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CAPABILITIES, CONTRACTUAL HAZARDS, AND GOVERNANCE: INTEGRATING RESOURCE-BASED AND TRANSACTION COST PERSPECTIVES

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We address independent and joint effects of contractual hazards and technological capabilities on governance, arguing that strong technological capabilities improve a firm's ability to govern transactions, making outsourcing feasible despite certain contractual hazards. Examining a random sample of 405 service contracts from a single information technology firm, we found that contractual hazards encouraged internalizing transactions. Weak technological capabilities increased the likelihood of subcontracting, but strong technological capabilities had no independent effect. The latter had impact only in the presence of certain contractual hazards. These results illuminate why firms facing similar levels of contracting hazards organize their transactions differently.

One of the fundamental research questions in the field of strategy revolves around whether to organize activities internally (within a firm) or externally (using the market). For such governance decisions, proponents of transaction cost economics (TCE) maintain that the individual transaction is the appropriate unit of analysis and that the nature and extent of contractual hazards with which transactional exchange is imbued are the key determinants of integration (see Coase, 1937; Williamson, 1975, 1985). The prescription from TCE is that firms should internalize transactions when contractual hazards are present and favor the market when such hazards are absent.

Although contracting hazards have been shown to play a key role in governance (see Shelanski and Klein [1995] for a review), they are not the only factors that stand to influence such decisions. Firm capabilities can also play a role. However, because transaction cost economics fundamentally concerns characteristics of exchange, its logic typically holds firm capability constant. Missing from the TCE perspective is how differing firm capabilities influence governance. Although firm heterogeneity does not explicitly enter transaction costs logic, TCE scholars recognize the potential for capabilities to influence governance, and a literature exploring these effects is beginning to emerge (e.g., Argyres, 1996; Leiblein & Miller, 2003; Mayer, 2006; Nickerson & Silverman, 2003; Nickerson & Zenger, 2002; Silverman, 1999). Williamson (1999), however, called for more research into how existing firm capabilities influence governance, and much remains to be done in this area.

In this article, we help advance this work by addressing how the resource-based view can complement the standard TCE approach to governance. We draw on recent work that suggests that a firm's technological capabilities (or the lack thereof) represent an important consideration when the firm makes governance decisions (see Hoetker, 2005; Kogut & Zander, 1992; Leiblein & Miller, 2003; Martin & Salomon, 2003a, 2003b).[1] We argue that, with transaction characteristics held constant, firms will outsource transactions when technological capabilities are weak, and govern transactions Fn1

[1] We acknowledge that capabilities come in many forms and variations—technological, managerial, operational, marketing-based, etc. We focus on technological capabilities, defined as superior ability to create a good or service that meets a customer's requirements for functionality, quality, and cost and schedule (see Hoetker, 2005: 78). We focus thus for several reasons. First, technological capabilities have been shown to have a strong influence on governance (e.g., Hoetker, 2005; Leiblein & Miller, 2003). Second, technological capabilities are central to resource-based theories of firm-specific advantage (see Kogut & Zander, 1992; Mahoney & Pandian, 1992; Martin & Salomon, 2003b). Finally, technological capabilities have been shown to be particularly important in high-technology industries such as information technology, which is examined here (e.g., Mayer, 2006; Mayer & Argyres, 2004; Martin & Salomon, 2003b).

internally when technological capabilities are strong.

We then combine insights derived from the resource-based view with insights from transaction cost economics to advance hypotheses regarding joint effects of contractual hazards and technological capabilities. Although prevailing resource-based logic suggests that strong technological capabilities should lead firms to integrate, we argue, somewhat counterintuitively, that technological capabilities can actually improve a firm's ability to govern interfirm, market transactions. To the extent that technological capabilities enable firms to select capable suppliers, effectively monitor their progress, and effectively share knowledge with them, technological capabilities translate into "governance capabilities" that diminish costs imposed by contractual hazards. Further, these governance capabilities are likely to impact some hazards more than others. We hypothesize that the ability to manage and monitor suppliers will play a larger role when transactions present "hold-up" and observability hazards, but less of a role when transactions are subject to appropriability hazards.

Empirically, we tested our hypotheses using a random sample of 405 service contracts from a single firm between 1986 and 1998. The firm, a large information technology (IT) service provider, which we hereafter refer to as Compustar, provided access to the contract documents, each of which concerned a distinct project. For each project, Compustar had to decide whether to subcontract or perform the work internally. This governance choice was our dependent variable. With the help of several engineers and managers at the firm, we were able to identify several capabilities and contracting hazards that formed the basis for measures of independent variables. Overall, these data provide a very comprehensive and detailed view of the governance decisions made by a firm with varying capabilities in several technical areas. Moreover, the panel structure of the data allowed us to better isolate how our hypothesized variables, versus other sources of heterogeneity, influenced governance.

Various literatures have acknowledged the importance of contractual hazards and firm capabilities in governance decisions (e.g., Leiblein & Miller, 2003), yet to our knowledge, none has explicitly examined such effects jointly. This article then stands to make several contributions to the extant strategy literature. Our study combines insights from the resource-based view with those from transaction cost economics. It brings capabilities into TCE by suggesting that technological capabilities influence governance costs through their impact on contractual hazards. Differences in capabilities may therefore help explain why firms facing similar levels of contractual hazards might rationally select different forms of governance. This capability differential holds important implications for the identification of "mistakes" and misalignments in governance choice. Similarly, this study raises the possibility that firms develop governance capabilities that help mitigate contractual hazards and that these capabilities are a consequence of technological competence. Finally, we show that governance capabilities do not affect all contractual hazards equally. Rather, governance capabilities help firms overcome some hazards but have little effect on others.

CONTRACTUAL HAZARDS AND CAPABILITIES IN GOVERNANCE DECISIONS

Transaction Cost Economics and Governance

Transaction cost economics holds a prominent place in the field of strategic management and has offered powerful descriptive evidence, and prescriptive guidance, regarding a central strategic issue: the boundary of the firm. TCE focuses on the individual transaction as the unit of analysis and demonstrates how the attributes of a transaction influence governance decisions. In particular, TCE addresses the level of contractual hazards in transactional exchange as the key driver of integration (Williamson, 1975, 1985). The extent of such hazards is shaped by the degree of asset specificity (Williamson, 1985), appropriability (Oxley, 1997; Pisano, 1990), or observability (Holmstrom, 1979) in an exchange.

Asset specificity refers to the transferability of assets to alternative uses (Williamson, 1985). When assets are specific to a transaction, they have very little value outside of a given context. In situations that require such dedicated assets, suppliers may act opportunistically to extract excessive rents from customers. Detailed contracts or other safeguards may be used to prevent the supplier from thus "holding up" the customer; however, drafting detailed contracts and implementing safeguards can be costly. In fact, contracting costs can be so severe that the customer will prefer to internalize the transaction and perform the activity itself rather than be subject to potential ex post hold-up. Therefore, when assets are specific to transactions, firms are likely to prefer internal forms of governance.

Appropriability refers to contracting hazards that expose valuable intellectual property to expropriation (Gulati & Singh, 1998; Oxley, 1997; Pisano, 1990). When firms contract in an external market, they may exchange proprietary information and technology. Such an exchange leads to the possibility that a partner firm will expropriate valuable knowledge, denying the originating firm sole rights to a rent-generating asset. Although a firm has the option of trying to specify a detailed contract to protect against such expropriation, contracts are limited in their effectiveness at mitigating this hazard (Shapiro & Varian, 1999). Firms therefore have an incentive to internalize transactions where assets are at risk of misappropriation.

Finally, the observability of the outcomes of transactional exchange is an important exchange hazard (Holmstrom, 1979). When the quality of output is difficult to observe and measure ex post, using market-based contracts to govern transactions can be problematic because it is unclear how to gauge, and thereby reward, quality. The prospect that any discovery of poor quality will occur only well after the fact, if at all, gives contractors an incentive to shirk and cut corners on a project. Under such conditions, a firm may prefer administrative oversight so as to focus on controlling the input process rather than on metering the output (Holmstrom & Milgrom, 1991; Mayer & Nickerson, 2005).

The implication of the reviewed research is that firms should internalize transactions when hold-up, observability, and appropriability concerns are great. By corollary, firms should outsource work when contracting hazards are inconsequential to take advantage of the benefits of the market mechanism. Internalizing transactions is not costless, and the market offers benefits of flexibility and autonomous adaptation, coupled with high-powered incentives (Williamson, 1985, 1996). Although the administrative apparatus of a hierarchy is costly to set up and operate, when the contractual hazards in a transaction are great, integration offers a more effective safeguard than the market. That is, in the presence of contractual hazards, the costs of transacting internally are lower than the costs of transacting in the market.

Hypothesis 1. A firm is more likely to use internal forms of governance when a transaction is subject to contractual hazards.

Capabilities and Governance

According to the resource-based view of the firm, firm-specific capabilities are critical to a firm's success (Peteraf, 1993; Wernerfelt, 1984, 1995). Supporting this underlying theory, empirical research has shown that distinctive technological, marketing, and managerial capabilities can be value creating for firms (see Mahoney and Pandian [1992] for a review). Although the resource-based view provides insight into what types of capabilities are likely to generate value, comparatively little attention has been devoted to how capabilities impact governance. In recent years however, a literature has begun to emerge (e.g., Argyres, 1996; Foss, 1996; Kogut & Zander, 1992). This research shows that technological capabilities impact governance decisions and, as such, this work can complement the standard transaction cost approach to governance (e.g., Hoetker, 2005; Leiblein & Miller, 2003).

One of the key assumptions associated with the resource-based view is that capabilities are inherently complex, causally ambiguous, and difficult to replicate (Barney, 1986, 1991; Conner & Prahalad, 1996; Kogut & Zander, 1992). The prescription is therefore relatively straightforward for areas in which a firm has relatively weak capabilities: it is more efficient for the firm to use market forms of governance to gain access to the skills and capabilities that it lacks, because it will be very difficult, costly, and time consuming to try to develop those capabilities from scratch. Further, uncertainty surrounding the "true" value of the capabilities results in firms overpaying for these assets when trying to acquire them in the open market (Dierickx & Cool, 1989). And, even if a firm internalizes transactions through acquisition, it may be unable to assimilate the complex capabilities of the acquired organization (Kogut & Zander, 1992; Martin & Salomon, 2003a).

We expect the converse to hold for strong capabilities. That is, because internal capabilities have a public-good character, exploiting them is more efficient within, rather than across, firm boundaries (Kogut & Zander, 1992; Martin & Salomon, 2003a). Therefore, for transactions drawing upon technological capabilities in which a firm has an advantage, the firm should prefer to internalize to leverage its existing capabilities.

On the basis of this intuition, we expect firms to internalize transactions that draw upon technological capabilities in which they have an advantage. Correspondingly, firms will prefer market-based forms of governance for transactions that rely on technological capabilities in which they lack advantage.

Hypothesis 2a. A firm is more likely to use market forms of governance when a transaction draws upon a technological capability in which the firm is weak (i.e., a technological capability that the firm lacks).

Hypothesis 2b. A firm is more likely to use internal forms of governance when a transaction draws upon a technological capability in *which the firm is strong (i.e., a technological capability that the firm possesses).*

Governance Capabilities

The above two sections describe how contractual hazards and firm capabilities independently influence governance decisions. We do not intend to imply, however, that all firms respond similarly to a given level of contractual hazards, or that all contractual hazards influence governance equally for a given set of capabilities. Transaction cost theory portrays contractual hazards as the main driver of governance decisions, but it does not account for the possibility that firms develop governance capabilities that help mitigate the impact of contractual hazards (Williamson, 1999). Governance decisions therefore may not be solely driven by contractual hazards, as TCE suggests, but may also be shaped by the interactions between firm capabilities and contractual hazards. Scholars addressing the governance costs that contractual hazards impose have paid relatively little attention to firm heterogeneity (Williamson, 1999). As a result, little is known about how firm capabilities moderate the effect of contractual hazards on governance modes. We turn to this issue next.

Recent work in the field of strategy has begun to acknowledge that firms may develop capabilities in governing certain types of transactions (e.g., Dyer & Singh, 1998). Specifically, technological and production capabilities may lead to governance capabilities. Galbraith (1990), for example, asserted that not only does the creation of technological knowledge through strong R&D matter to firm growth and profitability, but also that complementary technology transfer skills are a substantial source of competitive heterogeneity. According to Cohen and Levinthal (1990), one such complementary capability, absorptive capacity, results from investments in R&D. Martin and Salomon (2003a) formalized technology transfer as a firm-specific capability. They proposed that this capability, inherent in the development and creation of technological capabilities, decreases the costs of sharing knowledge and bestows upon a firm the capability to better protect proprietary assets during technology transfer.

Building upon those ideas, we propose that just as R&D investments can play a role in the development of technology transfer capabilities, technological capabilities can play a role in the development of governance capabilities—which extend well beyond technology transfer. Although strong technological capabilities certainly lower the cost of internal production, a firm with these capabilities may also, because it understands the technologies relevant to a project, be better able to identify appropriate project suppliers and avoid low-quality subcontractors in a potential "market for lemons" (Akerlof, 1970). The firm can do so because it can better evaluate a partner's skills, judge its readiness to perform the task, assess its ability to accept and receive guidance, and provide such guidance through technology transfer when necessary. Furthermore, strong technological capabilities lower the cost of external governance by enabling more effective monitoring. The firm has a better understanding of what problems to look for when contracting and how much progress to expect from a supplier. In short, firms with technological capabilities can overcome potential information asymmetries when governing suppliers. Strong technological capabilities may even help a firm craft better ex ante contracts to clearly define the roles and responsibilities of each party, specify the knowledge to be exchanged, identify appropriate milestones, stipulate monitoring mechanisms, and introduce appropriate pecuniary incentives. For these reasons, we expect a firm with superior technological capabilities to be able to govern external market exchanges better than a firm without such capabilities.

Technological capabilities are likely to be especially valuable when a given transaction is subject to contractual hazards, as the costs associated with the external governance of high-hazard transactions decrease in technological capabilities at a rate faster than internal production and governance costs (see Hennart, 1993). For example, if a firm chooses to use a supplier for a transaction that faces contractual hazards, the firm will try to craft a contract that provides safeguards to mitigate the hazard. If the firm has strong technological capabilities in an area germane to the contract, it will be better equipped to design the contract with the right amount of detail, contingency planning, and pecuniary incentives. If the transaction were not subject to contractual hazards, we would expect the firm, regardless of its technological capability, to easily craft such a contract.

It is our contention, therefore, that the same technological capabilities that lower the costs of doing a project internally more than proportionally lower the cost of using an external supplier in high-hazard transactions. Consequently, the accumulation of technological capabilities translates into governance advantages in the form of an ability to manage contractual hazards in outsourced transactions.

Although governance capabilities derived from technological capabilities provide firms identification, monitoring, and contracting benefits, it is likely that such capabilities help overcome some contractual hazards more than others. For example, one concern with hold-up is that a firm will make an investment that is specific to a given transaction, while the contractor takes actions that devalues the initial firm's investment (Masten, 1996). Governance capabilities can help a firm deal with such situations. Capabilities in monitoring, a key component of governance capabilities, will help the firm track the progress of the contractor's investment and head off any attempts to shirk. Furthermore, knowing how to craft an effective contract will help the firm better align expectations to avoid misunderstandings, better specify milestones to facilitate monitoring, and provide pecuniary incentives to discourage opportunistic renegotiation. Finally, in the event that a contractor threatens or attempts to walk away from a project, the firm's technological capabilities may enable it to step in and complete the work.

Governance capabilities are also likely to help firms deal with hazards arising from observability. A robust understanding of an underlying technology allows a firm to verify a contractor's capabilities, and monitoring helps ensure that the contractor is making adequate progress toward project completion by dedicating appropriate resources to the task.

By contrast, appropriability concerns are less likely to be impacted by governance capabilities. It is precisely those contractors with strong technical skills—skills that a firm can identify because of its own technological capabilities—that pose the greatest risk of appropriation of proprietary knowledge. Although at first glance, skills in monitoring and drafting clearer contracts should help mitigate these concerns, some technology inevitably spills over when firms transact willingly with partners (Martin & Salomon, 2003a); and, as Shapiro and Varian (1999) pointed out, contracts are only minimally effective at preventing technology leaks.

For these reasons, we expect the governance capabilities that result from strong technological capabilities to moderate the impact of hold-up and observability hazards on governance, but not affect the impact of appropriability hazards on governance. This is not to say that governance capabilities completely overcome the hazards, but rather, that a higher level of a particular hazard will be required to lead to integration in the presence of such capabilities.

Hypothesis 3a. The relationship between contractual hazards arising from hold-up and internal governance decreases in the presence of strong capabilities.

Hypothesis 3b. The relationship between contractual hazards arising from observability and internal governance decreases in the presence of strong capabilities.

Hypothesis 3c. The relationship between contractual hazards arising from appropriability and internal governance is unaffected by the presence of strong capabilities.

DATA AND METHODS

Sample

An industry characterized by technology-intensive products, and one in which firms have the option to outsource, was appropriate for testing our hypotheses. Therefore, we elected to study the information technology services industry, which possessed several advantages for our purpose. First, the industry is characterized by numerous individual projects that firms can either outsource or complete in-house. Second, the industry is large in scale and scope, allowing us to observe a wide range of projects involving an assortment of hardware and software solutions and drawing upon varied technological capabilities. Finally, because we had access to all contracts for the IT projects performed by one firm, we could analyze individual contracts for contractual hazards. All of these features provided us with the opportunity to study—over time, and in a rich, well-documented setting—governance decisions for projects drawing on specific technological capabilities and facing varying degrees of contractual hazards. As the foundation of organizational choice, the transaction is the primary unit of analysis in transaction cost economics (Williamson, 1985, 1996). In keeping with an extensive body of theoretical and empirical research in TCE, we likewise employed the transaction as our unit of analysis (e.g., Shelanski & Klein, 1995). However, in a project-based industry such as IT, the repeated exchange of an identical good is largely absent. Rather, each project is a separate transaction. We therefore focused on the project, as a self-contained transaction, as the unit of analysis. The customization of service projects in many high-technology industries means that suppliers in these industries must make sourcing decisions—use in-house resources or use subcontractors—on the basis of their technological capabilities as suppliers and an evaluation of the attributes of each project.

Information technology projects generally involve the storage, transfer, and management of information, typically by means of mainframes, servers, or related hardware devices. In this industry, customers (e.g., *Fortune* 500 companies) contract with IT suppliers (e.g., IBM, Fujitsu, and CSC) for specific products and services. The suppliers perform a variety of projects for their customers that include, but are not limited to, designing customized software systems, updating and maintaining existing software or hardware systems, and assisting with network design and security. The work is performed using hardware such as IBM-compatible mainframes or Sun servers, operating systems such as OS/390 or Solaris, and customizable solutions such as Oracle databases. Capabilities in this industry, although certainly specific to firms, are generally developed around given technologies—tailored to particular hardware, software applications, and programming languages.

Work is predominantly performed, as noted above, on a project basis. For example, a customer may engage EDS for a mainframe maintenance project and CSC for a network security project. Projects are typically sourced separately. Once a supplier is awarded a project, the supplier must decide how to fulfill the project requirements—sometimes using internal resources, sometimes outsourcing work to subcontractors. This governance decision is particularly important because it stands to substantially affect the quality of the end product delivered to customers.

To study governance decisions in this industry, we collected data on IT service projects undertaken by one firm, Compustar. (Compustar, a producer of mainframes and related hardware since the 1970s, entered the platform-independent IT services business in the mid 1980s.[2] By 1997, Compustar's IT services division accounted for revenues of approximately $100 million.[3] Compustar provided us with access to all IT projects in their U.S. corporate contracts library. The contracts dated back to 1986 and up until mid 1998.

A typical contract was about five pages long and provided a description of the project, the services to be rendered, and the responsibilities of the parties. In addition, each project file contained information regarding the use of subcontractors and, in some cases, subcontractor invoices. Some projects were fixed-fee arrangements, and others stipulated an hourly wage (with or without a maximum number of hours to complete the task). Project duration ranged anywhere from one week to over a year, and project value ranged from around one to several hundred thousand dollars.

We randomly selected a sample of 405 of Compustar's IT contracts with U.S. customers, a figure representing approximately 25 percent of the entire population of contracts.[4] We selected the sample on the basis of the first letter of a customer's name in order to generate an unbiased, representative sample (that is, including all customers whose names began with "C," or "E," or another letter). In addition to dissecting each of the randomly drawn contracts in detail, we conducted interviews with Compustar managers and engineers, to identify the capabilities and contracting hazards involved in each project. We further supplemented these data with financial information (e.g., free cash flow) from 10Ks and other firm reports collected through Lexis-Nexis. Our final sample therefore included detailed information at both the firm level and the individual contract level for 405 of Compustar's IT service contracts over the period 1986–98.

Measures

Dependent variable. Our dependent variable captured whether Compustar governs a particular transaction internally or elects to use an external subcontractor. The dependent variable, *subcontract*, was a dummy variable coded 1 if a subcontractor was involved in a given project and 0 if the project was completed using only in-house resources. Variable coding was based on an analysis of the records in the project file.[5] When subcontracting, Compustar generally contracts out a significant portion of the work for a given project. Even if a project is performed entirely by a subcontractor, Compustar remains involved as a project manager, taking responsibility for delivery of the end product and ensuring that the customer is satisfied.

[2] "Platform-independent" means that services can be rendered on a variety of different hardware, proprietary or not. Services include programming, network support, data migration, and so forth.

[3] Revenues such as these render Compustar similar to, though slightly smaller than, its main competitors in size and scope. We therefore feel relatively confident generalizing our results to other firms in its industry.

[4] Compustar limited our access to North American accounts. Foreign clients were managed out of Compustar's various foreign subsidiaries. For this reason, we were unable to include foreign projects.

[5] Unfortunately, data limitations prevented us from using a finer-grained dependent variable. The data only indicate if a subcontractor was employed, not the percentage of the contract completed by any subcontractor or the number of subcontractors. Examining the detailed invoices and payment records that were available indicated that subcontractors were rarely only peripherally involved.

Contractual hazards. To test Hypothesis 1, we included five measures of contracting hazards that Compustar faced to attempt to capture whether hold-up, observability, and appropriability were present in a given transaction and to test their effects on Compustar's decision to subcontract or not. Through detailed interviews with engineers and managers at Compustar, we were able to identify the contracting hazards present in each project.

As a proxy for hold-up derived from asset specificity, we measured interdependencies between the client's and Compustar's resources. *Interdependence* captured the need to coordinate with the customer's personnel in a given transaction; two Compustar engineers aided in coding this variable, which was identified from the "Deliverables and Responsibilities" sections of each contract. Interdependence was coded 1 if a customer's personnel were directly involved in the project in such a way that Compustar had to depend on them to complete the task(s), and 0 otherwise. This variable captured bilateral dependence between Compustar and its client. Bilateral dependence created a specificity problem for Compustar because of the tight deadlines of these projects. Compustar was ultimately responsible for completing projects, but in cases of bilateral dependence arising from technological interdependence, the firm had to rely on the customer's personnel to perform key tasks in a specific sequence with the supplier's tasks.

We included *time specificity* as an additional measure of asset specificity. Time specificity referred to whether a contract stipulated that Compustar must complete a project by a specified date. We defined time specificity as a dichotomous variable coded 1 if such a clause existed in the contract and 0 otherwise. This treatment of temporal specificity is consistent with the empirical TCE literature (Masten, Meehan, & Snyder, 1991; Pirrong, 1993). In the presence of temporal specificity, firms are likely to internalize transactions to preserve control and ensure on-time completion (Williamson, 1996).

Transactions differ in the extent to which a customer's assets are at risk. Some transactions require the customer to subject little to risk. In such cases, there is little room for Compustar or a subcontractor to opportunistically renegotiate during the project. Other transactions, however, put the customer in a position in which the supplier's actions can devalue the customer's assets, through incompetence or opportunism. One such situation occurs when Compustar takes on a project working on central elements of a customer's data center. The data center is at the heart of the customer's operations, and interruptions in service have the greatest potential to negatively impact its operations. On such projects, actions taken by Compustar or its subcontractors could cause the customer's data center to shut down. Such events are very costly and disruptive to a client's entire business. When Compustar takes on a project at the core of the customer's data center and allows subcontractors access, mistakes can be especially costly to Compustar. Because Compustar is ultimately responsible for delivery of end products to customers, subcontractor actions could hurt Compustar as much or more than the subcontractor itself. As a result, a subcontractor could take advantage of its position to opportunistically renegotiate the terms of its contract. In that sense, then, Compustar is subject to ex post hold-up by its subcontractors in transactions involving customers' data centers.

With the help of Compustar engineers, we were able to identify projects with the potential to shut down a customer's data center. We coded the dichotomous variable *disrupt* as 1 if a project could shut down a "significant portion" of a customer's data center and as 0 otherwise.

To assess observability, we evaluated whether Compustar was able to gauge output quality. The variable *lack of observability* captured whether the technology employed in a project made it difficult to determine the quality of the output generated by the project team. Compustar engineers coded the data on the basis of whether a brief, inexpensive inspection could have determined the quality of the output. Lack of observability was coded 1 if the quality of the end product associated with a particular project was difficult to observe and 0 otherwise.

Our final contractual hazard variable, *appropriability concerns*, captured whether assets were at risk of misappropriation in a given project. Compustar engineers and managers generated a list of their proprietary technologies and coded appropriability concerns as 1 if any of these technologies or processes were to be used for a transaction and as 0 otherwise. Projects that required Compustar to use proprietary technologies subjected valuable knowledge to the risk of misappropriation by a subcontractor.

Technological capabilities. We could identify four distinct technological capabilities in the data to test Hypotheses 2a and 2b. These capabilities were identified through detailed discussions and interviews with Compustar employees and managers and were verified by engineers from other firms in the IT services industry. Two of the capabilities were in areas where Compustar had an advantage over its competitors, and two others were in areas where the firm did not have an advantage. Compustar had superior (relative to competitors) internal capabilities in working on mainframes and hardware that they manufactured. Their own hardware was primarily sold as new by their own internal marketing and sales group, although there was also a market for resale by third-party vendors. There was also an active market to provide services for these machines. These were therefore not specific assets, as other firms provided these services, but Compustar had employees with world-class capabilities in this area. *Compustar hardware* was a dummy variable coded 1 if a project involved working on Compustar-manufactured hardware and 0 otherwise. In addition to being experts in the firm's own machines, Compustar engineers were acknowledged experts at servicing mainframes from other vendors because of their experience in all aspects of mainframe technology. Compustar had been designing and manufacturing mainframes since the 1970s and had developed very strong capabilities in this area—mainframes are Compustar's primary product. The variable *mainframe* was therefore coded 1 if a contract involved working on a mainframe computer and 0 otherwise. External industry experts verified Compustar's capabilities in these areas.

The situation is very different for projects involving programming and nonmainframe hardware manufactured by other firms. Many other firms possess capabilities associated with programming and hardware, which have not historically been part of Compustar's focus.[6] Programming capabilities are highly specialized, complex, and typically technology-specific (e.g., Oracle databases, Unix, OS/390). We therefore defined programming as a dichotomous variable that took the value 1 if a project primarily involved programming tasks, 0 otherwise. As with programming, there are many firms that can service nonmainframe IT hardware, including the firms that manufactured the equipment. Compustar's capabilities in working on these machines are not superior to those of several other firms in the industry. *Other hardware* was a dummy variable coded 1 if a project involved working on hardware from another vendor and 0 otherwise.[7] Two Compustar engineers coded all four capability variables on the basis of project descriptions in the contracts.[8]

These measures of capabilities are consistent with others in the literature (e.g., Mayer & Nickerson, 2005) and with the more general experience-based measures of capabilities used in earlier studies (e.g., Leiblein & Miller, 2003). For example, Compustar had more than 20 years of experience supporting mainframes and its own hardware, but was relatively new to programming and working on hardware from other firms. Experience differences can account for the capabilities consistently identified by individuals both inside and outside Compustar.

Control variables. We controlled for several other variables with potential to influence the dependent variable. The first was the number of *previous projects* that Compustar had performed for a specific customer. Customer-specific relationships may be important in sourcing decisions. For example, Compustar personnel indicated that they liked to do the first few projects with new customers in-house because they believed that using in-house resources helped them develop closer relationship with the customers and increased the potential for future business. We therefore defined previous projects as a running count of the number of IT projects Compustar had performed for a given customer.[9]

[6] The fact that Compustar was awarded contracts for which their technological capabilities were not a good match begs the question of how Compustar won such contracts. Firms may win business even without superior technological capabilities for three reasons. First, a strong relationship with the customer may have given the firm an inside track on the project. Many firms prefer to deal with a familiar supplier they trust rather than with a firm they don't know anything about. Second, Compustar may have a reputation for quality, which makes the decision to use them easier to justify to a board of directors, especially if there is a problem. Even if a firm has not exhibited clear technological superiority in a particular domain, the customer may value its reputation enough to overlook relative inexperience in the relevant technological area. Third, Compustar may have submitted a lower bid than competitors with superior capabilities. A low price can be a powerful inducement to cost-conscious buyers.

[7] All capability (and contract hazard) variables were independent and not mutually exclusive. For example, a given project could involve working on either programming or on another firm's hardware; or both; or neither.

[8] The following coding process was used for those variables requiring expert coding: Each engineer coded the same 80 randomly selected contracts. Then the two engineers and one of the authors went through all 80 to identify discrepancies and disagreements. We found three for disrupt, three for measurement, and two for programming. After some discussion, the engineers clarified the conflicts and agreed that they were using the same criteria as they coded the remaining contracts.

[9] We acknowledge that we lacked data on prior ties between Compustar and some subcontractors; however, we are confident that such data limitations do not bias

Second, the sheer size of a project might have influenced Compustar's governance choice. Large projects were more likely to exceed the capacity of single suppliers and thus required outsourcing. However, large projects might also have been the ones that were more critical to Compustar—projects that they might have preferred to perform in-house. We controlled for either of these possibilities by including a variable labeled *project size*, measured as the total dollar value of a project's revenue, expressed as a natural logarithm.

In addition to size, we included measures of organizational slack, defined by Bourgeois as "a cushion of actual or potential resources which allow an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy, as well as to initiate changes in strategy with respect to the external environment" (1981: 30). Slack resources are those a firm has in excess, in amounts over and above those required for survival, and that allow it to pursue growth strategies (Cyert & March, 1963). One measure of slack (commonly referred to as "unabsorbed slack") is the amount of cash that a firm has available to it. A greater amount of cash implies that a firm has more than enough resources to hire personnel to perform projects in-house (see Tan & Peng, 2003). We therefore defined *free cash flow* as the natural log of Compustar's available cash (in millions of U.S. dollars) in a given year. Another measure of slack (commonly referred to as "absorbed slack") captures a firm's human resource capacity constraints (Tan & Peng, 2003). Compustar managers indicated that their busiest months, when capacity was most highly utilized, were the ends of the first three fiscal quarters (March, June, and September), because sales managers had incentives to reduce prices in order to hit sales targets at these times, and customers had the incentive to delay projects in anticipation of such discounts. Managers indicated that November was also a busy month for Compustar, because fourth-quarter demand was compressed. Customers preferred to not bring down their systems during the busy holiday season. Bearing out the managers' reports, we found that nearly 40 percent of the projects in our sample came from these four months. We therefore defined *peak months* as a dummy variable coded 1 if a project originated during one of the four peak months and 0 otherwise. The conjecture was that firms with substantial slack resources have the personnel available to perform work in-house even during peak months if they wish. Our treatment of slack is consistent with other prevailing measures (e.g., Bromiley, 1991; Reuer & Leiblein, 2000; Tan & Peng, 2003).[10] Fn10

Finally, Compustar managers suggested that subcontracting activity might have varied over time as the IT services business was developing. They indicated that Compustar initially subcontracted extensively, as demand was growing faster than Compustar's internal capacity. Subcontracting leveled off later in the sample period as capacity caught up with demand and demand for IT services began to decline slightly. We therefore included time fixed effects to control for the changing nature of subcontracting for this firm over time.

Statistical Method

Given a dichotomous dependent variable, a logit or probit model is the preferred estimation technique (Kennedy, 1998). We employed the probit model because its maximum-likelihood estimation procedure is particularly appropriate for dealing with qualitative data of the sort collected in this study (Maddala, 1983).

Although unobserved heterogeneity, endogeneity, omitted variables, and simultaneity can bias results based on panel data of the sort that we employed in this study, we took several measures to control for such possibilities. First, we included time-specific effects to control for possible correlation of errors over time. Second, we selected projects using randomization, which allows for a better approximation of experimental treatment to inherently nonexperimental data. Finally, the independent variables, with the exception of free cash flow, captured characteristics either of a project, as defined before the subcontract decision was made, or of the customer-Compustar relationship. The project-specific variables were known when subcontract decisions were made.

RESULTS

In Table 1, we present summary statistics and product correlations for all variables. Correlations were generally as expected, and moderate in magnitude. Moreover, influence tests did not show evidence of problematic multicollinearity. T1

Table 2 presents multivariate regression results. As previously mentioned, the event of interest for T2

results because prior ties likely have more of an impact on subcontractor selection than on the decision to subcontract in the first place.

[10] We thank an anonymous reviewer for suggesting capacity as a control.

TABLE 1
Descriptive Statistics and Product-Moment Correlations

Variables	Mean	s.d.	Minimum	Maximum	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Subcontract	0.25	0.44	0.00	1.00													
2. Interdependence	0.12	0.33	0.00	1.00	−.11*												
3. Time specificity	0.06	0.24	0.00	1.00	−.08	.09											
4. Appropriability concerns	0.15	0.36	0.00	1.00	−.17*	.03	−.08										
5. Disrupt	0.47	0.50	0.00	1.00	−.23*	.00	.09	−.03									
6. Lack of observability	0.44	0.59	0.00	1.00	−.27*	.19*	.08	−.14*	−.05								
7. Compustar hardware	0.23	0.42	0.00	1.00	−.05	−.10*	.10*	−.01	.31*	−.22*							
8. Mainframe	0.26	0.44	0.00	1.00	−.10*	.04	.13*	.01	.28*	.06	.35*						
9. Programming	0.46	0.50	0.00	1.00	.19*	.14*	−.07	−.06	.08	.27*	−.26*	.07					
10. Other hardware	0.09	0.29	0.00	1.00	.35*	.01	−.01	−.09	−.06	−.21*	.07	.01	.05				
11. Previous projects	4.11	7.44	0.00	41.00	−.03	−.04	−.09	.27*	−.06	−.10*	.02	−.07	−.06	−.06			
12. Project size	4.66	0.61	2.30	6.28	.21*	.04	−.05	.03	.12*	−.11*	.00	.06	.17*	.19*	.07		
13. Free cash flow	5.30	0.19	5.11	5.73	−.06	.07	.07	−.01	−.21*	.06	−.09	−.03	−.07	.01	−.21*	−.15*	
14. Peak month	0.39	0.49	0.00	1.00	.09	.03	−.08	.04	−.08	−.02	−.02	−.08	.05	.17	−.04	−.06	−.05

* $p < .05$

TABLE 2
Results of Probit Regression Analysis for Main Effects of Capabilities and Contractual Hazards[a]

Independent Variables	1	2	3	4
Constant	−16.58	−26.01	−6.20	−16.48
	(64.55)	(79.81)	(52.76)	(57.30)
Previous projects	−0.01	−0.01	−0.004	−0.001
	(0.01)	(0.01)	(0.01)	(0.01)
Project size	0.59***	0.79***	0.41***	0.58***
	(0.13)	(0.16)	(0.14)	(0.17)
Free cash flow	2.07	3.75	0.32	2.16
	(11.33)	(14.00)	(9.27)	(10.06)
Peak months	0.08	0.03	0.05	−0.01
	(0.16)	(0.18)	(0.16)	(0.19)
Interdependence		−0.62**		−0.99***
		(0.35)		(0.38)
Time specificity		−0.44		−0.04
		(0.41)		(0.42)
Appropriability concerns		−1.35***		−1.17***
		(0.29)		(0.30)
Disrupt		−1.00***		−0.97***
		(0.19)		(0.21)
Lack of observability		−0.95***		−1.21***
		(0.19)		(0.22)
Compustar hardware			−0.06	−0.23
			(0.21)	(0.25)
Mainframe			−0.33*	−0.01
			(0.20)	(0.22)
Programming			0.44***	0.90***
			(0.17)	(0.21)
Other hardware			1.33***	1.01***
			(0.27)	(0.32)
Year effects	Yes	Yes	Yes	Yes
n	405	405	405	405
Likelihood ratio (*df*)	76.93 (13)	161.34 (18)	115.03 (17)	195.52 (22)
Pseudo-R^2	0.17	0.35	0.25	0.43

[a] The dependent variable, governance choice, was coded 1 for subcontracting. A positive coefficient indicates a greater probability of subcontracting, and a negative coefficient indicates a greater likelihood of integration.

* $p < .10$
** $p < .05$
*** $p < .01$

our purposes was whether or not a firm subcontracted. Therefore, the dependent variable, subcontract, was coded 1 if a subcontractor was involved in a project and 0 if the project was completed in-house. Thus, positive coefficients indicated a greater probability of subcontracting, and negative coefficients indicated a preference for integration. We included fixed time dummies in all equations to control for trends in Compustar's use of subcontractors. Although not reported, the time dummies were significant as a set in all specifications ($p <$ .05), suggesting that Compustar was more likely to subcontract in the early to mid 1990s.

Column 1 presents results for the base sample of control variables. The base model was significantly more explanatory than a model consisting of a constant alone (likelihood ratio [LR] = 24.66, $p < .01$). Project size was positive and significantly related to subcontracting. This result suggests that Compustar lacked the internal capacity to perform large projects in house, or that the sheer scope of large projects made them more likely to include tasks in which Compustar lacked capabilities. None of the other control variables were significantly related to the subcontracting decision.[11] Fn11

Column 2 includes our measures of contractual

[11] We also ran models (results not reported here) that included project duration, although it is highly correlated with our current project size measure, and also the type of payment terms in a customer-Compustar contract (fixed fee, hourly wage, etc.). These additional controls were not significant and did not affect results.

hazards. Because the models were nested, we could directly compare their likelihood ratio statistics to determine which dominated. The LR_5 increase of 84.59 from column 1 to column 2 was significant at the .01 level, suggesting that column 2 better fitted the data. With the exception of time specificity, all hazards in column 2 were negative and significantly related to the subcontracting decision. Although directionally correct, the nonfinding for time specificity was likely a combined result of its limited variance (only 25 observations) and the relationships among other hazards. In fact, when we ran the results without the other four hazards, time specificity was negative and statistically significant. The time specificity finding notwithstanding, Compustar was more likely to subcontract when projects were subject to contractual hazards, supporting Hypothesis 1.

The results for firm capabilities appear in column 3. Again, this model fitted the data better than the base model alone (LR_4 increment = 37.78). We found support for Hypothesis 2a, as the results in column 3 indicate. In keeping with expectations, a firm that lacks capabilities relevant to a particular project is more likely to subcontract. Rather than trying to develop the capabilities from scratch, Compustar subcontracted to gain access to specific capabilities. These results held across projects that drew upon capabilities related to both programming and hardware from other vendors.

We found only weak support for Hypothesis 2b. In keeping with the resource-based view, Compustar was less likely ($p < .10$) to subcontract projects that drew upon the firm's capabilities in mainframes. However, the marginal effect for hardware they manufactured was statistically insignificant.

Column 4 shows results of our considering transaction cost and resouce-based predictions jointly to assess the robustness of the results to the inclusion of both sets of explanatory variables. Column 4 fitted the data better than all previous model (LR_4 increment = 33.39 vs. column 2; and LR_5 increment = 80.20 vs. column 3). This result implied that the TCE and resource-based perspectives could inform governance choices. The TCE variables, however, explained a greater portion of the variance.

Results on the contractual hazard independent variables remained consistent over columns 2 and 4. Likewise, the findings in columns 3 and 4 for Compustar hardware were unchanging. Interestingly, however, the marginal effect of mainframe, though directionally consistent, was not statistically different from 0 in column 4. Hypothesis 2b was not robust to the specification in column 4 and, as a result, did not receive empirical support. Such a finding could have several interpretations. First, it could simply be that because contractual hazards were more reliable predictors of decisions about firm boundaries, the inclusion of the hazard variables in model 4 caused the variable for mainframe to become insignificant. Second, if firms develop governance capabilities as a result of strong technological capabilities, they may be indifferent to the choice between subcontracting and performing a function in-house simply if strong technological capabilities are present. Rather, strong technological capabilities may interact with contractual hazards in ways that decrease the impact of those hazards on governance. Here, although the TCE variables explained a greater portion of the overall variance, the fact that the Compustar hardware results did not change over columns 3 and 4 rendered the former explanation less plausible. We explore the latter possibility below.

To test Hypotheses 3a–3c, we classified individual hazards as hold-up, observability, and appropriability. Lack of observability was our proxy for observability hazards, and appropriability concerns was our proxy for appropriability hazards. Hold-up, an amalgamation of the variables interdependence, time specificity, and disrupt, was a count variable taking values ranging from 0 to 3. We grouped these three hazards into one hold-up variable for a theoretical and a practical reason: Theoretically, all three represented hold-up hazards, and we lacked sufficient variance to test them individually with interactions.[12] Likewise, weak capabilities and strong capabilities were aggregates (varying from 0 to 2) of the number of individual capabilities that a particular project drew upon. Practically, we aggregated capabilities in this way because testing Hypotheses 3a–3c using the individual capability Fn12

[12] Given that temporal specificity hazards were present in only 25 of the 405 projects, we did not have enough variance to run interactions for this variable in isolation. However, in robustness tests that we do not present, we parsed the effects of the individual hazards comprising hold-up to the extent possible, given our data. Results remained unchanged. That is, we found a negative main effect for disrupt with a positive interaction term. Likewise, we found a negative main effect for interdependence with a positive interaction term. We also found a negative main effect for temporal specificity but, as we mentioned above, we were unable to run the interaction.

TABLE 3
Results of Probit Regression Analysis for Interaction Effects[a]

Variables	1	2	3	4
Constant	−23.24	−13.71	−24.46	−22.85
	(82.42)	(63.09)	(81.92)	(75.05)
Previous projects	−0.001	0.00	−0.001	−0.002
	(0.01)	(0.01)	(0.01)	(0.01)
Project size	0.57***	0.56***	0.57***	0.55***
	(0.17)	(0.17)	(0.17)	(0.17)
Free cash flow	3.37	1.71	3.59	3.32
	(14.46)	(11.07)	(14.37)	(13.17)
Peak months	0.02	0.03	0.01	0.03
	(0.19)	(0.19)	(0.19)	(0.19)
Hold–up	−0.82***	−1.22***	−0.81***	−0.81***
	(0.17)	(0.22)	(0.17)	(0.17)
Lack of observability	−1.16***	−1.16***	−1.24***	−1.16***
	(0.20)	(0.20)	(0.24)	(0.20)
Appropriability concerns	−1.18***	−1.27***	−1.19***	−1.00***
	(0.29)	(0.29)	(0.29)	(0.34)
Weak capabilities	0.88***	0.95***	0.89***	0.93***
	(0.17)	(0.18)	(0.17)	(0.18)
Strong capabilities	−0.09	−0.50**	−0.13	−0.05
	(0.14)	(0.20)	(0.16)	(0.14)
Hold-up × strong capabilities		0.64***		
		(0.22)		
Lack of observability × strong capabilities			0.19	
			(0.30)	
Appropriability concerns × strong capabilities				−0.51
				(0.58)
Year effects	Yes	Yes	Yes	Yes
n	405	405	405	405
Likelihood ratio (*df*)	191.33 (18)	200.20 (19)	191.71 (19)	192.28 (19)
Pseudo-R^2	0.42	0.44	0.42	0.42

[a] The dependent variable, governance choice, was coded 1 for subcontracting. A positive coefficient indicates a greater probability of subcontracting, and a negative coefficient indicates a greater likelihood of integration.
** $p < .05$
*** $p < .01$

terms would have resulted in 12 (three hazards times four capabilities) interaction terms.[13]

T3 Table 3 presents results of analyses exploring the moderating effects of capabilities on the relationship between contractual hazards and subcontracting. To ensure that our aggregated variables preserved the fidelity of the underlying relationships found in Table 2, in column 1 of Table 3 we replicated the results presented in column 4 of Table 2. The results for all three contractual hazard measures were negative and significant; the marginal effects for weak capabilities (other hardware and programming) were positive and significant; and the results for strong capabilities were nonsignificant. Findings from column 1 of Table 3 therefore mirrored those from column 4 of Table 2.

Results of our direct tests of Hypotheses 3a–3c appear in columns 2–4. Column 2 shows that the interaction of strong capabilities with hold-up had a positive and significant effect on subcontracting, providing support for Hypothesis 3a. Strong technological capabilities allowed Compustar to subcontract a project in the face of higher levels of hold-up hazards. By contrast, the interaction between observability and strong capabilities (from column 3) was not significant, failing to provide support for Hypothesis 3b. Finally, supporting expectations, the interaction between appropriability hazards and technological capabilities in column 4 was statistically insignificant—lending support to Hypothesis 3c. By contrast, a firm with weak capabilities would

[13] In results not reported, we reran all of the interactions using the individual capability terms. Results did not vary and, thus, our inferences do not change.

need to subcontract to access the capabilities that it lacked, irrespective of the level of contractual hazards present.[14]

DISCUSSION AND CONCLUSION

In this study, we attempted to gain a deeper understanding of how capabilities and contractual hazards jointly shape governance. Williamson highlighted the need to move beyond merely examining contractual hazards to take firm heterogeneity into account when studying governance decisions:

> Rather, therefore, than ask the question "What is the best generic mode (market, hybrid, firm, or bureau) to organize X?" which is the traditional transaction cost query, the question to be put instead is "How should firm A—which has pre-existing strengths *and* weaknesses (core competencies *and* disabilities)—organize X?" (1999: 1103)

Our findings support taking such a contingent view. In keeping with transaction cost logic, we found that contractual hazards provided firms an incentive to internalize, independently of firm capabilities. Faced with contractual hazards, Compustar was unequivocally more likely to internalize a project. Likewise, as the resource-based view literature suggests, weak capabilities had an effect on governance independently of contractual hazards. For projects that drew upon capabilities in which Compustar was weak, the firm was more likely to subcontract.

For strong technological capabilities, the story is more complex. Strong internal capabilities did not produce a significant independent effect on governance decisions. They did play a role, however, in the presence of contractual hazards. Compustar was more likely to subcontract in the presence of hold-up hazards when it had strong internal capabilities than when those capabilities were not present. These findings support the view that strong technological capabilities make it easier for a firm to identify, monitor, contract with, and manage contractors.

Of particular interest from these findings is that technological capabilities affected the governance decision only in the presence of hold-up hazards, not in the presence of observability or appropriability hazards. Specifically, firms with strong technological capabilities are more likely to use the market in the presence of hold-up hazards but more likely to internalize transactions in the presence of other hazards. This finding has several implications. First, they highlight the need for a fruitful integration of transaction costs and resource-based perspectives that carefully addresses how different capabilities affect different contractual hazards.[15] Scholars need to better understand what types of governance benefits are derived from different types of firm capabilities (e.g., R&D, marketing, production) and to what extent these benefits help firms overcome different types of contractual hazards.

Second, these findings also highlight the limitations of governance capabilities derived from technological capabilities. Technical skills did not enable Compustar to overcome hazards arising from observability and appropriability. It appears that when observability is an issue, knowledge of an underlying technology has only limited benefits. If quality is inherently hard to observe, even a knowledgeable engineer may be of little use in governing contractors. With regard to appropriability, the results suggest that leakage remains an issue, even when technological capabilities are present. Contractors may use projects to observe Compustar in an effort to copy their best practices—even for generic types of technical skills. Nevertheless, these results confirm that we cannot treat all hazards as equivalent in their effects on governance decisions, and our results highlight the need for additional research on the link between different types of capabilities and different contractual hazards.

Taken together, our findings highlight the contingent nature of governance decisions. Firms with stronger technological capabilities seemingly have more options—both internal and external—in dealing with contractual hazards, and firms with weaker capabilities may be unable to overcome such hazards and therefore rely on the market. Otherwise stated, strong technological capabilities increase the level of contractual hazards that a firm can effectively manage before turning to integration.

At first glance, the fact that strong technological capabilities do not directly favor integration seems

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[14] In analyses not presented here, we sought to verify the robustness of our results by checking interactions for contractual hazards in the presence of weak capabilities. In keeping with underlying theory, we found that weak capabilities did not moderate the contractual hazards–subcontracting relationship for any of the three hazard measures. Like the absence of strong capabilities, this result corroborated that a firm with weak capabilities would need to subcontract to access capabilities that it lacked, irrespective of the level of contractual hazards.

[15] We thank an anonymous reviewer for suggesting that governance capabilities may have different effects on different types of hazards.

inconsistent with prevailing resource-based view logic and contrary to its foundational assumptions with regard to the boundary of the firm. On closer inspection, however, it is not. If technological capabilities lead to firm-specific governance capabilities, then governance capabilities (a potentially valuable, rare, inimitable, and nonsubstitutable firm-specific capability) may be central to governance decisions. Resource-based arguments, at their root, are agnostic to the mechanism through which capabilities operate to influence governance mode. Therefore, the fact that they impact governance through moderating the impact of contractual hazards is not inconsistent with the underlying theory. More research is certainly necessary to unpack the specific mechanisms by which technological capabilities result in governance capabilities and how governance capabilities interact with different types of contractual hazards to influence firm boundaries; however, this study provides a first step in that direction.

This is not to say, however, that the idea of governance capabilities is entirely novel in the literature. For example, Dyer and Singh (1998) introduced the concept of interorganizational advantage and the closely related concept of alliance capability (e.g., Kale, Dyer, & Singh, 2002). Our results provide some support for such a construct and offer a broader conceptualization. As more economic activity takes place through alliances and outsourcing, managing interorganizational relationships becomes increasingly important. Our study highlights how the management of interorganizational relationships may improve with a firm's technological capabilities, which help firms better manage hold-up hazards in outsourcing relationships. Further, our research raises the possibility that governance capabilities may be a more general capability that can be leveraged across all sorts of interorganizational relationships (alliances, joint ventures, etc.).

The governance of individual projects and alliances has received increased attention in the literature in recent years. For example, Sampson (2004) examined governance choice in R&D alliances, and Mayer (2006) and Mayer and Nickerson (2005) explored project-level determinants of governance and performance, respectively. Reuer and Ariño (2002) examined contract renegotiation in alliances from a TCE perspective. Finally, Mayer and Argyres (2004) examined the role of learning to contract at the project level. None of the studies in this vein, however, has examined the interaction of transaction cost and capability-based factors in explaining governance choice.

By accounting for heterogeneity in the form of variance in capabilities, results from this project-level study help enrich traditional TCE literature. Williamson (1985, 1996) argued that contractual hazards were a primary driver of governance decisions; however, left unexplained was why two firms facing transactions with identical levels of contracting hazards would select different governance structures. Scholars have generally attributed such variance to misalignments or "mistakes" in organizational choice (Sampson, 2004; Silverman, Nickerson, & Freeman, 1997), or to historical factors such as links among governance decisions (Argyres & Liebeskind, 1999). Our findings suggest that the answer may have more to do with differences in capabilities than with historical legacy or "mistakes" owing to bounded rationality.

Our findings appear to bridge theories in the strategy literature regarding the links among contractual hazards, capabilities, and governance. However, more thorough methods and follow-on questions may tease out further insights. For example, although we did not explicitly test the performance implications of Compustar's governance decisions, we expect these decisions to have impacted performance (see Williamson, 1985). Future research could examine how capabilities and contractual hazards jointly determine the ex post performance of governance decisions. Further, to the extent that we have uncovered a general governance capability, future studies could examine how such capabilities develop. For example, how do technological capabilities exactly translate into governance capabilities, and are there other means by which firms can develop such capabilities? Taken to its extreme, the general governance capability could translate into a firm that "produces" only governance—a "virtual" organization dedicated to managing interorganizational relationships rather than physical assets. Similarly, what role does organizational culture play in the development of governance capabilities? A culture that is heavily inward-focused could lead to an arrogance that stunts the development of such capabilities.

At this point, we draw several caveats. First, this study relies on microanalytic data from a single firm. Although this data limitation could raise some concerns regarding the generalizability of the findings, it allows us to offer insights that are not available from larger intra- or interindustry studies. We recognize that there is a trade-off between depth and breadth in studies of this sort. Although breadth is generally perceived as offering the advantages of being generalizable to a host of different settings, rich insights can be gleaned from disaggregated data of the sort used in this study.

Second, we recognize that our measures of firm capabilities are inherently subjective. Although we verified these capabilities with independent third parties, we ultimately relied on managers at Compustar to identify capabilities in which they had an advantage. To the extent that the managers and third parties over- or underidentified Compustar's technological capabilities, some bias may inhere in the results.

Third, in this paper we focused on a specific governance capability arising from technological capabilities. We acknowledge that firms likely develop a range of governance capabilities, not all of which are associated with technological capabilities. Although other governance capabilities are outside the scope of this paper, they represent a productive avenue for future research.

Finally, we draw one caveat with regard to the implications of our results. Our results do not imply that firms should outsource all activities. The main effects of the hazard measures clearly show that firms are more likely to internalize in the presence of these hazards. Moreover, although technological capabilities can help mitigate the impact of hold-up hazards, they do not help with appropriability or observability hazards: firms are more likely to internalize in the presence of those hazards, even with strong technological capabilities. Nevertheless, main effects here do show that firms are more likely to outsource in the presence of weak capabilities. This finding raises an interesting question: At what point do strong hazards or weak capabilities dominate when they are present in the same transaction? Although we could calculate marginal effects to get some idea of the economic magnitude of this trade-off, we could not meaningfully inform such a decision without more precise
Fn16 measures of the hazard and capability variables.[16] With finer-grained, continuous measures, we might be able to better determine the nuances of how variations in the strength of a particular capability or hazard affect organizational form. This is an important area for future research.

The aforementioned limitations notwithstanding, our findings have valuable implications for both research and practice. Admittedly, we have taken only a first pass at what is surely a much more complicated phenomenon. We hope others will follow in exploring the interplay among firm heterogeneity, contractual hazards, and governance. Given the findings, further conceptual and empirical research in this area seems well warranted.

[16] Calculating economic significance is further complicated by our econometric specification. Estimating marginal effects with interaction terms is especially challenging in probit and logit models because of the underlying nonlinearity of the pdf function (Ai & Norton, 2003; Norton, Wang, & Ai, 2004).

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