Antecedents and Performance Implications of Contracting for Knowledge Workers: Evidence from Information Technology Services

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Abstract

This paper develops a theory that predicts why firms organize their knowledge workers as employees vs. independent contractors and predicts the performance implications of this choice. It then empirically examines this organizational choice, which our theory predicts will be driven by contracting difficulties arising from expropriation concerns, measurement costs, and interdependence, and its implications for profitability for 190 information technology service projects. Using a two-stage switching regression model, our analysis shows that projects aligned according to our theory are on average more profitable than misaligned projects and that firm capability impacts organizational choice but not profitability.

Key Words: Knowledge Workers, Employment Relation, Performance, and Information Technology

The use of non-standard employment arrangements such as independent contractors, job sharing, part-time workers, temporary workers, and other flexible staffing arrangements have been increasing over the past two decades (e.g., Kalleberg, 2000). Of particular importance has been the trend toward the use of independent contractors to perform tasks previously assigned to employees (Lepak & Snell, 1999). Independent contractors are frequently used in construction, (Eccles 1981), entertainment (Baker & Faulkner, 1991), defense, IT services, and other industries in which activities are performed in discrete projects that involve forming a team for a task and disbanding the project team when the task is complete. Understanding the use of independent contractors is important because not only is their rising use in these industries, but also they are increasingly being used for technical and complex tasks (e.g., Slaughter & Ang, 1996).

In this paper, we examine the project (or task) level factors that influence the use of independent contractors and the performance consequences of this choice, an issue that has received little theoretical or empirical attention. The choice of whether to use independent contractors or employees can be viewed as a governance decision. While transaction cost theory (Williamson 1985, 1991) has frequently been employed to analyze governance decisions regarding firm boundaries, specific investments in physical assets, the typical concern of transaction cost scholars, are largely absent in many high technology and project-based industries. Thus, following Gulati and Singh (1998), we examine the impact of appropriability concerns and the degree of interdependence among workers, and show that both types of contracting difficulties lead to a preference for employees over independent contractors. In addition, we draw upon agency theory (Holmstrom, 1979) to argue that increases in the cost of verifying project quality also lead to the choice of employees over independent contractors. Thus, we predict that projects involving any of these three contracting difficulties are more likely to be organized internally, while those that are not are more likely to be assigned to independent contractors.

While researchers have examined the determinants of variation in governance theoretically (e.g., Williamson, 1985, 1991) and empirically (e.g., Anderson 1985; Gulati & Singh 1998) in a variety of contexts, much less attention has been paid to the performance implications of governance choice (for exceptions, see Masten, Meehan & Snyder 1991; Walker & Poppo 1991; Silverman, Nickerson &

Freeman 1997; Poppo & Zenger 2002). Hence, we develop a theory that predicts how governance choice for a project impacts its profitability. We argue that projects organized as we predict realize performance benefits relative to projects that are not.

We use a unique data set from the information technology (IT) services industry to empirically examine the choice and performance implications of using employees versus contractors at the project level. Our data consist of 190 projects of a large IT services firm (hereafter fictitiously known as Compustar) in Silicon Valley, and includes a variety of transaction attributes, measures of Compustar's relative capabilities, choice of employment relation, and profitability for each project. This field survey is conducted within a particular organizational context, which allows us to control for a number of firm level variables and capture detailed data on individual projects, but does raise concerns of generalizability that we address in the discussion.

Our empirical analysis provides strong support that the choice of employees vs. independent contractors indeed is related to contracting difficulties. Coefficients for all three contracting difficulties are statistically significant. We also find statistically significant results for our predictions with respect to profitability. Projects that use independent contractors despite the presence of contracting difficulties arising from expropriation concerns and measurement costs experience lower performance than projects that use employees. Conversely, using independent contractors leads to higher profitability than using employees when projects are not subject to these contracting difficulties. Such misalignment leads to lower profitability, with the magnitude of the effect depending on type of contractual difficulty and type of misalignment. We find no profitability effect with respect to interdependency. However, this result is due to the fact that the presence of task interdependence nearly perfectly predicts the use of employees, which makes econometric identification of its effect on profitability impossible in this context.

This paper makes four contributions to the fields of organization theory and strategy. First, we provide the first direct empirical evaluation of the profitability of using independent contractors versus employees for a variety of knowledge-intensive tasks. Independent contractors generally provide superior performance, except in the presence of contracting difficulties arising from expropriation, measurement cost, and interdependence.

Our second contribution is methodological. We show that studies of profitability at the project level that merely regress a variety of dependent variables on performance will miss the impact of contractual difficulties on performance because firms make organizational choices in order to maximize profitability. This "self-selection" of governance choice must be accounted for by the econometric model or the resulting coefficient estimates are biased and uninformative (Hamilton & Nickerson, 2003). By estimating a switching regression model that accounts for endogeneity between choice of organizing mode and performance, we overcome this self-selection problem.

Third, we undertake the first direct test of Williamson's transaction cost alignment-profitability hypothesis with the transaction as the unit of analysis. Although Boerner and Macher (2001) have identified more than 600 empirical papers examining transaction cost predictions, no prior study directly links alignment to profitability at the transaction level. Some critics of transaction cost theory (e.g., Gulati, 1999; Winter, 1990) argue that the lack of research on this alignment-profitability relationship is a severe shortcoming of the transaction cost literature, which limits the theory's usefulness. Our results show for the first time at the transaction level that transaction cost theory does have important profitability implications, but the results also indicate that more theoretical development is necessary to fully develop the performance implications of transaction cost theory.

Fourth, we show that the *type* of misalignment matters. Extant theory on the performance implications of organizational choice does not address this issue. We find that with Compustar, outsourcing when transaction cost theory argues for the use of employees is more costly than insourcing when transaction cost theory argues for independent contractors. Hence, using independent contractors for projects involving contracting difficulties is more costly to the firm than using employees in the absence of such difficulties.

The following section discusses prior work on independent contractors and we then move on to develop our hypotheses on organizational choice and performance in high technology industries. We then describe our data, statistical methods, and variables, which are followed by the results, discussion and conclusion.

BACKGROUND

Previous studies of independent contractors examine how the use of temporary workers may benefit employees by increasing their job security and mobility and/or serving as a buffer when revenues decline (Barnett & Miner, 1992), how the use of temporary workers varies by firm and industry level factors (Mangum, Mayall, & Nelson, 1985), and how the use of temporary workers provides flexibility (Kalleberg, 2000) especially in rapidly changing technological environments (Carnoy, Castells, & Benner, 1997). Other studies show that the use of temporary workers provides cost savings (Houseman, 2001) and avoids legal obligations related to full-time employment and unionization (Kochan, Smith, Wells, & Rebitzer, 1994). Davis-Blake and Uzzi (1993) develop task-level predictions about bureaucratization and complexity and the use of contract workers, but they offer no empirical analysis of independent contractors at the project level.

On a more strategic note, firms use employees for core functions that are key elements of their competitive advantage and use contractors for peripheral areas (Deavers, 1997; Slaughter & Ang, 1996). Relatedly, Lepak and Snell (1999) focus on the value and uniqueness of the human capital in explaining the use of contractors versus employees. A study by Masters and Miles (2002) is one of the few to analyze contingent workers from a transaction cost perspective while also considering the impact on sustainable competitive advantage, but they also use the job (e.g., managing a firm's foreign operations) as the unit of analysis. In sum, these studies attest to the increasing use of independent contractors but due little to inform the drivers of project-level decisions since they focus on the job rather than the project as the unit of analysis

We also know little about the performance implications of this choice. Strategy researchers have examined the influence of many factors on performance, including a variety of social factors (e.g., Westphal, 1999), the presence of experience and intangible assets (Delios & Beamish, 2001), and many others. Previous studies examine the link between the use of contractors and innovation (Matusik & Hill, 1998; Storey et al., 2002), and between employment status and job outcomes such as commitment or satisfaction (Feldman, 1990; Pearce, 1993). Nonetheless, only one study (Jarmon, Paulson, & Rabne, 1998) examines the performance implications of using contractors versus employees. It finds that the

performance of both types of employment relation is roughly equivalent; however, performance is based on an aggregate measure of perceived performance using survey responses about an individual's effort, attendance, and other subjectively measured variables. Performance was not measured for specific tasks or in specific situations and the study did not account for the endogeneity concern that the choice between employees and contractors is made to maximize performance—an issue that we discuss in more detail in our empirical section. To date, no study links an analysis of costs and benefits, such as profitability, with the choice between staffing a task with independent contractors versus employees.

THEORY AND HYPOTHESES

The project is the foundation of organizational choice in many high technology industries. In keeping with an extensive body of theoretical (Williamson, 1985, 1991) and empirical (Boerner & Macher, 2001; Shelanski & Klein, 1995) research on organizational governance, we employ the transaction, which in our context is the project, as the unit of analysis. However, in project-based high technology service industries, the repeated exchange of the identical good is largely absent. Thus, each project is a separate transaction. These projects are typically self-contained (though often sizable) tasks. The customized nature of such service projects in many high technology industries means that suppliers in these industries must make a sourcing decision (i.e., utilize in-house resources or an independent contractor) based on an evaluation of the attributes of each project. Customized projects are important in many high technology industries (e.g., software, information technology, semiconductors and telecommunications) and also in many industries not often considered high technology (e.g., construction, machine shops, film and television production).

When a supplier undertakes an obligation to a customer, the supplier has the option of engaging an independent contractor to perform all or part of the firm's responsibilities. Using contractors is often desirable because of possible gaps in the firm's internal skill base, a lack of available internal resources, and advantageous governance properties such as strong incentives to perform. Contractors have strong incentives because they must perform well in order to induce the firm for whom they are working to utilize them in the future. Yet, firms are limited in their ability to exert direct control over contractors,

especially since work in many high technology industries takes place at the customer's site, which makes monitoring difficult. In contrast, managers can direct employees to follow procedures, socialize them into the culture of the firm and verify their training by consulting company records. Contractors are outside the direct control of the firm, except for the specific rights delineated in the contract between the firm and the contractor.

There is also an important difference between independent contractors and employees in terms of adaptation and allocating future tasks (Penrose, 1959: 146-7). Since firms have less administrative control over contractors, implementing coordinated changes to a project may be more difficult when contractors are involved (Barnard, 1938). If unscheduled changes arise, a firm can direct employees to accommodate the change, whereas the firm must incur the cost of renegotiating its contract with contractors, which can make changes time consuming and costly.

Contracting difficulties influence the desirability of using independent contractors. Unlike more traditional manufacturing industries for which physical asset specificity is a primary source of contracting difficulty, we draw upon prior research and posit that the main contractual problems in high technology industries are related to expropriation, measurement cost, and interdependence.

Expropriation. Expropriation concerns (Gulati & Singh, 1998; Oxley, 1997; Pisano, 1990) create contracting difficulties because valuable intellectual property may be expropriated by another party without appropriate safeguards. While others have referred to this issue as appropriability concerns, we employ the term "expropriation" to focus on the potential for losing sole rights to a rent-generating asset. Many high technology industries contain a variety of valuable and proprietary technologies for which patents and trade secret law offer imperfect protection (Shapiro & Varian, 1999). Since a supplier's proprietary technology must be transferred to those engaged in providing the service to customers, whether employees or independent contractors, those individuals with the technological knowledge may have an opportunity to expropriate the technology and re-use it without the IT supplier's approval or knowledge. Such technological leakage imposes substantial opportunity costs on the supplier, which encourages the supplier to take steps to prevent expropriation.

We argue that the risks of expropriation differ with the choice of employment relation. While employees could expropriate technology, independent contractors pose a relatively greater threat to the firm. First, employees should be less inclined to expropriate proprietary technology than contractors. Employees have a stronger identity with or allegiance to the firm due to having a higher level of socialization (Chatman, 1991) that should decrease their willingness to engage in activities that hurt the firm. In addition to socialization, the bureaucracy within firms, including establishing standardized processes and routines, helps make it easier to control employees (Bills, 1987). Such bureaucracy is not likely to help control independent contractors. While firms can monitor contractors and often stay involved in project management, there may be limits on how effectively an IT supplier can ensure that it can keep the contractor from expropriating any of the firm's proprietary technology that the contractor is exposed to during the project. Firms can enforce a variety of rules and compensation schemes (e.g., vesting of rights in profit sharing or options) that are not available to independent contractors (Liebeskind, 1997) to prevent the loss of proprietary technology to employees. In addition, firms have internal labor markets (Baron, Davis-Blake & Bielby, 1986), which can be used to select workers who will follow the firm's rules (Cohen & Pfeffer, 1986) and provide opportunities for employees (DiPrete, 1987). Independent contractors do not participate in these internal labor markets.

A related factor is that, in contrast to independent contractors, employees have a fiduciary duty to their employers and often sign employment contracts that place restrictions on their activities after leaving the firm (Masten, 1993). While such contracts may be difficult to enforce, defending employer-filed lawsuits represents additional costs and uncertainty for employees who might be tempted to expropriate proprietary technology.

A final factor is that independent contractors typically can re-deploy expropriated technology at low cost because they usually have a critical complementary asset—an existing network of customers to whom they could attempt to sell the technology. Employees would have to locate customers and determine how to re-deploy the technology. Realizing this contracting difficulty, the IT supplier has an incentive to engage in costly monitoring and limit access to only those pieces of proprietary knowledge necessary for providing the service when using an independent contractor. Employees, in contrast, do not

possess an existing network of customers and face higher uncertainty and greater costs in finding customers for the technology, which attenuates their incentive to expropriate compared to independent contractors.

Although the administrative apparatus of a hierarchy is costly to set-up and operate, we argue that integration offers a more effective safeguard than that available through independent contractors when the opportunity cost of expropriation is great; otherwise, outsourcing is less expensive than integration because it substantially avoids such administrative costs. Therefore we hypothesize:

H1: Insourcing of workers supplants the outsourcing of workers as expropriation concerns about a firm's proprietary technology increases.

Measurement Costs. Measurement costs create a moral hazard by generating noise in the relationship between effort and outcome (Alchian & Demsetz, 1972; Eisenhartd, 19985; Holmstrom, 1979). If any key dimension of the output of the task is difficult to measure, an incentive (or outcome)-based contract is problematic and the principal may prefer to couple weaker pecuniary incentives with administrative oversight (i.e., focus on controlling the input process rather than output) (Holmstrom & Milgrom, 1991; Ouchi, 1979).

Projects vary in the cost of determining its quality after completion (Jones, 1987). Observation or a simple diagnostic test can easily assess the quality of some projects. Other projects, however, involve output that is much more difficult to examine and thus its quality is much more costly and difficult to verify. For example, assessing the quality of upgrading a network; designing a complex, integrated software application; or designing networks or applications to accommodate future expansion is difficult. The complexity of these projects makes it costly to fully verify system functionality or to verify that the system is designed to minimize the cost of future upgrades. For instance, programmers can take short cuts to minimize the cost of a current project but, by doing so, increase the cost of future upgrades. The architecture created by the programmer, much like the foundation of a house, can be built to readily accept expansion or to just support the current requirements. An unscrupulous developer could use inferior grade concrete or pour the foundation too thin—both of these problems would typically not be immediately visible upon a latter stage inspection. Likewise with a software program, the programmer

can either build a full foundation to accept upgrades and some level of disruption, or he can implement a less developed architecture that will have to be modified later to accept upgrades and/or additional traffic.

Quality issues are important because firms have an incentive to maintain their reputation with customers in order to enjoy the prospects of repeat business. This prospect creates a desire to supply quality output. As with the risk of losing proprietary technology, the likelihood of shirking differs by employment relation, which can influence internal organization and the use of contractors versus employees (Jones, 1987). In addition to the cost and benefits of employees and independent contractors described above, we highlight here that insourcing provides the firm with the opportunity to punish any employees whose work is found to be substandard, even if that discovery is made well after the fact. When a project requires the firm to provide a good or service whose quality is difficult to measure, there is an incentive for the contractor to shirk and cut corners on the project. A contractor is more difficult to manage in such situations. If a fixed fee contract is used, that compensates the contractor with a predetermined fee in exchange for their services, the contractor will have incentives to get the job done as quickly and inexpensively as possible so as to increase their profit margin. Thus the firm will need to monitor the contractor carefully to ensure that quality is high. If the contractor is compensated with a cost-plus or hourly wage contract, then the incentive to shirk is weakened, but problems remain. A contractor being compensated with an hourly wage has little incentive to work quickly and efficiently, thus requiring the firm to monitor to ensure that the job is being completed in a timely manner.

A market relationship is predicated on pay for performance. When performance is hard to measure, a market relationship becomes more problematic and the likelihood of internalizing the activity increases (Anderson, 1985; Anderson & Schmittlein, 1984; Barzel, 1982; Mahoney, 1992). Employees are less likely to shirk than independent contractors for reasons unrelated to incentives. Firms actively recruit employees who fit the organization and are more likely to follow the organization's rules and norms (Cohen & Pfeffer, 1986) and socialize employees into the firm's norms and culture (Chatman, 1991). In addition, there is a threat of diminished promotion possibilities or even termination should shirking eventually be discovered (Williamson, 1991). Firms in many high technology industries, including the firm that is the subject of our empirical analysis, have fired employees as a result of low

quality work, which makes the threat of dismissal credible. Firms have more control over the processes and procedures followed by employees and thus can have much greater control over the process by which the work is done. The logic behind using standardized processes is that such processes are reliable and are designed to produce quality output, which lessens the need to verify quality after the work has been completed. Thus employees are subject to greater administrative controls.

Weaker pecuniary incentives facilitate employee effort being guided by administrative controls that include documented processes and procedures to ensure high-quality design, documentation, and implementation; verification of training; socialization into the design standards of the firm; and self-regulation by peers and managers. Thus, insourcing, while costly because of these bureaucratic processes, reduces the likelihood of shirking and the attendant need for verification. We therefore hypothesize:

H2: Insourcing of workers supplants the outsourcing of workers as the cost to verify project quality increases.

Interdependence. While interdependence influences the formation of ties between firms (Pfeffer & Nowak, 1976; Gulati, 1995b), it also influences organizational form (Gulati & Singh, 1998). Interdependencies within or among projects give rise to a third type of contracting difficulty because they lead to bilateral dependency among firms involved with the project. Customers, for a variety of reasons, may segment one large project into a set of subprojects and contract with different suppliers for each module (or assign some modules to suppliers and others to their own employees). Such segmentation may arise because the size of the project requires more resources than the firm or any particular supplier currently has available or because the project requires a greater variety of skills than any single firm possesses.

Although segmentation offers the buyer access to world-class capabilities in a variety of technological areas, it creates a bilateral dependency problem for the various suppliers because such projects often involve leading edge technology, for which standard interfaces have not been developed, and their interaction involves much uncertainty. Such a condition is consistent with Thompson's (1967) concept of reciprocal interdependence and with Gulati and Singh, who state that "the primary concerns

from interdependence are the administrative challenges of coordinating tasks between partners" (1998: 785). Technological diversity and uncertainty make it costly, if not impossible, to fully specify system functionality and module interfaces in a contract. Such interdependencies thus increase the degree to which contracts are incomplete as well as the need for adjustments among suppliers as they reduce the uncertainty of how diverse technologies can work together to achieve the desired functionality over the duration of the project.

Unfortunately, interdependencies also make verification of the effort to mutually adjust difficult since the performance of one module depends on another, which creates an incentive to strategically shift costs from one supplier to another. For instance, if there is more than one way to adapt to an unexpected interface problem, which is almost always the case, then the groups in charge of the affected modules are likely to prefer solutions that require others to make the necessary changes to accommodate the innovation. Insourcing is an effective response to the type of coordination problem that arises from interdependence for a variety of reasons, including creating a shared vision and motivating employees to work together (Barnard, 1938; Thompson, 1967; Blau, 1972). Outsourcing poses problems when confronted with this type of coordination problem because of the lack of structure and systems compared to that which exists within the firm (Litwak & Hylton, 1962).

Interdependencies give an independent contractor the opportunity and incentive to strategically shift costs to the customer or another supplier. Relational governance might diminish this incentive to shift costs if the contractor expects to work with the firm again in the future. Given that in knowledge-intensive industries, firms may not know how often the will need the specialized skills of a particular contractor, relational governance can not fully eliminate the incentive to shift costs. Such cost shifting increases conflict among suppliers and the customer, which leads to higher costs. Employees, on the other hand, have incentives more aligned with their employer to continue the employer's relationship with its customers, many of which arise from the socialization of employees and organizational culture (Chatman, 1991). We therefore hypothesize:

H3: Insourcing of workers supplants outsourcing of workers as the degree of interdependence between personnel from the supplier and personnel from another supplier or the customer increases.

Performance. The first three hypotheses predict that firms will internalize those projects subject to high levels of contracting difficulties because outsourcing becomes problematic in such situations. Each of the three contracting difficulties outlined above either generates additional costs or increases the likelihood of sub-optimal project outcomes when outsourcing is chosen. The direct implication is that profits generated by a project will be lower when *any* of the three contracting difficulties is present *and* the project is outsourced. Therefore, when proprietary technologies are involved, using independent contractors is likely to result in additional costs from training and from safeguarding the technology against expropriation. Measurement difficulty is likely to result in greater monitoring costs in order to verify quality and prevent project disruptions when independent contractors are employed. Interdependencies are likely to lead to cost shifting, a loss in reputational capital, and higher dispute resolution costs when using independent contractors. In each of the three cases when contracting difficulties are present, using employees is likely to lead to greater profits than using independent contractors. These predictions are consistent with Sampson's (2004) study of governance choice in R&D alliances, however she examined the performance implications of choosing between two types of alliances rather than between employees and independent contractors. In sum, employees are less expensive and/or likely to lead to better project outcomes when contracting difficulties are present. We therefore hypothesize:

H4a: When a project poses high expropriation concerns, insourcing will result in higher performance (i.e., greater profitability) than outsourcing.
H5a: When the cost of verifying project quality is high, insourcing will result in higher performance (i.e., greater profitability) than outsourcing.
H6a: When a project involves high levels of interdependence between the supplier and either another supplier or the customer, insourcing will result in higher performance (i.e., greater profitability) than outsourcing.

Our first three hypotheses also indicate that firms will outsource those projects subject to low levels of contracting difficulties because insourcing becomes problematic in such situations. In the case of expropriation, initial and ongoing investments in socialization, bureaucracy, and internal labor markets make expropriation by workers less likely than by independent contractors. These costs of

internalization, however, are incurred whether an individual project faces expropriation concerns or not. Managers cannot enact socialization, bureaucracy, and internal labor markets—all of which are costly to introduce and maintain—for employees engaged in some projects and not others because doing so would incite equity, distributed justice, and procedural justice concerns that could greatly increase the cost of hierarchy (Nickerson & Zenger 2003a). Thus, the cost of hierarchy remains high for all projects while the benefits derived from it are limited in the absence of expropriation concerns. Moreover, when no proprietary knowledge is needed for a project, the IT supplier need not engage in costly monitoring to limit access to proprietary knowledge. Hence, the cost for independent contractors declines when expropriation concerns are not present. In combination, these arguments suggest that the net benefit derived from outsourcing is likely to increase in relation to the net benefit derived from in sourcing as expropriation concerns diminish.

H4b: When a project does not pose expropriation concerns, outsourcing will result in higher performance (i.e., greater profitability) than insourcing.

A similar argument is made concerning measurement costs. When the quality of a completed project is easy to measure then creating an incentive/outcome-based contract that provides strong pecuniary incentives for a contractor is straightforward and relatively low-cost. Agency theory argues that such a contract is the optimal form of organization in this instance. In contrast, hierarchy, which we argue above offers cost performance advantages when measurement is costly, utilizes weaker pecuniary incentives coupled with administrative oversight and socialization. These features of hierarchy and the absence of measurement difficulties lead to high costs and weaker pecuniary incentives in comparison to an incentive/outcome-based contract because employees have less of an incentive to work hard and administrative oversight is costly. While socialization and monitoring will provide incentives for employees, these are argued to be weaker than the incentives facing a contractor, who needs to complete an easily measurable task in order to be paid and/or used again in the future. Hence, outsourcing is likely to be less expensive that insourcing when the quality of a completed project can be measured with little cost.

H5b: When the cost of verifying project quality is low, outsourcing will result in higher performance (i.e., greater profitability) than insourcing.

When a project does not involve interdependencies, independent contractors no longer have either the opportunity or the incentive to strategically shift costs to the customer or another supplier, the major disadvantage of and cost increase—compared to employees—from independent contractors when interdependencies are present. The initial and ongoing investments in socialization create little additional value when interdependencies are absent. Moreover, Nickerson and Zenger (2003b) argue that based on a problem-solving perspective, outsourcing is more likely to be lower cost than in sourcing when problems being solved are independent and not complex because contractors face strong pecuniary incentives to complete the task. These arguments suggest that insourcing is more expensive than outsourcing when interdependencies are absent.

H6b: When a project does not involve interdependence between the supplier and either another supplier or the customer, outsourcing will likely result in higher performance (i.e., greater profitability) than insourcing.

EMPIRICAL ANALYSIS

We empirically examined our hypotheses derived above with data from Compustar, a provider of a variety of information technology (IT) services and computer-related hardware. The IT industry is ideal to test our hypotheses as it relies on rapidly changing technology and is a very large industry that is important to customers in virtually all sectors of the world economy. The IT industry involves the storage, transfer, and management of information, typically using mainframes, servers or related devices. There are three tiers to this industry: customers (e.g., Fortune 500 firms), primary IT suppliers (e.g., IBM, Fujitsu, CSC), and smaller contractors. The suppliers perform a variety of IT 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 technological areas included in this industry are many and include, but are not limited to, areas such as IBM-compatible mainframes, OS/390 programming, Sun systems, databases (e.g., Oracle, Informix), customized software support, and development in a variety of languages. Capabilities in this industry are technology-specific, but not firm-specific, which means that subcontracting options are always available.

While suppliers do learn how to work with specific customers over time (Mayer & Argyres, 2004) and this may represent some level of co-specialized investment, no project relies on capabilities that are only available from one firm.

Work is predominantly performed on a project basis. Customers will identify an IT project and then secure resources to complete it. Each project is sourced separately. A customer may engage IBM for one project and CSC for another project, and these suppliers must decide how to fulfill the project requirements. The sourcing decision is particularly important because the members of the project team will typically interact directly with the customer as the work is typically performed at the customer's site. In many cases, independent contractors are utilized to fulfill projects for customers. In the IT services industry, contractors are often smaller firms with specialized skills in relatively narrow areas. In many cases contractors will work exclusively with large IT service providers, while other contractors will work with IT service providers on some projects and directly with end customers on others.

Compustar, a producer of mainframes and related hardware since the 1970s, entered the platform-independent IT services business in the mid-1980s, and by 1997, Compustar's IT services division accounted for revenues of approximately $100 million worldwide. This growth was accomplished through the development of an internal delivery force (employees) and the use of a variety of independent contractors. Compustar facilitated our research by providing access to IT service contracts and corresponding internal documentation in their corporate contracts library and we inspected contracts with North American customers that span 1994 - 1998. Each contract describes the project in detail, including the type of service required and the responsibilities of the parties. In addition to the quantitative data provided by the contract and corresponding internal documentation, we interviewed Compustar managers and other personnel involved in IT projects to identify a proxy for measurement cost and to evaluate the appropriateness of our other proxies. The projects in this data do not reflect large IT outsourcing contracts; rather, they represent smaller projects with an average duration of a few months for specific tasks required by the customer.

While a few firms, including Microsoft, have faced litigation for treating contractors like employees, Compustar treats independent contractors and employees differently. Employees typically

receive more oversight than contractors in terms of adherence to policies and procedures. Employees are much more integrated into the culture of Compustar than are contractors. Moreover, Compustar manages employee training to reinforce or upgrade their skills. Compustar provides no such management for contractors. Employees have offices at Compustar locations, while contractors typically only have temporary desks located at the job site for the duration of the project. Also, Compustar provides employees, but not contractors, with full benefits (e.g., medical care, dental, profit sharing, and 401K with employer matching contributions). Finally, Compustar works on a project basis. Employees are paid whether they work on projects or not (they receive a fixed salary with some bonus component). Contractors, on the other hand, typically are engaged for specific projects. Once the project is complete contractors may or may not be used again by Compustar. In sum, Compustar treats the two types of workers differently.

The data were drawn primarily from the contracts between Compustar and their customers, contractor invoices, and other records included in the contract file. Revenues are captured from the customer billing and costs are captured from project hours and expenses submitted by employees and contractors. Compustar applies allowances for SG&A and overhead to employee wages, a topic we will return to in the discussion.

We asked Compustar for a random sample of 200 projects from their accounting system. They complied with the request, but missing data led to a final sample of 190 projects. We subsequently pulled the corresponding contracts from Compustar's contracts library. The 190 contracts represent approximately 10-12% of the total population of Compustar contracts. Along dimensions we could measure, we found our final sample to be quite similar to a larger random sample of 405 projects drawn from Compustar's contract library (but for which we lack performance data). The only substantial difference is that projects in our sample are slightly larger than projects in the broader sample of Compustar's IT contracts. Nonetheless, the data offer the advantage of detailed description of the project tasks and objectives, and all costs and revenues associated with employees and/or subcontractors for the project.

Dependent Variables. The dependent variable for our first stage analysis corresponds to the mode of organizing. As one might expect, all projects involved at least some Compustar employees if only to monitor independent contractors; thus, the relevant question is whether or not independent contractors were used to fulfill the project. We define MODE as a binary variable that is coded as one if the project was insourced and zero if an independent contractor was involved in the project. While this is a crude measure of the contractor's involvement, it reflects the fundamental decision of whether or not to outsource the project, which is consistent with nature of our theory development.

The dependent variable for our second stage analysis corresponds to a project's profitability. We calculate MARGIN as the profit margin, expressed as percentage, for each project. Since as some projects incurred losses, MARGIN can be negative. The cost data in Compustar's accounting system uses fully burdened labor rates for employees, so internal labor rates are similar to the average for independent contractors. However, there is greater variance in the fees paid to contractors depending upon their skill set. By using a profitability measure we implicitly are concerned with the extent to which the following covariates affect both costs and revenue.

Independent Variables. We construct three variables to capture contracting difficulties corresponding to our theory. We seek to identify where the risk of expropriation is great, the cost of verifying project quality is great, and large interdependencies among IT suppliers are present. Compustar personnel were instrumental in the confirming the appropriateness of our proxies and in coding the variables.

Compustar engineers and managers created a list of proprietary technologies that are important elements of their competitive advantage in IT services. No interviewees disagreed over the identity of the proprietary technologies. We code EXPROPRIATION as one if one or more of Compustar's proprietary technologies is required for a project and zero otherwise. If one of Compustar's proprietary technologies is used, it is typically at the center of the project, thus this variable is not capturing projects where the technology is used in a peripheral way.

Due to the largely subjective nature of measurement costs, Compustar personnel did not feel they could accurately assess the measurement cost using continuous or polychotomous scales. Thus,

Compustar personnel coded MEASUREMENT COST using a binary scale. MEASUREMENT COST is coded as one if Compustar personnel believed that, based on the technological description of the project, technology employed in the project made it difficult to verify quality upon an initial test or inspection of a project and zero otherwise. This variable was coded by two Compustar engineers and inter-rater reliability was over 97%. For example, if a project involves relocating equipment or migrating data then measurement of output is straightforward. However, if the project involves development of a customized application, system design consulting, or other system support services, the quality of the output is much more subjective and only revealed over time. The issue is not specific investment, as it is often easy to determine if a specific investment has been made, but rather it is with the ability to determine the quality of the output, which is with respect to the customer's specification.

Since in the context of IT services we assume that interdependencies arise when multiple parties are directly involved in a project, we code INTERDEPENCENCY as one if persons outside the project team are directly involved in the execution of the project and zero otherwise. This information is recorded in the deliverables and responsibilities sections of the contracts. INTERDEPENDENCY is only coded as one if the other party, either another supplier or customer personnel, is listed as being responsible for some portion of the project deliverables. These parties were only included in the deliverables section of the contract if they had a significant role in the project—not just a small piece that did not affect Compustar. While continuous measures of measurement cost and interdependence would be ideal, we are limited by what Compustar was able to give us. However, we believe the use of experts from the company and how we structured the questions to Compustar result in meaningful bivariate measures that capture the core concepts.

When these attributes take on the value of one, Hypotheses 1, 2, and 3, predict an increased likelihood in insourcing. Hence, the coefficients for these three variables are predicted to be positive in our first stage Probit analysis. In the second stage of our switching regression analysis, Hypotheses 4-6 predict that the coefficients for these variables will be negative if the project is outsourced because contracting difficulties increase the cost of outsourcing, and positive if the project is insourced because insourcing is more costly when no contracting difficulties are present.

Control Variables. While transaction cost theory focuses on organizational form and minimizing governance costs, the resource-based view of the firm (RBV) focuses on the role of capabilities as the primary driver of performance. Firms are viewed as bundles of unique, difficult to transfer resources and capabilities. Performance is determined by assigning the project to the resource, either internal or external, with the capabilities best matched to that project. Theoretically, the key variable of interest is the capability of the firm to perform a given project *relative to* the capabilities of prospective independent contractors. If Compustar has a strong internal capability base in a certain area, then projects in that area should be integrated to achieve superior financial performance while projects for which Compustar has a weak internal capability should be outsourced. Controlling for capabilities is particularly important because of their ability to affect revenues or costs in the second stage of the analysis. In determining for which skills Compustar has an advantage, we consider Compustar's traditional expertise because others have shown that skills and other resources for diversification are most successfully employed for activities that are close to the firm's traditional expertise (Silverman, 1996; Teece et al., 1994).

We control for Compustar's relative skills with four binary variables. HARDWARE is coded one if a Compustar manufactured hardware is involved in the project and zero otherwise. Compustar has an advantage over independent contractors in projects involving its own hardware because Compustar field engineers are trained in maintaining and using the equipment before it is introduced into the marketplace. MAINFRAME is coded as one if the contract involves working on or with a mainframe computer and zero otherwise. In consultation with Compustar personnel and a variety of experts outside Compustar, including end customers, we identified that Compustar has extensive experience with mainframes that gives it a relative advantage over prospective independent contractors. Both HARDWARE and MAINFRAME represent project areas in which Compustar has had traditional expertise and strong capabilities.

Two other variables capture skills for which Compustar has a relative disadvantage compared to potential contractors. PROGRAMMING is coded as one if the primary task for the project is programming and zero otherwise. Compustar has historically been a large hardware-oriented

manufacturer that specialized in mainframe computers. Compustar had little historical competence in programming application software. CLIENT/SERVER is coded as one if the primary task of the project is to work on distributed client/server technologies and zero otherwise. Since Compustar has historically focused on mainframes, Compustar employees admitted that their skills in this then-emerging market for client/server technology (primarily Unix) were not at the technological frontier. While Compustar's skills were not well developed in these areas, they were able to leverage complementary skills and their reputation as a reliable systems company to secure many projects that required these skills. Several Compustar managers also noted that they were trying to improve their skills in these areas during the 1990s. While these categories do not include all skill areas that Compustar possesses, Compustar personnel consider them to be central capabilities for which capability relative to the industry average can be determined.

We include two additional variables—size of the project and whether or not the customer is a government agency—that might influence organization choice and profitability. LREVENUE is the logarithm of the project's revenue. Large projects are more likely to exceed the capacity of single suppliers and thus require outsourcing. However, large projects may also be more critical to Compustar, so they may want to staff them with employees. We have no prediction about the relation between size and profitability. GOVERNMENT is coded one if the customer is a government agency otherwise zero. We have no prediction about the effect of GOVERNMENT on organization choice. However, government contracts were viewed by some interviewees as being highly profitable.

Finally, we include the variable CONSTRAIN in the first stage of our analysis to facilitate econometric identification of the Probit model. CONSTRAIN is a binary variable coded 1 for years 1994 - 1996 and otherwise zero. Compustar's managers believed it was capacity constrained during these years. In response, Compustar added personnel in 1997 and 1998. The managers believed that this constraint may have influenced organizational choice during 1994-1996, but had little direct effect on demand it faced or its profitability over the entire time frame studied. CONSTRAIN is expected to increase the use of independent contractors but have no direct effect on profitability. CONSTRAIN captures a period during which demand was high, so revenues would be expected to rise, but the firm was

capacity constrained, so they had to pay more to keep employees and access independent contractors. Thus, we include it in our Probit analysis and omit it in the second stage analysis.[1] All other variables could affect both organization choice and profitability and thus must be included in both stages of our analysis. Table 1 contains descriptive statistics for all variables. Correlations are low to moderate with none exceeding 0.426, which suggests that multicollinearity is not problematic for our estimation.

METHODS

The challenge for our statistical analysis is to evaluate the profitability of one mode of organization compared to another mode for the same set of project attributes. An estimation problem arises because the choice of governance is likely to be chosen systematically, not randomly, which implies that a simple OLS of performance as a function of organization mode leads to biased estimates and the drawing of incorrect conclusions (for a discussion see Masten, 1996; Hamilton & Nickerson, 2003; Shaver 1998). The use of interaction terms also leads to biased estimates. Such estimation problems have become known as models with self-selection or treatment effects, and the failure to account for these problems has been highlighted as general failing of much of the literature on organizational choice and performance (Hamilton & Nickerson, 2003). The now accepted approach for correcting for such treatment effects is a switching regression model (see for example, Maddala, 1983, Chapter 9, and Greene, 1997, Chapter 20). Hamilton and Nickerson (2003) discuss the application of a reduced-form switching regression model approach specifically to organization choice and performance. The model has two stages. The first stage of the model uses covariates to predict the choice of organization mode using Probit formulation. Hence,

(1) $S_i^* = \beta' X_i + u_i$
$S_i = 1$ if $S_i^* > 0$, 0 otherwise.

[1] In effect, we identify the second stage off the nonlinearity of the Probit model, which separates the selection effect from the direct effect of the IVs on performance by assuming that the direct effect is linear in the independent variables (and can therefore be identified with the coefficients in the regression), and the selection effect is non-linear (and is therefore the coefficient on the inverse Mills ratio). While this is standard practice in the literature on selection models, the true relationship between performance, selection and the independent variables may be more complex.

Where X_i are independent covariates that influence mode choice, β' is a vector of coefficients, u_i is distributed normally, S_i^* is a latent measure of governance, $S_i = 0$ corresponds to outsourcing and $S_i = 1$ corresponds to insourcing. The second stage analyzes performance, profitability in our case, conditioned on the choice of organizing mode. So, profitability for outsourced and insourced projects, respectively, takes the form:

(2) $E[\pi_1 \mid S_i = 0] = \gamma_0' W_i + E[\varepsilon_i \mid S_i = 0]$

(3) $E[\pi_2 \mid S_i = 1] = \gamma_1' W_i + E[\varepsilon_i \mid S_i = 1]$

where π_1 and π_2 are profit for projects organized as outsourced and insourced, respectively; W_i is the reduced form vector of exogenous covariates; and γ is a vector of coefficients. Note that W_i and X_i are identical except for instruments in X_i to econometrically identify Eq. (1) that are not included in W_i. While the nonlinearly of the Probit models is sufficient to identify the equation in the second stage, it is generally preferred to use at least one instrument to identify the equation. Assuming that π_1 and π_2 are jointly distributed, Eqs. (2) and (3) become:

(4) $$E[\pi_1 \mid S_i = 0] = \gamma_0' W_i - \sigma_0 \frac{\phi(\beta' X_i)}{\Phi(\beta' X_i)}$$

(5) $$E[\pi_2 \mid S_i = 1] = \gamma_1' W_i - \sigma_2 \frac{\phi(\beta' X_i)}{1 - \Phi(\beta' X_i)}$$

where $\phi(\cdot)$ is the density function and $\Phi(\cdot)$ is the distribution function of the standard normal, and σ_0 and σ_1 are coefficients. While all observations are used to estimate Eq. (1), only those observations that are outsourced or insourced are used for estimating Eqs. (4) and (5), respectively. The terms $E[\varepsilon_i \mid S_i = 1]$ and $E[\varepsilon_i \mid S_i = 0]$ are commonly referred to as the inverse Mill's ratio and its complement, which correct for endogenous self-selection. Hypotheses concerning choice of outsourcing v. insourced are evaluated by coefficients estimated in the first stage of the model whereas hypotheses concerning performance are evaluated by comparing coefficients from the two equations in the second stage of the model.

RESULTS

Table 2 reports coefficient estimates for our Probit analysis. Since we have directional hypotheses we use one-tailed tests for hypothesis variables and two-tailed tests for control variables in all

models. Model 1 includes only our control variables. The model is statistically significant ($\chi^2 = 58.95^{**}$) with a pseudo R^2 of 0.267 and correctly predicts insourcing for 76.8% of the observations. While 76.8% is quite high, it is important to note that because 61% of the projects are insourced, a model consisting of only a constant term will correctly predict 61% of the projects. LREVENUE, MAINFRAME, CLIENT/SERVER, and PROGRAMMING are the only statistically significant coefficients ($p < 0.05$) for our control variables. The coefficient for LREVENUE is negative, which implies that the larger the project the more likely it is to be outsourced. This finding is consistent with the notion that large projects in this industry often exceed the capacity of single suppliers, even large ones, and thus are more likely to require outsourcing. The coefficient for MAINFRAME is positive, which is consistent with Compustar's view that its capabilities for mainframe projects are superior to rivals. Discussions with Compustar personnel indicate that superior capabilities for Compustar act as a shift parameter to increase the likelihood of integration, ceteris paribus. The coefficients for CLIENT/SERVER and PROGRAMMING are both negative. Compustar acknowledges that its capabilities in these two areas are inferior to rivals, which, for the reason stated above, increases the likelihood of outsourcing projects when these capabilities are needed.

Model 2 reports our complete Probit specification with control variables and our three independent variables. Model 2 provides a statistically significant improvement over Model 1 ($\chi^2 = 15.10^{**}$). Moreover, Model 2's pseudo R^2 increases to 0.357 and it correctly predicts insourcing for 80.05% of our observations, which is a substantial increase over Model 1. The signs and magnitude of the control variables remain broadly similar so we focus discussion on our independent variables. The coefficient for EXPROPRIATION is positive and significant ($p < 0.05$), which provides support for the hypothesis that appropriability concerns increase the likelihood of insourcing. The coefficient for MEASUREMENT COST is positive and significant ($p < 0.01$), which provides support for the hypothesis that measurement cost difficulty increases the likelihood of insourcing. Finally, the coefficient for INTERDEPENDENCY is positive and significant ($p < 0.05$), which provides support for the hypothesis that interdependencies increase the likelihood of insourcing. To better assess the impact of these coefficients we calculate the marginal probability for each hypothesis variable by changing its value from

zero to one while holding all other covariates at their means. The marginal probability for EXPROPRIATION, MEASUREMENT COST, and INTERDEPENDENCY is 0.213, 0.323, and 0.315, respectively. Moreover, the marginal probability of integration when going from all exchange conditions equal to zero to all equal to one, is 0.583. These marginal probabilities are substantial and thus demonstrate a strong effect of our hypothesized variables on organizational choice.

We now move to our analysis of profitability. We begin by running a simple OLS regression to determine whether the independent variables directly influence profitability, irrespective of the choice of organizational form, which is a traditional way organizational studies have evaluated the effects of organizational choice on performance. Model 3 in Table 2 reports the coefficient estimates for this analysis. The only significant variable is MODE ($p < 0.10$), which indicates that projects completed with employees are more profitable than those completed with contractors. In this analysis, none of the contracting difficulty or capability variables has a significant impact on profitability.

This analysis, we argue, is erroneous. Compustar is likely to choose the organizational form that they believe will be more profitable, while this initial analysis implicitly assumes that Compustar chooses organizational form randomly. Thus, we cannot simply regress MODE on MARGIN; we must control for the endogeneity problem created by the fact that Compustar is working to select the most profitable organizational form. We employee a switching regression model to examine profitability in the second stage of our analysis, which accounts for this endogeneity. Model 4 in Table 2 reports the coefficient estimates for the effect of our covariates on profitability for those projects outsourced. The overall model is weakly significant ($F = 1.81$, $p < 0.10$) and has an R^2 of 0.247. Of our control variables, only the coefficient for GOVERNMENT is significant ($p < 0.01$). The coefficient is positive, which indicates that profitability increases when independent contractors are utilized on projects for government agencies. We also note that our inverse Mills ratio is weakly significant. Since the Mills ratio provides a correction for endogeneity, its significance signals that endogeneity should be a concern. The positive sign of the inverse Mills ratio indicates positive selection, which indicates that the performance of outsourced projects would have been worse if they instead had been insourced (for a discussion, see Hamilton and Nickerson, 2003).

The coefficient for EXPROPRIATION is negative and weakly significant ($p < 0.10$), which indicates that the profitability of outsourced projects declines when expropriation concerns are present. The coefficient for MEASUREMENT COST is negative and significant ($p < 0.05$), which indicates that the profitability of outsourced projects declines when measurement-cost concerns are present. Finally, the coefficient for INTERDEPENDENCY is negative but just misses statistical significance. This insignificance may be due to the fact that only one project that is outsourced was evaluated as having interdependencies (and it also had measurement cost difficulties). We return to the issue of statistical significance after we discuss the second equation in the switching regression model.

Model 5 in Table 2 reports the coefficient estimates for the effect of our covariates on profitability for those projects organized as insourced. The overall model is significant ($F = 2.20$, $p < 0.05$) and has an R^2 of 0.094. As with our prior results, only the coefficient for GOVERNMENT is significant ($p < 0.01$); however, in contrast to our prior finding, the coefficient is negative indicating that profitability decreases when government projects are insourced. The sign of our inverse Mills ratio is negative, as expected, but it is not statistically significant, which implies that endogeneity may be less of a concern for this equation. The coefficient for EXPROPRIATION is positive and weakly significant ($p < 0.10$), which indicates that the profitability of integrated projects increases when expropriation concerns are present, which implies that either higher revenue or lower costs or both are associated with insourced projects involving expropriation concerns. The coefficients for MEASUREMENT COST and INTERDEPENDENCY are positive but not significant.

It is important to note that the key question with respect to coefficient estimates for our hypothesis variables is not whether they are different from zero but instead whether the coefficients estimated with respect to outsourcing is statistically different from the coefficients estimated with respect to insourcing. We predict that in the presence of contracting difficulties, insourced projects will have higher profits than outsourced projects. Thus we need to compare the coefficients for each of the three contracting hazard variables under outsourcing and insourcing, which is different from the typical hypothesis test of comparing a coefficient to zero. Comparing the coefficients from Models 4 and 5 for EXPROPRIATION and MEASUREMENT COST we find that both sets of coefficients are significantly

statistically different (i.e., from a difference of means test) from one another ($p < 0.05$). Thus, contracting difficulties stemming from expropriation and measurement cost do lead to differential impacts on profitability depending on the choice of governance, which supports Hypotheses 4a and 5a, but not Hypothesis 6a.

We now use these findings to comparatively assess profitability between organization modes of outsourcing and insourcing to examine Hypotheses 4-6. We focus our analysis on EXPROPRIATION and MEASUREMENT COST since our coefficients for INTERDEPENDENCY were not significant for either insourcing or outsourcing, which provides no statistical support for Hypotheses 6a and 6b. We do this by comparing a randomly chosen project's profit when organized as predicted versus organized opposite to prediction. We do this for EXPROPRIATION and MEASUREMENT COST, which leads to four comparisons. For instance, assume that a randomly selected project corresponds to all covariates at their mean and assume that EXPROPRIATION is 0. By assuming a randomly selected project we do not include the inverse Mills ratio in our estimate. The inverse Mills ratio must be included when the estimate for a specific project is calculated. Next, we compute and compare profitability for employees versus independent contractors. When assessing a single independent variable, the other independent variables, as well as the control variables, are held at their means. The difference between these two profits is the cost of organizing as insourced when transaction cost theory predicts outsourced. Figures 1 and 2 display this analysis for EXPROPRIATION and MEASUREMENT COST.

From these figures we find relationships consistent with Hypotheses 4a-5b. The average margin across all projects in the sample is 27%. If Compustar chose insourcing when we predict outsourcing, profit is lower by 5.6 and 26.8 margin points (which represent decreases of 20.8% and 99.6%) for EXPROPRIATION and MEASUREMENT COST, respectively. Please note that in this analysis we assume the coefficients for MEASUREMENT COST, and INTERDEPENDENCY under integration are zero because of their insignificance. Alternatively, if Compustar chose outsourcing when our theory predicted insourcing, profit is lower by 54.2 and 7.7 margin points (which represent decreases of 200% and 28.6%), for EXPROPRIATION and MEASUREMENT COST, respectively. As a final evaluation, in Figure 3 we evaluate the difference in profit if all three attributes are perfectly correlated (i.e., all three are

zero or all three are one). If Compustar chose integration when we predict outsourcing, profit is lower by 34.1 margin points, which represents a change of 127%—from 26.9% to –7.2%. Alternatively, if Compustar chose outsourcing when we predict integration, Compustar's profit is lower by 67.7 margin points (a change of 252%—a change from 26.9% to –40.8%).

DISCUSSION

Our empirical analysis shows that the choice of employment relation does influence project performance. We show that each type of organization—employees and independent contractors—is best suited to specific situations, which implies that attempts to show in general that the use independent contractors is superior or inferior to employees are unlikely to be successful. For example, D'Aveni and Ravenscraft's (1994) results showing a small benefit to vertical integration might show different situations in which vertical integration and contracting were beneficial if they had examined the influence of contracting difficulties. Projects with minimal contracting difficulties exhibit superior performance when outsourced, while projects with greater contracting difficulties perform better when insourced.

Our strongest profitability findings come from EXPROPRIATION and MEASUREMENT COST. The project's profit margin drops by 20.8% and 200% for the former and 99.6% and 28.6% for the latter, depending on whether we predict outsourcing or insourcing, when the project's organization is misaligned with project attributes. These results indicate an asymmetry in the penalty for misalignment—it seems that a lack of measurement difficulty strongly favors independent contractors whereas the presence of expropriation concerns strongly favors employees. We believe that the significant penalty for outsourcing in the presence of proprietary technology is consistent with the importance of protecting proprietary technology in this industry. The added cost may derive from of training independent contractors to use the firm's technology. Furthermore, we conjecture that Compustar incurs added costs by to shape and monitor the project to minimize the leakage of technology, which incurs efficiency losses. We anticipate that additional costs may be incurred if the technology does leak to contractors but that these opportunity costs an not measurable in the current project. Likewise, the penalty for insourcing when measurement costs are lacking shows the power of pecuniary incentives, as when independent

contractors work hard to try make a favorable impression and increase their chances of repeat business. An alternative explanation for these cost differentials is that our measure for expropriation hazard may actual measure capabilities. While we can not dismiss this alternative explanation, interviews with managers indicate that the former explanation may have greater currency.

In contrast, the penalties for poor organizational choice for INTERDEPENDENCY are small—10.8% and 17.1%—and based on parameter estimates that are not significant. Further investigation revealed that INTERDEPENDENCY nearly perfectly predicts integration—that is, only one project that had interdependencies was outsourced. Because of this limited variation, our econometric model cannot provide accurate estimates of this effect of misalignment on profitability. This finding might suggest that the problems associated with interdependencies were both important and relatively easy for Compustar to identify and thus it chose an organization mode that mitigated the contracting difficulty. Indeed, this result indicates that the cost of selecting the non-economizing organizational form with respect to INTERDEPENDENCY is substantial. We conjecture that when projects are vying for scarce internal resources, Compustar prefers to allocate employees to projects that are interdependent because of the direct reputational problems that can result from using independent contractors for these projects. It is not that independence is a "greater" hazard, but rather than its effects are more predictable—problems will arise if steps are not taken to govern the project carefully.

These results indicate the strategic importance of getting governance right. Tradeoffs will have to be made given that the firm lacks sufficient employees to insource all projects with some level of contracting difficulty and firms that know what types of misalignment are least costly will have an advantage over competitors.

The results also highlight an aspect of transaction cost theory that requires further development. What theoretical attention the alignment-performance hypothesis has received has been focused on explaining why the performance of the market will decline in the presence of contracting difficulties. However, little has been said about why integration is problematic when contracting difficulties are not present. Our finding that different types of misalignment have different performance implications

highlights the fact that all types of "misalignment" are not created equal. This highlights the need for organizational theorists to examine this issue more carefully.

A useful comparison to our estimates is provided by Masten et al. (1991), who analyzed organizational costs in shipbuilding and predicted the change in those costs due to inefficient choice of organizational form. Masten et al. measured organization costs and not profits for each component rather than for each transaction. However, Masten et al. provide sufficient data to convert their estimates of organizational cost from misalignment to the change in total costs—production plus governance costs—which, assuming revenue in shipbuilding is unaffected by changes in exchange attributes, provides a useful point of comparison. Masten et al.'s estimates suggest that producing internally those shipbuilding items that that were bought through from the market would have increased total cost by approximately 11%. Conversely, procuring through a market those items that were produced internally would have increased total cost by approximately 24%. Our estimates, except for when expropriation concerns are present and the project is outsourced, are in line with Masten et al.'s estimates. The result from outsourcing when EXPROPRIATION is equal to one may be substantially larger that Masten's estimates because such projects require the transfer of technological know-how to an independent contractor, which can be a costly endeavor. Nonetheless, our estimates are similar even though the technological contexts—shipbuilding versus information technology—are vastly different.

The impact of expropriation concerns, measurements cost, and interdependence, show that knowledge-based industries such as IT services can still be examined to advantage using transaction cost logic. However, the transaction attributes that lead to contracting difficulties are related to technology and complexity more than specific physical assets. Thus, the underlying transaction cost logic of insourcing in the presence of contracting difficulties has currency in the IT industry, but the industry context will determine the specific mechanisms that drive insourcing.

Coefficient estimates of our control variables also offer some interesting insights. Three of the four capability variables were significant in our Probit analysis and thus influenced organization choice. As expected, Compustar was more likely to internally undertake projects that involved a mainframe. It is knowledge about mainframes where Compustar has a relative advantage over prospective independent

contractors. The converse was the case for CLIENT/SERVER and PROGRAMMING: Compustar was more likely to outsource projects that required these skills.

While the results provide some support for the resource-based view of the firm with respect to choice of organization, we note that none of the relative resource variables affected profitability. Two factors may account for this. First, there is significant competition for all projects, including those involving Compustar's strengths, which may compete away above normal returns based on capabilities. Similarly, competition among independent contractors may be sufficiently intense such that resource-based advantages do not yield above normal returns for contracts (and hence costs for Compustar). Alternatively, Mata, Fuerst, and Barney (1995) separate the impact of managerial and technological capabilities in IT. Our largely insignificant results for the measures of technical capabilities on profitability may implicate managerial capability—a capability for which we had no measure—as effecting profitability of IT services. Even when utilizing an independent contractor, a Compustar project manager oversees the project and interacts with the customer. It may be that some managers are better than others for managing certain types of projects, regardless of whether independent contractors or internal resources are employed. Additional data is needed to examine this dimension of the resource-based explanation of firm performance. The need for additional data notwithstanding, our approach responds to Williamson's (1999) call for investigating the organization of particular exchanges in which a firm's strengths and weaknesses are considered.

Our study suffers from several limitations. First, our data comes from a single firm, which limits the generalizability of our results. However, testing hypotheses at the level of the transaction requires detailed data, which makes data collection from multiple firms very costly. Only by replicating research of this type in a variety of settings can scholars gain confidence that our empirical results apply more broadly. Our study begins this effort with respect to profitability at the transaction level.

A second limitation is that the number of observations in our study is relatively small, which may limit the reliability of our estimates. Nonetheless, the number of observations is larger than most other studies in this research program. For example, Masten et al. (1991) based their analysis on only 73 observations. Third, our estimates depend critically on Compustar's reporting of internal costs. Their

internal accounting and overhead allocation may lead to incorrect estimates if the GAAP procedures they follow are systematically different from economic costs. However, in our interviews with Compustar managers we found no indication that Compustar's internal costs were systematically different from the cost information we would have collected if we could have done so.

We lack the ability to control for the prior relationship between Compustar and each contractor. It may be that Compustar is more willing to use independent contractors for tasks with higher levels of contractual hazard once a relationship has developed. Panel data is critical for understanding and evaluating the evolution of contractual relationships and few dataset have been collected with which to study such phenomena.

Also, we note that while our empirical model explains well the sourcing decision, our model does less well at explaining variation in profitability, especially for insourcing. As mentioned above, we did not examine managerial capability as a potential explanation for such variation, which is an area that Compustar personnel indicated might provide some explanatory power. However, this omission does not bias or undermine our results; instead, it suggests an additional avenue for research. While our methodology offers a well accepted approach for interpreting our data, we can not reject the possibility that alternative model specifications could lead to different results. More critically, we desire more powerful instruments and perhaps better proxies for some of our variables.

Several findings suggest avenues for future research. For instance, the result that not just misalignment, but the type of misalignment, matters has received little theoretical attention. We need to better understand why there are asymmetric effects of misalignment. Additional theoretical and empirical research is needed to better understand when different types of misalignment will be more or less costly to the firm. Such research would help managers make choices by taking into account downside risk as well upside benefit especially in the face of resource constraints.

The role of social ties between the buyer and supplier, as well as the influence of prior exchanges on the performance of the current exchange (in line with Gulati's (1995a) study of the role of prior alliances on the choice of alliance type) could be further examined. Social ties are important in sourcing decisions and could be more fully incorporated into transaction cost logic. Relationships and social

interaction may act as an alternative safeguard that could diminish the need for integration. Alternatively, relationships could result in learning that lowers the cost of using the market. Predicting when each type of outcome should be expected requires additional research. Our results also suggest that integrating social ties and transaction cost theory calls for more microanalytic measures of both the nature of the social tie (i.e., the specific relationship) and performance. Linking various social ties to changes in firm performance is interesting, but makes it difficult to isolate the effect of the social tie in resource decisions. Project (or transaction) level data on performance, including data on different attributes of performance (e.g., quality, on-time delivery, profitability) would help us better understand how different social ties, and contractual hazards, affect different aspects of performance.

A related issue for future research is that different types of contractual hazards are likely to have differential effects on the governance decision and on resulting performance. More research is needed to understand when different types of contractual hazards will be more or less important. While Williamson (1985) has repeated called for researchers to examine the transaction in its entirety, he has also called asset specificity the "big locomotive" of transaction cost economics. Asset specificity clearly is important. Yet, more research is necessary to understand when different types of hazards, including but not limited to measurement problems and appropriability concerns discussed herein, have a bigger impact on governance and performance. Thus, we need to know more about the relative importance and weights attached to different contractual hazards in different settings in order to most effectively help managers make better decisions.

This paper has useful implications for managers in high technology industries. Our analysis indicates that organizational form, even at the project level, matters for profitability. Managers are well advised to understand the potential sources of contracting difficulties, which may vary with industry and customer needs, and choose organizational forms to mitigate these difficulties. Indeed, the industrial context of our study suggests that such organizational concerns are not just relevant for low-technology industries, such as ship building, but also relevant for high-technology industries such as IT services. In addition, our asymmetric costs of misalignment provide some support for the conventional wisdom that

outsourcing mistakes can be more costly than excessive integration. Managers need to carefully consider which transactions are suitable candidates for outsourcing.

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Table 2: Switching Regression Model

	Organization Choice Probit Model				OLS Profitablity		Profitability for BUY		Profitability For MAKE	
	Model 1		Model 2		Model 3		Model 4		Model 5	
MAKE					0.979	†				
					(0.050)					
LREVENUE	-0.394	**	-0.402	**	0.000		0.137		-0.078	
	(0.082)		(0.080)		(0.013)		(0.093)		(0.098)	
CONSTRAIN	-0.113		-0.167							
	(0.253)		(0.264)							
GOVERNMENT	-0.151		-0.114		0.437		0.186	**	-0.094	*
	(0.275)		(0.342)		(0.031)		(0.050)		(0.043)	
MAINFRAME	0.644	**	0.554	*	-0.002		-0.081		0.058	
	(0.212)		(0.253)		(0.037)		(0.134)		(0.138)	
HARDWARE	0.357		0.540		0.035		0.084		0.092	
	(0.655)		(0.673)		(0.072)		(0.111)		(0.156)	
CLIENT/SERVER	-1.162	*	-1.250	†	0.067		0.461		-0.249	
	(0.551)		(0.651)		(0.050)		(0.332)		(0.244)	
PROGRAMMING	-0.384	*	-0.636	**	-0.025		0.124		-0.075	
	(0.190)		(0.237)		(0.039)		(0.143)		(0.172)	
EXPROPRIATION			0.670	*	0.061		-0.364	†	0.234	†
			(0.393)		(0.077)		(0.248)		(0.174)	
MEASUREMENT COST			0.897	**	-0.016		-0.345	*	0.184	
			(0.252)		(0.033)		(0.202)		(0.229)	
INTERDEPENDENCY			1.151	*	-0.004		-0.075		0.182	
			(0.611)		(0.057)		(0.067)		(0.269)	
Mills Ratio for Buy							0.410	†		
							(0.316)			
Mills Ratio for Make									-0.169	
									(0.306)	
Constant	4.855	**	4.488	**	0.208		-0.958		1.243	
	(0.904)		(0.886)		(0.148)		(0.784)		(1.320)	
Wald χ^2	58.95	**	75.670	**						
Psuedo R^2	0.267		0.357							
F-Statistic					1.3		1.805	†	2.2	*
R^2					0.239		0.247		0.094	

Table 1: Summary Statistics and Correlations (N = 190)

	Variable	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8
1	MODE	0.611	0.489	0	1								
2	MARGIN	0.269	0.221	-0.531	0.952	0.199							
3	LREVENUE	11.045	1.689	5.298	16.709	-0.426	-0.090						
4	CONSTRAIN	0.205	0.405	0	1	0.005	0.027	0.010					
5	GOVERNMENT	0.147	0.355	0	1	-0.186	0.045	0.215	-0.028				
6	MAINFRAME	0.268	0.444	0	1	0.240	0.037	-0.026	-0.043	-0.118			
7	HARDWARE	0.063	0.244	0	1	0.163	0.100	-0.256	-0.025	0.014	0.038		
8	CLIENT/SERVER	0.100	0.301	0	1	-0.309	0.021	0.145	-0.169	0.257	-0.202	-0.087	
9	PROGRAMMING	0.447	0.499	0	1	-0.280	-0.118	0.257	0.041	0.104	-0.067	-0.147	0.1
10	EXPROPRIATION	0.084	0.278	0	1	0.126	0.116	-0.004	-0.060	-0.073	0.159	0.233	-0.1
11	MEASUREMENT COST	0.495	0.501	0	1	0.164	-0.042	0.042	0.071	-0.055	0.066	-0.214	0.0
12	INTERDEPENDENCY	0.089	0.286	0	1	0.213	0.035	0.017	0.115	0.026	0.101	0.070	-0.0

Figure 1: Effect of Expropriation Concerns on Project Profitability

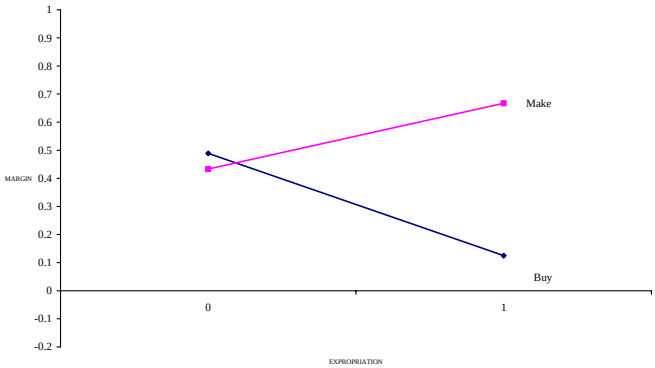

Figure 2: Effect of Measurement Cost on Project Profitability

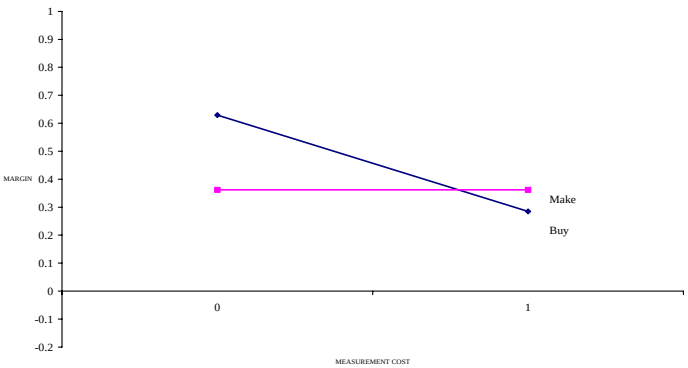

Figure 3: Effect of All Exchange Conditions on Project Profitability