaborations (e.g., Gulati & Higgins, 2003; Khoury & Pleggenkuhle-Miles, 2011; Santoro & McGill, 2005; Stuart et al., 2007). Our sample comprises 2,437 licensing transactions for 406 bioscience firms.[5] In addition to Recap, we sourced data from the U.S. Centers for Disease Control and Prevention (CDC), the U.S. Patent and Trademark Office (USPTO), initial public offering (IPO) prospectuses, and Compustat.

Dependent and Independent Variables

All variable definitions and sources are detailed in Appendix A. Building on prior transaction cost work on licensing (Aulakh et al., 2010; Jiang et al., 2007; Somaya et al., 2011),

Nonexclusive license is the dependent variable (coded 1 for nonexclusive deals and 0 for exclusive deals).

We calculated *Prior Out-Licensing Deals* and *Prior In-Licensing Deals* as the respective number of out- and in-licensing relationships the focal firm engaged in until up to a year prior to the focal licensing transaction. To calculate our measures, we included all licensing deals for the firms in our sample with horizontal and vertical partners, dating back as far as 1967 to avoid left-censoring our deal experience data. We used a one-year lag to reflect the often-lengthy negotiation period prior to finalizing licensing alliance contracts (Austin, 2012; Cannady, 2013; Lerner & Merges, 1998), which was substantiated by informal interviews with bioscience licensing executives, consultants, and attorneys.

A few prior studies have modeled decreasing marginal returns to prior deals using the squared term (Hoang & Rothaermel, 2005; Sampson, 2005) or the natural logarithm of the number of prior deals (Zollo, Reuer, & Singh, 2002). This approach, however, ignores the timing of prior deals, which is problematic as the value of experience is subject to decay over time. In response, some authors have reported robustness tests using deal windows (Gulati et al., 2009; Kale et al., 2002), but there is little consistency across studies with respect to the length of such windows, making this approach seemingly arbitrary. Moreover, prior work on the bioscience industry suggests that truncating prior deals may not be appropriate for this context (Hoang & Rothaermel, 2010).[6] We therefore follow the approach outlined by Ingram and Baum (1997) and apply a discount to each prior deal, depending on how long ago it occurred with respect to the contract date. Prior deal experience is calculated as

$$\sum_{T_i}^{T-1} \frac{E_{it}}{Discount},$$

where T_i is the first year a firm enters the dataset, T–1 is the year prior to the focal deal year, E_{it} is the number of prior deals accumulated by firm i in year t, and *Discount* is the extent to which the experience benefits from prior deals depreciate over time due to possible antiquation (due to environmental change) or decay (due to forgetting). Given our empirical context of the bioscience industry, *Discount* is modeled as the square root of the ages of prior deals (Ingram & Baum, 1997).

Acknowledging the unique context of the bioscience industry (Arora, Gambardella, Magazzini, & Pammolli, 2009; Lerner & Merges, 1998), we accounted for a licensed technology's targeted disease/pathology indications as *Market Relevance*. Given that our dependent variable is focused on licensing out the access rights to a technology to one or more interested partners, technologies with greater market relevance should increase the number of interested parties, as there is validation for a real and immediate need for products to mitigate fatalities (Porter et al., 2003). This variable takes the value of 1 when the licensed technology was identified as supporting either the treatment of a specific medical indication represented in the top-ten mortality causes according to the CDC's annual data in the year before the licensing transaction or associated with these causes due to the indication's morbidity. In any other case, it was coded 0.

Control Variables

We accounted for a number of control variables at the deal, licensee, licensor, and industry levels of analysis. At the deal level, we controlled for the scientific focus of the licensed

technology since the markets for technology can be domain-specific (Robbins-Roth, 2000): *Antibodies/Proteins*, *Bioinformatics/Genomics*, *(Chemical) Synthesis*, *Therapeutics*, *Novel Chemicals*, or *Vaccines*. To isolate these domains, we identified 58 distinct scientific area labels in our sample coded by Recap. We then provided this list to two university scientists located at a prominent PhD program in pharmacy and pharmacology who assigned the 58 scientific labels into these six bioscience foci. For some licenses, more than one technological area was listed, in which case each of the listed codes was assigned. These technology-specific controls account for latent or deal-specific attributes associated with a license to capture the fit between these technologies and the licensee's interests. Further, specific technologies can also receive more attention or coverage by the press (Robbins-Roth, 2000), which can lead to more visibility and, perhaps, increase the prospective licensee pool. Analogous to Somaya et al. (2011), we also operationalized *Early-Stage Technology* as 1 to represent more nascent technologies in the stages of early chemical formulation, "lead molecule" research (e.g., identifying valuable peptides and antibodies per Recap), or preclinical trials; whereas 0 designated later-stage development, such as trials involving human subjects (U.S. Food and Drug Administration [FDA] Phases I, II, and III), new drug applications, and approved drugs.

We created dummy variables to account for whether or not a license was a *Downstream Alliance* (Gulati & Higgins, 2003; Khoury & Pleggenkuhle-Miles, 2011), and we controlled for *Partner-Specific Experience* as the quantity of previous licensing deals a firm has had with the focal licensee (Gulati et al., 2009; Hoang & Rothaermel, 2005; Holloway & Parmigiani, 2016).

To account for the licensee's resource position, prior work on bioscience alliances (e.g., Gulati & Higgins, 2003; Khoury, Junkunc, & Deeds, 2013; Kim & Higgins, 2007) has examined whether a partner was prominent in its respective industry as indicated by its track record of downstream capabilities (Austin, 2012; Cannady, 2013). This measure of licensee prominence as a sales-based proxy is highly representative of bargaining power within bioscience interfirm contracting as it shows the prospective market power of the licensee based on its sales track record (Argyres & Liebeskind, 2002; Ariño et al., 2008; Lerner & Merges, 1998). In line with prior work, we therefore coded whether licensor and licensee were represented, respectively, in the top 30 of either pharmaceutical/chemical firms (for downstream vertical partners) or biosciences (for lateral partners) according to their sales in the year prior to the licensing deal. *Prominent Licensee* was then coded 1 if the licensee was prominent and 0 otherwise.

At the licensor level, we controlled for variables that account for the licensor's demonstrated licensing and technological capabilities and the licensor's stage of development. Specifically, we controlled for *Licensor Age* in years to reflect the licensor's stage of development, where, conceivably, younger firms may be more in need of a nonexclusive relationship in order to create more incoming rent streams to enhance survival prospects. We also controlled for how recent the last licensing transaction occurred with the natural log of lapsed days to measure the pace of engaging in this type of transaction (*Time Since Last Deal*). To account for the dual capability of a firm that engages in both roles of out- and in-licensing, we created a binary variable of *Both Experiential Roles* to capture if the firm, as of the deal date, had accumulated both types of deal experience, and coded it 1 for this case, and 0 otherwise.

At the industry level, we controlled for the *Number of Bioscience IPOs* within a year prior to the contract as the IPO market presents an alternative survival strategy for bioscience firms

needing to survive long product-development cycles without revenues through out-licensing (Khoury et al., 2013; Robbins-Roth, 2000). This variable may influence the likelihood of a nonexclusive outcome such that during "hot" IPO markets, with more IPOs occurring, there may be less competition between firms to win licensing deals. During "cold" IPO markets, more firms may be actively pursuing licenses in order to survive. Lastly, we accounted for unobserved heterogeneity by including 26 year-dummies to represent all but one year of our sample period.

Analyses

In line with previous studies on technology licensing (Aulakh et al., 2010; Somaya et al., 2011), we tested our hypotheses with a maximum likelihood estimator in a logistic regression model; and to avoid any bias due to cross-sectional correlations across the residuals for a firm's observations, we used Huber-White robust standard errors clustered by the licensor (Cameron & Miller, 2015). In our results, the estimates reported represent the changes in likelihood for each coefficient, and in line with recommendations in the literature (Echambadi, Campbell, & Agarwal, 2006), we have not standardized our measures. To investigate the confidence intervals of our tests, we followed more recent recommendations on handling logistic regression estimation when testing moderation hypotheses (Ai & Norton, 2003; Brambor, Clark, & Golder, 2006; Hoetker, 2007; Zelner, 2009). We follow Hoetker's (2007: 336) recommendations for interpreting effect significance and size within our interaction tests since "the sign of the interaction coefficient may not indicate the direction of the interaction effect" and "the significance of the interaction effect cannot be determined just by the significance of the interaction coefficient." Thus, to understand the relative contributions of bargaining power to the relationship between prior out- and in-licensing deals and nonexclusivity, we followed recommendations to analyze and interpret the marginal change in probability through graphs (Ai & Norton, 2003; Hoetker, 2007; Zelner, 2009) alongside the suggestion to also report the marginal effects of our direct independent variables at meaningful values, that is, at the mean (Hoetker, 2007).

Results

Table 1 reports descriptive statistics and correlations for all variables. Although there are significant correlations between some variables, multicollinearity is not a significant problem; with a mean variance inflation factor (VIF) of 1.35 and a maximum VIF of 2.41, all VIFs are below the acceptable tolerance (Gujarati, 2003). We found that the average percentage of deals that are nonexclusive (9% over 27 years with individual years as high as 34% and as low as 0% for our sample) is consistent with prior studies that have focused on exclusivity within biosciences.[7] Considering our focal variables, we find that for both prior out- and in-licensing deals, there is good variance with the respective mean number of prior deals at 8.36 and 7.28 within our sample. With similarly good variance, our sample shows that 50% of the deals considered involve technologies with market relevance. Although the correlation between experiential roles is expectedly high at .72, there is a low correlation between prior deals and market relevance.

Table 2 reports estimates from our logistic regression analysis. We isolate the effects of the control variables in Model 1 and find a significantly greater likelihood of

Table 1
Descriptive Statistics and Correlations

	Variable	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Nonexclusive license	0.09	0.28	1.00																		
2	Prior out-licensing deals	8.36	8.26	−.08	1.00																	
3	Prior in-licensing deals	7.28	10.43	.01	.72	1.00																
4	Market relevance	0.50	0.50	.08	−.01	.08	1.00															
5	Antibodies/proteins	0.15	0.36	.01	.05	.02	.01	1.00														
6	Bioinformatics/genomics	0.30	0.46	.02	.00	−.01	−.04	−.27	1.00													
7	(Chemical) Synthesis	0.10	0.30	.03	−.01	−.01	.06	−.14	−.21	1.00												
8	Therapeutics	0.21	0.41	−.01	.00	.01	.03	−.21	−.34	−.17	1.00											
9	Novel chemicals	0.01	0.12	−.01	.02	.04	−.01	−.05	−.08	−.04	−.06	1.00										
10	Vaccines	0.02	0.14	.02	.02	.03	.02	−.06	−.09	−.05	−.07	−.02	1.00									
11	Early-stage technology	0.39	0.49	.07	.09	−.01	.07	.04	.15	.00	−.04	−.05	−.04	1.00								
12	Downstream alliance	0.53	0.50	.08	−.05	−.03	.11	−.06	.00	.06	.00	.03	.01	.02	1.00							
13	Partner-specific experience	0.30	0.84	−.02	.24	.23	.06	.01	.01	−.03	.02	−.02	.00	.01	.15	1.00						
14	Prominent licensee	0.24	0.43	.04	.06	.04	.05	−.04	.09	.05	−.04	−.05	−.04	.09	.20	.18	1.00					
15	Prominent licensor	0.14	0.35	−.04	.08	.17	.08	.02	−.02	.01	.02	−.01	.00	−.03	−.05	.03	.03	1.00				
16	Licensor age	10.77	6.06	.01	.44	.52	.08	.02	−.04	−.03	.04	.04	−.02	−.14	−.07	.20	.05	.22	1.00			
17	Time between deals (ln of days)	4.46	2.00	.04	−.27	−.15	.11	.01	−.02	.01	.00	.00	−.01	−.06	.01	−.13	.00	−.04	.03	1.00		
18	Both experiential roles	0.90	0.30	.01	.25	.22	.07	.04	−.02	−.03	.04	.00	−.01	−.01	−.03	.06	−.02	.09	.29	.01	1.00	
19	Number of bioscience IPOs	35.14	25.19	.02	−.06	−.04	−.03	−.04	−.01	.01	−.01	.03	.02	.05	−.03	−.03	−.02	.05	−.02	.01	−.01	1.00

Note: $N = 2{,}437$. Correlation absolute values if $> .032$, $p < .10$; if $> .038$, $p < .05$; if $> .050$, $p < .01$; if $> .065$, $p < .001$.

Table 2
Results for Logistic Regressions of the Probability of a Nonexclusive License

Variables	Model 1	Model 1a	Model 1b	Model 2	Model 3	Model 4
Independent variables						
Prior out-licensing deals (H1a)		−.05***		−.09***	−.09***	−.09***
		(.02)		(.03)	(.03)	(.03)
Prior in-licensing deals (H1b)			.01	.05***	.05***	.06***
			(.02)	(.02)	(.02)	(.02)
Market relevance (H2a)				.38**	.40*	.46**
				(.17)	(.23)	(.22)
Prior Out-Licensing Deals × Market Relevance (H2b)					−.0034	
					(.02)	
Prior In-Licensing Deals × Market Relevance (H2c)						−.011
						(.01)
Control variables						
Antibodies/proteins	.43	.46	.43	.43	.43	.43
	(.31)	(.32)	(.31)	(.32)	(.32)	(.32)
Bioinformatics/genomics	.39	.39	.38	.38	.38	.39
	(.24)	(.25)	(.24)	(.25)	(.25)	(.25)
(Chemical) Synthesis	.58**	.61**	.58**	.55**	.55**	.56**
	(.27)	(.27)	(.27)	(.28)	(.28)	(.28)
Therapeutics	.31	.3	.31	.28	.28	.29
	(.25)	(.26)	(.25)	(.26)	(.26)	(.26)
Novel chemicals	−.048	.014	−.075	−.06	−.06	−.058
	(.81)	(.80)	(.80)	(.81)	(.82)	(.84)
Vaccines	.98**	1.09**	.93**	.95**	.95**	.95**
	(.45)	(.45)	(.46)	(.45)	(.46)	(.45)
Early-stage technology	.56***	.64****	.55***	.61***	.61***	.60***
	(.19)	(.19)	(.20)	(.19)	(.19)	(.20)
Downstream alliance	.42**	.43**	.42**	.38**	.38**	.38**
	(.18)	(.17)	(.18)	(.18)	(.18)	(.18)
Partner-specific experience	−.2	−.15	−.21*	−.19	−.19	−.18
	(.13)	(.13)	(.13)	(.12)	(.12)	(.12)
Prominent licensee	.35*	.33	.36*	.37*	.37*	.37*
	(.20)	(.20)	(.20)	(.20)	(.20)	(.20)
Prominent licensor	−.62	−.63	−.64	−.91**	−.91**	−.89**
	(.53)	(.54)	(.51)	(.45)	(.45)	(.45)
Licensor age	.046	.069**	.038	.044*	.044*	.044*
	(.03)	(.03)	(.03)	(.03)	(.03)	(.03)
Time between deals (ln of days)	.069	.011	.078	−.0037	−.0036	−.004
	(.06)	(.05)	(.05)	(.05)	(.05)	(.05)
Both experiential roles	.3	.46	.28	.42	.42	.41
	(.34)	(.33)	(.34)	(.32)	(.32)	(.32)
Number of bioscience IPOs	.0077	.0072	.0078	.0066	.0066	.0066
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Constant	−4.91****	−4.60****	−4.90****	−4.42****	−4.43****	−4.44****
	(0.83)	(0.80)	(0.83)	(0.81)	(0.80)	(0.80)
N	2,437	2,437	2,437	2,437	2,437	2,437
Log likelihood	−663.20	−654.00	−662.40	−640.20	−640.20	−639.90
McFadden's pseudo *R*-squared	.07	.09	.07	.11	.11	.11
Chi-square	3,887.20	3,435.60	3,922.20	3,197.40	5,478.20	3,364.10
LR statistic	104.57	122.86	106.09	150.56	150.58	151.18
LR test[2]		18.29	1.52	45.99	46.01	46.61

Note: Unstandardized coefficients shown, with robust standard errors (*SE*) clustered by licensor in parentheses. Year dummies included for all models, but not reported.
*$p < .10$.
**$p < .05$.
***$p < .01$.
****$p < .001$.

Table 3
Marginal Effects of Hypothesized Direct Relationships

Hypothesized Variables and Tests	Coefficient	Marginal Effects[a]	Range of Experience Values Significant at $p < .05$ (percentage of sample covered by the range)
Prior out-licensing deals (H1a)[b]	−.09*** (.03)	−.01*** (.00)	
Prior in-licensing deals (H1b)[b]	.05*** (.02)	.003*** (.00)	
Market relevance (H2a)[b]	.38** (.17)	.03** (.01)	
Prior Out-Licensing Deals × Market Relevance (H2b)[c]		−.007*** (.002)	0 to 38.25 (99.6%)
Prior In-Licensing Deals × Market Relevance (H2c)[c]		.004** (.001)	0 to 70 (100%)
N	2,437	2,437	

Note: Robust standard errors for coefficients in parentheses.
[a]Marginal effects calculated at one unit change for discrete variables and at variable means for all other variables.
[b]Calculations made based on Model 2's results in Table 2.
[c]Calculations made based on Model 4's results for H2b and H2c, respectively, in Table 2.
**$p < .05$.
***$p < .01$.

nonexclusive licenses occurring with a number of our control variables. These are all in line with prior work and expectations, with perhaps the exception that prominent licensors are more likely to enter into a nonexclusive license ($p < .05$, Models 4, 5, and 6). A plausible explanation for this finding is that firm capabilities between licensors and licensees in the bioscience industry are highly segmented toward either a more upstream or downstream orientation (Somaya et al., 2011). When licensors obtain prominence through greater revenue, they often exhibit greater marketing capabilities—such as a large, downstream pharmaceutical firm (Argyres & Liebeskind, 2002)—and this may limit the pool of parties willing to work nonexclusively with a firm with strong downstream capabilities. In such deal circumstances, exclusive licenses are more likely to occur. Although Table 2's Model 2 is the most appropriate model to evaluate Hypotheses 1a, 1b, and 2a (Echambadi et al., 2006), we include Models 1a and 1b to show the isolated effects of each experiential variable.

Regarding our main-effects hypotheses, we find that, in support of Hypothesis 1a, the accumulation of prior out-licensing deals decreases the likelihood of licensors obtaining a nonexclusive contract ($p < .01$). More prior in-licensing deals increases the likelihood of licensors obtaining a nonexclusive contract ($p < .01$), supporting Hypothesis 1b. Hypotheses 2a accounts for the isolated role of bargaining power, specifically, whether a licensed technology has more market relevance. We find significant results for this relationship ($p < .05$), with Hypothesis 2a falling in line with our bargaining power theory. Following Hoetker (2007), in Table 3, we confirm that the marginal effects are consistent in sign and significance to those reported in Model 2.[8]

Consistent with the recommendation to interpret the significance of our direct effects at the mean (Hoetker, 2007) and to summarize the range of values in which the moderating effect is significant at .05 or better (Ai & Norton, 2003; Brambor et al., 2006; Zelner, 2009),

we present these results in Table 3. Using our sample's range of prior involvement in out- and in-licensing deals, this table shows the boundary conditions of the moderating effects' significance. Both relationships indicate a significant moderating effect at the mean number of prior licensing deals to plus (at least) three standard deviations.[9]

With regard to market relevance as bargaining power leverage applied towards realizing nonexclusive licenses (Hypothesis 2b), Table 3 indicates that within the range of 0 to 38.25 prior deals (representing 99.6% of our observations), market relevance does not effectively counter the negative effects of prior out-licensing deals. Thus, within this range, exclusive licenses are more likely to occur ($p < .01$). Although the effect of market relevance represents a positive sway on the negative relationship between prior out-licensing deals and nonexclusivity (as noted in Appendix Figure B1), this effect is not strong enough to yield a positive relationship with the likelihood of nonexclusivity. Further, with increasing prior out-licensing experience, the positive effect of market relevance becomes less important as a bargaining chip. For Hypothesis 2c's proposal that the relationship between prior in-licensing deals and nonexclusivity is positively moderated by market relevance, we observe this marginal effect to occur over the entire range of values in our data ($p < 0.05$). Thus, the positive relationship between a licensor having been involved in more in-licensing deals and a nonexclusive license is even more likely to occur when licensing out a market-relevant technology. Similar to Hypothesis 2b, Figure B2 in Appendix B shows that the effect of market relevance becomes less complementary with increasing in-licensing deal experience.

Robustness Tests

We completed a number of robustness tests to ensure the quality of our models and theory. First, in line with recommendations for our industry context (Hoang & Rothaermel, 2010) and our focus on licensing (Gordanier & Miao, 2011), we conducted tests around the time-based assumptions of a firm's deal history. We did this by applying the logarithmic and squared terms as discount factors, as well as no discount to our deal experience calculations (Ingram & Baum, 1997) and also tested common experience windows. We find that the results for out-licensing experience are the same, but the more prior in-licensing experience is either depreciated or cut off by smaller windows, the more its significance diminishes (e.g., Sampson, 2005).

Using data from the National Bureau of Economic Research (NBER) Patent Database, we also considered the inclusion of a licensor's knowledge stock with the natural log of the number of U.S. patents accumulated up to the year prior to the license date (Kim & Vonortas, 2006). Using the same one-year lag, we also accounted for the licensor's *Technological Breadth*, to capture the diversity of technology classes represented within their time-varying patent portfolio (Argyres, 1996). More and broader patents account for whether the licensor may be more likely to overlap in its scope of technological capabilities relative to a licensee. Both variables are highly correlated, are not found to be significant, and do not alter our findings. With data from Recap, we tested the inclusion of the deal's *Equity Arrangement* and *Geographic Restriction* terms (Somaya et al., 2011) despite the potential of endogeneity posed to our models. All findings remain the same with both included. Further, we obtained access to 13 years of data (at the end of sample period) providing annual revenues for each

licensor and we replaced *Licensor Age* with *Licensor Sales* and tested a subsample of N = 1,937 licensing transactions (which eliminated 13 year dummies); this variable was insignificant and did not change our findings.

Discussion

Acknowledging exclusivity as a strategic outcome that reflects a licensor's evaluation of associated trade-offs (Aulakh et al., 2010; Somaya et al., 2011), this study provides a more in-depth understanding of interfirm contracting. Building on transaction cost, experiential learning, and bargaining power theories, we argued that, while licensors have a strong motive to engage in nonexclusive licenses a priori, experience with prior licensing deals and deal-specific bargaining power considerations also influence this outcome. Specifically, we developed and tested a framework to explain (a) how the likelihood of a nonexclusive deal outcome is shaped by the accumulation of prior involvement in out- and in-licensing deals and (b) how the bargaining power condition of a technology's market relevance can directly and interactively affect the likelihood of a nonexclusive outcome.

Our study has a number of theoretical implications. First, while both interfirm contracting (Argyres & Mayer, 2007; Ariño et al., 2014; Kim & Mahoney, 2010; Mayer & Argyres, 2004) and strategic alliance literatures (Anand & Khanna, 2000a; Gulati et al., 2009; Kale et al., 2002; Ryall & Sampson, 2006) have maintained that prior involvement in interfirm collaborations can yield experience benefits for subsequent relationships, robust empirical support for this relationship remains elusive. By examining the differential effects of prior out- versus in-licensing deal roles, as well as the interactive influence of bargaining power, our study answers calls in the literature on organizational learning for a "more fine-grained analysis of experience [that] moves forward the specification of when experience has positive or negative effects on learning outcomes" (Argote & Miron-Spektor, 2011: 1127). In extending recent work that explores the "conditions under which learning discounts might occur" (Perkins, 2014: 173), this study identifies a potential downside to the accumulation of prior out-licensing deals.

In particular, our results provide broad corroboration for the argument that ex ante and ex post transaction costs can be economized through a firm's licensing experience but also highlight that there are limits to such economies. With greater *direct deal experience* accruing from prior out-licensing deals, a firm eventually struggles with the management of the more difficult-to-economize ex post transaction costs, even when prior deals occurred long ago and/or are no longer active (Gordanier & Miao, 2011; Wathne & Heide, 2000; Williamson, 1991). Perhaps, what has been conceptualized as diminishing returns to prior collaborations (e.g., Sampson, 2005) may actually reflect a situation in which experiential learning continues to occur, but its incremental benefits cannot keep pace with the increasing demands associated with ex post relationship management. As a result, by accumulating out-licensing deals, firms are increasingly likely to settle for exclusive licensing contracts.

Our study also highlights the benefits of *indirect deal experience*, which may allow partners to develop a better understanding of each other's capabilities and motivations, and thereby mitigate associated transaction costs. Specifically, our results show that with greater numbers of prior in-licensing deals, firms are better poised to secure nonexclusive licenses

due to the indirect learning benefits that accrue through perspective taking and the ex post transaction cost economies that this type of deal yields over out-licensing deals (Laursen et al., 2010). With few exceptions (Argote & Miron-Spektor, 2011; Laursen et al., 2010), the organizational learning literature, and particularly the interfirm alliance literature, is largely silent on this source of learning. Our results, however, underscore the value of exploring perspective taking when studying experiential learning in interfirm relationships and suggest that studies of learning to contract (in order to effectively secure favorable deals and minimize the associated transaction costs) should consider how indirect experiential effects matter within these relationships.

Using the interorganizational transaction of licensing to differentiate prior deal experience, our study contributes more generally to a reconciliation of the conflicting arguments and empirical evidence on the role of experience within interfirm collaborations (Anand & Khanna, 2000a; Ariño et al., 2014; Aulakh et al., 2010; Gulati et al., 2009; Hoang & Rothaermel, 2005, 2010; Mayer & Argyres, 2004; Sampson, 2005; Somaya et al., 2011) and highlights the benefits of indirect experience as well as the potential downside of prior collaboration experience.

Our results also resonate with the concurrent or plural sourcing literature (e.g., Jacobides & Billinger, 2006; Krzeminska, Hoetker, & Mellewigt, 2013; Parmigiani, 2007; Parmigiani & Mitchell, 2009), which suggests that learning is enhanced when a firm concurrently sources because it gains knowledge as both the supplier and the buyer. Similarly, as a previous licensee, a firm learns through "doing," which helps it gain a deeper understanding of their partner's situation versus the vantage point of only having acted as a licensor. This literature, however, also notes that there are limits to accruing benefits when firms engage in both make and buy roles (Puranam, Gulati, & Bhattacharya, 2013; Rothaermel, Hitt, & Jobe, 2006), resulting in excessive transaction costs. Although we focus on firms' roles in licensing deals, this literature further corroborates our findings.

Moreover, this study sheds new light on when and how bargaining power position matters to the structure of interfirm governance arrangements. By revealing the boundary conditions on experiential learning that are imposed by bargaining power, we demonstrate the importance of adopting an integrated lens and the necessity of considering bargaining power in conjunction with transaction cost considerations when examining the contractual outcomes of interfirm agreements (Argyres & Liebeskind, 1999, 2002; Ariño et al., 2008; Lerner & Merges, 1998). Specifically, we find that accounting for a licensed technology's market relevance directly and indirectly influences the probability of obtaining a nonexclusive outcome, which further reveals how closely TCE logic and bargaining power are intertwined in interfirm contracting and speaks to the literature highlighting the dynamic nature of the bargaining process (Coff, 2010).

Second, by focusing on when and how prior deal experience and bargaining power matter for obtaining preferential contractual outcomes, our study also expands the growing literature on interfirm contracting (Argyres & Mayer, 2007; Ariño et al., 2014; Mayer & Argyres, 2004; Reuer & Ariño, 2007; Schepker et al., 2014). Further, our theoretical framework and empirical results bring to focus how licensors can leverage their differential prior deal experiences to realize preferential contractual outcomes. Our study therefore expands work on how firms *learn to contract* (Argyres et al., 2007; Mayer & Argyres, 2004), which constitutes a

crucial factor to evolve the firms' alliance management capabilities (Kale et al., 2002; Kale & Singh, 2007; Schepker et al., 2014), and has important implications for both alliance and firm performance (Adegbesan & Higgins, 2010; Ariño et al., 2014; Hoetker & Mellewigt, 2009; Kale et al., 2002).

Third, this research also has implications for transaction cost research (Argyres & Liebeskind, 1999; Argyres & Zenger, 2012; David & Han, 2004; Ghoshal & Moran, 1996) by offering greater clarity as to when interfirm transactions can be depicted as idiosyncratic and when they are pushed toward specific outcomes. Particularly, the results of the proposed interaction effects reveal (a) that there are distinct profiles of when the effects of prior licensing deal experience on nonexclusive contract outcomes are enhanced or diminished by bargaining power and (b) when role-specific prior deal experiences more directly influence contract outcomes. Our findings thus help delineate boundaries conditions of transaction cost-focused explanations for contractual outcomes and thereby enhance TCE's explanatory power (David & Han, 2004). Our interaction findings also enrich TCE given that "ex ante bargaining power is not a feature of the established TCE argument" (Argyres & Liebeskind, 2002: 214).

Moreover, firms with active licensing strategies and contractual arrangements face the challenge of managing the marginal changes in costs versus benefits that accrue with each prior arrangement *dynamically*, while still accounting for the market conditions that surround the focal deal. In sum, the dynamic perspective on interfirm governance arrangements advanced in this study suggests that, indeed, "focusing on the characteristics of isolated transactions can be insufficient" (Argyres & Liebeskind, 1999: 49). Instead, our study provides theoretical and empirical corroboration of the difference between static and dynamic efficiency considerations in studying TCE (Argyres & Zenger, 2012; Cassiman & Gambardella, 2009; Kim & Mahoney, 2010) and highlights it as an important avenue for continued research.

Finally, our study complements and extends the fledgling empirical literature on the antecedents of nonexclusive licensing outcomes as well as the broader alliance literature. Concerning the former, our study expands prior licensing studies on innovativeness (Aulakh et al., 2010), safeguards (Kim & Vonortas, 2006; Somaya et al., 2011), transaction hazards (Aulakh et al., 2010; Oxley, 1997; Somaya et al., 2011), and absorptive capacities (Jiang et al., 2007; Laursen et al., 2010) and identifies additional enablers of and constraints on licensors' abilities to achieve their preferred contractual outcomes. By drawing on TCE, experiential learning, and bargaining power theories, the contingency framework presented emphasizes the importance of integrating different and partially conflicting perspectives (Mayer & Sparrowe, 2013) to examine complex interorganizational phenomena, such as licensing agreements, and allows us to develop a more comprehensive understanding of the dynamic trade-offs that influence transaction outcomes.

Managerial Implications

Our study provides timely and tangible guidance for an increasingly relevant business model, as evident in the already large and growing use of licensing in interfirm agreements (Arora et al., 2001; Link & Scott, 2002; Somaya et al., 2011). In particular, we focus on two

important considerations for actively leveraging licensing strategies towards realizing specific deal outcomes. First, designated processes—designed to increase absorptive capacity within firms and to capture both ex ante and ex post deal experience that can then help the firm connect prior deal-specific information to subsequent contract settings—help firms economize transaction costs and guide deals toward more preferential deal outcomes. Given the importance of learning to effectively contract as a key alliance management capability, the need to establish a learning system from prior relationships within firms is particularly valuable to more entrepreneurial firms that may be at an earlier stage of development or actively depend on licensing as their focal business model. In these situations, negotiating optimal terms (e.g., nonexclusivity) is even more critical for the firm's ability to draw in revenues from multiple relationships (Cannady, 2013; Stuart et al., 2007). More experienced firms can also enhance their ability to obtain a nonexclusive license by actively learning through perspective taking and leveraging prior in-licensing deals.

Second, our study also provides insights for managers regarding their bargaining power in prospective out-licensing deals. Specifically, when managers consider licensing out a technology, the bargaining power advantage posed by a technology with greater market relevance is most pronounced for firms with limited prior out-licensing deal experience. Thus, by taking into account the history of their role-specific licensing experience along with the technology-specific elements affecting the firm's bargaining power, managers can better assess their prospects for realizing a nonexclusive license. Altogether, then, knowing upfront when nonexclusive deals are more likely helps firms economize ex ante search, negotiation, and contract preparation costs.

Limitations and Future Directions

This is the first study to examine the theoretical tension between a firm's involvement in and accumulation of prior licensing deals, bargaining power, and the likelihood of preferential contract outcomes. As such, the measures and framework employed here could be improved upon in future work. For instance, our measure of a licensed technology's market relevance could be further refined to capture pathologies and indications that represent substantial product-market opportunities, but do not necessarily fall under the umbrella of the indications with the highest mortality and related morbidity rates that this study's context-specific measure captures. Additionally, while this study has examined bargaining power as an important contingency on the effects of prior deal experience, additional moderators may exist that will inform future studies of exclusivity, such as the number of interested and qualified licensees. Building on this study's findings around the direct and contingent effects of bargaining power, there also exist opportunities for future research to unpack other relationships amongst our focal variables, such as considering the antecedents to bargaining power, or to explore how our focal variables affect other contractual features, such as geographical territory and equity arrangement outcomes.

By controlling for latent industry variables, our single-industry sample provides a number of advantages for the consideration of individual contract terms at the transaction level of analysis. In spite of these advantages, single-industry studies raise generalizability questions. While we have no a priori reason to question the generalizability of our findings to other

technology licensing markets, only future studies can provide a definite answer. Bioscience firms typically face severe financial constraints (Hornick & Burns, 1999; Robbins-Roth, 2000), but firms in other industries may be more capable of handling the accumulated transaction costs due to prior deals by investing in an expansion of their monitoring capacity (e.g., by hiring additional personnel). While we pursued robustness tests for capacity in terms of patent-related dimensions, other industries could have greater variance in firm capacity, which may warrant investigation.

Alternatively, future research could examine the exclusivity decision from a real options perspective. Given that previous research has found that R&D investments by pharmaceutical firms are consistent with real options reasoning (McGrath & Nerkar, 2004), this reasoning may offer a complimentary approach to examining exclusivity decisions. Specifically, a firm's deal decision to engage in a nonexclusive license mirrors the logic of a real option in that it offers firms the opportunity to increase their scope, yet the decision is also influenced by the existing portfolio of options (McGrath & Nerkar, 2004). In this way, the interdependent nature of real options aligns well with transaction cost and bargaining power perspectives.

Finally, we see this work having future relevance to scholarship focused on other interfirm relationships, such as within operations and supply-chain management studies. Within these domains, role boundaries on either side of buyer-supplier relationships are clearly defined (Wathne & Heide, 2000), yet firms involved in more elaborate supply chains must play both roles (Parmigiani, 2007; Puranam et al., 2013). These relationships are also supported by interorganizational contracts and commonly require the buyer to weigh exclusivity choices within its supply chain in order to fulfill its downstream production obligations. Thus, we see applicability for our framework based on learning, TCE, and bargaining power to study contractual outcomes within these other research streams.

In conclusion, technology licensing agreements represent the predominant business model in the market for inventions (Arora & Gambardella, 2010; Conti et al., 2013). Given the societal externalities affected by the level of technology access (Scotchmer, 1991), the choice between exclusivity and nonexclusivity has become central to antitrust and intellectual property rights policies (Lerner & Tirole, 2004). Understanding the constraints imposed on firms' abilities to obtain and manage nonexclusive licenses can therefore inform policy and the competitive structure of an industry. Leveraging a large dataset of technology licenses spanning 27 years of the biosciences industry, this study provides critical insights into the differential effects of prior out- and in-licensing deals and the moderating role of bargaining power on the likelihood of a nonexclusive deal outcome. By disentangling the learning benefits and accumulated transaction costs accruing from a firm's history of role-specific experiences as well as its negotiation leverage, we extend the field's understanding of experiential effects and refine how firms can learn to contract as a way to enhance their alliance capabilities. Lastly, our multilens framework offers strong potential to further unravel the complexities of interfirm contracting strategies.

Appendix A

Table A1
Variable Definitions, Roles, and Sources

Variable	Definition	Role of Variable	Source
Nonexclusive license	Coded licensing deals 1 for nonexclusive and 0 for exclusive contracts per Recap designation	Dependent variable	Recap
Prior out-licensing deals[a]	Number of out-licensing relationships the licensor engaged in up to a year prior to the contract	Independent variable	Recap
Prior in-licensing deals[a]	Number of in-licensing relationships the licensor engaged in up to a year prior to the contract	Independent variable	Recap
Market relevance[a]	Coded 1 if the licensed technology is noted as being relevant to support the treatment or morbidity mitigation of a specific medical indication (e.g., diseases, disorders, conditions, or illnesses) that is represented in the top-ten mortality causes according to the Center for Disease Control and Prevention's (CDC's) annual data for contract year, and 0 for all other indications	Independent variable	CDC
Antibodies/proteins	Coded 1 for noted focus, and 0 otherwise	Control variable	Recap
Bioinformatics/ genomics	Coded 1 for noted focus, and 0 otherwise	Control variable	Recap
(Chemical) Synthesis	Coded 1 for noted focus, and 0 otherwise	Control variable	Recap
Therapeutics	Coded 1 for noted focus, and 0 otherwise	Control variable	Recap
Novel chemicals	Coded 1 for noted focus, and 0 otherwise	Control variable	Recap
Vaccines	Coded 1 for noted focus, and 0 otherwise	Control variable	Recap
Early-stage technology	Coded as 1 if technology noted in the contract is at stages of early chemical formulation, "lead molecule" research, or preclinical trial stages, and 0 designating later-stage development, such as trials involving human subjects (per U.S. Food and Drug Administration's [FDA's] Phases I, II, and III), new drug applications, or approved drugs	Control variable	Recap
Downstream alliance	Coded as 1 for licensing alliances with downstream vertical partners, and 0 if horizontal to the licensor	Control variable	Recap
Partner-specific experience[a]	Number of previous licensing engagements a licensor has previously conducted with a specific licensee-partner prior to the contract date	Control variable	Recap
Licensee prominence[a]	Coded 1 if the licensee is represented, respectively, in the top 30 pharmaceutical/chemical firms, according to sales during the year prior to the contract date, and 0 otherwise	Control variable	Compustat
Licensor prominence[a]	Coded 1 if the licensor is represented, respectively, in the top 30 pharmaceutical/chemical firms, according to sales during the year prior to the contract date, and 0 otherwise	Control variable	Compustat
Licensor age	Age of the licensor in days, by calculating the difference between the incorporation date and the contract date	Control variable	Compustat, IPO prospectuses
Time between deals	Natural log of the number of days since last licensing transaction	Control variable	Recap
Both experiential roles	Coded 1 if firm has experience as both licensor (out-licensing) and licensee (in-licensing), and 0 otherwise	Control variable	Recap
Number of biotech IPOs[a]	Number of bioscience initial public offerings (IPOs) that occurred within a year prior to the date of the licensing contract	Control variable	Recap, IPO Prospectus

[a]Denotes variable lagged by one year prior to the transaction.

Appendix B

Figure B1
Moderating Effect of Market Relevance on the Relationship Between Out-Licensing Experience and the Likelihood of a Nonexclusive License

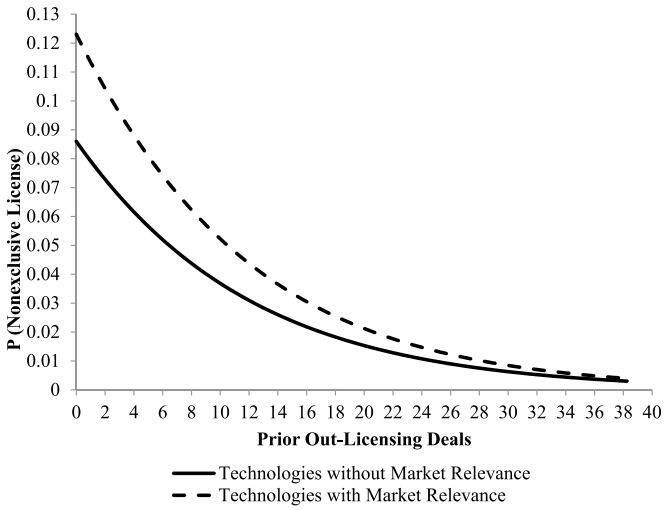
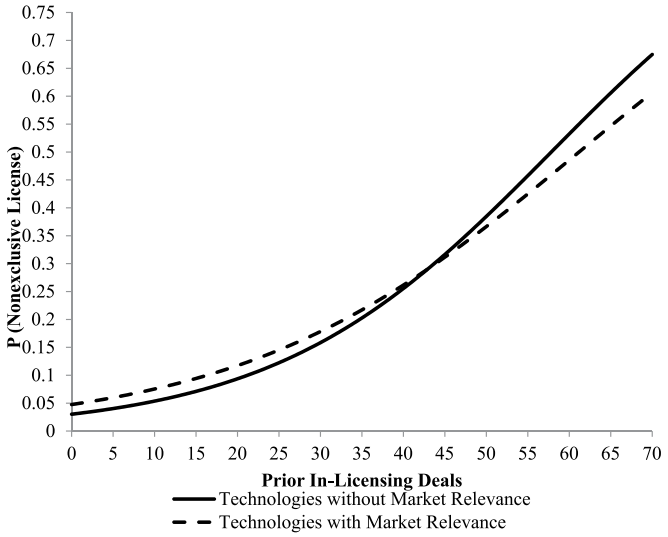


Figure B2
Moderating Effect of Market Relevance on the Relationship Between In-Licensing Experience and the Likelihood of a Nonexclusive License



Notes

1. For example, on May 5, 2016, WAVE Life Sciences announced that it entered into a license with Pfizer for the development of therapies targeted at metabolic diseases. Per the agreement, WAVE will advance up to five programs from discovery to selection of clinical candidates, at which point Pfizer has the option to exclusively license the programs and pursue further development. Pfizer agreed to an upfront payment of $40 million; and should all five programs be developed and commercialized, WAVE may earn up to $871 million in payments from Pfizer plus up to low-double-digit royalties on sales of any products resulting from this collaboration (Gulati & Srivastava, 2014).

2. The value of royalty revenue collected from an individual license, particularly in high-technology industries, is very difficult data to obtain. This is because the rents collected by a licensor are not just dependent on the rate size, but other factors, such as whether the rate is based on the licensee's profits or revenues, and whether one accounts for these rents after the license has expired or at interim stages of its commercial life. Also, revenues collected as upfront payments can sometimes contain a portion to cover contract R&D work or milestone payments and may not accurately reflect the revenues a licensor would directly receive from the sale of a technology (Cannady, 2013).

3. In line with the broader literature on organizational learning (see, e.g., Argote & Miron-Spektor, 2011, for a recent review), a key tenet underlying these studies is that "organizational learning is different from the simple sum of the learning of its members. Although individuals may come and go, what they have learned as individuals or in groups does not necessarily leave with them" (Crossan, Lane, & White, 1999: 529). In line with this principle, the alliance literature maintains that partners are able to absorb and codify collaborative experiences, which become embedded in organizational routines (Kale et al., 2002). Thus, learning benefits occur and are sustained despite turnover (Schulz, 2002).

4. Our sample begins in 1981, per the U.S. Patent and Trademark Office (USPTO) change to allow for life form patenting (Hoang & Rothaermel, 2010).

5. We originally obtained 4,113 transactions from Recap's coded licensing contracts of human therapeutic bioscience firms (which included the subsidiaries of these firms). Sample loss occurred after resolving that: the deals represented firm-to-firm (i.e., bioscience to bioscience or bioscience to pharmaceutical) contracts, the coding of the exclusivity provision was done, the specified time frame was within our designated period, and missing values per Recap or other data sources were accounted for. The majority of sample loss occurs due to deal-level variables, depending on whether Recap had coded all available deal fields within the contract. We followed the approach recommended by Dubin and Rivers (1989), which is analogous to a two-step Heckman procedure, and did not find any evidence of bias due to a loss of deal observations. For this test, we created a unique selection variable (Mills inverse ratio) from a separate first-stage probit model and included this variable in our models. This variable was based on whether the contract data supporting the observation came from coded contracts by Recap (noted as 1 in this case and 0 if not per Recap's notation). The selection variable was created by regressing the selection variable on 26 year dummies, the six technology variables, Early-Stage Technology, and Downstream Alliance, with the robust standard errors clustered by licensor. We found that our results are not biased due to this selection bias factor (Dubin & Rivers, 1989).

6. Accounting for a firm's entire history of experience is contextually accurate within bioscience since (a) valuation approaches for licenses can be influenced by any former contract precedents (Austin, 2012; Cannady, 2013), and firm- or market-specific precedents can date back several years; (b) ex-post monitoring of previous contracts continues well beyond the license life to account for unanticipated know-how spillovers (Gordanier & Miao, 2011); and (c) lengthy timelines of product development or Food and Drug Administration (FDA) approval up to 15 years from "laboratory bench to market" (Austin, 2012: 62) are an industry norm. These factors extend the time boundary relevance of licensing contracts.

7. To compare our study with previous studies that have underscored the importance of exclusivity, we isolated the observations that occurred during the same periods studied in these prior works focused on licensing within the biosciences. Nonexclusive agreements represented 14% of our 226 agreements that occurred between the years 1990 and 1993—the sample period considered by Anand and Khanna (2000b: 112-116)—versus their finding of 12% for 615 agreements. For 1990 to 1999, the period studied by Somaya et al. (2011: 168, 171), we find that 11% of the 1,134 agreements that we investigate are nonexclusive versus their finding of 20% of their sample size of 265 agreements.

8. We find similar results at the median and within one standard deviation of the mean (e.g., per Hoetker, 2007).

9. As a further step to analyze our interaction relationships (Ai & Norton, 2003; Zelner, 2009), we graphed the marginal change due to a discrete change in the binary moderator variables to see how the moderator's marginal effect changes with increasing experience with the two-tailed 95% confidence interval.

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