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CHOOSING BETWEEN SAFEGUARDS:
SCOPE AND GOVERNANCE DECISIONS IN R&D ALLIANCES

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Abstract

Research on transaction cost economics has emphasized the choice of an appropriate governance structure as an important mechanism in alleviating exchange hazards in interfirm transactions, yet firms may also manipulate the characteristics of a transaction so as to make it less hazardous in the first place by carefully selecting the activities or assets involved in the transaction. In this paper, we explore this theoretical issue in transaction cost economics by examining how firms design R&D alliances to mitigate appropriation hazards in these interfirm transactions. In particular, we investigate when firms will prefer to limit the scope of functional activities involved in an R&D alliance, thus addressing appropriation hazards directly by manipulating the alliance's characteristics, versus when they will opt for an equity-based governance structure in order to mitigate appropriation hazards *ex post*. We argue that firms are more likely to limit the scope of alliance activities rather than choose an equity-based governance structure when there are multiple partners in an alliance and when the partners are from different nations, because monitoring and other control mechanisms become more cumbersome and problematic in these circumstances. In contrast, firms that are direct competitors are more likely to choose an equity-based governance structure in order to mitigate exchange hazards such as knowledge misappropriation through carefully monitored knowledge sharing. Empirical analysis of data on R&D alliances in a variety of industries provides support for our arguments regarding alliances involving multiple partners and alliances between competitors. We discuss the implications of our study for research on transaction cost economics.

INTRODUCTION

Research on transaction cost economics has most commonly emphasized the choice of an appropriate governance structure or organizational form, such as the choice between hierarchical and market-like arrangements, as a way to mitigate exchange hazards in interfirm transactions (e.g., Colombo, 2003; Oxley, 1997; Pisano, 1989; Williamson, 1985). These governance choices depend upon the characteristics of a transaction, such as the extent to which the transaction is complex and so it is difficult to specify all possible contingencies in a contract, or the transaction requires extensive investments in physical or human assets that may not be recoverable (Ai-Najjar, 1995; Williamson, 1985). Transaction cost theory initially treated the characteristics of a transaction as an exogenous given, and examined how these influence the choice of governance structure (e.g., Oxley, 1997; Pisano, 1989; Williamson, 1985).

More recent research informed by transaction cost economics has drawn attention to the fact that transaction characteristics are also endogenously determined and can be the result of firms' choices (e.g., Bensaou & Anderson, 1999; Jia, 2013; Kang et al., 2009; Oxley & Sampson, 2004). For instance, firms may manipulate the characteristics of a transaction that they enter by carefully selecting the activities or assets involved in the transaction (Bensaou & Anderson, 1999; Oxley & Sampson, 2004). The result could be a transaction that is less complex and easier to monitor, or one that is less prone to opportunistic behavior in the first place. Interestingly, Williamson (2010) also recognized that transactions could be designed so as to reduce certain hazardous features. The above discussion leads to an interesting theoretical puzzle: When will firms attempt to manipulate the characteristics of the transaction itself and thus avoid entering a hazardous transaction in the first place, versus when will they adopt an appropriate governance structure in order to address exchange hazards in a transaction *ex post*?

In other words, how do firms choose between these two distinct mechanisms for mitigating exchange hazards?

An examination of how firms design R&D alliances provides an appropriate and interesting setting in which to study the above theoretical puzzle in transaction cost theory. Prior research on alliance design suggests that firms can protect themselves against knowledge misappropriation and other hazards in R&D collaborations by choosing an appropriate governance structure, such as an equity-based rather than a non-equity alliance (Colombo, 2003; Gulati, 1995, Gulati & Singh, 1998; Oxley, 1997). More recent research suggests that another way that firms may respond to misappropriation hazards in R&D alliances is by reducing the scope of functional activities that an alliance encompasses, hereafter simply "alliance scope" (Kalaignanam et al., 2007; Li et al., 2008, 2012; Oxley & Sampson, 2004). In particular, these studies suggest that the risk of unintended knowledge leakage is higher when an R&D alliance encompasses also other functional activities such as manufacturing and marketing, because the alliance is more complex and difficult to monitor, with many points of contact between the partner firms. In alliances of broader scope, it is also more difficult to specify *ex ante* partners' legitimate claims on the alliance and responsibilities owing to the greater complexity of these collaborations (Reuer et al., 2002). Partners may therefore reduce misappropriation hazards by restricting the alliance scope (i.e., excluding other functional activities from the alliance), thus making the alliance a transaction that is less complex and easier to monitor, effectively changing the characteristics of the transaction itself.

The present study seeks to address the theoretical puzzle described above by identifying conditions under which firms are more likely to choose an equity-based governance structure or a narrow alliance scope as distinct ways of mitigating appropriation hazards in R&D alliances.

We suggest that firms are more likely to use a narrow alliance scope when there are multiple partners in an alliance (i.e., in multilateral alliances) and when the partners are from different nations (i.e., in international alliances), because monitoring and other control mechanisms associated with equity-based structures become more cumbersome and problematic in these situations. In contrast, when firms are direct competitors outside the collaborative agreement, they are more likely to choose an equity-based governance structure in order to mitigate knowledge misappropriation and other exchange hazards through more careful monitoring. We investigate these issues by analyzing data on R&D alliances obtained from a survey of strategic alliance agreements in a variety of industries. Our findings indicate that a narrow alliance scope is more likely than an equity-based governance structure in multilateral alliances involving multiple partners, whereas the opposite holds when there is a high level of competition between partner firms. We also find that a narrow alliance scope and an equity-based governance structure are equally likely in international alliances involving partners from different nations. We therefore make a theoretical contribution to research grounded in transaction cost economics by identifying when firms will attempt to manipulate certain characteristics of an R&D alliance (e.g., narrowing its scope) versus when they will adopt an appropriate governance structure in order to mitigate appropriation hazards in these interfirm transactions.

THEORY AND HYPOTHESES

Theoretical Background

Research on transaction cost economics suggests that concerns about knowledge misappropriation and opportunism more broadly have important implications for firms' alliance design choices (e.g., Colombo, 2003; Gulati & Singh, 1998; Oxley, 1997; Pisano, 1989). In particular, transaction cost theory has given particular emphasis to the choice of an appropriate

governance structure as a way to mitigate appropriation concerns and other exchange hazards (e.g., Gulati & Singh, 1998; Oxley, 1997; Williamson, 1985). Although there are also other aspects of alliance governance, such as crafting detailed alliance contracts (e.g., Lerner and Merges, 1998; Parkhe, 1993), scholars have paid particular attention to the choice of equity-based structures as a governance mechanism (e.g., Colombo, 2003; Gulati, 1995, Gulati & Singh, 1998; Pisano, 1989), especially when studying the scope and governance of R&D collaborations (Aggarwal & Hsu, 2009; Li et al., 2008, 2012; Oxley & Sampson, 2004).

Choosing an equity-based governance structure for an alliance is a particularly important governance mechanism because contracts are incomplete (Oxley, 1997; Williamson, 1985). Equity-based alliances such as joint ventures and minority equity investments reduce misappropriation and other exchange hazards due to the monitoring mechanisms and incentive alignment they provide (Oxley & Wada, 2009; Williamson, 1985). In joint ventures, enhanced monitoring is achieved through the creation of a separate administrative hierarchy that oversees the functioning of the alliance (e.g., the top management team and the board of directors of the joint venture), which is staffed by representatives of the partner firms. For instance, the administrative hierarchy in joint ventures leads to more structured and carefully monitored knowledge sharing, because a firm can use its representatives in the top management team and the board of directors of the joint venture to monitor knowledge flows and partner's behavior (Oxley & Wada, 2009). Minority equity investments do not involve the creation of a separate administrative entity as a firm takes an equity position in another firm itself, yet enhanced monitoring is achieved by the former partner joining the board of directors of the latter, because ownership provides for board representation and residual control rights (e.g., Gulati & Singh, 1998). Moreover, shared equity (either in a separate entity, as in joint ventures, or in the partners

themselves, as in minority equity investments) also works as an incentive alignment mechanism that reduces partners' incentives to behave opportunistically, because any reduction in returns due to opportunism is shared among the partners.

Notwithstanding the above benefits of equity-based alliances, these collaborations also have certain disadvantages. Equity-based alliances involve certain costs, such as the opportunity costs associated with management's time that is spent in board meetings and monitoring the other firms, the bureaucracy costs of erecting and operating an administrative hierarchy, as in joint ventures (e.g., staffing, managing, etc.), and the cost of the equity investment itself. Moreover, the monitoring mechanisms that equity-based alliances provide may not be equally effective in all situations.

While choosing an appropriate governance structure is an important mechanism in alleviating appropriation and other exchange hazards, this does not exhaust the set of possible mechanisms available to alliance partners, however. According to recent work using transaction cost theory, another way to mitigate such hazards is by manipulating the characteristics of the transaction itself (Jia, 2013; Oxley & Sampson, 2004). For instance, transactions encompassing multiple activities and affecting a large area of partner firms' operations are more complex and difficult to monitor (Oxley, 1997). Such transactions may also require significant investments in physical or human assets owing to the greater complexity of these agreements and the extent of activities involved, which in turn may give rise to opportunistic behaviors. Rather than choosing an appropriate governance structure (e.g., an equity-based alliance) for such a complex transaction, partners may attempt to reduce the complexity of the transaction in the first place. For instance, partners may choose an alliance with a narrow domain of activity that is easier to monitor, thus obviating the need for equity-based governance.

Building upon the above theoretical arguments deriving from transaction cost economics, a number of studies in the alliance literature suggest that alliance scope is another important alliance design choice that can help reduce misappropriation hazards in an alliance (Jiang & Li, 2009; Kalaignanam et al., 2007; Li et al., 2008, 2012; Oxley & Sampson, 2004). In particular, scholars have focused on the functional or 'vertical' scope of R&D alliances, i.e., "comparing alliances that involve R&D activities alone against those that combine R&D with other activities" (Oxley & Sampson, 2004: 726). As they note, more functional activities within the alliance implies more points of contact between the partner firms, with a concomitant reduction in control over information flows across the relevant organizational boundaries (Oxley & Sampson, 2004). In addition, operational routines may exhibit inseparabilities across functional activities, and therefore it is difficult to manage all these functional activities together within the alliance without extensive sharing of tacit knowledge embedded in partners' operational routines. Moreover, adding more functional activities may also increase misappropriation risks in an R&D alliance because a partner may also get access to other types of knowledge (e.g., leakage of contacts such as key suppliers or distributors) in addition to technology leakages (so combined together, both types of leakages could have more serious consequences). Such problems are further compounded by the difficulties in specifying *ex ante* partners' legitimate claims on the alliance and responsibilities in collaborations of broader scope (Reuer et al., 2002). Based on the above, reducing the alliance scope mitigates exchange hazards by limiting the extent to which partners expose valuable knowledge (e.g., skills, know-how, contacts, etc.) to each other (Li et al., 2008, 2012; Oxley & Sampson, 2004) and making it easier to monitor information flows and partner behaviors (e.g., partner's actions and contributions to the alliance).

Despite these advantages of a narrow scope, reducing the scope of collaboration has its own disadvantages. For example, as Oxley and Sampson (2004) noted, restricting the alliance scope reduces opportunities for cross-functional collaboration, which is particularly important in R&D alliances. For instance, restricting the scope of an alliance might have adverse effects on partners' attempts to bring the best product to market in the timeliest fashion (Oxley & Sampson, 2004). More generally, restricting the alliance scope may oblige partners to forego some opportunities for joint value creation (Zajac & Olsen, 1993), since each value chain activity represents a separate source of value creation for the alliance.

Based on the above, prior research on alliance design suggests that adopting an equity-based governance structure and narrowing alliance scope are two mechanisms for mitigating exchange hazards such as appropriation concerns in an alliance. Of course, if appropriation concerns are low in an alliance, firms may not use any of these safeguards against appropriation hazards. This is consistent with the discriminating alignment principle of TCE, which states that transactions presenting significant exchange hazards necessitate appropriate safeguards to protect against such hazards, but in the event that transaction hazards are low, it is more efficient not to use such safeguards (Williamson, 1991). This is because these safeguards also come with certain drawbacks, as discussed above, and will therefore be used only when it is necessary. However, current theory does not explain how firms choose between different safeguards such as equity governance and narrow scope in situations where exchange hazards are significant.

In the hypotheses presented below, we identify conditions under which firms are more likely to choose an equity-based governance structure or a narrow alliance scope as a way to mitigate exchange hazards such as appropriation concerns in R&D alliances. In particular, we focus on conditions that meet two criteria. First, the conditions should reflect situations in which

misappropriation hazards are likely to be present in an R&D alliance. Otherwise, the choice between narrow scope and equity governance would not be relevant in the first place (due to the discriminating alignment principle mentioned above). Second, these conditions should also reflect situations in which one safeguard may be preferred over the other for addressing misappropriation hazards. In particular, the theory and arguments we develop below suggest that firms may prefer a narrow alliance scope in situations where monitoring becomes more cumbersome and problematic for the administrative mechanisms that equity governance provides (e.g., board representation). This is because reducing the alliance scope obviates the need for significant monitoring in the first place. In contrast, firms are more likely to choose an equity-based governance structure in situations that favor more vigilant monitoring by these administrative mechanisms. Thus, as a second criterion, we sought to identify conditions that can facilitate or hamper monitoring by the administrative mechanisms that equity governance offers.

In seeking to identify conditions that meet the above criteria, we need to focus on variables that lie at the intersection of two streams of research. First, research on the scope and governance of R&D collaborations, which discusses misappropriation hazards in these collaborations, is useful in order to identify conditions in which misappropriation hazards are likely to be present in an R&D alliance (i.e., the first criterion described above). For instance, this research has considered international alliances and competition between partner firms (Oxley & Sampson, 2004) as well as multilateral alliances (Li et al., 2012), which suggests that these are important variables in the context of R&D collaborations and should reflect situations in which misappropriation hazards are likely to be present in these collaborations.

Second, corporate governance research has paid significant attention to corporate boards and their functioning as a monitoring mechanism, so this research provides a useful basis for

identifying conditions that facilitate or hamper monitoring by the administrative mechanisms

(e.g., board representation) that equity governance provides (i.e., the second criterion described

above). For instance, this research emphasizes the monitoring problems (e.g., free-riding, less

control, etc.) that arise when there are many minority shareholders due to the dilution of

ownership and residual control rights (e.g., each shareholder has a small representation on the

board) (Jensen, 1993; Yermack, 1996). More recently, corporate governance research has also

been extended to hybrid organizational forms such as joint ventures, since these also have their

own board of directors. This stream of research also discusses the monitoring problems that arise

when there are multiple partners in a joint venture (Gong et al., 2007), but also stresses

additional issues that are unique to hybrids, such as monitoring problems in international

collaborations where partners may have difficulties understanding each other's cultures (Reuer et

al., 2014), as well as the need for more vigilant monitoring in situations where partners are

competitors outside of the collaborative agreement and are therefore prone to opportunism and

conflict (Cuypers et al., 2017; Reuer et al., 2014). Below we therefore associate monitoring

difficulties with alliances involving multiple partners (or multilateral alliances) and alliances

involving partners from different nations, suggesting that firms are more likely to choose a

narrow alliance scope for these types of collaborations. We also associate monitoring vigilance

with partners' competition in common end markets, suggesting that firms are more likely to

choose an equity-based governance structure in this situation.

Research Hypotheses

  Multilateral vs. bilateral alliances. Previous research suggests that when an alliance

involves more than two partner firms, monitoring becomes more difficult as firms need to

control the behavior of multiple partners simultaneously and the knowledge exchanged with each

partner (e.g., García-Canal et al., 2003; Gulati, 1995; Li et al., 2012; Oxley, 1997). Thus, in multilateral alliances it is more difficult to avoid unintended knowledge leakage (Li et al., 2012). Such leakage may be a serious problem in multilateral alliances because each partner has its own motives and incentives for joining the alliance and so this raises the possibility that at least one of the partners may have incentives to engage in opportunistic behavior, and because knowledge is diffused to a wider network of firms with uncontrollable consequences. The above problems in monitoring knowledge flows are further compounded by the difficulties in monitoring each partner's contribution to the alliance as well as ascertaining why the alliance is performing well or poorly based on the inputs and efforts of multiple firms.

Transaction cost theory would argue that the governance safeguards provided by equity-based alliances can help to mitigate such hazards (Oxley & Wada, 2009; Williamson, 1985). For instance, the administrative hierarchy in joint ventures (i.e., the top management team and the board of directors) leads to more structured and carefully monitored knowledge sharing (Oxley & Wada, 2009), so this should be more useful in multilateral alliances in which there is knowledge sharing with multiple partners simultaneously than in bilateral alliances where only two partners are involved. Board representation in minority equity alliances offers related benefits in multilateral agreements, since the investing partner can use its board representatives in order to carefully monitor the knowledge shared with the other partners. Indeed, Li et al. (2012) found that multilateral R&D alliances are more likely than bilateral R&D alliances to be governed by equity-based structures in order to promote knowledge sharing and knowledge protection. Earlier studies also found that alliances involving a greater number of partners are more likely to be organized with equity-based governance structures (e.g., García-Canal et al., 2003; Gulati, 1995; Oxley, 1997).

While an equity-based governance structure may help to mitigate the exchange hazards of multilateral alliances described above, an alternative solution to such hazards from a transaction cost perspective is to narrow the alliance scope. As we have emphasized, narrowing the alliance scope makes it more difficult for a partner to appropriate knowledge (e.g., skills, know-how, contacts, etc.) since there is less exposure of knowledge and it is easier to monitor information flows, as well as partner's actions and contributions to the alliance. These advantages of a narrow alliance scope should also be more useful in multilateral alliances that present greater monitoring challenges owing to the presence of multiple partners than in bilateral alliances in which firms need to monitor the behavior of one partner only and the knowledge exchanged with that partner. Furthermore, as will be argued below, we also expect that in multi-party collaborations, alliance partners may actually prefer to narrow the alliance scope rather than choose an equity-based governance structure for the alliance.

Although multi-party alliances have a greater need for governance safeguards than bilateral alliances, some of the governance mechanisms that equity-based alliances provide, such as board meetings and equity shares, may also become less effective when there are multiple partners in an alliance. For instance, although board meetings generally lead to carefully monitored knowledge sharing, monitoring other partners' actions and the know-how and skills they might absorb from the alliance is harder when there is a large group of participants involved (Gong et al., 2007; Park & Russo, 1996). Alliances that are established by multiple partners are also more prone to coordination challenges that need to be resolved by the board of directors (either the joint venture board or the boards of directors of the partners themselves, as in minority equity alliances), resulting in the board having less time to engage in intense monitoring of the alliance (e.g., Faleye et al., 2011). In joint ventures, for instance, as the number of partners

increases, the joint venture board will need to spend more time in coordinating partner and venture actions, making strategic plans, and helping the venture reconcile the different needs of the partners in its operations (Gong et al., 2007; Reuer et al., 2014). All these coordination activities to which the board must attend thus hamper monitoring by the board. In minority equity alliances, these monitoring obstacles may become more serious due to the difficulties in coordinating operations and decisions across multiple firms, each one with its own board of directors, and the fact that a partner may need to send its representatives to the boards of multiple firms. Similarly, although shared equity generally works as an incentive alignment mechanism, as noted above, this works less well in multi-party collaborations due to the dilution of equity ownership. In multilateral joint ventures, for instance, the equity ownership of the JV is split over a greater number of partners, so each individual partner holds a smaller equity share in the JV. The same holds when multiple partners take together a minority equity position in another partner firm. The dilution of equity ownership hampers not only incentive alignment but also monitoring, because each partner has a smaller representation on the board. In minority equity alliances, sharing equity may also become more costly as the number of partners increases, since equity exchanges may need to take place between each possible pair of firms. Rather than choosing an equity-based governance structure, firms entering a multilateral alliance are more likely to limit the scope of alliance activities in order to reduce their partners' potential to absorb knowledge in the first place, and thus the need to monitor partners' behavior and the knowledge exchanged with the partners. Narrowing the alliance scope is the preferred alternative for multi-party alliances because, despite the monitoring challenges presented by such collaborations, narrowing the alliance scope reduces the need for significant monitoring in the first place.

In summary, multilateral alliances involving multiple partners entail greater appropriation concerns and other exchange hazards than bilateral collaborations, and adopting an equity-based governance structure represents one possible solution to such hazards. At the same time, however, we expect that alliance partners are even more likely to choose a narrow alliance scope in multilateral alliances, in order to avoid the challenges associated with monitoring or other control mechanisms in these collaborations in the first place. We therefore hypothesize:

> Hypothesis 1: *Alliance partners are more likely to choose a narrow alliance scope compared to an equity-based governance structure in multilateral alliances rather than in bilateral alliances.*

International vs. domestic alliances. The ways in which firms design R&D alliances may also differ across international versus domestic collaborations for parallel reasons. Indeed, previous research suggests that firms collaborating with geographically remote partners located in different nations may have less information and knowledge about their partners (Balakrishnan & Koza, 1993) and face greater uncertainty about the others' motives and behavior as a consequence (e.g., García-Canal, 1996; Gulati, 1995). These information asymmetries can also exacerbate appropriation hazards, because when firms have less information about others' motives and behavior, they are also more concerned about potential appropriation of knowledge by a partner and opportunism more broadly. For instance, in several international alliances between US and Japanese firms, the Japanese company emerged from an alliance stronger than its partner because of its intent to learn the core skills of its US counterpart (Hamel, 1991). We therefore expect that the two safeguards suggested by transaction cost economics (i.e., using an appropriate governance structure and reducing the scope of the alliance) are both more likely in the case of international rather than domestic collaborations. For instance, the heightened concerns about a partner's motives and behavior in international collaborations imply that there

is an even greater need for firms to join the board of directors of the partner or to establish an administrative hierarchy with its own management and board of directors, in order to carefully monitor knowledge sharing and partner's behavior in general (Oxley & Wada, 2009). Similarly, in international collaborations alliance partners are also more likely to mitigate concerns about partner's motives and behavior by choosing a narrower alliance scope, since that would make it easier to monitor partner's behavior and the knowledge exchanged with the partner and more difficult for the partner to appropriate knowledge in the first place.

While adoption of an equity-based governance structure and narrowing of alliance scope are both more likely in international than in domestic collaborations, we also expect that narrowing scope may be the preferred alternative in international alliances involving partners from different nations. Again, this is because some of the monitoring mechanisms that equity-based governance structures provide, such as joining the board of directors of a joint venture or a partner firm, may become less effective in international collaborations. Administrative and organizational practices and systems vary widely across countries (Kogut & Singh, 1988), and the opinions, beliefs and attitudes of employees are influenced by their cultures (Schneider & De Meyer, 1991). In international collaborations, differences in administrative and organizational practices make it more difficult to interpret other firms' actions, while differences in employees' beliefs and attitudes lead to miscommunication and misunderstandings (i.e., Kale et al., 2000) that need to be resolved. All these issues hamper monitoring by the individuals who represent a firm in the board and management team of a joint venture or in the board of a partner firm (e.g., Faleye et al., 2011). Moreover, given that firms have less information and knowledge about their partners' motives and behavior, it is also more difficult to identify which alliance activities they need to monitor more carefully with their board representatives, and what kind of partner

behaviors they need to look for in order to prevent unintended knowledge leakage. Under these

conditions, it is more difficult for firms to transfer the right information back and forth between

their board representatives in a joint venture or in a partner firm and their own managers in order

to monitor partner's actions and the knowledge exchanged with the partner (Reuer et al., 2014).

Given these problems associated with monitoring knowledge flows and partner behaviors in

international alliances, it may be less worthy for firms to incur the high costs associated with

equity-based governance structures. Rather, firms entering such alliances are more likely to

restrict the alliance scope in order to reduce their partners' potential to appropriate knowledge in

the first place and thus the need to monitor the partner. As before, narrowing the alliance scope is

the preferred alternative for international alliances because it obviates the need for significant

monitoring in the first place. Thus, we posit:

> *Hypothesis 2:* *Alliance partners are more likely to choose a narrow alliance scope compared to an equity-based governance structure in international alliances rather than in domestic alliances.*

Partner competition. Previous research suggests that appropriation concerns and other

exchange hazards tend to magnify when the partners compete in common end markets outside of

the collaborative agreement (Kogut, 1989; Park & Russo, 1996). In these circumstances, the

partners' incentives to engage in opportunistic behavior such as knowledge appropriation are

higher because partners can come to view the collaboration in zero-sum terms (Park & Russo,

1996). For instance, knowledge appropriated by the partner can be used to compete outside of

the collaborative agreement. Thus, knowledge leakage is a more serious problem in these

circumstances (Oxley & Sampson, 2004). As before, we expect that firms may respond to such

hazards by using an equity-based governance structure or a narrow alliance scope.

However, we also expect that an equity-based governance structure may be preferred

over a narrow alliance scope when the alliance partners are direct competitors. Anticipating the

above hazards, firms collaborating with competitors will need to monitor partners' actions and the knowledge exchanged with partners more carefully. This means that a firm's representatives in the board of directors of a partner firm and the administrative hierarchy of joint ventures will be more vigilant in monitoring, and will monitor the alliance activities and other firms' actions more intensively. Moreover, monitoring difficulties due to lack of information and knowledge about the partner are less likely to arise since competitor firms operate in the same markets.

Alternatively, firms collaborating with competitors can also attempt to reduce the alliance scope (Oxley & Sampson, 2004). As noted above, reducing the scope of an R&D alliance implies collaborating on R&D only, thus excluding other functional activities such as manufacturing and marketing from the alliance. However, when the partner firms are direct competitors in end markets, the residual hazards of R&D collaboration may be non-trivial even when other functional activities are excluded from the alliance. Indeed, when an alliance involves the exchange and creation of intangible assets such as R&D, it can be difficult to circumscribe, monitor, and codify the knowledge to be used in the alliance (Gulati & Singh, 1998), as well as assess accurately partners' contributions without exposing proprietary knowledge to each other (Arrow, 1974; Teece, 1980). When the partner firms compete in the same markets, these concerns about knowledge appropriation due to R&D activities become particularly important, since partners' incentives to appropriate knowledge are higher in these circumstances, as described above. Given that partner competition raises serious appropriation concerns when an alliance involves R&D, such concerns may persist even if the firms narrow the alliance scope by excluding other functional activities from the alliance (e.g., downstream activities such as manufacturing or marketing). In these circumstances, it may be less worthy for

partners to narrow the alliance scope and sacrifice some of the opportunities for joint value creation that a broad alliance scope may provide (Zajac & Olsen, 1993).

Based on the above, we therefore expect that partners that are direct competitors are more likely to choose an equity-based governance structure for the alliance in order to reduce unintended knowledge leakage and other exchange hazards through the incentives and monitoring mechanisms it provides. Of course, when competitive rivalry between alliance partners is intense, even an equity-based governance structure may not provide complete protection against appropriation hazards. This is because, no matter what particular incentives the firms put in place in a specific collaboration, the firms remain independent organizations with operations outside of the collaborative agreement. However, a firm's representatives in a joint venture or in the board of a partner firm will be more vigilant in monitoring knowledge flows and partner behaviors, as noted above, and given the hazards involved when competitor firms collaborate on R&D without any governance safeguards to protect them, we expect that firms that are direct competitors are more likely to choose an equity-based governance structure rather than a narrow alliance scope to mitigate such hazards through carefully monitored knowledge sharing. We therefore posit:

> *Hypothesis 3:* *Alliance partners are more likely to choose an equity-based governance structure compared to a narrow alliance scope when partners compete more extensively in end markets outside of the alliance.*

METHODS

Sample and Data

We collected primary data by survey, as this allowed us to measure several aspects of market overlap and other potential theoretical determinants of alliance scope, as well as obtain detailed information about all the functional activities that an alliance encompasses. The survey

targeted two groups of alliance professionals. The first group consists of full members of the Association of Strategic Alliance Professionals (ASAP), most of them representing US firms. The second group consists of alumni participants of an executive program on strategic alliances at a major European business school. One cohort of executive program participants was used in the pretest phase and thus was excluded from the survey population. The great majority of participants belonging to this second group represent European companies.

The pretest phase also included semi-structured interviews with five executives experienced in strategic alliances. These interviews served to check whether the questionnaire responses coincided with the interview-derived information. Any items that showed inconsistency in the responses were modified accordingly. Following these adjustments, an invitation to participate in the survey was distributed. Each respondent was asked to select one formal, project-based alliance agreement (i.e., the partners came together in order to accomplish a certain task) that their company had formed with one or more other private organizations and was strategically important for their company. In most cases there were multiple alliances that met these criteria, so the respondent was also asked to select the most recent alliance agreement among the ones of which he or she was very knowledgeable and in a position to provide accurate answers. Respondents who did not meet these criteria, or for whom contact information proved to be incorrect, were excluded from the initial sample. This resulted in a sample of 426 respondents (232 ASAP members and 194 executives). After at least two rounds of follow-up calls, information was obtained for 230 agreements (54% response rate) of which 146 were R&D alliances. In order to obtain reliable information on alliance design (scope and governance), we eliminated agreements in which the respondent was not involved in the alliance from the outset and agreements that were still in the process of formation at the time when the survey was

administered. Although respondents were asked to select an agreement involving private organizations, we also had to eliminate two agreements that involved other types of entities (e.g., charity organizations, research institutes). Thus, we ended up with 133 agreements. Since these are project-based alliance agreements that involve R&D, our sample does not include other types of interfirm contractual agreements such as licensing or franchising (Parmigiani & Rivera-Santos, 2011). Having respondents from both groups increased the study's external validity. Furthermore, a Wald test indicated that there is no significant difference in parameter estimates for the two groups (i.e., $\chi^2(12) = 14.76$, $p = 0.255$), and thus we pooled the data to increase the efficiency of the estimates.

Although our dependent variable is not a perceptual measure and does not require respondents to make a subjective assessment based on a Likert-type scale, we took several additional actions to further mitigate common method bias. Following the suggestions of Podsakoff et al. (2003), we changed the order of the predictor and outcome variables so that the former appear later in the survey. The web-based survey automatically registered the date and time when each respondent started and completed the survey. It also allowed respondents to log in multiple times and to resume the survey from the point where they had stopped, but prevented them from revisiting prior questions. This allowed us to create a temporal separation by introducing a time lag between the measurement of the predictor and outcome variables for 32 respondents who started and completed the survey on two different days (Podsakoff et al., 2003). We then assessed possible differences in the means of all of the variables across these 32 respondents and the 101 respondents who completed the entire survey on a single day. Two-sample t-tests indicated that these two groups of respondents do not differ from each other for any of the variables in this study (i.e., $|t| < 1.2$, $p > 0.259$). We also performed Harman's (1967)

one-factor test and did not detect a significant amount of common method variance in the data.

Specifically, exploratory factor analysis revealed that only 14% of the variance in the variables

used in the study can be explained by a single factor. We also controlled for common method

bias with a latent variable approach known as the single common method factor approach, which

consists of adding a factor with all of the measures as indicators (Podsakoff et al., 2003). The

addition of this latent factor did not affect our results. Based upon all of these considerations and

tests, we conclude that our results and interpretations are unlikely to be explained by common

method bias and are robust.

The respondents' self-selection of alliances and the criteria that determined it ensured that

the respondents held key roles in the selected alliances and were in a position to provide accurate

answers. In assessing the competence of the respondents, we followed Kumar et al.'s (1993)

prescriptions that alliance-specific measures of informant competency are preferable to

company-specific measures and that multiple measures should be used to increase the reliability

of the answers. First, respondents were asked to report the percentage of working hours that they

allocated to the alliance and, on average, percentages were found to be high (mean 39.5%).

Second, most of the respondents took almost an hour to complete the survey, which is substantial

given their seniority. Respondents held titles such as partnership director, alliance manager, or

business development manager.

Measures

Alliance scope. The measure of alliance scope used in our study represents a vertical, or

functional, definition of scope (e.g., Oxley & Sampson, 2004). Following prior research on R&D

collaborations (Li et al., 2008; Oxley & Sampson, 2004), alliance scope was set to one when an

alliance involved R&D in combination with other functional activities, and zero when the

alliance involved R&D activities exclusively. The additional activities that a broad-scope alliance covered could be manufacturing-related activities (e.g., manufacturing, procurement), marketing-related activities (e.g., marketing, distribution, sales) or other activities specified by the respondent (e.g., services) (e.g., Cuypers & Martin, 2010).

Governance structure. Following prior alliance research (e.g., Colombo, 2003; Oxley & Sampson, 2004), we captured the alliance's governance structure with a dummy variable that equals one for an equity-based alliance, and zero for a non-equity collaboration. This taxonomy of alliances is the most frequently-used way of categorizing alliances within the markets–hierarchies continuum (e.g., Colombo, 2003; Gulati, 1995; Hennart, 1988).

Multilateral alliance. To distinguish multilateral alliances from alliances involving two partners, we used a variable that equals one if the alliance had more than two partners, and zero otherwise. Previous research suggests that alliances with multiple partners may have different scope and governance than bilateral collaborations (Li et al., 2012; Oxley, 1997), and our theory suggests that this effect will be stronger for alliance scope than it is for governance.

International alliance. We classified an alliance as international when at least two of the partner firms involved in the alliance were headquartered in different nations, whereas domestic alliances are those in which all partners were headquartered in the same country. This measure is used to proxy for the fact that firms with geographically remote headquarters may have less information about others' motives and behavior (e.g., García-Canal, 1996; Gulati, 1995), and this may influence their scope and governance decisions.

Market overlap. To obtain a measure of partner competition outside of an alliance, we assessed the extent of overlap in partners' end markets (e.g., Oxley & Sampson, 2004). We therefore multiplied three five-point Likert-type items measuring the extent to which partners

were operating in similar (i) product markets, (ii) geographic markets and (iii) customer

segments. The multiplicative measure reflects the idea that competition might not be relevant if

firms that operate in the same country do not also compete in the same product markets (and

vice-versa), or if they target different customer segments within a given industry. In

supplemental analyses, we also constructed an additive measure that sums the three items of

market overlap and found the same results as those presented below.

Control variables. We introduced several controls to account for alternative

explanations of alliance scope and governance. To control for external environmental forces, we

included a measure of *environmental uncertainty*. Alliance partners may adjust the alliance scope

and governance in order to protect themselves against uncertainty in the environment (e.g.,

Williamson, 1985). Respondents were asked to allocate 100 points among five environmental

factors (customer demand, competitive climate, technological trends, supply of raw materials and

equipment, and government policies and regulation) based on the importance of each factor for

the success of the alliance. The environmental factors were adopted from Kumar and Seth

(1998). In a different part of the survey, respondents were also asked to assess the

unpredictability of each factor on a five-point Likert-type scale. Information on the importance

and unpredictability of these environmental factors were combined to arrive at our measure of

environmental uncertainty, as follows:

$$(1) \quad Environmental \ Uncertainty = \frac{1}{100} \sum_{i=1}^{5} w_i u_i$$

where w_i is the importance and u_i the unpredictability of environmental factor i. Existing research

suggests that prior alliances affect the level of trust or knowledge about a partner, and this in turn

may influence firms' scope and governance choices (e.g., Gulati, 1995; Holloway & Parmigiani,

2016; Li et al., 2008). We therefore controlled for the number of prior alliances between the

firms (*prior ties*). An examination of this variable's distribution indicated significant positive

skewness, so we redefined the variable using the natural log transformation "transformed

variable" = ln(1 + "variable"). We also expect that alliance design may depend not only on the

functional activities but also on the geographic areas that an alliance covers (Khanna, 1998;

Khanna et al., 1998). Thus, we also controlled for the *geographic scope* of the alliance, measured

by the number of continents that the alliance covered. We also controlled for the number of

alliance managers that the focal firm dedicated to the alliance, expecting that a greater number

of managers would be devoted to a broader scope alliance. The variable can take on values from

1 to 4, which correspond to 'one', 'two', 'three or four', and 'more than four'. We also

incorporated a dummy variable indicating whether or not there was any *rotation* of employees,

expecting that a broader scope alliance would require greater employee rotation. Firms with a

dedicated alliance function may be better able to manage broad scope alliances as well as non-

equity collaborations that have fewer governance mechanisms in place. We therefore created a

dummy variable indicating whether any of the partnering firms had created an *alliance function*

dedicated to handling alliance-related issues (Kale et al., 2002). We also controlled for the scale

of *partner operations*, because firms with more extensive operations may have more resources to

allocate to an alliance, and this may influence their scope and governance choices. To construct

this measure, we first coded each firm's operations as national (coded '1'), international but

limited to one continent (coded '2') and global (coded '3'), and then averaged over the partners.

We also controlled for the *age* of the alliance, which was measured as the number of years the

alliance was active at the time the survey was administered or, in the case of terminated

alliances, the duration of the alliance. Finally, to address potential differences in alliance scope

and governance across industries, we incorporated sector fixed effects into the specifications.

RESULTS

In order to identify the type of alliance design used in a particular collaboration, we considered the specific combination of scope and governance used in that alliance. In particular, there are four possible combinations of scope and governance: (i) broad scope and non-equity governance, (ii) narrow scope and non-equity governance, (iii) broad scope and equity governance, and (iv) narrow scope and equity governance. These four combinations therefore represent four different categories of alliance design. The first category describes alliances that do not have any of the two safeguards discussed in the literature on alliance design (i.e., neither narrow scope nor equity governance). The second category represents an alliance design that uses a narrow scope as a safeguard, while the third category uses equity-based governance. Finally, the fourth category of alliance design incorporates both safeguards simultaneously (i.e., narrow scope and equity governance). However, we found that only one alliance in our sample belongs to the fourth category. In the models presented below, we therefore analyze the other three categories.

Table 1 reports variable means, standard deviations, and correlations. With respect to our dependent variables, 61 percent of the alliances in our sample have broad scope and non-equity governance (i.e., they belong to the first category of alliance design, which has neither safeguard in place), 15 percent have narrow scope and non-equity governance (i.e., the second category), and about one fourth of the total sample (i.e., 24%) have broad scope and equity governance (i.e., the third category). With respect to our independent variables, 12 percent of the alliances involve more than two partners, i.e., they are multilateral alliances, while about half of our sample (i.e., 49%) are international alliances. We also found that half of our sample (i.e., 50%) involves alliances in which there is partner competition, since in these cases partners have some market

overlap in each of the three dimensions, i.e., product markets, geographic markets and customer segments (as noted above, competition might not be relevant if firms do not have market overlap in all three dimensions). Overall, the table indicates modest correlations among the independent variables. Nevertheless, variance inflation factors (VIFs) were examined for all of the independent variables appearing in the models to assess potential multicollinearity problems. The maximum VIF was 1.37, which is well below the rule-of-thumb cutoff of ten (Neter et al., 1985). Multicollinearity problems were thus not evident for any of the models presented below.

Insert Table 1 about here

We used multinomial logit regression to test our hypotheses because our dependent variable is categorical and has more than two outcomes (i.e., categories). We also tested whether the assumption of independence of irrelevant alternatives was violated and found that was not the case (i.e., $\chi^2(12) < 1.2$ for the Hausman test and $\chi^2(12) < 9.2$ for the Small-Hsiao test, both $p > 0.690$). In multinomial logit models, the estimated coefficients measure the effect of an independent variable on the probability that a certain category of the dependent variable will be selected versus another category which is used as reference. In our case, the first category of alliance design (i.e., broad scope and non-equity governance) was used as the reference category. Thus, we estimate the probability of using a particular safeguard against appropriation hazards (either the second or third category of alliance design) relative to using no safeguard at all (the first category). For instance, partners may avoid the appropriation hazards arising from a broad alliance scope (the first category) either by choosing a narrow alliance scope in the first place (the second category) or by adopting an equity-based governance structure for the alliance (the third category), and a multinomial logit model therefore allows us to examine when partners choose one safeguard over the other.

Table 2 presents the results of multinomial logit regressions for the second category (i.e., narrow scope and non-equity governance) and the third category (i.e., broad scope and equity governance) described earlier; both are assessed relative to the first category. A listwise deletion of missing values reduced our sample from 133 to 119 observations. Model 1 serves as a baseline model that includes only the control variables, and model 2 adds the theoretical variables (multilateral alliance, international alliance and market overlap). We report results after standardizing the independent variables (except those that are dummy variables) so that our results do not reflect scaling differences but rather the actual magnitude of the coefficients. We also accounted for the possibility that the disturbances are not independently and identically distributed across observations using the Huber-White sandwich estimator.

<div align="center">Insert Table 2 about here</div>

In model 2, when referring to the second category of alliance design (i.e., narrow scope and non-equity governance), the coefficient of multilateral alliance is positive ($b = 2.51$, $p = 0.010$). This shows that a higher number of partners increases the probability of choosing the second category of alliance design over the first category, which does not provide any safeguards against appropriation hazards. Thus, a narrow scope is more likely to be used as a safeguard in multi-party rather than in bilateral collaborations. The coefficient of international alliance is also positive for the second category of alliance design ($b = 2.08$, $p = 0.015$). Thus, a narrow alliance scope is also more likely to be used as a safeguard in international rather than in domestic collaborations. In contrast, market overlap does not have a significant effect on the probability of choosing the second category over the first category ($b = -0.62$, $p = 0.184$). Turning to third category of alliance design (i.e., broad scope and equity governance), now the coefficient of multilateral alliance is insignificant ($b = -1.04$, $p = 0.183$). In contrast, the coefficient of

international alliance is again positive ($b = 1.72$, $p = 0.011$). Thus, international alliances are also more likely than domestic collaborations to have an equity-based governance structure as a safeguard against appropriation hazards. The coefficient of market overlap is also positive for the third category of alliance design ($b = 0.42$, $p = 0.047$). This shows that a higher level of partner competition increases the probability of choosing the third category of alliance design over the first category. Thus, an equity-based governance structure is more likely to be used as a safeguard when there is higher partner competition.

While the above findings indicate when a particular alliance design may be used as safeguard against appropriation hazards (i.e., relative to using no safeguard at all, as indicated by the omitted category), in order to test our hypotheses we need to compare the different safeguards against each other. In other words, we need to assess whether an independent variable increases the probability of using one safeguard more than the other by testing for any difference in coefficients between the second and third categories of alliance design. The chi-square tests that we conducted show a significant difference in the coefficient of multilateral alliance when comparing the second and third categories (i.e., $\chi^2(1) = 9.92$, $p = 0.002$). This supports H1, which stated that multilateral alliances have a greater positive effect on the probability of choosing a narrow alliance scope compared to an equity-based governance structure. In contrast, there is no significant difference in the coefficient of international alliance (i.e., $\chi^2(1) = 0.13$, $p = 0.722$). Thus H2 is not supported because, although this variable is positive for both safeguards, it does not increase the probability of using one safeguard more than the other. In international alliances partners may choose a narrow alliance scope or an equity-based governance structure with almost equal probability. Finally, our results show a significant difference in the coefficient of market overlap when comparing the second and third categories of alliance design (i.e., $\chi^2(1)$

$= 4.88$, $p = 0.027$). This provides support for H3, which stated that partner competition has a greater positive effect on the probability of choosing an equity-based governance structure compared to a narrow alliance scope.

In supplemental analyses, we also run multinomial logit models by changing the reference category (i.e., using either the second or the third category of alliance design as the reference category) and found results that are equivalent to those of the chi-square tests presented above. For instance, with the second category of alliance design used as reference, the results for the third category were consistent with the above interpretations (i.e., the coefficients of multilateral alliance, international alliance and market overlap were $b = -3.55$, $p = 0.002$, $b = -0.36$, $p = 0.722$, and $b = 1.04$, $p = 0.027$ respectively). Similar results and interpretations were obtained when using the third category of alliance design as reference (results of all these supplemental analyses are available from the authors upon request).

Results for some of the controls are also interesting and worth noting. Our results show that firms with an alliance function are less likely to adopt a narrow alliance scope. Previous research suggests that an alliance function enables firms to centrally coordinate alliance-related activities and serves as an important locus of learning how to manage alliances (Kale et al., 2002). Thus, firms with an alliance function may have developed capabilities in monitoring alliances. When firms have such capabilities, they may not need to use safeguards in an alliance, even if the alliance presents significant exchange hazards. For instance, firms with an alliance function are less likely to adopt a narrow alliance scope as a safeguard, even if exchange hazards are significant, because such firms are better able to monitor broad scope alliances that present greater monitoring challenges (due to their alliance capabilities). Our results also show that firms with a broader scope of operations are also less likely to use any safeguards in an alliance. Firms

with more extensive operations may be less intimidated by exchange hazards in an alliance because they have more resources to protect their knowledge through other means besides private ordering (e.g., litigation). Finally, in the face of environmental uncertainty, firms are less likely to use narrow scope as a safeguard in their collaborations. This could indicate that when firms enter an R&D alliance in a fast-changing environment with high uncertainty, they may want to work together in multiple functional areas (i.e., broad alliance scope) in order to bring the best product to market in the timeliest fashion (Oxley & Sampson, 2004).

DISCUSSION

Contributions and Implications

Research on transaction cost economics has emphasized the choice of an appropriate governance structure as a safeguard against exchange hazards in interfirm transactions, yet firms may also manipulate the characteristics of a transaction so as to make it less hazardous in the first place by carefully selecting the activities or assets involved in the transaction. This presents an important puzzle for transaction cost theory since it suggests that firms may not necessarily adopt governance safeguards even in situations where such safeguards are warranted (i.e., when exchange hazards are significant). The present study investigated this theoretical puzzle in transaction cost theory by examining how firms design R&D alliances to mitigate appropriation hazards in these interfirm transactions. Our theoretical arguments and evidence suggest that alliance partners are more likely to narrow the scope of activities involved in the alliance rather than choose an equity-based governance structure in situations where monitoring becomes more cumbersome and problematic, such as when there are multiple partners in an alliance. In contrast, when there is a high level of partner competition, firms may prefer an equity-based governance structure over a narrow scope due to more vigilant monitoring by the administrative

mechanisms that equity governance provides. Overall, these findings suggest that firms may prefer to manipulate the characteristics of a transaction rather than adopt an equity-based governance structure when the monitoring mechanisms associated with the latter are likely to function less effectively, whereas in the opposite case they are more likely to choose an equity-based governance structure. Thus, a combined analysis of the determinants of transactional attributes and governance structures appears to be useful for delineating more precisely the situations in which governance solutions are warranted for a specific transaction, and future research could go further in this direction to refine the predictions of transaction cost theory.

Transaction cost theory argues that hierarchical or organizational governance forms emerge when markets fail as a result of exchange hazards. Thus, the theory assumes that "in the beginning, there were markets" (Williamson, 1985: 87), which means that markets exist by default, and then the question is when firms will choose a hierarchical governance structure or organizational form instead of relying on the market. Although market failure may explain well the emergence of hierarchical or organizational governance forms, hierarchies can fail as well, and transaction cost theory does not devote significant attention to organizational failure. By theorizing about the hierarchical elements of hybrids, such as the administrative mechanisms of equity-based alliances (e.g., board representation), and the situations where these administrative mechanisms may function less effectively, we are able to complement transaction cost theorizing with some arguments about organizational failure. Indeed, our results suggest that when the administrative mechanisms of equity governance become less effective in monitoring, firms may resort to other solutions to address exchange hazards, such as designing the alliance in a way so as to make it less hazardous in the first place. Just as market failure leads to the emergence of hierarchical or organizational governance structures (e.g., an equity-based rather than a non-

equity alliance), organizational failure may prompt firms to abandon such structures, and attempt instead to make the transaction less hazardous by manipulating its characteristics. This suggests an important avenue for further research on transaction cost economics (e.g., Oxley, 1997; Pisano, 1989; Williamson, 1985), which is to further explore how firms design different types of transactions by taking into account both market failure and organizational failure.

In research on alliance governance using transaction cost economics, monitoring and incentives are often inter-twined and difficult to separate empirically. This is because equity-based alliances provide both superior monitoring and alignment of incentives compared to non-equity alliances. In some situations, this is not necessarily a problem, because monitoring and incentives may go in the same direction. For instance, our research suggests that the monitoring and incentives provided by equity-based governance structures may both become less effective when an alliance involves multiple partners, owing to the difficulties of monitoring partners' behavior and aligning partners' incentives through shared equity in these circumstances. Yet, in other situations, it is important to disentangle the effects of monitoring and incentives as alternative safeguards against exchange hazards in alliances, because one of these safeguards may be more effective than the other. For instance, when partners are direct competitors in end markets, shared equity may not be sufficient to align partners' incentives because the firms remain independent organizations with operations outside of the collaborative agreement. Yet, our study suggests that the administrative mechanisms of equity-based alliances will be more vigilant in monitoring the knowledge exchanged with partners in these circumstances. Thus, monitoring and incentives may not necessarily go together in this situation. Future research might therefore examine how firms choose between the different safeguards that equity-based alliances provide (e.g., monitoring and incentives) in these kinds of situations. Governance

theories such as TCE may need to be adapted to address such issues. Our study focused on the choice between narrow scope and equity governance, and so it has addressed administrative controls and incentives together under the equity governance choice, but it would be interesting to delve more into the different safeguards embedded within equity-based governance structures.

Previous research has compared formal control mechanisms such as equity-based governance structures with relational governance mechanisms such as trust (e.g., García-Canal et al., 2003; Poppo & Zenger, 2002). For instance, García-Canal et al. (2003) found that formal structural mechanisms are more appropriate than relational governance mechanisms for multi-party collaborations, because building a trusting relationship with multiple partners is more difficult and requires higher relational investments. Our study suggests that future research in this area needs to distinguish between alliance governance and scope as formal mechanisms for addressing appropriation hazards. Indeed, alliance scope is an aspect of alliance design and thus represents another formal structural solution to appropriation hazards, and our findings indicate that partners are more likely to choose a narrow alliance scope rather than an equity-based governance structure as a way to address such hazards in multi-party collaborations. Thus, building upon previous research which shows that formal, structural solutions are more appropriate than relational governance mechanisms for multi-party alliances (García-Canal et al., 2003), our findings demonstrate that certain structural solutions (e.g., narrow alliance scope) may be more appropriate than others (e.g., equity-based governance) for such collaborations.

Our results also show that the choice between narrow scope and equity governance becomes less relevant for international versus domestic collaborations. Previous research found significant differences between international and domestic alliances in terms of firms' propensity to use equity-based governance forms versus non-equity arrangements (e.g., García-Canal, 1996;

Gulati, 1995; Kogut & Singh, 1988). Our study shows that international alliances are also more

likely than domestic collaborations to have a narrow scope. Again, this shows the importance of

considering different structural mechanisms, such as alliance governance and scope, as

safeguards against appropriation hazards in international collaborations. At the same time,

however, our study also suggests that when we compare equity-based governance with other

safeguards such as alliance scope, the differences between international and domestic alliances

are less substantial as they relate to firms' choice between these different alliance safeguards.

While choosing an appropriate alliance governance and scope helps to mitigate

misappropriation hazards in interfirm collaborations, this does not exhaust the set of possible

solutions available to alliance partners. For instance, Tiwana (2008) found that misappropriation

hazards in alliances depend not only on alliance design but also on the characteristics of the

product or technology that an alliance involves, and especially the degree to which the product

exhibits a high level of modularity. In particular, modularity can mitigate knowledge

misappropriation hazards by lowering the need for firms to reveal valuable private knowledge to

the partner (Tiwana, 2008). Our study as well as other research on alliances endogenizes facets

of alliance design, and so it would also be interesting to consider whether firms alter features of

technologies or products to enhance modularity for a particular collaboration and whether these

decisions are related to alliance governance and scope choices.

Limitations and Future Research Directions

Beyond the research suggestions offered above, we see several avenues for additional

extensions that could address some of the limitations of our study. First, it would be interesting

to examine other aspects of alliance governance, including more fine-grained consideration of

the specific contractual provisions used in alliances (e.g., Lerner and Merges, 1998; Parkhe,

1993). In addition, future research could examine the roles played by boards, external investors and different forms of managerial compensation, and how these compare with alliance scope choices. Future studies could also explore other aspects of alliance scope related to the 'horizontal' scope of activities, such as the number of product categories or geographic areas involved, or the size of a particular project (e.g., in terms of economic value or strategic importance) (Khanna, 1998), and how these vary within functional areas and across alliances. These studies could also consider the content of different functional activities (manufacturing, marketing, etc.) or focus on alliances that involve other types of activities besides R&D. For instance, in marketing alliances we would expect that other aspects of alliance scope (e.g., in terms of product categories or geographic areas) are likely to take on more importance.

Second, future research could also go beyond the specific activities or products in a given alliance to consider the underlying resources associated with these activities (Lavie, 2006). An advantage of focusing on the functional activities that partners perform in the collaboration is that it is easy to identify the kind of resources associated with these activities (e.g., R&D know-how, marketing expertise, etc.). Yet, future research might characterize these resources in more fine-grained ways to identify the shared and non-shared resources that are more subject to misappropriation (Lavie, 2006).

Third, it would be interesting to examine how the appropriation hazards arising from multi-party alliances, partner competition or other factors potentially influence the dynamics of alliances. Our research design is cross-sectional in nature and focuses on the initial set-up of collaborative agreements, but it would be valuable to examine similar issues using longitudinal methods. For instance, studies could examine how individual partners adjust the initial alliance

contract or introduce governance mechanisms to their collaborations. Such research designs could also accommodate changes in alliance scope or other features of collaboration over time.

Finally, future research might explore further the theoretical puzzle in transaction cost economics that we studied by examining other determinants of scope and governance besides the ones considered in this study. Such research could also examine other transactional attributes besides alliance scope or other types of interfirm transactions besides R&D alliances, as noted above. By investigating the above issues, we would ultimately achieve a better understanding of the conditions that may warrant governance solutions in a variety of contexts in order to refine the predictions of transaction cost theory.

Conclusion

In this paper, we aim to address a theoretical puzzle in TCE by investigating when firms will attempt to manipulate certain characteristics of an R&D alliance (e.g., narrowing its scope) versus when they will adopt an appropriate governance structure (e.g., an equity-based structure) in order to mitigate appropriation hazards in these interfirm transactions. Our study suggests that firms may respond to appropriation hazards by using either a narrow alliance scope or an equity-based governance structure, depending on whether monitoring may work well as a control mechanism or it becomes cumbersome and problematic for the administrative mechanisms that equity governance provides. Thus, firms may not necessarily adopt governance safeguards for a transaction even if exchange hazards are significant, and a combined analysis of the determinants of transactional attributes and governance structures appears to be useful for delineating more precisely the conditions in which the latter are more likely to emerge.

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APPENDIX: SUMMARY OF ITEMS USED IN THE SURVEY

Alliance Scope: Which of the following functional activities did the alliance cover? (tick all that apply; see text)

Governance Structure: Which of the following best describes the type of the agreement? (see text)

Multilateral Alliance: Number of firms in the alliance:

International Alliance: Country of location of firms' headquarters:

Market Overlap: Extent to which the firms were operating in similar markets: (1 = not at all similar, 2 = a little similar, 3 = quite similar, 4 = similar, 5 = very similar)
1. Product markets
2. Geographic markets
3. Customer segments

Environmental Uncertainty: 1. Please allocate 100 points among the following factors according to their importance for the success of the alliance. (see text)
2. To what extent could you predict each of the following about the areas covered by the alliance? (1 = not at all predictable, 2 = a little predictable, 3 = quite predictable, 4 = predictable, 5 = accurately predictable; reverse-scaled)

Prior Ties: Number of alliances with the same partner(s) prior to this alliance:

Geographic Scope: Which of the following continents were covered by the alliance? (tick all that apply)

Alliance Managers: How many managers of your firm worked for the alliance? (1 = one, 2 = two, 3 = three or four, 4 = more than four)

Rotation: Was there any rotation or transfer of personnel (for a long period of time) between the firms?

Alliance Function: Did any of the firms have an alliance function at corporate level dedicated to handling all alliance-related issues?

Partner Operations: Geographic scope of the firms' operations: (1 = national, 2 = international but limited to one continent, 3 = global)

Age: (This variable was coded using information about the formation year of the alliance)

Table 1
Descriptive Statistics and Correlations

Variable	Mean	s.d.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Broad scope and non-equity	0.61	0.49													
2. Narrow scope and non-equity	0.15	0.36	-0.52												
3. Broad scope and equity	0.24	0.43	-0.70	-0.24											
4. Multilateral alliance	0.12	0.32	-0.08	0.14	-0.03										
5. International alliance	0.49	0.50	-0.28	0.15	0.19	0.06									
6. Market overlap	22.32	24.54	-0.01	-0.07	0.08	0.17	0.00								
7. Environmental uncertainty	2.73	0.72	0.03	-0.11	0.05	0.04	0.01	-0.11							
8. Prior ties	0.35	0.68	0.05	0.05	-0.10	0.16	-0.12	0.22	0.08						
9. Geographic scope	2.12	1.35	-0.03	0.12	-0.06	-0.15	0.24	0.18	-0.13	0.03					
10. Alliance managers	2.76	1.07	-0.10	-0.10	0.20	0.18	0.08	-0.01	-0.13	0.09	0.16				
11. Rotation	0.27	0.45	-0.09	0.11	0.01	-0.05	-0.14	-0.04	-0.12	-0.02	0.07	0.14			
12. Alliance function	0.71	0.45	0.17	-0.20	-0.03	0.06	-0.09	0.08	-0.13	0.08	0.10	0.07	0.09		
13. Partner operations	2.49	0.61	0.27	-0.07	-0.25	-0.08	0.17	0.11	-0.02	0.11	0.40	0.10	0.02	0.24	
14. Age	1.00	0.65	-0.19	-0.02	0.23	0.01	0.03	0.04	-0.02	-0.08	0.03	-0.03	0.12	0.02	0.00

0.16≤|r|<0.19 significant at 0.10, 0.19≤|r|<0.24 significant at 0.05, |r|≥0.24 significant at 0.01

Table 2
Alliance Design Choice (Multinomial Logit)

	Model 1		Model 2	
	Dependent variable = Category 2 or Category 3 (default = Category 1)			
Variable	Narrow scope and non-equity governance (Category 2)	Broad scope and equity governance (Category 3)	Narrow scope and non-equity governance (Category 2)	Broad scope and equity governance (Category 3)
Intercept	-0.97 (s.e.=0.50; p=0.053)	-1.26 (s.e.=0.49; p=0.010)	-2.88 (s.e.=0.89; p=0.001)	-2.53 (s.e.=0.76; p=0.001)
Sector fixed effects	Incl.	Incl.	Incl.	Incl.
Environmental uncertainty	-0.50 (s.e.=0.29; p=0.087)	0.15 (s.e.=0.25; p=0.563)	-0.70 (s.e.=0.36; p=0.050)	0.32 (s.e.=0.28; p=0.264)
Prior ties	0.21 (s.e.=0.26; p=0.416)	-0.18 (s.e.=0.26; p=0.491)	0.37 (s.e.=0.27; p=0.164)	-0.08 (s.e.=0.30; p=0.782)
Geographic scope	0.55 (s.e.=0.29; p=0.061)	0.18 (s.e.=0.30; p=0.558)	0.72 (s.e.=0.34; p=0.034)	-0.13 (s.e.=0.29; p=0.660)
Alliance managers	-0.35 (s.e.=0.32; p=0.268)	0.63 (s.e.=0.28; p=0.023)	-0.66 (s.e.=0.31; p=0.034)	0.82 (s.e.=0.31; p=0.008)
Rotation	0.86 (s.e.=0.66; p=0.194)	0.03 (s.e.=0.55; p=0.956)	1.47 (s.e=0.88; p=0.096)	0.23 (s.e.=0.60; p=0.699)
Alliance function	-1.58 (s.e.=0.67; p=0.019)	-0.14 (s.e.=0.57; p=0.806)	-1.85 (s.e=0.76; p=0.014)	0.27 (s.e.=0.59; p=0.642)
Partner operations	-0.51 (s.e.=0.37; p=0.169)	-0.84 (s.e.=0.27; p=0.002)	-0.88 (s.e.=0.41; p=0.034)	-1.17 (s.e.=0.37; p=0.001)
Age	0.05 (s.e.=0.31; p=0.862)	0.67 (s.e.=0.28; p=0.017)	0.24 (s.e.=0.30; p=0.438)	0.77 (s.e.=0.35; p=0.029)
Multilateral alliance			2.51 (s.e.=0.97; p=0.010)	-1.04 (s.e.=0.78; p=0.183)
International alliance			2.08 (s.e.=0.85; p=0.015)	1.72 (s.e.=0.67; p=0.011)
Market overlap			-0.62 (s.e.=0.46; p=0.184)	0.42 (s.e.=0.21; p=0.047)
χ^2	40.43 (p=0.004)		53.69 (p=0.001)	
Log-pseudolikelihood, L(β)	-89.71		-76.94	
N	119		119	