

CHOICE AND PERFORMANCE OF GOVERNANCE MECHANISMS: MATCHING
CONTRACTUAL AND RELATIONAL GOVERNANCE TO SOURCES OF ASSET
SPECIFICITY

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ABSTRACT

We examine the relationship between the nature of assets involved in an alliance and the optimal configuration of contractual and relational governance mechanisms. Examination of governance choice and performance in the German telecommunications industry indicates that physical assets are more suited to contractual controls, while knowledge assets are best governed via relational mechanisms. Relational governance actually harms alliance performance in the presence of physical assets. Implications for the study and management of alliances are discussed.

INTRODUCTION

Alliances allow firms to “pool imperfectly tradable resources in order to gain greater efficiency in the use of existing resources as well as opportunities to create new resources” (Dussauge, Garrette, and Mitchell 2000:207). Successful alliances must accomplish two goals: coordinating the optimal combination of productive resources across parties and mitigating the risks of opportunistic behavior (Mitchell, Dussauge, and Garrette 2002; Nickerson and Zenger *forthcoming*).

Transaction cost economics has argued that increases in exchange hazards will lead to the greater use of contractual governance mechanisms (Williamson 1991). At the same time, a parallel literature has argued for the role of more relational governance mechanisms based largely on trust and social identification, e.g., establishing teams, frequent direct managerial contact, shared decision making and joint problem solving (Uzzi 1997; Gulati 1998). Recent work has shown that these approaches are not mutually exclusive (Poppo and Zenger 2002; Hoetker *forthcoming*).¹ However, we understand little about when one approach is superior to the other.

In this paper, we argue that the optimal configuration of contractual and relational governance mechanisms in an alliance is contingent on the origin of the asset specificity in a transaction. Specifically, we argue that the optimal configuration of controls in a relationship depends critically on the degree to which the specificity present in a relationship is generated by physical assets or by knowledge assets. Physical assets that are easily codifiable and transmitted will be more suited to contractual controls. On the other hand, knowledge assets will be best

¹ Indeed, although greatly overshadowed by the study of contractual governance mechanisms, elements of relational governance have been discussed in the transaction costs framework from as far back as Williamson (1979).

suited to the use of relational governance mechanisms due to the inability to specify exact processes and outcomes in advance. Furthermore, we argue that a mismatch between the governance mechanism and the source of asset specificity can harm the performance of a relationship.

Our approach is consistent with the organizational design literature, which has as a fundamental notion the idea that control mechanisms vary in their ability to bring about specific organizational outcomes (Ouchi 1979; Eisenhardt 1985). Both relational and contractual mechanisms have been well-established as means of control and coordination in alliances. By relating the content of an alliance to the specific mix of diverse outcomes required for a given alliance to succeed, we can make specific predictions for the optimal combination of control mechanisms.

Using data on alliances in the German telecommunications industry in 2001, we test the relationship between the source of asset specificity and the choice of governance mechanisms, the performance of each type of governance mechanism, and the overall performance of the alliance. Our hypotheses are broadly supported. Firms use more relational governance mechanisms in the presence of knowledge assets and more contractual mechanisms in the presence of physical assets. Relational and contractual governance mechanisms perform better in the presence of knowledge and physical assets, respectively. Relational governance mechanisms improve overall alliance performance to the degree that knowledge assets are involved, but actually impairs performance when property assets are involved, pointing to a managerial dilemma when alliances involve extensive assets of both types.

By introducing this critical contingency, our findings contribute to transaction cost economics, the literature on relational governance, and recent work studying their interaction.

We advance transaction cost economics by showing that a finer-grained view of asset specificity allows more precise predictions about the appropriate level of contractual governance for a transaction. We confirm the advantages of relational governance mechanisms in managing knowledge resources, but discover that their costs may be higher than previously appreciated. In combination, our findings confirm that relational and contractual governance partially complement each other. However, they are not interchangeable. Extending prior work, we establish the distinct limitations of each, which make the optimal combination of governance mechanisms highly dependent on the content of the alliance.

Additionally, we extend the literature on interfirm alliance along three related dimensions. First, we show that the most effective means of governing an alliance depends critically on the specific content of that alliance. Second, our findings have implications for the optimal scope and content of alliances, as broad alliances containing both physical and knowledge assets will be disadvantaged by the conflicting governance demands of those assets. Lastly, our findings suggest an optimal sequence of alliance activities between firms, initially focusing on physical assets, including knowledge assets only once the foundation for relational governance mechanisms has developed.

ASSET SPECIFICITY

In order to generate value, many alliances require one or both parties to make investments in support of the alliance that would be of less value in other applications. In the language of transaction cost economics, differing degrees of “asset specificity” characterize alliances. To the degree that one firm has made such relationship-specific investments, it is vulnerable to the other firm attempting to extract additional rents through opportunistic behavior (Williamson 1985).

Asset specificity can arise from multiple sources, of which we focus on two. Commonly, specialized *physical assets* are required to support the activities of the alliance. The prototypical example is a specialized stamping machine in the automobile industry (Klein 1988), but physical assets may also be specific to a relationship by virtue of their location or because they are discrete investments “made at the behest of a particular customer” (Williamson 1991:281).

Asset specificity is not limited to physical property however. Employees of a firm often develop specialized *knowledge* that would be of limited application outside of the relationship in which it was developed (Williamson, Wachter, and Harris 1975). For example, the parties may develop specialized vocabulary to describe technical issues (Monteverde and Teece 1982) and efficiency-enhancing knowledge of the partner's structure and routines (Fichman and Levinthal 1991; Larson, Bengtsson, Henriksson, and Sparks 1998; Kumar and Nti 1998). Asset specificity arises because this knowledge is specific to a given relationship—specialized vocabularies, for example, could not be transferred to relationships with another partner.

Relationship specific assets of either type create an obstacle to the formation of an alliance, as neither party wants to expose itself to their inherent risks. Firms must therefore structure their relationship in order to mitigate these risks. Two common approaches to doing so in the context of alliances are the use of formal contractual governance mechanisms and relational governance mechanisms (Poppo and Zenger 2002). Following Poppo and Zenger, we assume that these approaches may be complements, both occurring to varying degrees within the same alliance.²

² Firms may also resort to integration, rather than an alliance, as a response to asset specificity. Since very different contractual (Masten 1988) and social (Kogut and Zander 1992) regimes apply within firms, we limit our theoretical development and empirical testing to the governance of transactions that occur in alliances.

CONTRACTUAL GOVERNANCE MECHANISMS

Contracts can play a vital role in enabling transactions that require investments in specific assets (Klein, Crawford, and Alchian 1978). They create a mutually agreed upon range of acceptable behaviors, backed by the option of redress to the legal system in the event of disputes (Masten 1996). Contracts can specify each party's roles, performance expectations, and dispute resolution mechanisms (Poppo and Zenger 2002). By placing credibly enforceable limits on the actions of each party, contracts constrain the subsequent ability of one party to extract additional rents from the other by failing to perform as agreed (Williamson 1985).

Associated with the initial contract are the ongoing activities required to monitor compliance with the terms of the contract. These formal and legalistic governance mechanisms, which reflect the objectives specified in the initial contract, are characterized by several characteristics (Macneil 1978; Williamson 1979): their scope is closely delimited, their formal aspects govern when informal (e.g., oral) terms are contexts, and their terms can be separated from the specific identities of the parties. Examples include standardized procedures, technical reports, cost accounting systems, and budget/planning systems (Martinez and Jarillo 1989; Sitkin and Weingart 1995; Gulati 1995; Uzzi 1997; Das and Teng 1998).

When little is at risk in a relationship, simple contracts will be sufficient. As asset specificity increases, placing more at risk, a more complex and costly contract, establishing a more sophisticated set of associated activities, becomes worthwhile (Klein, Crawford, and Alchian 1978). This leads to our first baseline hypothesis, which is consistent with a wealth of prior empirical work, but still important to establish before presenting more fine-grained hypotheses:

Hypothesis 1: The greater the asset specificity in an alliance, the more contractual governance mechanisms will be used.

RELATIONAL GOVERNANCE MECHANISMS

The alliance literature has focused extensively on partner opportunism and the use of contractual agreements to resolve it. Gulati (1995) points out that this approach fails to capture an important element in alliances, namely the role of interfirm trust. In recent years, however, many scholars including transaction cost economists have emphasized the importance of relational governance mechanisms in economic exchange (Poppo and Zenger 2002).

Relational governance mechanisms refer broadly to mechanisms based largely on trust and social identification (Martinez and Jarillo 1989; Dyer and Singh 1998). They include establishing teams, task forces, and committees (Schrader 1991; Grandori 1997); direct managerial contact through trips, meetings and even the transfer of managers (Martinez and Jarillo 1989); mechanisms for shared decision making (Saxton 1997:446); and formal systems for conflict resolution relying on two way communication and joint problem solving (Kale, Singh, and Perlmutter 2000). In contrast to contractual governance mechanisms, the scope of these mechanisms is more open; they create no formal alternatives in the event of unresolved conflict; and the identity of the parties (executives transferred, members of task forces) is critical.

Alliances vary, of course, in the specific mix of these activities they use, but all have the common goal of developing trust and social identification through the interaction of personnel across firms. Through repeated interaction, managers in each firm learn about each other and develop personal ties (Macaulay 1963; Shapiro, Sheppard, and Cherasky 1992). The exchange

of extra effort voluntarily given and reciprocated builds trust (Uzzi 1997).³ Thus, these mechanisms enable the parties to resolve conflicts based on open communication and a preference for non-opportunistic win-win solutions (Kale, Singh, and Perlmutter 2000).

The benefits of using relational governance mechanisms in strategic alliances are numerous, including lowering transaction costs (Barney and Hansen 1994; Gulati 1995), learning (Kale, Singh, and Perlmutter 2000), strategic flexibility (Young-Ybarra and Wiersema 1999), and reducing relational risk (Nooteboom, Berger, and Noorderhaven 1997). However, these activities carry considerable costs in terms of time and resource allocation (Larson 1992; Das and Teng 1998). Consequently, “firms should invest in the development of relational governance only when significant hazards are present” (Poppo and Zenger 2002: 710). This leads to our second baseline hypothesis:

Hypothesis 2: The greater the asset specificity in an alliance, the more relational governance mechanisms will be used.

Matching governance to the source of asset specificity

To this point, our theoretical development has been conventional. Consistent with the existing literature, we have argued that increasing asset specificity leads to greater governance challenges, which firms address through some combination of contractual governance and

³ Note that relational governance mechanisms are related to, but distinct from, relational *capital*, the “mutual trust, respect and friendship that reside at the individual level between alliance partners” (Kale, Singh, and Perlmutter 2000:221). While the presence of trust may ease governance of an alliance, it is not a governance mechanism in and of itself. Rather, alliance partners apply specific governance mechanisms that both have relational capital as their basis and contribute to further accumulation of relational capital. These relational governance mechanisms are our focus.

relational governance mechanisms. We now argue, however, that the appropriate combination of the approaches depends critically not on the *amount* of asset specificity, but on the *nature* of that specificity.⁴

Figure 1 illustrates the predictions of current theory on the choice of governance mechanisms. When neither knowledge- or property-based assets are highly specific (Cell A), there are few governance challenges and we expect little use of either contractual or relational mechanisms. Because current theory does not distinguish between knowledge and physical asset specificity, it cannot distinguish between Cells B, C, and D. Each is high in “total asset specificity” and should thus lead to greater use of governance mechanisms than Cell A. But there is no basis for predicting whether they will be contractual, relational or a mix of the two.⁵ In the remainder of this section, we will develop differentiated predictions for each cell.

Figure 1: Predictions from current theory

		Knowledge asset specificity	
		Low	High
Physical asset specificity	Low	(A) Little of either contract or relational governance mechanisms	(B) Contract &/or relational mechanisms
	High	(C) Contract &/or relational mechanisms	(D) Considerable contract &/or relational mechanisms

We develop our predictions based on two key arguments. First, physical and knowledge assets present different governance problems, which contractual and relational governance

⁴ In work of a similar flavor, Klein, Crawford, and Alchian (1978) address the impact of the source of asset specificity on integration decisions.

⁵ As total specificity is higher in Cell D, we would expect more use of governance mechanisms than in Cells B or C. However, the cells are indistinguishable in their predicted mix of mechanisms predicted.

mechanisms address with different degrees of effectiveness. Second, contractual and relational governance mechanisms differ in their ability to support the coordination of efforts across firms, which is as important to the success of an inter-firm relationship as the mitigation of opportunism.⁶

The first governance issue posed by the exchange of knowledge assets is a variation of the well-known appropriability problem. Arrow (1962) argues that once a party discloses knowledge to a potential buyer, that buyer is in a position to apply that knowledge without paying for it. Of course, a potential buyer will not agree to pay for the knowledge until it has the opportunity to evaluate it. In the governance context, it is unlikely that the parties will be able to negotiate a mutually acceptable contract in this situation (Teece 1986).⁷

Contracting parties can specify concrete performance criteria that a physical asset being supplied by one party must meet. In the event of disagreement, courts can judge whether or not the asset meets those criteria. It is much harder to develop concrete criteria for knowledge that one party is to supply, particularly in light of the reluctance on the part of the asset owner to disclose detailed information about the knowledge, as discussed above (Teece 1988). As a result, in the event of disagreement, the courts will find it much harder to judge whether or not the knowledge delivered by one party meets the agreed upon criteria (Arrow 1971; Masten 1984).

⁶ Klein, Crawford, and Alchian (1978) address the impact of the source of asset specificity on integration decisions.

⁷ Arora *et al* (2001) argue that this problem can be overcome with a fairly simple contractual schema. However, it remains the case that appropriability concerns mean that a knowledge based resource poses a level of contractual complexity beyond that posed by a physical asset, which can be demonstrated to the buyer without relinquishing control of the asset.

Further, the transfer of knowledge requires effort on the part of both the provider and receiver (Cohen and Levinthal 1990). However, the quality of effort put forth by each party is difficult or impossible for a third party to verify (Arora, Fosfuri, and Gambardella 2001:118). Thus, opportunities for shirking arise that the courts will not be able to ameliorate (Alchian and Demsetz 1972). Even if the courts were able to ascertain fault, the range of potential remedies varies for physical and knowledge assets. Firms can be forced to return property, but it is difficult to force a firm's employees to unlearn the knowledge once transferred (Arora, Fosfuri, and Gambardella 2001:118).

The difficulty in crafting contracts to govern knowledge assets may also diminish the effectiveness of the alliance. Because of the cost of renegotiating a formal agreement when a circumstance outside its scope arises, contractual governance mechanisms may limit the ability of the parties to respond to new information revealed over the life of the alliance, preventing the alliance partners from pursuing unforeseen opportunities (Masten and Crocker 1985).

Similar difficulties make contractual governance mechanisms ineffective for coordinating the use of knowledge assets. Although often thought of as primarily governance tools, contractual mechanisms can also serve an important coordinating role (Gulati and Singh 1998). Mayer and Argyres (2004:404) found that firms included clauses regarding communication of technical problems, delivery dates, and information about system interactions to enable "better information flow between the parties, so as to avoid coordination failures." Such prior arrangements enable coordination by enhancing the predictability of each party's actions (Galbraith 1977; Gulati, Lawrence, and Puranam *forthcoming*).

However, contractual governance mechanisms are handicapped in coordinating knowledge assets, which are difficult to specify concretely in advance and influenced by the

unobservable efforts of both parties. It is more realistic to specify the date by which a generator will be delivered than the date by which one partner will completely master knowledge provided by the other.

For all of these reasons, contractual governance mechanisms are likely to be a suboptimal response to transactions involving extensive knowledge assets. The difficulty and cost of negotiating an adequate contract will be higher for knowledge than physical assets and the ultimate utility of the contract in the event of disputes will be lower. Thus, we do not expect firms to vary their use of contractual governance mechanisms according to the presence or absence of knowledge assets.⁸ Since our interest is in the *source* of asset specificity, we phrase our hypothesis in terms of the composition of assets involved in an alliance, holding the level of overall asset specificity constant.⁹

Hypothesis 3: For a given level of asset specificity in an alliance, there will be a negligible relationship between the amount of knowledge assets involved in the alliance and the use of contractual governance mechanisms.

Relational governance mechanisms provide a more flexible means of addressing this problem. By creating the “expectation that alleviates the fear that one’s exchange partner will act opportunistically” (Bradach and Eccles 1989:104), relational governance mechanisms

⁸ We state our hypotheses in a strong form, while recognizing that contracts are not completely without utility in the presence of knowledge assets (see, e.g., Lyons 1994).

⁹ While it is generally inappropriate to test a null hypotheses, Cohen (1988; 1990) notes that the absence of a relationship is a valid phenomenon of interest when theory calls into question previously accepted relationships. Our hypotheses three and six represent such questioning and are thus appropriate to test. As described in our methods section, we use statistical power analysis to properly test these null hypotheses. See also Lane, Cannella and Lubatkin (1998).

minimize contracting costs by allowing the parties to move forward with a less fully specified contract under the assumption that contingencies will be addressed in good faith and shirking will not occur (Cusumano 1985).

Beyond the mitigation of potential opportunism, a successful inter-firm relationship requires coordination of productive efforts and assets across firms. In addition to their role in governance, the activities associated with relational governance mechanisms also support this coordination in a way that contractual mechanisms do not.

Knowledge assets are particularly difficult to coordinate across firms because they tend to be embedded in the routines and culture of the originating firm, composed largely of tacit (hard to articulate) knowledge and couched in the firm's specialized technical language (Arrow 1974; Nelson and Winter 1982; Kogut and Zander 1992). The repeated interaction across partners that accompanies the use of relational governance mechanisms helps overcome these problems through the development of coordinating routines (Mitchell and Singh 1996; Zollo, Reuer, and Singh 2002), a common language for discussing technical issues (Arrow 1974) and a sense of social cohesion increases the open exchange of knowledge (Reagans and Mcevily 2003).

Because relational governance mechanisms offers advantages over contractual mechanisms in governing and coordinating the use of knowledge assets, we expect to observe more use of relational governance mechanisms when substantial knowledge assets are involved in an alliance. Since our interest is again the *source* of asset specificity, we phrase our hypothesis in terms of the composition of assets involved in an alliance, holding the level of overall asset specificity constant.

Hypothesis 4: For a given level of asset specificity in an alliance, the more knowledge assets involved in the alliance, the more relational governance mechanisms will be used.

Just as relational governance mechanisms are particularly effective in addressing asset-specificity generated by knowledge assets, it is *inappropriate* as a response to asset-specificity generated predominantly by physical assets. For purely physical assets, relational governance mechanisms require time-consuming, often costly, activities when more efficient contractual mechanisms are available. Further, it may lead to poorer performance via diminished incentives.

Because relational governance mechanisms depend on the repeated interaction of personnel across the firms, particularly in face-to-face meetings, it inevitably requires managers and engineers to travel between firm locations (Teece 1977). Modern telecommunications such as video-conferencing can help reduce travel costs, but cannot reduce the inefficiency of having multiple employees, often highly compensated, engaged in meetings rather than their normal productive activities. These costs may be merited when governing knowledge assets because of the advantages they provide over contractual mechanisms. However, these advantages are less relevant for physical assets, increasing the net costs of these activities.

Furthermore, there is less need to—and less value in—developing coordinating routines, a common language or a sense of social cohesion when coordinating the use of physical assets. The transfer of physical assets makes it possible to transfer the fruits of productive knowledge between firms without requiring the receiving firm to master that knowledge (Demsetz 1988).

Beyond merely being an unnecessarily expensive approach to the governance and coordination of physical assets, relational governance mechanisms can directly diminish performance. More so than formal contracts, relationships based on frequent interaction take on some aspects of internal supply that diminish incentives, such as second chances being given more frequently, an expectation of due process before termination, and greater willingness to negotiate unexpected cost increases. This is a nearly inevitable accompaniment to the

assumption underlying relational governance mechanisms: that disputes will be resolved “fairly”. For example, Uzzi (1997:43) quotes a contractor as saying “With people you trust, you know that if you have a problem with a fabric they’re just not going to say, ‘I won’t pay’ or ‘take it back’. If they did then we would have to pay for the loss.” As a result, relational governance mechanisms may elicit less of what Williamson (1985:150) refers to as “inordinate energies”.

Therefore, we expect firms to bring contractual governance mechanisms to bear when considerable physical assets are involved, since they provide effective and efficient governance and coordination of these assets. Since relational mechanisms are a less effective response to physical asset specificity, we do not expect the use of relational governance mechanisms to be affected by the presence or absence of physical assets.¹⁰

Hypothesis 5: For a given level of asset specificity in an alliance, the more physical assets involved in the alliance, the more contractual governance will be used.

Hypothesis 6: For a given level of asset specificity in an alliance, there will be a negligible relationship between the amount of physical assets involved in the alliance and the use of relational governance.

We conclude by developing hypotheses for the performance implications of the choice of governance mechanisms. In an advance over prior work, we make predictions for the performance of each type of mechanism, as well as the overall performance of the alliance. Each of the hypotheses is based on the assumption that success will come when the mechanisms employed match the composition of the assets involved.

¹⁰ A stronger prediction would be that firms would avoid using relational governance mechanisms in the presence of considerable physical assets. However, we do not believe theory supports such a strong prediction.

Hypothesis 7: Alliance partners will consider contractual (relational) governance mechanisms successful to the degree that physical (knowledge) assets are involved in an alliance.

Hypothesis 8: Contractual (relational) governance mechanisms will contribute to the overall success of the alliance to the degree that physical (knowledge) assets are involved in the alliance.

We are now able to make differentiated predictions for the cells of Figure 1, as demonstrated in Figure 2. Cell (A) remains the same. When there is little asset specificity, we expect to see little governance activity of either type. However, we can now distinguish between cells (B) and (C), previously indistinguishable because both represent high asset specificity. When primarily knowledge based assets are involved, Cell (B), we expect to see relational governance mechanisms used, rather than contractual. Conversely, when primarily physical assets are involved, Cell (C), we expect contractual governance mechanisms to be used. Lastly, we now expect firms to employ both types of governance mechanisms when both physical and knowledge assets are involved, whereas previously we could predict high levels of “total” governance activity, but not whether that governance would be contractual, relational, or a mix of the two.

Figure 2: Differentiated predictions

		Knowledge asset specificity	
		Low	High
Physical asset specificity	Low	(A) Little of either contract or relational governance mechanisms	(B) Relational governance mechanisms
	High	(C) Contractual governance mechanisms	(D) Contractual and relational governance mechanisms

METHODS

Sample

The research sample was alliances in the German telecommunications industry. According to Section 4 of the German telecommunications law, every company that wants to offer telecommunication services is required to notify the regulatory authority. Therefore, the register of the German regulatory authority for telecommunication and postal services was used as the starting data source for this study. This register is updated twice a year and is publicly available. Targeted respondents in this study were all telecommunication companies that owned a class 3 license (i.e., a network license allowing the company to build network infrastructure), or a class 4 license (i.e., a service license allowing the company to offer voice telephony to the public) according to § 6 of the German telecommunications law.

In total, 257 companies were identified that owned a class 3, a class 4, or both licenses. Surveys were sent to the CEO of the respective company and completed by the CEO, the Director of Business Development or the Director of the Legal Department. Respondents were asked to describe the management of their most important alliance. Of the 257 questionnaires mailed, 83 questionnaires were obtained, representing a 32 percent response rate. The high response rate may be attributed to the follow-up procedure of sending a reminder letter and of making supplemental phone calls (Dillman 2000) and the fact that the study was supported by two letters of recommendation from the leading telecommunication industry federations. In addition, the guarantee of confidentiality and a report on the main results of the study provided further incentives to answer the questionnaire. As an illustration of the competence and appropriateness of key informants, 65 percent were members of the board and were involved in the formation of the collaborative agreement.

Several steps were taken to ensure the validity of the data. Preliminary versions of the questionnaire were reviewed by four business scholars and nine practitioners from the telecommunications industry to ensure face validity. Variables that were previously used in US empirical studies were translated into German and reviewed by two German-speaking researchers. After the data were collected, in order to assess potential nonresponse bias, we tested for possible differences between early and late respondents, under the assumption that late respondents are more similar to non-respondents than early respondents are to non-respondents (Armstrong and Overton 1977). We tested for differences in firm size based on number of employees and sales. A one-way analysis of variance (ANOVA) for firm size across early and late respondents yielded an insignificant F-value of 0.02 for number of employees and 0.12 for sales. Additional tests examining early and late respondents for differences in alliance experience based on the number of current alliances and experiences with alliances in the past were similarly insignificant. Thus, we found no evidence of response bias.

We also sought to address the possibility of consistency artifacts and common methods bias. Specifically, we used Harman's (1967) single-factor test to examine whether a significant amount of common method variance exists in the data. If so, a factor analysis of all of the variables will generate a single factor or a general factor that accounts for most of the variance in the data (e.g., Podsakoff and Organ 1986). Unrotated factor analysis using the eigenvalue-greater-than-one criterion revealed four factors, and the first factor explained only 24.1 percent of the variance in the data. Thus, we concluded that the analysis was not subject to common methods bias.

Measures

Use of relational and contractual governance mechanisms

Our dependent variables in the first set of equations are the amount of relational governance and contractual governance mechanisms used in an alliance. We measured relational governance mechanisms as the extent to which certain informal control mechanisms were used in the alliance. Drawing on Martinez and Jarillo (1989), Kale *et al* (2000), and Makhija and Ganesh (1997), we identified mechanisms that enhance open communication and sharing of information, trust, dependence, and cooperation (Poppo and Zenger 2002). This measure was constructed as an unweighted index based on seven activities: cooperation guidelines, steering committees, project groups, expert committees, cooperation manager, face-to-face meetings at the top management level, and filling of key positions. The degree to which each was used in the alliance was measured on a 5-point scale ranging from “not at all” to “to a large extent”.

We measured contractual governance mechanisms as the extent to which certain formal control mechanisms were used in the alliance. Drawing on Das and Teng (1998), Sitkin (1995), Martinez and Jarillo (1989), and Makhija and Ganesh (1997), our measure was constructed as an unweighted index based on eight mechanisms: business plans, balance sheets, performance indices, profit and loss accounts, internal prices, economic efficiency calculations, reports, service level agreements. The use of each in the alliance was measured on a 5-point scale ranging from “not at all” to “to a large extent”.¹¹

¹¹ We do not calculate a measure of agreement for these measures as we do not believe they constitute a single construct, but rather a range of activities a firm can choose to use or not. A company could make heavy use of steering groups and expert committees, but no other relational governance mechanisms.

Knowledge assets and physical assets

To generate our measures of the knowledge and physical assets involved in the alliance, we analyzed the relevant literature in order to identify strategic resources in telecommunications. The list of resources thus identified was then discussed with experts with regard to relevance, completeness, and comprehensibility. This elicited a final list of 14 resources (9 physical and 5 knowledge assets). Physical assets include buildings/facilities, capital, backbone infrastructure, access network infrastructure, licenses, rights of way, IN-platforms, sales networks and brand name. Knowledge assets include knowledge of marketing and sales know-how, planning and construction of telecommunications networks, operating a telecommunications network, operating a billing system, and customer care. Respondents indicated on a scale of 1 (low) to 5 (high) the extent to which the own company and the partner transferred these resources into the alliance. We based our measures on the average scores of the nine and five measures respectively.¹²

Asset specificity

Asset specificity was measured by adapting a scale from Reuer and Ariño (2002). We used the average response to two items on a 5-point scale (ranging from “negligible” to “substantial”) to measure the degree to which assets were custom-tailored to the alliance: (1) “If we decided to stop this venture, the difficulty that we would have in redeploying our people and facilities presently serving the venture to other uses would be ...” and (2) “If this venture were to dissolve, our non-recoverable investments in equipment, people, etc. would be ...”. The

¹² We again do not calculate a measure of agreement for these measures, as they do not represent a single construct. An alliance might involve only licenses and infrastructure, for example.

Cronbach alpha for this index 0.74, indicating that it demonstrates satisfactory reliability (Nunnally 1978).

Performance of relational and contractual governance mechanisms

Our first measurement of performance focuses on the performance of contractual and relational governance mechanisms respectively. Respondents were asked to rate on a scale of 1 to 5 the effectiveness of the same mechanisms used to identify the use of contractual and relational mechanisms. We use the average ratings as the measures of performance for each type of governance mechanism.

Overall alliance performance

We also measure the overall performance of the alliance. Our measure is based on the degree to which the alliance achieved fourteen goals, weighted according to the extent to which each goal was rated as “relevant to the alliance”: access to network infrastructure, access to sales network, access to capital, access to technical know-how, access to marketing/sales know-how, higher utilization of own network infrastructure, higher utilization of own sales network, extension of product line, access to new markets, cost reduction, risk reduction, time advantages, and spreading of financial burden. The degree to which each goal was reached was rated on a scale of 1 (not at all) to 5 (to a high extent). The final measure is an average of these weighted ratings.¹³

Organizational fit, prior alliance experience, strategic importance, and prior success

We use prior experience with alliances as identifying instruments in the contractual governance mechanisms equation. We expect that firms with more experience will make more

¹³ An alternative measure, the average rating of only those goals for which relevance was rated as 4 or 5 on a scale of 1 (not at all relevant) to 5 (high relevant) scale, yielded substantively identical results.

use of formal control mechanisms (Poppo and Zenger 2002; Mayer and Argyres 2004). We adapted a scale from Kale et al. (2000) to measure organizational fit. Companies indicated on a 5-point scale to what degree organizational culture and management and operating styles of the partners are compatible with each other. We used this as an identifying instrument in the relational governance mechanisms equation. We expect more compatible firms to make greater use of relational governance mechanisms. We have no theoretical basis for believing compatibility to be directly associated with the use of contractual mechanisms. Both equations also include a measure of the strategic importance of the alliance, constructed as an unweighted index of four items, each rated on a five point Likert scale: the significant strategic importance for our company/our partner; failure means serious disadvantages for our company/our partner ($\alpha=0.80$). We expect firms to use more of both types of governance mechanisms for more strategically important alliances.

In our models of performance, we delete the strategic importance measure, which we do not expect to directly impact the performance of the chosen governance mechanism. We add a measure of the average degree to which the firm has accomplished 8 key strategic goals over the last three years, assuming that perceived corporate performance may influence perceptions of how well governance mechanisms are performing. This deletion and addition provides the identifying conditions necessary to allow us to use the predicted amounts of contractual and relational mechanisms used in our performance equations, as discussed below.

Control Variables

To account for potential confounds to the theoretical relationships, we include three control variables in all of our models. These include the number of alliance partners (Gulati 1995; Das and Teng 2002); prior knowledge of the alliance partner (Gulati 1995; Kale, Singh,

and Perlmutter 2000), rated from 1 (not at all) to 5 (very good); and an indicator of whether the partners were of common nationality (Gulati 1995; Kale, Singh, and Perlmutter 2000).

Table 1 presents descriptive statistics and correlations. There is no evidence of multicollinearity difficulties (mean VIF: 2.26; maximum VIF: 3.65).

Statistical models

Our analysis takes place in three steps: modeling the choice of contractual and relational governance mechanisms in a relationship, modeling the performance of the chosen governance mechanisms, and modeling the performance of the overall performance as a function of the mechanisms chosen.

In modeling the choice of contractual and relational governance mechanisms, we must control for the fact that the choices regarding contractual and relational mechanisms may be inter-related. If so, we would obtain biased results if we treated these choices as exogenously determined. Therefore, we model the amount of contractual and relational mechanisms used via two-stage least squares (Davidson and McFetridge 1984; Greene 1997). The first stage of this method generates instrumented values of the endogenous variables, use of contractual governance and relational governance mechanisms, by regressing each against all of the exogenous variables in the system. In the second stage, each equation is estimated using the instrumented variables in place of the endogenous variables.¹⁴ This approach generates consistent coefficient estimates.

¹⁴ Poppo and Zenger (2002) applied three stage least squares (3SLS) for a similar model. We use 2SLS for our dataset because 3SLS requires a much larger sample size than 2SLS and is more sensitive to specification and measurement error. Although less efficient than 3SLS, 2SLS avoids the bias and inconsistency of OLS, making it a

Two of our choice hypotheses, three and six, are tests of a null, that is, the lack of a significant relationship. Our analysis of these hypotheses follows Lane, Cannella and Lubatkin (1998). While a null hypothesis is never strictly true, meaning absolutely no correlation exists between the independent and dependent variable (Lane, Cannella, and Lubatkin 1998), Cohen (1988:16-17) argues that a null can be accepted when the expected relationship is found to be “trivial” using power analysis. A relationship is trivial (Cohen 1990:1307-1309) when the sample size used in a test is large enough for the risk β of a Type II error (incorrectly accepting the null) to be equal to the commonly accepted five-percent risk α of a Type I error (incorrectly rejecting the null). If, given a sufficient sample size, the relationship is found to be insignificant, the null can be accepted.

The definition of a “trivial” relationship is, of course, critical. Cohen (1992) provides values for “small”, “medium” and “large” effects. While a “small” effect is intuitively appealing, Cohen (1990) points out that this is often impractical and suggests that a “large” effect are often reported in economics (1988:13).

The formula for the required sample size, N , is $N=\lambda(1-R^2)/R^2$, where the effect size index λ is a function of α , β , and the number of independent variables (Cohen 1988:444-445). Using tables provided by Cohen (1988:452) for 9 independent variables and $\alpha=\beta=0.05$ yields a λ of 23.6, leading to a required sample size of 44 for a “large” effect, well below our sample size of 79.¹⁵ Even for a more stringent test with a power of .99 ($\beta=.01$), which requires a sample size of 72,

“good compromise choice among the group of various estimators” (Intriligator, Bodkin, and Hsiao 1996:389) in settings such as ours.

¹⁵ Cohen (1988:414) suggests that his suggested “large” effect may actually be too small for research in economics.

our sample size is sufficient to detect a large effect.¹⁶ Thus, a finding of no statistical significance for a variable means that either its relationship to the dependent variable is trivial in the context of economic research or we have “been the victim of the [0.01] risk of making a Type II error” (Cohen 1992:157-158).

Having estimated the determinants of each type of mechanisms use, we next want to model their performance. In doing so, we face two challenges. As in the first step, the performance of contractual mechanisms is likely to be endogenous to the performance of relational mechanisms and vice versa. We again apply two-stage least squares to control for potential bias. Further, the choice and performance of governance mechanisms is not exogenous. A firm that was particularly legalistic for reasons we do not observe might attempt to manage a relationship primarily through contractual means. The firm may also be more likely to feel that this approach fell short of expectations, given their high degree of faith in the power of contracts. This would lead to a spurious negative relationship between the amount and performance of contractual mechanisms. Following Artz and Brush (2000), we address this by replacing the amount of contractual (relational) mechanisms used with the amount that would be predicted by only the observable characteristics of the transaction from step 1.

In our last step, we model the overall performance of the relationship via OLS. We again use the fitted values of contractual and relational mechanisms used from the initial equations to control for endogeneity (Artz and Brush 2000).¹⁷

¹⁶ A medium sample size would require a sample size of 133. Our current sample size provides statistical power approximately half-way between Cohen’s “medium” and “large” effects.

¹⁷ As is the case with many studies of alliances, we do not observe transactions that the firm carried out internally. Theory suggests that the decision to engage in an alliance is a feature of our independent variables, e.g., asset

RESULTS

Choice of governance mechanisms

Models 1 and 2 of Table 2 present our results for the choice of governance mechanisms. Results are largely in line with hypotheses one to six. Our baseline hypotheses were that greater asset specificity would be associated with greater use of both contractual and relational governance mechanisms. However, we find support only for hypothesis one, the relationship between asset specificity and contractual mechanisms. No relationship is observed with the use of relational mechanisms.

Hypotheses three and four addressed the impact of knowledge assets within an alliance, while hypotheses five and six concerned physical assets. Consistent with hypotheses three and four, the presence of knowledge assets in an alliance is positively associated with the use of relational mechanisms, while it has no significant relationship with the use of contractual governance mechanisms. As predicted by hypothesis five, the greater the amount of physical assets in an alliance, the more the parties use contractual mechanisms. Consistent with hypothesis six, there is no significant relationship between the amount of physical assets in an alliance and the use of relational mechanisms.

Turning to other variables, we find that the use of contractual mechanisms increases the use of relational mechanisms. This is consistent with prior research suggesting that contracts complement and support relational governance (Das and Teng 1998; Poppo and Zenger 2002). We find no relationship in the opposite direction. As anticipated, companies with better

specificity. Thus, our data on alliances may represent a limited range of values for these values (Poppo and Zenger 2002). Our results must be interpreted as conditional upon the transaction being carried out in an alliance.

organizational fit make more use of relational mechanisms, while firms with greater alliance experience make more use of contractual mechanisms.

Performance of governance mechanisms

We find mixed support for hypothesis seven, which concerned the performance of relational and contractual governance mechanisms, as reported in columns 3 and 4 of Table 2. Consistent with expectations, we find no significant relationship between the presence of knowledge assets and the performance of contractual governance mechanisms. However, we do not find the hypothesized relationship between physical assets and contractual governance mechanisms. As hypothesized, we find a significant positive relationship between the amount of knowledge assets in an alliance and the performance of relational governance mechanisms. Consistent with expectations, the presence of physical assets does not affect the performance of relational governance mechanisms.

There are several interesting results among the other variables. The amount of contractual governance mechanisms used is positively associated with the performance of those mechanisms, suggesting that firms generally find contractual governance mechanisms perform well. The use of contractual governance mechanisms is also positively related to the success of relational mechanisms, while the use of more relational governance mechanisms leads to more success with contractual mechanisms. This provides additional evidence for the argument that contractual and relational governance are complementary. Interestingly, the use of relational mechanisms is *negatively* associated with their performance. Although relational mechanisms offer many advantages, a finding that a surfeit of relational governance activities (meetings, work groups, etc.) may be perceived as a poor means of governing an alliance (or other

organization) is theoretically consistent with findings focusing on associated costs in time, energy, and money (Teece 1977).¹⁸

When contractual governance mechanisms have performed well, relational governance mechanisms are also reported to perform well. We also find the reverse, success with relational governance mechanisms leads to contractual governance mechanisms performing well. This could be taken as further evidence of the complementary nature of the two governance approaches. A more conservative interpretation is that the perception that an alliance is well-governed will be attributed to all governance activities in the alliance, as will perceptions of poor governance.

As expected, relational governance mechanisms perform better in alliances with better fit between partners. Prior experience with alliances has a negative effect on the performance of contractual mechanisms. This finding may reflect companies learning the limitations of contractual mechanisms through bitter experience. The German telecommunications market opened to competition in 1998 and has experienced high environmental dynamics, with rapid growth in the number of companies from 1998 to 2000, followed by a shake-out period with numerous liquidations and mergers and acquisitions. Therefore, most German telecommunications companies have relatively little experience with alliances. Those with the most experience likely best understand the limitations of contractual mechanisms in managing alliances in a highly dynamic environment.

¹⁸ It is also, we expect, empirically consistent with the experience of most faculty members with extensive service commitments.

Overall alliance performance

Our final hypothesis, hypothesis eight, concerns the determinants of overall alliance performance. As reported in column five of Table 2, we first note that neither the use of relational governance mechanisms nor the use of contractual governance mechanisms has a direct effect on overall alliance performance. However, the interaction of knowledge assets and relational governance mechanisms is significant and positive.¹⁹ As hypothesized, relational governance mechanisms contribute to the overall success of the alliance to the degree that knowledge assets are involved. Relational governance mechanisms interact negatively with the amount of physical assets in an alliance. That is, relational governance mechanisms actually impair the performance of alliances involving substantial physical assets. The result is consistent with our theory, and is actually a stronger result than we were willing to hypothesize. We do not find the hypothesized positive interaction between contractual governance mechanisms and physical assets. We also find no interaction between contractual governance mechanisms and knowledge assets, which is consistent with our theory. The lack of a negative interaction suggests that, while contractual governance mechanisms do not support governance of knowledge, they do not impair it. The relative inflexibility of contractual governance mechanisms implied by theory does not appear to limit the ability of the partners to fully exploit the knowledge assets of the alliance. Overall, hypothesis eight receives strong support regarding relational governance mechanisms, but is not supported for contractual governance mechanisms.

Among the other variables in the model, we first note that the amount of knowledge assets in an alliance has a negative effect on overall performance, while physical assets have a

¹⁹ The full model in column five is a statistically significant improvement over an unreported model without the interactions between governance mechanisms and asset types.

positive effect. This is consistent with the well-documented difficulty of managing knowledge across firm boundaries (Makhija and Ganesh 1997; Kale, Singh, and Perlmutter 2000). Firms that have been more successful in the prior three years report greater overall alliance performance. Alliances involving more partners are viewed as less successful, as are alliances involving partners from different countries, reflecting the difficulty of managing multi-sided alliances (Gulati 1995) and cross-border alliances (Harrigan 1988; Parkhe 1993).²⁰

In summary, when large amounts of knowledge assets are involved in an alliance, firms will employ more relational governance mechanisms and will be more satisfied with their performance. Further, relational mechanisms will make a larger positive impact on the overall performance of the alliance. When extensive physical assets are involved, firms will employ more contractual mechanisms and will actually find relational mechanisms prejudicial to the success of the alliance, reflecting its relative inefficiency as a means of governing purely physical assets.

²⁰As a robustness check, we ran a Heckman selection model to control potential selection bias (Masten 1993). To do so, we dichotomized the governance variable into “high” and “low” using the mean of each as a dividing point. Results suggest selection bias is not a significant threat to the validity of our results. For both types of governance mechanisms, the estimated selectivity effect had an extremely high standard error and a likelihood ratio test could not reject the hypotheses that the selection and performance equations were independent. That is, any unobserved factors that influence both selection and performance of governance do not exert a significant effect on the estimation of our model. The results of the selection-corrected performance equations are consistent with the results reported above. Separately, we note that due to the presence of interaction terms, this model was the only model to exhibit potential multi-collinearity problems. When we mean-centered the governance type and asset type variables before interacting them, thus reducing the amount of multicollinearity (Aguinis 2002), our results were substantively unchanged, although the unhypothesized negative main effect of knowledge assets lost significance.

DISCUSSION AND CONCLUSION

Our goal, as presented in Figure 2, was to predict the use of governance mechanisms, differentiating our predictions according to the assets involved in a way that existing models do not. We have done so. Taken together, our results provide strong evidence that the choice and performance of governance mechanisms do not only depend on the level of asset specificity, but on the nature of the assets involved in the alliance.

Consideration of this contingency has direct implications for three elements of the literature on alliances that are not otherwise evident: their governance, their scope and content, and the optimal sequence of alliance activities between firms. On the subject of alliance governance, we believe our work has immediate relevance to two underlying literatures: transaction cost economics and the literature on relational governance. We find support for the central tenets of each, while also establishing important boundary conditions for their application.

Transaction cost economics has long recognized a variety of sources of asset specificity, but most studies have not distinguished between them when predicting the appropriate governance response. As transaction cost research moves from studying industries dominated by physical assets, e.g., coal (Joskow 1987) and shoe manufacturing (Masten and Snyder 1993), to high-technology, knowledge-intensive settings, e.g., technology transfer alliances (Oxley 1999), it will become increasingly important to do so.

Consistent with the literature on relational governance, we find that relational governance mechanisms play a critical role in helping firms exploit knowledge assets in alliances. However, their costs may be higher than has previously been appreciated. When the only assets being governed are amenable to contractual mechanisms, e.g., physical assets, relational mechanisms

may be unnecessarily burdensome. They may actually be counter-productive in the presence of extensive physical assets due to high costs and over-socialization.

This paper also extends recent work (e.g., Poppo and Zenger 2002) examining the interaction of relational and contractual governance. Our findings confirm that relational and contractual governance complement each other. Like prior work, we find that relational and contractual governance mechanisms often co-occur. We further find that each performs better when accompanied by the other, providing direct evidence for the theoretical logic underlying the complementary relationship between them (Poppo and Zenger 2002). However, our findings demonstrate that they are not interchangeable. Each has distinct limitations, making the optimal combination of governance mechanisms highly dependent on the content of the alliance, a contingency absent in both literature streams.

Our findings also inform the optimal scope and content of alliances. Both physical and knowledge assets may contribute to the alliance's goals; further, bundling activities together offers governance advantages through raising the cost of opportunistic behavior (de Figueiredo and Teece 1996). However, when asset types are mixed, the partners will have to choose suboptimal governance arrangements. If the alliance can be narrowed to either predominantly physical assets or predominantly knowledge assets, managers can employ the optimal amount of relational mechanisms for the predominant asset type, with fewer repercussions in the management of the other assets. In many cases, however, managers must choose the level of relational governance mechanisms they use as best they can, given the mix of assets required by the alliance's goals, either under-supporting knowledge assets or inefficiently governing physical assets.

Our work also suggests an optimal sequence of alliance activities between two firms. Relational governance mechanisms effectively manage alliances rich in knowledge assets, but cannot be deployed simply at will. Rather, they depend on the existence of trust and social identification, which develop only as firms interact over time (Macaulay 1963; Uzzi 1997; Kale, Singh, and Perlmutter 2000). Contractual governance mechanisms, in contrast, rely much less on prior interactions. Thus, early alliances between two firms should involve primarily physical assets, amenable to governance via contractual mechanisms, rather than knowledge assets, which the partners are ill-equipped to govern. These early alliances allow the firms to develop trust and social identification, making relational governance mechanisms more feasible. Later alliances can build on this to incorporate increasing amounts of knowledge assets.

Our paper shares the same limitations of any single industry, single country study. While we have no reason to believe the German telecommunications industry is less generalizable than any other setting, similar studies in other industries and institutional settings would be valuable. We also see opportunities to extend the research by directly studying learning in an alliance as a function of governance mechanisms and the distribution of assets. The inclusion of knowledge assets in an alliance often indicates that learning is an explicit goal of the alliance, beyond creating value by combining the knowledge assets of each party. However, learning cannot be separated from the governance of the overall relationship. We believe this paper provides the basis for a detailed understanding of the mechanisms firms use to balance these two tasks.

Table 1: Summary statistics and correlations

	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Amount of relational governance	2.75	0.75	1.29	4.71	1.00														
(2) Amount of contractual governance	3.02	0.86	1.00	4.63	0.40*	1.00													
(3) Performance of contractual governance	3.16	0.80	1.00	4.63	0.38*	0.75*	1.00												
(4) Performance of relational governance	2.97	0.80	1.43	4.71	0.72*	0.10*	0.36*	1.00											
(5) Knowledge assets	2.84	0.90	1.00	5.00	0.43*	0.31*	0.25*	0.31*	1.00										
(6) Physical assets	2.62	0.74	1.22	5.00	0.37*	0.35*	0.30*	0.27*	0.77*	1.00									
(7) Asset specificity	2.20	0.98	1.00	5.00	0.07	0.21*	0.22*	-0.03	0.13	0.14	1.00								
(8) Fit between partners	2.83	1.14	1.00	5.00	0.17*	-0.04	-0.10	0.23*	-0.04	-0.15	-0.06	1.00							
(9) Experience with alliances	3.17	1.05	1.00	5.00	0.26*	0.27*	0.16	0.05	0.24*	0.21	0.06	-0.01	1.00						
(10) Strategic importance of alliance	3.47	0.85	1.00	5.00	0.23*	0.13	0.12*	0.05	0.33*	0.27	0.40*	0.09	0.30*	1.00					
(11) Success in last three years	4.64	0.82	2.50	6.75	0.04	0.22*	0.17	0.02	0.20	0.13	-0.15	-0.05	0.39*	0.12	1.00				
(12) Number of alliance partners	1.83	1.14	1.00	4.00	-0.02	-0.05	-0.06	0.01	0.12	0.04	-0.09	-0.04	0.37*	-0.08	0.12	1.00			
(13) Nationality of alliance partner	1.19	0.40	1.00	2.00	0.12	0.15	0.11	0.10	0.13	0.16	0.04	-0.10	-0.08	-0.00*	0.07	-0.2	1.00		
(14) Knowledge of alliance partner	3.53	1.11	1.00	5.00	0.02	0.05	0.07	0.02	0.05	0.18	0.01	0.01	0.17	-0.09	-0.04	0.11	-0.36*	1.00	
(15) Overall alliance performance	3.25	0.68	1.63	4.67	0.22*	0.18	0.24*	0.17*	0.22	0.28	0.03*	0.13	0.08	0.26*	0.19*	-0.16	-0.20	0.16*	1.00

* significant at 10%

Table 2: Governance choice and performance

	(1) Amount of contractual governance	(2) Amount of relational governance	(3) Performance of contractual governance	(4) Performance of relational governance	(5) Overall alliance performance
Knowledge assets	-0.054 (0.203)	0.199* (0.149)	-0.001 (0.292)	0.840** (0.428)	-1.718** (0.738)
Physical assets	0.281* (0.202)	-0.036 (0.226)	-0.496 (0.499)	-0.367 (0.361)	1.731** (0.919)
Amount of contractual governance		0.650** (0.378)	2.529* (1.560)	0.839** (0.502)	-0.173 (0.693)
Amount of relational governance	0.440 (0.515)		0.611** (0.323)	-2.938** (1.409)	0.044 (0.576)
Asset specificity	0.173** (0.098)	-0.111 (0.108)	-0.241 (0.293)	-0.596** (0.247)	0.024 (0.082)
Fit between partners		0.111* (0.078)		0.595** (0.271)	0.069 (0.070)
Experience with alliances	0.176* (0.126)		-0.575** (0.343)		-0.025 (0.103)
Strategic importance of alliance	-0.126 (0.121)	0.047 (0.109)			
Performance of relational governance			-1.188* (0.810)		
Performance of contractual governance				2.645** (1.390)	
Success in last three years			0.174 (0.183)	-0.086 (0.192)	0.196** (0.106)
Relational governance * Knowledge assets					0.509** (0.286)
Relational governance * Physical assets					-0.547* (0.368)
Contractual governance * Knowledge assets					0.129 (0.325)
Contractual governance * Physical assets					-0.016 (0.369)
Number of alliance partners	-0.062 (0.096)	-0.014 (0.076)	0.180 (0.157)	0.024 (0.134)	-0.185** (0.078)
Nationality of alliance partner	0.087 (0.248)	0.003 (0.240)	-0.202 (0.363)	0.170 (0.419)	-0.533** (0.216)
Knowledge of alliance partner	0.001 (0.086)	-0.038 (0.078)	0.032 (0.118)	-0.149 (0.150)	0.044 (0.075)
Constant	0.744 (0.968)	0.215 (0.808)	-0.013 (1.190)	-1.036 (1.624)	2.671 (2.009)
Observations	79	79	75	75	73

* significant at 10%; ** significant at 5%; *** significant at 1%
 one-tail tests for hypothesized variables; two-tailed tests for controls
 standard errors in parentheses

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